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editing and finally seeing the book through the press.

Curriculum construction and development of instructional materials are on-going processes. We shall be grateful for suggestions from students as well as teachers for improving this book.

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Contents

12 (B)

PREFACE	iii
CHAPTER 1	Natural Resources of India
CHAPTER 2	Main Features of Agriculture
CHAPTER 3	Manufacturing Industries
CHAPTER 4	Transport Systems
CHAPTER 5	Regional Development
APPENDIX	Productivity Level, 1980-83

THE CONSTITUTION OF INDIA

PREAMBLE

WE, THE PEOPLE OF INDIA, having solemnly resolved to constitute India into a '[SOVEREIGN SOCIALIST SECULAR DEMOCRATIC REPUBLIC]' and to secure to all its citizens:

JUSTICE, social, economic and political;

LIBERTY of thought, expression, belief, faith and worship;

EQUALITY of status and of opportunity;
and to promote among them all

FRATERNITY assuring the dignity of the individual and the ² [unity and integrity of the Nation];

IN OUR CONSTITUENT ASSEMBLY this twenty-sixth day of November, 1949, do
HEREBY ADOPT, ENACT AND GIVE TO OURSELVES THIS CONSTITUTION.

1. Subs. by the Constitution (Forty-second Amendment) Act, 1976, Sec.2, for "Sovereign Democratic Republic" (w.e.f. 3.1.1977)
2. Subs. by the Constitution (Forty-second Amendment) Act, 1976, Sec.2, for "Unity of the Nation" (w.e.f. 3.1.1977)

Part IV A Fundamental Duties

ARTICLE 51A

Fundamental Duties - It shall be the duty of every citizen of India-

- (a) to abide by the Constitution and respect its ideals and institutions, the National Flag and the National Anthem;
- (b) to cherish and follow the noble ideals which inspired our national struggle for freedom;
- (c) to uphold and protect the sovereignty, unity and integrity of India;
- (d) to defend the country and render national service when called upon to do so;
- (e) to promote harmony and the spirit of common brotherhood amongst all the people of India transcending religious, linguistic and regional or sectional diversities; to renounce practices derogatory to the dignity of women;
- (f) to value and preserve the rich heritage of our composite culture;
- (g) to protect and improve the natural environment including forests, lakes, rivers, wild life and to have compassion for living creatures;
- (h) to develop the scientific temper, humanism and the spirit of inquiry and reform;
- (i) to safeguard public property and to abjure violence;
- (j) to strive towards excellence in all spheres of individual and collective activity so that the nation constantly rises to higher levels of endeavour and achievement.

CHAPTER I

Natural Resources of India

The natural endowments in the form of land, water, vegetation and mineral, etc. are generally referred to as 'natural resources'. These resources form the backbone of the economy of a nation. 'Natural resource' is a broad term. The land area of a country, its fertile soils, rivers, water bodies, fisheries, vegetal cover, rocks and minerals, livestock and human population—all are its resources. These are the bases for the economic strength of a country and the prosperity of her people. The early human beings subsisted on the *natural means of subsistence*, i.e., edible plants and animals were utilised directly after uprooting the plants and hunting the animals without much of processing. The more primitive is a society, the higher is its dependence on its immediate environment. But the man and the environment relationship is not static. It is everchanging. While the environment is bountiful, human beings are constantly looking for newer opportunities for their sustenance.

With the help of tools, techniques and skills acquired by human beings through experience and experimentation, they interact with the environment. This can be termed as 'technology'. Human beings were able to identify and develop the means of production and did not depend on the means of subsistence for long. The quantum of utilisation of the natural resources, thus depends upon the level of technology attained by any society. Many societies were endowed with natural resource base, but were unable to utilise these resources because they could not develop the technology. The coal was available in China

in form of hard rock since ages, the mineral oil seepages were observed in Pennsylvania since 1750, but these natural resources could not become economic resources immediately. They became utilisable only with the invention of proper technology for their economic exploitation. The presence of the natural resources does not necessarily mean that the region is economically developed. Many resource-rich regions of India are still economically backward. The example of such regions are Chotanagpur plateau and Bastar. These regions are inhabited by people who lack technology. It shows that the resource is very closely related to the level of technological (cultural) development. That is why it is said that the concept of natural resource is culture-bound.

The nature by providing the natural resource base indicates the direction of economic development. The people living near the water bodies develop fishing, the forest dwellers develop lumbering and villagers in the river valleys where water and fertile soils are in abundance develop agriculture. But the extent of the development is decided by the level of technology attained by the respective societies. The highly mechanised extensive agriculture of the United States of America, Australia and Canada is entirely different from the intensive subsistence agriculture of South-east Asia, though as activity it is agriculture in all the above-mentioned regions. In India, there is a vast diversity in economic activities. Wide regional disparities are observed in the levels of economic development too.

India is a vast country. Its sheer size of 32,87,782 sq km is an important resource because the chances of the occurrence of large natural resources in a vast area are more than in a small area. India is very well endowed with a number of natural resources. Vast arable lands, flowing waters, underground water aquifers, large growing season, variety of natural vegetation, minerals, livestock and human resources—all are our economic assets. The roots of the economic history of India lie in the hoary past. The remnants of the economic activities of our ancestors can still be seen in shifting cultivation in Assam, nomadic herding by Gujars and Bakerwals in Jammu and Kashmir and fishing in the coastal region. Agriculture has been the mainstay of the Indian economy since the ancient times. We were able to develop our indigenous technologies in the primary as well as secondary sectors. The textile, iron and copper technologies were known to our ancestors.

In independent India, the breakthrough has been attained in the harnessing of our land, water and mineral resources. The package technology has contributed to our agricultural development. Almost all the cereal crops have witnessed increase in their yield rates. For example, the yield of rice has increased from 668 kg per hectare in 1950-51 to 1,744 kg per hectare in 1992-93 and the yield of wheat has risen from 663 kg per hectare in 1950-51 to 2,327 kg per hectare in 1992-93. In spite of tremendous increase in yield per unit area of land, the labour productivity in agriculture remains low. What are the main causes for this phenomenon? Examine the role of the size of the population, its rapid growth in depressing the labour productivity and neutralising the standard of living in India.

MAJOR RESOURCES OF INDIA A GENERAL SURVEY

Land Resources

India's vast and diverse size is the most important

resource. It has lofty mountains, old denuded plateaus and extensive plains. This diversity in topography guarantees different economic activities. About 43 per cent of the land area, which is plain, provides opportunity for crop farming. The mountainous areas, accounting for about 30 per cent of the surface area of the country, are storehouses of natural resources as well as they are important for their scenic beauty and ecological aspects. The plateau area covers about 27 per cent of the total area. It has rich reserves of mineral resources besides forests and arable lands. The mountains and plateaus also have fertile river valleys offering favourable locations for human concentration.

India is endowed with a year-round growing season except in the mountainous regions. This has made our land more valuable from the viewpoint of growth of crops and natural vegetation. This large growing season has ensured diversity of crops. The major constraint in Indian agriculture is not the factor of heat but that of moisture. Indian subcontinent, by and large, receives monsoonal rainfall, which is erratic and seasonal in nature. The moisture supply through rainfall is concentrated during three-four months. These are the summer months in the country, except in Jammu and Kashmir and Tamil Nadu. At this time heat is more and consequently the moisture loss through evaporation is also high. Besides, the higher intensity of rainfall induces higher run off and flooding in the rivers. The uneven distribution of rainfall also creates problem for plant growth. There is a vast area comprising Ladakh, Rajasthan, Kachchh, parts of Madhya Pradesh, Maharashtra, and Karnataka plateau, where rainfall is inadequate and varies between 100 and 500 millimetres. About two-thirds of the area of the country records more than 750 millimetres of rainfall. Some rain does occur during winter owing to the western disturbances but it is generally confined to the Himalayas and the north-western part of the North Indian Plains.

The uneven distribution of rainfall has thus forced us to arrange for artificial means of moisture supply in order to obtain efficient utilisation of our land. In some areas the rainfall is in excess than the required amount; in others it is less. Similarly, the rainfall may take place when it is not required and there will be no rain when it is required. It means that in view of the spatial as well as temporal variations of rainfall, irrigation is the only source of assured water supply for successful cropping. We are lucky to have large surface flow of water in our perennial rivers. The infrastructure of irrigation has been created by damming these rivers in order to obtain regulated moisture supply from the reservoirs. Intensity of cropping has largely depended on irrigation water. Punjab, Haryana and western Uttar Pradesh have recorded higher level of irrigation as well as higher cropping intensity. We should be careful about the dangers posed to the land such as the problem of waterlogging due to over-irrigation in some regions and salinity due to intensive water use in hot and dry parts. Thus, it is important to protect the land from degradation.

Soil

Soil is an important factor for the plant growth. The value of the land is fixed according to the fertility of the soils. It is a renewable abiotic resource which can be replenished by artificial means like manuring and fertilizers. The process of soil formation is known as *pedogenesis*. It is greatly influenced by the parent rocks, climate and biological lifeforms. Time is an important factor which provides maturity to soils. The diversity of the physiography is reflected in the diversity of soils in India.

The soils of India are classified into six broad groups—alluvial, peat, red, black, desert and mountain soils. The Indian Council of Agricultural Research has treated forest and saline and alkaline soils as separate classes. Alluvial soil is by far the most extensive soil and covers about

43.7 per cent of the total area of the country. These soils are deposited by the fluvial action of rivers and sea and, therefore, we find both riverine and coastal alluvium. It is the predominant soil in the Northern Plains, along the river valleys of the peninsular India, on the river deltas and the coasts. The older alluviums known as *bhangar* are not subjected to inundation but newer alluviums, known as *khadar* are not deposited along the flood plains of the rivers.

The black soils are derived from the Deccan trap and extensively occur in Maharashtra, western Madhya Pradesh, Gujarat, parts of Andhra Pradesh, Karnataka, and Tamil Nadu. These are very fine grained soils. They are rich in calcium and magnesium carbonate but poor in organic matter, phosphorus and nitrogen. They are difficult to work as they become sticky when wet and develop crack after drying.

Red and yellow soils are largely delluvial in nature but in some limited patches, these have been deposited due to fluvial action. Their colour is derived from their parent rock. Red soils and their many variants cover large areas in Tamil Nadu, Karnataka, Goa, South-eastern Maharashtra, eastern Andhra Pradesh, Orissa and Chotanagpur plateau. Its outliers extend up to Birbhum district of West Bengal and Jhansi, Mirzapur and Hamirpur districts of Uttar Pradesh. These soils are deficient in humus content and lack in plant nutrients.

In eastern and southern India where the moist climate is experienced intermittently followed by dry climatic conditions, laterite soils have developed. It has hydrated oxides of aluminium and iron. It is deficient in humus. These are widespread in Kerala, Tamil Nadu, Western districts of Karnataka, parts of Maharashtra, Madhya Pradesh, Meghalaya and Assam.

A large part of Rajasthan, Haryana and Punjab have expanses of sandy soils. Sand has developed *in situ* due to prevailing arid conditions but some sand has also been deposited due to

aeolian action. These soils lack in humus content but contain high proportion of soluble salts. They are liable to be subjected to acidity if over-irrigation is resorted to by farmers.

Peat soils develop under humid conditions in areas of thick vegetation and as a consequence large quantity of organic matter is accumulated. Such soils are confined to coastal areas in Kerala, West Bengal, Orissa and Tamil Nadu.

The soils which have higher capacity to supply plant nutrients are called fertile soils. Basically this fertility is the resource which is utilised for crop farming. The soils have naturally determined fertility as well as culturally induced fertility. When the naturally determined fertility declines, it has to be replenished by adding manures and fertilizers. The faulty management and agricultural practices lead to the exhaustion of soil fertility. Erosion hazards also render the soils infertile. The tillage practices in the undulating areas induce higher rate of erosion. Deforestation and overgrazing have aggravated the erosion of soils. The loss of vegetation has led to the intensification of desert conditions. It is estimated that about one crore hectares of land in India is affected by ravine and gully erosion. Over irrigation has also rendered the land infertile due to the infestation of salts. About 60 lakh hectares in Punjab, Haryana, Maharashtra and Uttar Pradesh suffer from alkalinity and salinity.

Conservation of soil is the keyword in keeping them productive. This is possible by improved agricultural practices in different regions. The tillage on higher slopes has to be avoided and contour ploughing on the erosion-prone slopes may help in maintaining the soil depth. Planting of shelter belts and stubble-mulching help in conserving the soils in desert regions. The ravines and gullies should be plugged to prevent the headward erosion. The pressure of livestock on pastures in hilly, desert and plateau region has to be reduced in order to avoid overgrazing such as in Jammu and Kashmir, Himachal Pradesh, Rajasthan and Karnataka.

Farmyard manure, green manuring and chemical fertilizers help in maintaining soil fertility.

Pattern of Land Utilisation

According to the statistics of 1990-91 the total reported area according to the village papers has been 3,050 lakh hectares. Of this 1,422 lakh hectares or 46.6 per cent is the net sown area. Fig 1.1 presents a comparative picture of land use pattern in India in 1950-51 and 1990-91. During these 40 years the net sown area has witnessed increase of about 20.10 per cent, recording an annual growth rate of 0.10 per cent. There is no doubt that the reported area has also increased over these years. In 1950-51, the area under forests accounted for about 14.2 per cent of the reported area which has increased to 22.3 per cent of the reported areas in 1990-91. The fallow lands have witnessed reduction in area and accounted for 7.7 per cent of the reported area in 1990-91 as against 9.9 per cent during 1950-51. Thus, the net sown area and fallow lands account for 54.3 per cent of the reported area which shows the extent of the cultivable land. Culturable wastelands witnessed a decrease from 8.1 per cent in 1950-51 to 4.9 per cent in 1990-91. Area under tree crops, has also recorded decrease in 1990-91 as compared to 1950-51.

The land use pattern shows large variation over space. While the net sown area in Punjab and Haryana is as high as 84 and 82 per cent of their respective reported areas, it accounts for only 3.1 per cent in Mizoram, 6.3 per cent in Manipur and 8.6 per cent in Meghalaya. The states lying in the North Indian Plains have recorded higher cropping intensity. The intensity of cropping can be explained by the following formula:

$$\text{Intensity of cropping} = \frac{\text{Gross cropped area}}{\text{Net sown area}} \times 100$$

Punjab has recorded the highest cropping intensity of 178 per cent followed by Haryana (165 per cent) and Uttar Pradesh (147 per cent) in

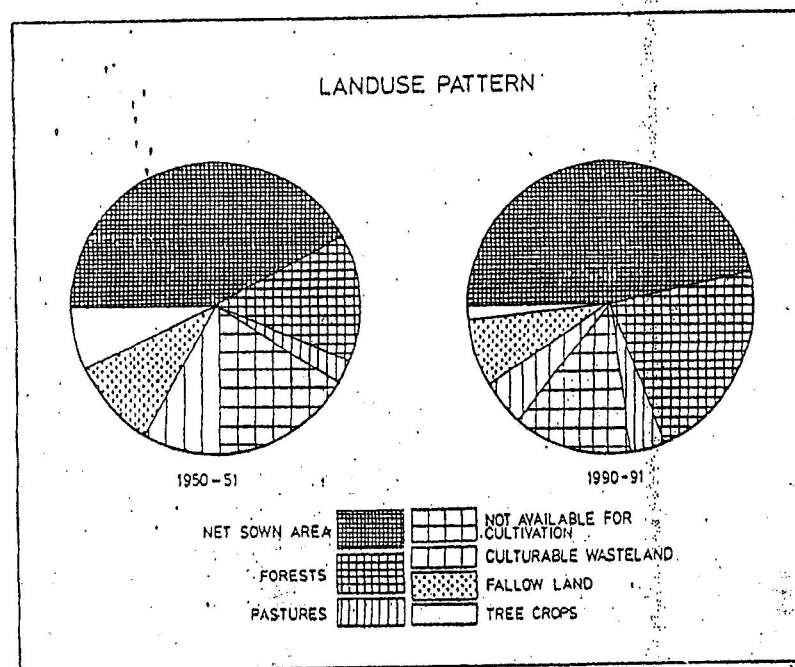


Fig. 1.1

1990-91. Higher cropping intensity shows higher intensification of agriculture which means higher proportion of net sown area is being sown more than once in the same agricultural year.

The cropping pattern of the country is dominated by foodgrains which occupy larger proportion of the gross cropped area in comparison to non-foodgrains. But it has witnessed a marginal decline. The share of foodgrain in 1950-51 was 76.7 per cent which came down to 69.1 per cent of the gross cropped area in 1990-91.

The breakthrough in the foodgrain production has been achieved by the expansion of the irrigated area. Therefore, it is not the expansion of the net sown area which is responsible for higher agricultural production but it is the increase in

production per unit area which has contributed to it. The net area under irrigation has increased from 210 lakh hectares in 1950-51 to 474 lakh hectares in 1990-91. About 33 per cent of the net sown area in the country is irrigated. The increasing pressure of population on the arable land will necessitate the higher level of intensification of agriculture with the help of adequate inputs of irrigation, high yielding varieties of seeds and intensive use of fertilizers.

Water Resources

Water is an important natural resource. It is vital for increasing the agricultural production. It is also in great demand for domestic as well as industrial use. It is an important medium for generating cheap hydro-electric power. Water is a precious

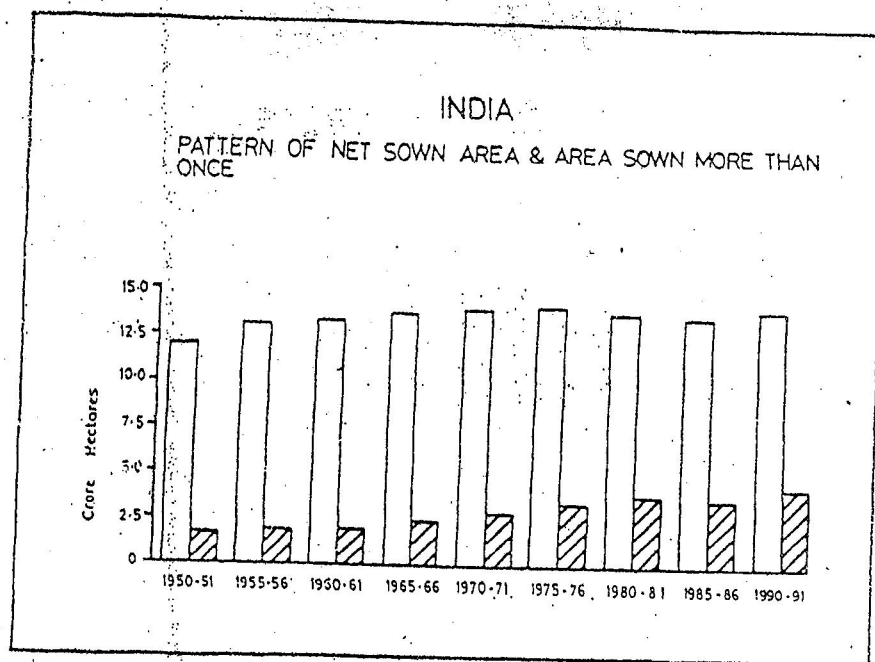


Fig. 1.2

and scarce resource which is indivisible and, therefore, its utilisation has to be planned for the basin as a whole. Water as a resource is not evenly distributed over space and time. Sometimes in the year, it is in plenty and sometimes it becomes scarce. In some areas of the country, it is abundantly found but in certain regions it is scarcely available. It is responsible for development in some regions but brings devastation in other areas. Looking at the importance of water as a resource the National Water Resources Council adopted the National Water Policy on 9 September 1987.

Rainfall in India is an important source of moisture supply to the plants and surface run off. A large proportion of the water resources of India

is located in those regions which lie in the zone having a mean annual rainfall of 100 cm. Rainfall is also the major source of the recharge of underground aquifers. The underground aquifers are generally brackish in the regions with scanty rainfall. For example, there are a number of areas in western Rajasthan where water from wells is very brackish. It cannot be used even for irrigation.

The other important source of water is the surface flow through rivers and water contained in lakes, tanks and reservoirs. Rivers and river valley have always attracted human habitations. Rivers are fed by rainfall as well as snow melt. This water is harnessed by damming the rivers and a number of multipurpose projects have been

REGIONAL DEVELOPMENT

launched since the independence of the country. Agriculture is a major claimant of water as the assured supply of water through irrigation reduces its dependence on rainfall which is highly variable and unreliable. The need for irrigation is more acutely felt in low rainfall areas of the country like Punjab, Haryana, Rajasthan, Gujarat, western Madhya Pradesh, eastern Maharashtra, Telangana and Rayalseema regions of Andhra Pradesh, and Karnatak Plateau.

The conventional unit for measuring water availability is hectare metre or cubic metre. If the water is allowed to stand up to the depth of one metre over one metre of level land, the total volume of water contained will be one cubic metre. Likewise if water is allowed to stand up to the depth of one meter over a level land of one hectare in area the total volume of water will thus be one hectare metre. On the basis of the normal flow of rivers in India, it has been estimated that water resources of about 16.7 crore hectare metres are available in the country. Of this, about 6.6 crore hectare metres can be used for irrigation. The major thrust in independent India was towards creating storage capacity of river water through various river valley projects. While the gross storage capacity of the reservoirs already existing in 1947 was about 14,000 million cubic metres, with the completion of the project the gross storage capacity of 190,000 million cubic metres is created. This would be about 27 per cent of the usable quantity of surface water resources in India. Why is the country not able to utilise all the usable water resources?

Ground water is another important source of water and is more ubiquitously available. This water is available through dug-wells, tube-wells and other devices of lifting water. It is estimated that about 333,000 million cubic metres of ground water is available in India. About 90 per cent of it is associated with the unconsolidated rock formations of North Indian Plains. It shows that the peninsular part of it is not well

placed as far as ground water resources are concerned.

A concerted effort has been made to utilise the water resources for agricultural purposes by developing the irrigation facilities since 1951 under different plan periods. The total irrigation potential created before 1951 was 226 lakh hectares which increased to 850 lakh hectares by 1993-94 registering an increase of about 375 per cent. It is being attempted to create irrigation potential of 1,130 lakh hectares by the year 2010. According to the statistics of 1990-91 for the country, only 33 per cent of the net sown area is irrigated. There are three major sources of irrigation in the country: canals, tanks and wells including tube-wells. Thirty-eight per cent of the net irrigated area is contributed by canals while the wells and tube-wells account for 48.3 per cent of the net irrigated area. Tanks, due to their limited capacity, account for only 7.24 per cent of the net irrigated area. Wells remain by far the most dominant source of irrigation in the country.

During the Fifth Five Year Plan, a centrally sponsored programme, known as Command Area Development Programme (CADP), was launched to ensure a faster realisation of the irrigation potential. There is a large spatial variation in the extent and intensity of irrigation in the country. While in Punjab, Haryana, western Uttar Pradesh, and delta areas in Andhra Pradesh and Tamil Nadu, the proportion of net irrigated area of net sown area is more than 60 per cent, there are areas like Rajasthan, Madhya Pradesh, Marathwada, Vidarbha, Rayalseema, and Karnataka where this share is very low. Ladakh district of Jammu and Kashmir is a cold desert and suffers from acute water shortage.

The supply of drinking water to rural and urban population is another important aspect of utilisation of water resources. Accelerated Rural Water Supply Programme (ARWSP) and National Mission on Drinking Water (NMDW) have been launched to achieve the goal of supplying drinking

water to all the villages in India.

There is a pressing need for conservation of water resources. The major task is to reduce the run off and evaporation losses. Over-irrigation leads to the deterioration of soils. Salinity and alkalinity are the outcomes of misuse of water. The sprinkler and drip irrigation may prove to be better techniques of applying water to crops. The effluents from settlements and industrial establishments form major pollutants of the water bodies. Recycling is essential to economise the water use. Flooding causes damage to life and property of people in about one-eighth area of the country which has been declared flood-prone. The

should be treated as one unit for planning the water utilisation. Water intensive crops should be avoided in dry areas to save them from waterlogging and salination. The methods of dry land farming should be experimented on the basis of the local conditions. The experimentation under the National Watershed Development Programme for Rainfed Agri-culture is being carried on from 1986-87.

Forest Resources

Forests are renewable resources and perform productive as well as protective functions. They provide industrial wood, timber, fuel wood, fodder and other minor products which have great economic value. Forests also perform protective function by reducing soil erosion, regulating the channel flow of water, controlling floods and enriching genetic reserve of flora and fauna. Forests play a major role in improving the quality of environment. The National Forest Policy, 1988 has rightly laid emphasis on the role of forests in maintaining life support system. Its one of the stated objectives is ".....to ensure environmental stability and maintenance of ecological balance including atmospheric equilibrium which are vital for sustenance of all life forms—human, animal and plants. The derivation of direct economic benefit must be subordinated to this principal

aim".

The country has an area of 747 lakh hectares notified as forest but there is no agreement between different sources giving out forest statistics. Out of this notified forest area about 51 per cent is classified as reserved, 29 per cent as protected and 12 per cent as unclassified forests. About 7 per cent of this area has been classified as 'other forest'. According to the data of 1991-92, about 22.3 per cent of the reporting area of the country was under 'forests'. The declared aim in different policy documents is to achieve a forest cover of 33 per cent of the total area of the country, of which 60 per cent should be maintained in hilly areas and about 20 per cent in the plain areas. It is evident from Fig. 1.1 showing land use that area under forests has increased from 14.2 per cent in 1950-51 to 22.3 per cent in 1991-92. The state forest departments claim that 23 per cent of the total geographical area of the country is classified as forest. This shows the presence of an area of 7.5 crore hectares of forests. But according to the National Remote Sensing Agency, there was an area of 5.5 crore hectares under forests during 1972-75 mapping cycle which declined to 4.6 crore hectares during 1980-82 mapping cycle.

The latitudinal extent of India has ensured a great variety of vegetation types from south to north and west to east. There is also great regional diversity in the foliage cover. Thus the area under forest loses meaning as one hectare of forest in Rajasthan is not comparable to one hectare of forest in Assam, Kerala or Kashmir. The western flanks of Western Ghats which is rainier has evergreen forests. These have also suffered over-utilisation. Kerala and Assam have tropical wet evergreen forests. In the drier parts of central India, Gujarat and Rajasthan, the vegetal cover comprises tropical deciduous trees to thorny bushes. There is altitudinal change in vegetation in the Himalayas. While the valley bottom has broad-leaved deciduous trees, the conifers extend

towards the higher slopes. Generally, thick forest cover is either confined to inaccessible areas or in the areas of low density of population in the country. The monsoon forests, comprising tropical deciduous vegetation, extend between the rainfall zone of 100 cm and 200 cm. They have some of the economically valuable tree species. The North Indian Plains extending from Punjab to West Bengal are devoid of forest cover due to higher pressure of population and extension of cultivated land. The higher altitudes in Uttar Pradesh, Himachal Pradesh, and Jammu and Kashmir are the main regions growing conifers particularly deodar, pines and firs. Broad-leaved sal and teak trees provide valuable timber. These species occur in terais of the Himalaya and Assam, Karnataka has sandalwood forests. The mangrove forests are found along the coasts abounding in delta areas. Sunderbans are known for *sundari* trees.

In view of the competition for land for different uses, the conservation of forests is essential for ecological security fuel, fodder and timber needs of the people and the requirements of the raw material for village, small scale and large scale forest-based industries. Besides the afforestation programmes of the forest departments, the social forestry, farm forestry and production forestry programmes have been introduced to enhance the area under forest cover. 16.55 lakh hectares of area was planted under social forestry during 1980-85 while 378.5 crore saplings were supplied for farm forestry. But the impact of these programmes will be reflected through the survival rate of the plants. The people are becoming aware about the conservation needs of the forests. Movements like 'Chipko' launched by non-governmental organisations (NGOs) have not only created awareness but are also encouraged active participation of the masses in the conservation work. The National Forest Policy, 1988 envisages to associate tribals and other people living in the vicinity of forests with

the process of protection, regeneration and development of forests.

Livestock and Grasslands

Animal husbandry is an auxiliary activity of the Indian agriculture. The Indian farmer, in all parts of the country, depends on animals for draught power. Animals provide the much-needed manure. The milch animals are reared to provide additional income to the household. Animals have always been treated as wealth in the Indian society as some of them are referred to as *godhan* (cow wealth), *gaj-dhan* (elephant wealth) and *vaji-dhan* (horse wealth). Our dependence on animals for various operations in agriculture has led to our reverence to them.

According to the quinquennial livestock census, 1987, India has a total number of 4,284 lakh livestock of which 45.7 per cent are cattle. Our cattle is of poor quality in terms of stamina for draught and milk-yield, but their sheer number is indicative of their importance. India is the home of some important cattle breeds, for example, *Kankrej*, *Rathi*, *Sahiwal*, *Gir*, *Tharparkar* and *Kangayam*. *Nagori* breed is famous for draught cattle. Better breeds of cattle are found in low rainfall areas of Rajasthan, Punjab, Haryana, Gujarat, Andhra Pradesh, Karnataka, and Tamil Nadu.

Buffaloes are important milch animals in India. They accounted for 17.42 per cent of the total livestock population in 1987. Seventy-five per cent of the total buffalo population consists of females which shows that these are reared for milk. They are also used for draught in humid and high rainfall regions of West Bengal, Assam, Orissa, and Kerala and are used to plough the flooded fields. Haryana and Punjab are well-known for their Murrah breed of buffaloes. The areas with high rainfall and rice as dominant crop, have higher proportion of male buffalo population.

10.46 per cent of the livestock in India

comprises of sheep, which are reared for meat as well as wool. India produced 4.1 crore kg of wool in 1991-92. Sheep are more numerous in Andhra Pradesh and Tamil Nadu but their wool is short-stapled and inferior to the wool found from the sheep reared in north-western India. Marwari breed of sheep found in Rajasthan gives good quality of wool. Sheep flocks are also reared by the nomadic graziers in the Himalayas such as Bakerwals of Jammu and Kashmir and Gaddis of Himachal Pradesh. In order to improve the breeds of sheep, the Central Sheep Breeding Farm has been established in Hissar.

Goats are found in larger number as compared to sheep and accounted for 23.2 per cent of the total livestock of the country in 1987. Goat is a poor man's cow. They are found in larger numbers in the North Indian Plains and the hills. Their numbers have sharply increased from 646 lakh in 1966 to 994 lakh in 1987. The sheep and goats provide ready cash to the shepherds as they can be sold at the time of need. As such the shepherds like to increase the size of their flock which in turn puts pressure on the pastures and grazing lands.

There are some animals which are used as beasts of burden in specific regions. Horses, ponies and mules are used in hilly terrain for carrying human beings and material. Camels are the main beasts of burden in arid and semi-arid regions. Yaks are used in Ladakh and Himachal Pradesh.

The quality of animals in India is poor. There are surplus animals which are not productive and put strain on the available fodder resources. The number of animals, however, increases not only due to economic reasons but also due to socio-cultural reasons. Animals give social status to the owner as they form his/her wealth. In India, permanent pastures and grazing lands account for 3.9 per cent of the reporting area of the country. If the fallow lands and culturable waste lands are also included in the pasture area, it covers about

16.5 per cent. The seasonal variations in moisture conditions cause variations in grass cover and carrying capacity of the pasture lands. Crops-residue is an important animal feed. The milch animals are given rich diet in the form of concentrates, oil cakes and grains. Farmers also augment the fodder supply by growing fodder crops like *burseem*, *jowar* and *bajra*. Seven regional stations have been established in different agro-climatic zones for making available the scientific fodder production technology available to people. They are located at Hissar (Haryana), Kalyani (West Bengal), Gandhi Nagar (Gujarat), Alamadi (Tamil Nadu), Hyderabad (Andhra Pradesh), Suratgarh (Rajasthan), and Shehama (Jammu and Kashmir).

In order to give impetus to dairy development, Operation Flood-I was initiated in July 1970. Operation Flood-II was started in April 1981 and it continued till March 1985. Operation Flood-III is in operation now. The Operation Flood is an integrated dairy development programme based on milk cooperatives. Its major objective is to provide remunerative price to the rural milk producers by linking the consuming areas like towns. This is one of the strategies of rural development also.

Fisheries and Marine Resources

Fish is a protein-rich food. Fishery helps in augmenting food resources and provides employment to people. It is one of the oldest occupations of human beings. While other forms of hunting as occupation are not prevalent in substantially large parts of the earth, fishing has not only survived but has been modernised. India has a long coastline of about 7,517 kilometres. There are numerous water bodies like tanks, reservoirs, rivers and lakes, etc. in the country. Fisheries in India are confined to the coastal areas but a substantial proportion of the total catch comes from the inland fishing. Though the development of fisheries in India cannot be

NATURAL RESOURCES OF INDIA

compared with that of Japan or Norway but it has shown significant growth over time. In 1950-51 the total fish catch was 7.52 lakh tonnes. Of this 5.34 lakh tonnes of fish were caught from the ocean and 2.18 lakh tonnes from inland water bodies. It has increased to 43.65 lakh tonnes in 1992-93. Of this marine fish accounted for 25.76 lakh tonnes and inland fish for 17.89 lakh tonnes. It shows an increase of four times in the total catch. India has four major fishing harbours, viz. Kochi, Chennai, Vishakhapatnam and Roychowk. Besides these, 16 minor fishing harbours and 82 fish landing centres have been constructed in order to augment the fish catches. The Brackish Water Aquaculture Scheme was launched for the development of brackish water fish and prawns. India has an area of 9.02 lakh hectares of brackish water area and 20.2 lakh sq km of Exclusive Economic Zone (EEZ). It shows a large potential of marine fisheries. The Integrated Fisheries Project envisages the popularisation of unconventional varieties of fish.

The other marine resource include oil and natural gas, sea weeds, salts and mineral resources. India has already started drilling oil from the continental shelf. 'Sagar Samrat' has been drilling oil from the Bombay High. India has also obtained permission to mine manganese nodules from an area of 15,000 sq km in the Indian Ocean. The oceans are the storehouses of resources for future.

Energy Resources

Energy is an important input to accelerate the process of production and thus leading to economic development. India lags far behind the world's per capita consumption of commercial energy, as it accounts for only one-eighth. Commercial energy obtained from coal, oil and electricity accounts for a little over 50 per cent of the total energy used in India. Other half is obtained from non-commercial energy resources like cowdung, fuel wood and crop by-products used as fuel. In order to overcome the energy crisis, attempts are being made for the development and promotion of non-conventional sources of energy such as solar, wind, bio-energy, etc. The major sectors using commercial energy are household, agriculture, industry and transport. Other sectors are minor. Table 1.1 represents the pattern of consumption of commercial energy in India over time.

Table 1.1 shows that the share of agriculture in using commercial energy has increased sharply over the last 30 years. The share of agriculture in the consumption of commercial energy has increased from 3.6 per cent in 1960-61 to 9.6 per cent in 1990-91. Industry and transport continue to remain major sectors to consume large proportion of commercial energy and together accounted for 74.9 per cent of the total commercial energy consumption during 1990-91. The major energy resources are coal, mineral oil and electricity.

TABLE 1.1
Pattern of Commercial Energy Consumption

Sectors	Commercial energy consumption (in per cent)		
	1960-61	1980-81	1990-91
Household			
Agriculture	20.6	12.3	17.8
Industry	3.6	6.1	9.6
Transport	39.2	51.0	50.1
Others	33.8	22.3	24.3
	2.8	1.1	2.3

Source: Eighth Five Year Plan, 1992-97, Vol. 2, Planning Commission, Government of India, p. 162

Coal

Coal as a source of power contributes maximum to industries as fuel. In view of the fact that our mineral oil resources are scarce, coal will continue to remain a major source of power. Its convertibility into other forms of energy like electricity, gas and oil provides it an added advantage.

According to the estimates of the Geological Survey of India, the coal reserves of India, up to January 1989, are 17,633.04 crore tonnes. Fig. 1.3 provides an idea of the spatial pattern of the coal reserves up to January 1989.

The largest reserve of coal is found in Bihar which accounts for about 33.22 per cent of the total coal reserve in India, followed by Orissa accounting for 23.85 per cent. Bihar, Orissa, West Bengal and Madhya Pradesh together accounts for 90.17 per cent of the total coal reserves of India.

The major coalfields in India are Jharia, Raniganj, east and west Bokaro, Karanpura, Pench-Kanhan, Tawa Valley, Singrauli, Talcher, Chanda-Wardha, and Godavari Valley.

India's coal production has been 25.3 crore tonnes in 1992-93 excluding 107 lakh tonnes of lignite. Bihar is the major producer of coal in the country. The coal production has gone up by five times from 1951 when the total production was 3.5 crore tonnes. It has witnessed 7 fold increase in 1992-93. Coal production in India is managed by Coal India Ltd. through its seven companies.

Power generation is a major sector consuming coal followed by steel, cement and fertilizer industries. The demand for coal from railways has diminished because of dieselisation and electrification of engines.

Coal mining faces a number of hazards such as collapse of the roof of the mines, flooding, occurrence of poisonous gases, and lack of oxygen and light.

Oil and Natural Gas

The area having the possibilities of oil extends

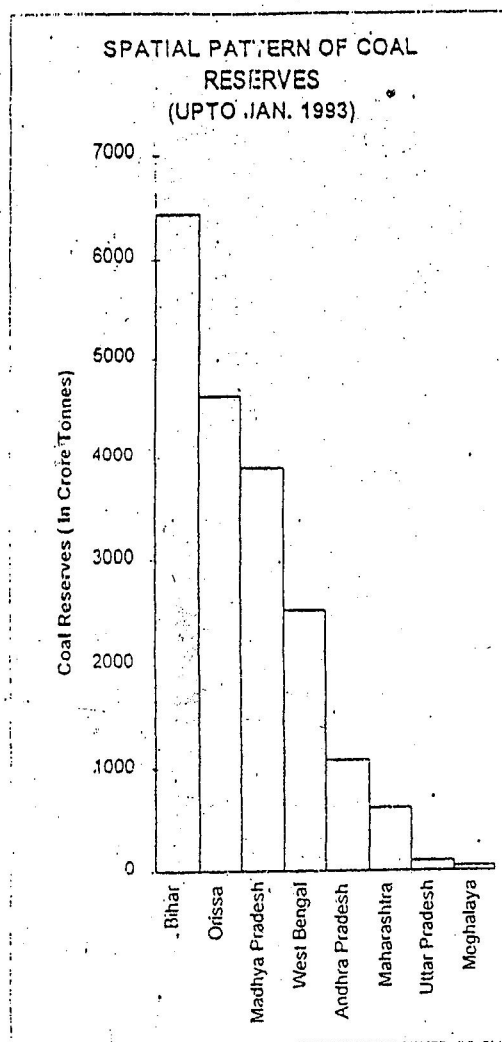


Fig. 1.3

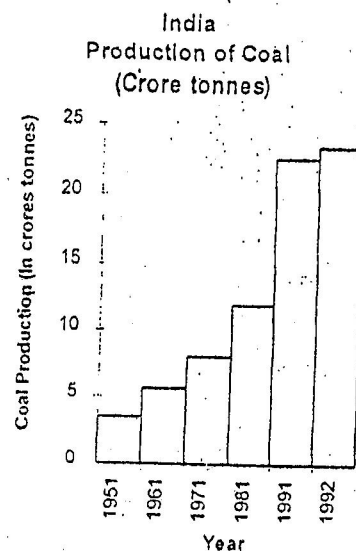


Fig. 1.4

over 17.2 lakh sq km. Of this total sedimentary basin area 3 lakh 20 thousand is an offshore area found up to a depth of 200 metres. There are 13 important basins bearing oil strata which can be put in three categories. Cambay basin, upper Assam and Mumbai offshore basin are petroferous basins from where commercial production is being taken. Rajasthan, Kaveri-Krishna-Godavari basin, Andaman, Bengal Himalayan foothills, Ganga-valley, and Tripura-Nagaland fold belt are known to have petroleum-bearing strata but commercial production from these regions has not been started. Kachchh-Saurashtra, Kerala-Konkan and Mahanadi have geological structures favouring occurrence of petroleum hence these basins are considered to be prospective regions.

The production of petroleum in the country has lagged far behind the consumption. In 1950-51 the total crude available was 2.5 lakh tonnes while the consumption of petroleum products was 3.4 lakh tonnes. In 1992-93 crude

oil production has gone up to 2.69 crore tonnes registering an increase of 2.66 crore tonnes over 1950-51. The consumption level has also gone up to 4.35 crore tonnes leaving a gap of 1.66 crore tonnes between production and consumption. The country had to import 407 lakh tonnes of crude oil and petroleum products to meet the consumption needs during 1992-93.

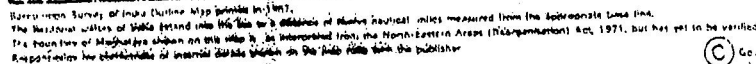
The oil refining is done in 12 refineries in India (see Fig. 1.5) with an aggregate refining capacity of 514.2 lakh tonnes per annum during 1991-92. Besides these 12 refineries, proposals for setting up refineries at Karnal (Haryana) and Mangalore are afoot. The refining capacity has been utilised to the extent of 95.8 per cent.

Natural gas has emerged as a dynamic source of energy. Large reserves have been identified in south basin off west coast of India. Natural gas is being obtained from Nada in Cambay basin, Kaveri offshore and Tanot in Jaisalmer district. India recorded a total production of 187 crore cubic metres of gas in 1990-91 as against 170 crore cubic metres during 1989-90. This means that the production has increased by 17 crore cubic metres during the period. The HBJ (Hazira-Bijapur-Jagdishpur) pipeline is a big venture of transporting gas through pipeline. Gas has significantly contributed to the household fuel supply.

Hydro-Electricity

India has vast possibilities of generating electric power which is a versatile energy source. Its transmission is conveniently done. It is a cleaner form of energy. It has an important role to play both in industry as well as agriculture. Electricity can be generated from coal, gas, oil, water and nuclear fuel.

Hydro-electric power (HEP) is the cheapest power amongst all the above-mentioned sources. It requires a perennial flow of large volume of water, falling from a height, occurring naturally or obtained by damming the river by diverting the



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Regineries :

Nuclear Power

The basic minerals used in generating nuclear

Sunlight is abundantly found in all parts of our country except in the northern hilly region. The technology for generating low grade thermal energy for cooking, water-heating, space-heating, etc. has already been developed in our country. According to the data available up to April 1988,

over 92,000 solar cookers were in use in the country as a whole. About 11,000 solar photovoltaic lights, 800 solar photovoltaic water pumping systems and 200 domestic lighting systems have also been installed in the country. A five kilowatt power plant based on geothermal energy has been established at Manikaran in Himachal Pradesh. The wind energy is being harnessed in Tamil Nadu, Orissa, Gujarat, and Maharashtra. The Indian Renewable Energy Development Agency Ltd., established in 1987, has been assigned the task of developing proper technology for generation and conservation of energy from non-conventional sources.

The main limitation in the large-scale utilisation of renewable energy system is their high capital costs in the initial stages. There are certain social and cultural inhibitions also in adopting a different type of energy source. The rural people still cannot think of using biogas from the human excreta-linked biogas plants. If this biogas is acceptable, villages will be clean, sanitation will improve, problem of scavengers will be solved and thus the quality of the environment will be upgraded. The cooperative efforts for developing community biogas plant require group action.

While India has witnessed substantial increase in generation of energy it lags far behind in the per capita consumption of energy. In 1965, per capita energy consumption was 100 kg of oil equivalents which increased to 235 kg of oil equivalents in 1992. The per capita energy consumption in 1992 for UK, USA, and Japan was 3743, 7662 and 3586 kg of oil equivalents, respectively. What are the main reasons for such a low energy consumption in India?

Mineral Resources

Mineral resources are the natural means of production which are used in many industries as raw materials. Iron ore, manganese, bauxite, copper, etc. are such minerals. Minerals are of two types: metallic and non-metallic. Iron ore and

copper are metallic minerals while limestone and dolomite are non-metallic minerals. Metallic minerals are further sub-divided into ferrous and non-ferrous mineral. Those metallic minerals, which have iron content belong to ferrous group. The metallic minerals belonging to non-ferrous group do not have iron content. Most of the minerals have certain unique characteristics. Distribution of minerals on the surface of the earth in some regions have large deposits of certain minerals, while the others do not have any deposit. Most of the minerals are exhaustible because they take very long time in their formation. The quality and the quantity of minerals is inversely related. Good quality minerals are found in smaller quantity.

India is well endowed in many minerals. In 1987 the total value of minerals was Rs 11,363.4 crores, as against the total value of 82.3 crores in 1950. Though some of the increase in value of output of minerals can be ascribed to increase in prices, there has been substantial increase in the quantity also. India is rich in ferrous metals but its reserves of non-ferrous metals are poor. Large size and diverse geological formations have favoured India in providing wider variety of minerals. The high rainfall areas of India lack in limestone, gypsum and salts which are soluble. The northern plains of India have thick layers of alluvium which has completely concealed the bedrocks. This region of the country is poor in mineral resources. The Himalayas have a variety of rocks but its geological structure is too complex. The exploitation of minerals in this mountainous terrain is not economically viable not only due to small quantity available at any one location but also due to difficulty in transportation, sparse population and adverse climatic conditions. It is, thus, evident that our rich mineralised zone with relatively sizeable quantity is confined to the old, crystalline rock structures of plateaus and low hills of peninsular India.

India is rich in iron ore, manganese, mica and

bauxite. It is self-sufficient in materials for making cement such as dolomite and limestone; chromite, marble and other building stones, sodium salts and precious stones. On the basis of the existing level of knowledge of occurrence, India is deficient in copper, lead, zinc, tin, nickel, and tungsten. The demand for these minerals is met by importing them from other countries.

Iron ore is an important raw material of our basic industry. India has an estimated reserve of 1916.6 crore tonnes of iron ore which accounts for about 20 per cent of the total reserves of the world. Thus, India occupies the second place after former USSR in iron ore reserves. Out of this reserve about 68.17 per cent is haematite and the rest is magnetite. Find out other types of iron ores.

The iron ore is mainly distributed on the peninsular part of India. There are a few distinct belts of iron ore. The Bihar-Orissa belt comprising of Gurumahisani, Badampahar and the Barajamda group of mines is an important iron ore-bearing belt. The other belt is located in Madhya Pradesh and Maharashtra. It is the Bastar-Durg-Chandrapur belt containing Bailadila iron ores of Bastar, Dalli Rajhara in Durg and Lohara-Pipalgaon and Surajgarh deposits in eastern Maharashtra. This third important belt is located in Karnataka and the important mines are located in Bellary-Chitradurga-Tumkur-Chikmagalur districts. Iron ore also occurs in Goa and Ratnagiri district of Maharashtra, Dharwar and Cuddapah systems of the peninsular India have magnetite iron ore. Kudremukh deposits of Karnataka are important ones. The iron ore deposits occur in Salem and North Arcot and Tiruchirappalli districts of Tamil Nadu and Kozhikode district of Kerala.

India produced 4.2 crore tonnes of iron ore in 1981 which increased to 5.8 crore tonnes in 1992. The production of iron ore has shown a marginal decrease in 1987 and 1988 with 5.1 and 4.9 crore tonnes, respectively. But it is a substantial increase from 1951 when India

produced 0.37 crore tonnes of iron ore. There is a great demand of iron ore in our own expanding iron and steel industry. India has also been exporting iron ore to other countries in order to earn foreign exchange. Major ports handling iron ore export are Vishakhapatnam, Paradip, Marmagao and Mangalore.

Manganese is an important mineral which is used in making iron and steel and it acts as basic raw material for manufacturing its alloy. According to the estimates of 1983, the total manganese reserves of India are 15.8 crore tonnes. India produced 18.67 lakh tonnes of manganese in 1992. Rich deposits of manganese ore are found in Andhra Pradesh, Goa, Gujarat, Karnataka, Madhya Pradesh, Tamil Nadu, Bihar, Orissa, and Rajasthan.

In Orissa, manganese is obtained from Gondite deposits in Sundargarh and Kendujhar districts and Kodurite and Khondolite deposits in Kalahandi and Koraput districts. Manganese is also mined from the lateritic deposits in Bolangir and Sambalpur districts. In Bihar the manganese deposits occur in Singhbhum district. The manganese belt of Madhya Pradesh and Maharashtra is interlinked with each other. This belt comprises of Balaghat and Chindwara districts of Madhya Pradesh and Nagpur and Bhandara district of Maharashtra. Low grade ores are found in Bilaspur (Madhya Pradesh) and Ratnagiri district (Maharashtra). In Andhra Pradesh, manganese is found in a belt extending between Srikakulam and Vishakhapatnam districts. The principal deposits of manganese in Karnataka occur in North Kanara, Shimoga, Bellary, Chitradurga and Tumkur districts. Other producers are Goa, Panchmahal and Vadodara districts of Gujarat and Banswara district of Rajasthan.

About 13 lakh tonnes of manganese was produced in 1986 and the same trend continued till 1992. In 1992, Orissa produced 6.7 lakh tonnes of manganese which is 35.7 per cent of the total

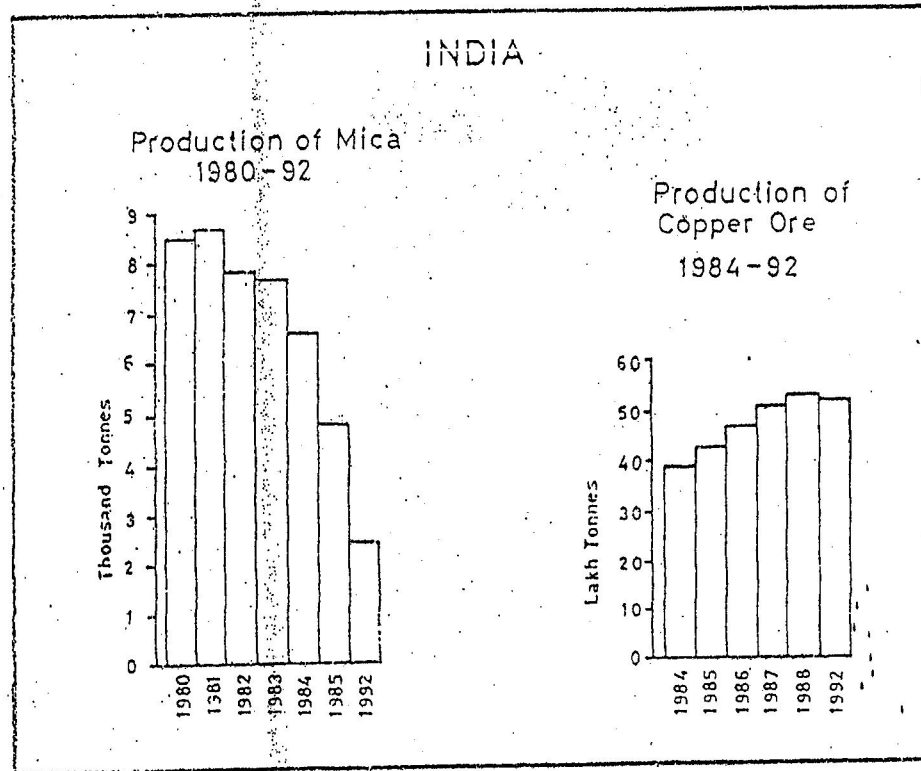


Fig. 1.6

production of the country. Madhya Pradesh and Maharashtra belt produced about 36.9 per cent of the total production of manganese in the country. Thus, about 72.6 per cent of the total production of manganese in the country is contributed by Orissa, Madhya Pradesh, and Maharashtra. The major internal demand for manganese comes from ferro-manganese, iron and steel, dry battery and chemical industry. The three-fourths of the total production of manganese in India was consumed internally in 1992 and about

one-fourth was exported to Japan, France, United Kingdom, Norway and Sweden, etc.

In India, mica has been used since ancient times as a medicinal item in Ayurveda and is known as *abhrak*. With the development of electrical industry, mica found new vistas of use. Its insulating properties have made it a valuable mineral in electrical and electronic industry. It can withstand high voltage and has low power loss factor. The three major types of mica found in India are: muscovite, phlogopite and biotite. Most

of the mica is produced in Bihar, Andhra Pradesh, and Rajasthan. In Bihar, mica is found in a belt extending for about 150 km in length and 32 km in width from Gaya to Hazaribagh districts. Koderma is a well-known place for mica production in Bihar which produces more than 50 per cent of the total mica production in India. In Andhra Pradesh, Nellore in Gudur district is an important area for mica-mining. The important mica-producing areas in Rajasthan are Beawar-Ajmer belt in Ajmer district, Bhilwara belt, Dungarpur-Banswara belt, Tonk belt and Kaunthal belt in Udaipur district. Some mica is produced in Maharashtra, Karnataka, Kerala, and Tamil Nadu.

The production of mica has shown a declining trend in India in 1970s and 1990s. From a total production of 9,494 tonnes in 1976, it has come down to 2,507 tonnes in 1992. This decrease is the result of the fall in its demand in the international market. Earlier there was no substitute for mica. Now materials like plastics and synthetics have been developed which can be used as substitutes for mica.

Bauxite is the raw material for making aluminium. It is not a specific mineral but a rock consisting mainly of hydrated aluminium oxides. It is a clay-like substance which is pinkish, whitish or reddish in colour depending on the amount of iron content. It is estimated that India has a total reserve of 23.2 crore tonnes of bauxite. The major bauxite-producing states in India are Madhya Pradesh, Bihar, Gujarat, Maharashtra, Karnataka, Tamil Nadu, Uttar Pradesh, and Goa in a descending order of importance. Anarkantak plateau area in Shahdol district, Maikal hills in Durg, Mandala and Balaghat districts, plateau region of Sarguja, Raigarh, Bilaspur and Katni area of Jabalpur are major bauxite-producing areas in Madhya Pradesh. The major bauxite reserves in Bihar lie in Ranchi and Palamau districts. Jamnagar, Kaira, Sabarkantha, Kachchh and Surat are the bauxite-producing districts of

Gujarat. Exploitation of bauxite in Maharashtra started late. It started first in Thana district but now it is mined in Kolaba, Ratnagiri and Kolhapur districts. The principal deposits of bauxite in Karnataka occur in Belgaum district. Bauxite deposits also occur in Nilgiris, Salem, Madurai and Coimbatore districts of Tamil Nadu. Some deposits are found in the Banda district of Uttar Pradesh. High grade bauxite ore is found in Punch and Udhampur districts of Jammu and Kashmir. Some bauxite deposits also occur in Orissa, Andhra Pradesh, and Kerala.

The production of bauxite has increased from 68,120 tonnes in 1951 to 5,078 thousand tonnes in 1992. Orissa is the largest producer of bauxite in the country and contributes about 44.8 per cent of the total bauxite production in the country followed by Bihar with 21.9 per cent. Gujarat's share is 11.1 per cent and Maharashtra produces 10.9 per cent of the total production in India. Italy was previously the main importer of Indian bauxite but now the United Arab Emirates and Saudi Arabia have emerged as major importers. The major internal demand for bauxite comes from aluminium refractory and chemical industries. Bauxite has to be transported to the site of the aluminium industry which is generally located near the power plants as it is highly power intensive industry.

Copper is a malleable and ductile metal. It is a non-ferrous metal. India is deficient in copper or deposits. The estimated reserves of copper ore in India are about 57.8 crore tonnes with a metal content of about 64 lakh tonnes. Singhbhum district of Bihar is leading copper ore-producing area. Besides, Santhal Parganas, Hazaribagh, Palamau, and Gaya also have some copper ore deposits. In Rajasthan, copper occurs in an extensive zone in Khetri running from Singhana belt in Jhunjhunu Kho-Dariba area in Alwar, Delwara-Keroli area in Udaipur and Aguncha-Rampura in Bhilwara district. Balaghat is an important copper ore-producing district of

Madhya Pradesh, Khamman, Guntur and Kurnool districts in Andhra Pradesh, Chitradurg and Hassan districts in Karnataka and Chandrapur district in Maharashtra also have copper ore deposits.

The copper ore production has shown a steadily increasing trend. From a mere 3,74,000 tonnes in 1951, it has increased to 52.1 lakh tonnes in 1992. The mining and smelting of copper ore is managed by Hindustan Copper Limited which is a public undertaking.

Gold is a valuable metal which occurs in auriferous lodes and some of it is found in the sands of several rivers. In India the total gold ore reserves are estimated to be 148.5 lakh tonnes with a total gold content of 81.06 thousand kilograms. Karnataka is the leading producer of gold. Kolar goldfields are well known. Hutti goldfield is located in Raichur district of Karnataka, Ramgiri and Yeppamanna goldfields are located in Anantapur district of Rayalseema region of Andhra Pradesh. India produced 1,865 kg of gold in 1992. It has shown a fluctuating trend over time.

The other important non-ferrous metallic minerals are lead, zinc and silver. The total reserves of lead and zinc have been estimated to be 35.85 crore tonnes. In terms of metal content, the total reserve of lead is 0.5 crore tonnes and, of zinc 1.6 crore tonnes. Rajasthan is the leading producer of lead and zinc. Zawar mines in Udaipur district are the most important mines of the country. Cuddapah district of Andhra Pradesh, Banas Kantha, Vadodara, Surat and Panchmahals in Gujarat. Meghalaya and Sikkim are the other area of lead and zinc deposits.

India recorded a total production of about 40 thousand tonnes of lead concentrate and 3.0 lakh tonnes of zinc concentrate in 1992. Our country is deficient in lead and zinc. This deficiency is met through imports from Australia and Canada.

Silver is obtained from the lead and zinc ores of Zawar mines in Udaipur and Aguncha-Rampura in Bhilwara district of Rajasthan.

India produced 46.5 thousand kilogram of silver in 1992.

Salt is an important mineral which is used in chemical industry. Sodium chloride, known as common salt, is edible and is consumed as food item. Salt is obtained from sea water, brine springs, wells and salt pans in lakes of arid regions of Rajasthan. Rock salts are taken out in Gujarat and Mandi area in Himachal Pradesh. Sea brine is the source of salt in Maharashtra, Gujarat, and Tamil Nadu. The important areas of salt production in Rajasthan are Sambhar, Didwana, and Pachpadra.

In your atlas, look at the map showing the occurrence of important minerals in India. Identify the major mineral zones. Describe the major characteristics of the distribution of minerals as inferred from the map.

Conservation of Natural Resources

The natural resources are a common heritage which we have shared with the past generations and our future generation will be inheriting these resources from us. Our greed for resources and our tremendous technological capacity to exploit them at a much larger scale has created a situation where we have started withdrawing from the future stocks. The pace with which the exploitation of resources is going on may lead to exhaustion of some resources. Therefore, conservation of resources is necessary for ensuring continuity of the ongoing process of economic development.

India is an agricultural country. The conservation of soil and water is essential for increasing agriculture output. The continuous use of soil results in depletion of its productivity. The erosion is a serious hazard which removes the soil cover itself. The soil conservation strategy has to be two-fold. Use of manures and bio-chemical fertilizer, scientific rotation of crops, and fallowing are some of the methods which are essential for maintaining the soil productivity. It

is also important to check the removal of soil cover by running water or wind. The erosion hazards are more severe in hilly areas and arid regions. Some regions with clay topography are also prone to erosion. The soil erosion, in the hilly area is checked by terracing, contour ploughing and plugging the gullies. The afforestation also plays a very important role in checking the soil erosion on slopes. Planting of shelter belts, stubble-mulching, controlling overgrazing, etc. are some of the methods used for reducing soil erosion in arid areas.

Water is a cyclic resource which can be used again and again after cleaning it. A very important step in conserving water is its judicious use. Water management in irrigation system may play a crucial role in its conservation. Over-irrigation through canals has led to waterlogging in western Uttar Pradesh, Punjab and Hirakud command area. The overdraft by tube-wells has resulted in lowering of water table in a number of villages in Haryana and western Uttar Pradesh. In arid areas, wherever water has been brought for irrigation, saline and alkaline tracts have emerged, rendering the solid infertile. Wasteful use of water should be checked. Though water is an ubiquitous resource, it is not available in adequate quantity everywhere. Many villages in India do not have potable drinking water. The regulation of industrial discharge in water bodies is essential to conserve water and reduce its wastage.

Depletion of forests by over-utilisation has a chain reaction in the ecosystem. Deforestation accelerates soil erosion. It also adversely affects the subterranean flow of water. Though it is a renewable resource, it takes time to regenerate. The substitute of timber may reduce the pressure of demand of forests. Lot of emphasis is being laid on social forestry and farm forestry to ensure fodder and fuel supply to the rural community. Afforestation on slopes is an effective method of

soil conservation and regulation of channel flow. It also checks the severity of flooding. The disappearance of forests means disappearance of wild life as well as of many wild varieties of plants, which leads to serious deterioration of genetic reserve.

Mineral resources are exhaustible resources. Their exploitation has been accelerated with the sophistication in mining technology. Can we think of a situation when there will be no minerals? What would be the consequences? In India, a number of minerals are exported to earn foreign exchange. The larger the need of foreign exchange, the higher will be the rate of exploitation of particular mineral. Mineral resources may be conserved by bringing in the efficiency in mining technology as well as in the technology of beneficiation. Recycling of some of the metals like iron, aluminium, copper and tin, etc. may help in reducing the waste. Japan presents an appropriate example of purchasing scrap iron and recycling it for her iron and steel industry. It is said that resources saved are resources created. The scarce minerals may be saved by substituting them by other similar minerals which are found in abundance. For example, aluminium is being extensively used in electrical industry in place of copper. Diesel engines, for example, in Indian Railways are progressively being replaced with electric engines. Electricity, thus, has helped in saving oil as well as coal. Likewise, the development of non-conventional energy resources will lead to the conservation of coal, oil as well as wood. Synthetic products may help in reducing the pressure on natural means of production. This calls for development of technology through extensive research and development programmes. The survival of our material-based civilization will depend on our capacity to preserve nature and conserve our resources.

EXERCISES

Review Questions

- Answer the following questions in brief:
 - "Concept of natural resources is culture bound." Discuss.
 - Identify three reasons for the disappearance of forests from the Northern Plains of India.
 - Why are the oil resources of India located on the eastern and the western margins of the peninsular region?
 - What do you mean by 'Mumbai High' and 'Sagar Samrat'?
 - What are the major land use categories according to our revenue records?
 - What are the major uses of copper and aluminium?
 - What are the hazards and disadvantages of nuclear energy?
 - Why is conservation of natural resources necessary?
- Distinguish between:
 - Ferrous and non-ferrous minerals
 - Metallic and non-metallic minerals
 - Natural means of subsistence and natural means of production
 - Net sown area and gross cropped area
 - Fresh water and deep sea fisheries
 - Sea salt and rock salt
 - Current and old fallow lands
- Why is the irrigation essential for increasing agricultural productivity in India? Mention a few favourable and non-favourable conditions of developing irrigation in India.
- "India is not poor in natural resources but poor in technology." Comment.
- Discuss the favourable conditions for the development of HEP in India giving suitable examples.
- Discuss the trends in production of petroleum in India.
- Give reasons:
 - India has a long coastline, yet she has not been able to develop fisheries
 - India has a very large bovine population but its productivity is low
 - India has vast net sown area but the area sown more than once is very limited
 - Western part of India is drought-prone while eastern part is flood-prone
- Give one technical term for each of the following:
 - Energy obtained by splitting the atom under controlled conditions
 - Energy generated by turbines through falling water
 - Gross cropped area divided by net sown area
 - Gross irrigated area divided by net irrigated area
 - The total volume of water standing to a depth of one metre over an area of one hectare

Activities

- Organise a class debate on 'conservation of natural resources is essential for human civilization'

- On a map of India show the following:
 - Areas of iron and coal mining
 - Iron and steel plants
 - Oil refineries and HBJ pipeline
 - Nuclear power station
 - Lead, zinc and copper deposits
- Collect the following data from the latest Statistical Abstract of India available to you and represent them on graph. Also interpret each graph:
 - Productions of coal in the last 5 years
 - Installed capacity of the generation of electricity for the last 10 years
 - Production of iron ore in the last 10 years

CHAPTER 2

Main Features of Agriculture

IN INDIA, agriculture has experienced substantial change and recorded appreciable development in the level of production, productivity, cropping pattern and input-use. India has a vast land area, high percentage of cultivable land, rich soils, wide climatic range and a long growing season. The environmental factors provide a wide agronomic range where a variety of crops comprising cereals, pulses, oil-seeds, and industrial crops like tea, jute, cotton and sugarcane can be grown. Agriculture provides work to about 70 per cent of the total work-force and contributes about 35 per cent of the net national product. It also contributes a sizeable share of the country's total exports. Agricultural production provides the base for the development of other sectors. As such, a prosperous agricultural sector, ensuring higher purchasing power in the rural areas, generates demand for industrial goods. On the other hand, any depression in the agricultural sector lowers the purchasing power in the rural areas and in turn depresses the industrial sector.

An important characteristic of Indian agriculture is the uncertainty of crops from year to year both in terms of the quantity as well as the quality. Farmers till the last moment are not sure of the success of the crops. When the harvest is poor, farmers may not get sufficient returns. On the other hand, in case of bumper crops, farmers may not get remunerative prices because the supply exceeds the demand.

The major role of agriculture is to provide food to the population, to supply industrial raw

materials to agro-based industries and to contribute to exports of the country to earn foreign exchange. India has witnessed tremendous expansion in the production of foodgrains. Its production has increased from a mere 549.2 lakh tonnes in 1949-50 to 1683.7 lakh tonnes in 1991-92. In spite of drought situation in 1987-88, the foodgrain production in the country was to the tune of 1,384 lakh tonnes which further increased to 1,800 lakh tonnes in 1992-93. The per capita availability of foodgrains has also gone up to about 468.5 grams per day from about 395 grams per day during the early fifties. The increase in the total quantum of foodgrain production is ascribed to the expansion of the net sown area until the mid-sixties but later, it was mainly achieved by the growth in productivity after the introduction of irrigation-added fertilizer technology. The provision of agricultural infrastructures like irrigation, power and credit have also given impetus to the substitution of low value crops with high value crops. The crops with higher potential of productivity have gained ground particularly in the irrigated tracts. These features of Indian agriculture have ushered in an era of self-sufficiency in cereals in the country, though the production of pulses could not keep pace. While the cereal production increased from 424 lakh tonnes in 1950-51 to 1,667 lakh tonnes in 1992-93, the production of pulses has witnessed a marginal increase from 84 lakh tonnes to 128 lakh tonnes in 1991-92. Find out the ratio in which cereals and pulses have increased.

The industrial crops have also witnessed

substantial increase in their production. The production of total oil-seeds* increased from 51.2 lakh tonnes in 1970-71 to 202.3 lakh tonnes in 1992-93 recording about four-fold increase during the last 22 years. Sugarcane, cotton and jute have not shown consistent trend in production. The production of sugarcane in 1992-93 was 2,308 lakh tonnes. The sugarcane is the major raw material in sugar industry. It is a weight-losing raw material hence the industry is located within the sugarcane producing-region. The cotton production has also risen. The highest production of cotton (116 lakh bales; each bale weighs 170 kg) was recorded in 1992-93. Its production is affected by drought and attack of pests. Jute, another industrial crop, has witnessed decline after 1985-86. This is largely due to decline in area under jute and mesta in 1987-88. In 1992-93, the production of jute and mesta was 90 lakh bales of 180 kg each.

The major agro-based export commodities are tea-coffee, cashew kernels, raw cotton, oil cakes, ice, sugar, tobacco and spices. The export of cashew kernel, coffee, oil cakes, raw cotton, sugar and tobacco has declined in 1987-88 as compared to the previous year, i.e. 1986-87. But the export of tea, rice and spices have registered increase. The main reason of the depressed export of these commodities during 1987-88 has been the drought condition prevailing over a large part of the country. It is evident from the data of 1992-93 that the export of these items has increased. Any strategy for agricultural development will have to take steps to increase the production and generate exportable surplus in order to earn foreign exchange.

Indian Agriculture : Traditional vs. Modern

In India, agriculture has been a way of life. It was described as intensive subsistence agriculture

*Oil-seeds include groundnut, rape-seed and mustard, sesamum, linseed, castor-seed, nigerseed, safflower, sunflower, soyabean.

before independence. It suggests that the Indian farmers were cultivating small holdings with draught animals and family labour. The techniques were primitive and the tools were simple. The productivity per unit area as well as per labour was very low. The chemical fertilizers were not used. There was lack of infrastructural facilities like electricity, irrigation and credit. A few individuals owned land and majority of the tillers were tenants.

Even after independence India suffered from food shortage. The methods of cultivation remained traditional and the productivity remained low. The level of mechanisation was also very low. Hence the major concern of the Indian Government immediately after independence was to introduce land reforms, correct the land ownership pattern and abolish the *zamindari* and *jagirdari* in all its manifestations. Ceiling on the land-holding size was introduced through law. Various steps were taken to pass the land ownership to the tillers of the soil. Though the land reform laws have been enacted in every state, they have not been implemented uniformly. The other measures taken were consolidation of land-holding in order to reduce the fragmentation of agricultural land to reduce the number of parcels of a single holding and provide security of tenure to tenants.

The initial difficulty of feeding the huge population of the country after the independence made it essential to adopt strategies for agricultural development. The construction of multipurpose projects with the development of irrigation as one of its major components was the first serious step towards the provision of agricultural infrastructure. The irrigation was developed in some areas before independence too. The total irrigation potential developed during the pre-plan period was 226 lakh hectares. It was realised that water is the basic input in developing agriculture. The total irrigation potential was, therefore, increased to 811 lakh hectares by the

end of 1991-92. The Community Development Programme was started in 1952 in order to bring about overall development including agricultural development but it could not make significant dent in the backward agriculture. Food shortage became acute and India landed itself in PL-480 food aid programme. The Intensive Agricultural District Programme (IADP) was started in 1961 on pilot basis. It aimed at diffusing technical know-how, credit and agricultural technology to step up the agricultural production in selected districts so that it may have demonstration effect. Later the Intensive Agriculture Area Programme (IAAP) was initiated as a new strategy for agricultural development with emphasis on the development of medium and minor irrigation sources and use of fertilizers. A breakthrough in seed technology was achieved by the mid-sixties and the High Yielding Variety (HYV) programme was launched in 1967-68. This strategy of agricultural development was based on water, fertilizer and seeds. This is also known as 'package technology' or 'green revolution' technology.

Indian agriculture has forged ahead since then. Paddy, wheat, jowar, bajra and maize were covered under this programme. 18.9 lakh hectares were cultivated under the HYV during 1967-68 which has increased to 654 lakh hectares during 1992-93. Fertilizer consumption has increased to 67 kg per hectare in 1992-93 from a mere 1.9 kg per hectare in 1960-61. We have already noted the increase in the production of different important crops due to the effect of agricultural technology. The major breakthrough has been achieved in cereal production but pulses have, more or less, remained stagnant. There is no doubt that Indian agriculture has witnessed substantial development but this development has not been uniform across regions and farming classes. Some regions have witnessed higher level of agriculture development while some others have not moved up fast enough. Therefore, there

exists a regional imbalance in the agricultural development. The agricultural development as obtained in India, has benefited large farmers much more than medium and small farmers, because the larger farmers were able to take advantage by investing in agricultural technology as they had the resources.

Let us look at the regional scenario of agricultural development. Punjab, Haryana and western Uttar Pradesh have witnessed higher level of agricultural development. This contiguous region had strong irrigation base through its canal network. The drier parts of the country such as Rajasthan, Gujarat, western Madhya Pradesh, Telangana and Rayalseema regions of Andhra Pradesh, and Karnataka Plateau have not witnessed the same level of agricultural development as Punjab, etc. This regional disparity in agricultural development is caused by the environmental constraints, cropping pattern, resource endowment and differential rates of input-use. Punjab, Haryana and western Uttar Pradesh adopted new technology, first in wheat and later in rice on an extensive scale. The southern states particularly Tamil Nadu and Andhra Pradesh recorded higher level of productivity but the eastern and central states did not record significant increase. In 1992-93, consumption of fertilizers in Punjab was 168.4 kg per hectare or 22 kg per hectare in Orissa, 57 kg per hectare in Bihar, 35 kg per hectare in Madhya Pradesh and 27 kg per hectare in Rajasthan. Punjab also recorded 147 tractors per 1000 hectare of cropped area followed by Haryana 108 (tractors per 1000 hectares) as against 0.8, 1.3, 1.4 and 1.1 tractors per 1000 hectares of cropped area in Assam, Orissa, Bihar and Madhya Pradesh respectively. Likewise 94 per cent of gross cropped area in Punjab is irrigated followed by 71.6 per cent in Haryana, as against 40 per cent in Bihar, 18.6 per cent in Madhya Pradesh and 11.4 per cent in Maharashtra. Thus, it is clearly evident that the input-use intensity in Punjab is

MAIN FEATURES OF AGRICULTURE

very high as compared to other states and this has made Punjab an island of agricultural development. Other supporting infrastructural facilities as cooperative banks, marketing facilities and rural electrification have also helped in the consolidation of agricultural development. The remunerative prices for important crops recommended by the Agricultural Costs and Prices Commission has also helped the farmers in adopting high value crops.

Wet and Dryland Agriculture

It has already been pointed out that while India has a long growing season with adequate photoperiod, the major inhibiting factor for crop growth is the moisture availability. One of the main sources of moisture for plants in India is rainfall. Rainfall sets the whole process of agricultural production in motion. Nothing satisfies the farmers of India as the first shower of monsoon and from these showers spring up their *rag malhar*, fairs, and festivities. The seasonality of monsoonal rainfall is so pronounced that even the wet areas also experience dry spells. Therefore, there is no such area which ensures moisture supply to the plant all the year round. Assam, parts of West Bengal and parts of western coasts are the only areas where the length of the dry spells is shorter. But the uncertainties of monsoonal rainfall like late onset, early withdrawal, long dry spells between two wet spells make it imperative to develop assured means of irrigation by wells, tubewells, tanks or canals.

In the regions having rainfall between 75 cm and 100 cm the moisture deficiency is experienced for about two-thirds part of the year. This is the subhumid zone of the country. In the semi-arid regions having rainfall of 30 cm to 75 cm, the moisture deficiency prevails for almost the year round. These are the drought-prone areas of southern Haryana, eastern Rajasthan, Gujarat, and the region lying in the rain shadow area of

Western Ghats. The arid regions having an average annual rainfall of less than 30 cm are not suitable for cultivation of crops without irrigation. Thus, in the drier parts, the productivity levels are low. Millets, pulses and oilseeds are the major crops. These areas have great potential provided moisture is made available through irrigation. The dry farming techniques may also be developed to increase the yield levels of crops like pulses and oilseeds. The International Crop Research Institute for Semi-Arid Tropics (ICRISAT), Hyderabad and the Central Arid Zone Research Institute (CAZRI), Jodhpur are engaged in research and development of such techniques. Sprinklers, drip system, hydrants, water turbines and hand pumps may be introduced in favourable areas with the financial support of cooperative and agricultural development banks.

The traditional cropping pattern of the country had a close relationship with the pattern of rainfall. The modern technology has made it possible to grow some crops in non-traditional areas. Expansion of rice cultivation in Punjab and Haryana and introduction of wheat cultivation in Bihar and West Bengal are the best examples of modern innovations. The irrigational facilities in Punjab and Haryana ensure water supply to the paddy fields as and when the plants require it. North western region, comprising Jammu and Kashmir, Haryana, Punjab, and Uttar Pradesh (data for Himachal Pradesh not available) has the higher concentration of gross irrigated area as it accounts for about 42 per cent of the gross irrigated area of the country. The network of canals was developed in Punjab, Haryana, Uttar Pradesh, and deltas areas of Krishna-Godavari and Kaveri. The multipurpose projects like Bhakra-Nangal, Damodar Valley Corporation, Hirakud; Kosi, Tungbhadra, and Nagarjun Sagar created additional irrigation facilities during the post-independence period. The Indira Gandhi Canal Project in Rajasthan is of great importance for this water-deficit region. In spite of all these

efforts only 33 per cent of the net cropped area was irrigated in 1992-93 which means a major position of India's cultivated land will have to remain rainfed.

Intensity of Cropping

One of the methods of increasing the total quantum of food production is the expansion of net sown area. But its expansion is not possible after certain limit. Thus, the alternatives available for increasing food production is intensification or increasing the intensity of cropping. Intensity of cropping refers to raising a number of crops from the same field during one agricultural year. For example, a farmer has an operational holding of 5 hectares. He sows crops on all the 5 hectares during the *kharif* season and after harvesting *kharif* crop, again sows another crop on 3 hectares during the *rabi* season. It means that the farmer has taken crops from 8 hectares (5 hectares during *kharif* + 3 hectares during *rabi*) though physically he has only 5 hectares. Had he taken only one crop during *kharif* season on 5 hectares, the cropping intensity index would have been 1 or 100 (in terms of percentage).

However, in the above example the intensity of cropping will be 160 per cent. The intensity of cropping reflects the intensity of land use. According to the data of 1990-91, the index of intensity of cropping for the country as a whole is 130 per cent. It shows large regional variation at the state and district levels. The highest index of cropping intensity of 176 per cent has been recorded in Punjab during 1989-90 followed by Himachal Pradesh (169 per cent) West Bengal, Haryana, Uttar Pradesh recorded intensity of cropping of 157, 145 and 143 per cent respectively. The inner parts, e.g. Maharashtra, Karnataka, Rajasthan and Gujarat have recorded comparatively lower index of cropping intensity of 125, 118, 116 and 110 per cent respectively. This index has also been low in wet region like

Assam (117 per cent).

Index of the intensity of cropping is closely correlated with the extent of area sown more than once. The higher the extent of area sown more than once the higher will be the index of intensity of cropping. It also means higher productivity per unit area of land under cultivation. The main factors influencing intensity of cropping are irrigation, fertilizer, early-maturing high-yielding varieties of seeds, selective mechanisation such as use of tractors, pumping sets and seed-drills, etc. and plant protection measures through the use of insecticides, pesticides and seedicides. The availability of water for irrigation ensures the use of higher doses of fertilizers which in turn reduces the incidence of fallowing. The quick-ripening varieties of seeds help in taking more than one crop from the same field in one agricultural year. The relationship of input-use and intensity of cropping may be illustrated by taking examples of Punjab where intensity of cropping is 176 per cent and Gujarat which has recorded a low intensity of cropping of 110 per cent. The Punjab recorded fertilizer use of 168.4 kg/hectare as against 75 kg/hectare in Gujarat. The share of tractors in Punjab has been found to be 14.2 per thousand hectares of gross cropped area while in Gujarat, this share is 26 tractors per thousand hectares of gross cropped area. Likewise the number of pump-sets per thousand hectare of gross cropped area in Punjab was 92 as against 52 pumping sets in Gujarat. 94 per cent of the gross cropped area in Punjab is irrigated while in Gujarat it is only 28 per cent. The intensity of input use per unit area in Punjab is much higher than that of Gujarat and hence the index of cropping intensity is also high in Punjab as compared to Gujarat. The possibility of the extension of the net sown area in the country being very limited, the enhancement in the intensity of cropping provides the avenue through which quantum of agricultural production may be increased.

Selected Cultural Practices : Their Utility and Relevance

It has been mentioned that agriculture in India is not only an important economic activity but also a way of life. The Indian farmers, therefore, have learnt about the techniques of cultivation through their experience acquired over thousands of years. The farmers do realise that continuous cropping in the same field for a long period results in the depletion of soil nutrients. In order to provide time for the recoupment of the soil fertility, the farmers developed the cultural practice of fallowing. The land is left without crop for a season or for the whole year so that the soil fertility improves through the natural processes. The extent of fallowing may be reduced by higher doses of fertilizers and manures.

Crop rotation is the other method through which the imbalance in the soil created by nutrient loss is corrected. It is realised that the same type of crop year after year accelerates the loss of soil nutrients. Therefore, after cereals, the fields are devoted to pulses or to any other leguminous crop. Legumes have the ability of fixing nitrogen to the soils from atmosphere. Oilseeds also help in nitrogen fixation hence the cereals follow the oilseed in the same field. Highly fertilizer-intensive crops like sugarcane or tobacco are rotated with cereals crops. The selection of crops for rotation depends upon the local soil conditions and the experience and the understanding of the farmers.

The farmers have evolved their own method of risk coverage, particularly in the dry regions of the country such as mixed cropping and relay cropping. Mixed cropping refers to the practice of sowing two or three crops together in the same field in one crop season. For example, wheat, gram and mustard are *rabi* crops and the farmers sow them in the same field. It has two advantages. The loss of solid nutrients is replenished by gram and mustard which fix nitrogen and secondly, if the wheat crop does not succeed, the farmer gets

some return from gram and mustard. In the same way wheat and barley are grown in the same field and the mixture is known as *gojari*. When wheat and gram is mixed together it is known as *gochani*. Mixing of barley and gram is known as *bejhar*. The local conditions of soil, weather and tradition are important factors influencing the mixture of number and types of crops. Such mixing reduces the uncertainty of the success of crops.

Regional Pattern of Major Crops

Indian soils, weather and other agronomic parameters are highly varied from one region to the other. This variety has resulted in large variations in cropping pattern. Very few areas have monocultures while in other areas different crops grow in close association. The decision to devote a particular field to a particular crop is taken by the cultivating household. The factors affecting this decision may be many, e.g., suitability of the soil, availability of water, capacity of the household to purchase inputs, the profitability of the crop ensured by higher prices and the needs of the household, etc.

In India, there are three crop seasons: *Kharif*, *rabi* and *zaid*. *Kharif* season starts with the onset of monsoon and major *kharif* crops are rice, maize, *jowar*, *bajra*, cotton, sesamum, groundnut and some pulses such as *moong*, *urad*, etc. *Rabi* season coincides with winters and the major crops grown are wheat, barley, *jowar*, gram and oilseeds such as linseed, rape and mustard. *Zaid* is summer cropping season and major *zaid* crops are rice, maize, groundnut, vegetable and fruits like water-melon, cucumbers, etc. Now some seeds of pulses have been evolved which can be successfully grown in summer.

A major change in the cropping pattern in India has been witnessed after the mid-sixties when seed-fertilizer-irrigation technology was introduced in India. The changes have occurred not only in area but in production as well as yields of

different crops. The changes in area, production and yield are more pronounced in cereals particularly wheat and rice. The production of wheat in 1992-93 has more than doubled from 1970-71. It has increased from 239 lakh tonnes in 1970-71 to 568 lakh tonnes in 1992-93. Its production has witnessed about eight and half fold increase from 1950-51 when the total production of wheat was 65 lakh tonnes. This increase in production is ascribed to increase in area under wheat but more so by tremendous increase in yield levels. Likewise the production of rice increased from 206 lakh tonnes in 1951-52 to 726 lakh tonnes in 1992-93. It slightly declined during 1987-88 due to drought conditions prevailing in large parts of the country. The performance of pulses has not been very satisfactory. The production of oilseeds has moved up slowly but it has not been able to keep pace with demand. The production of jute has almost stagnated over these years. Cotton and sugarcane have also not performed very well.

The 100 cm isohyet divides the country in two broad agricultural zones. The area receiving more than 100 cm of rainfall is predominantly rice zone and the area receiving less than 100 cm of rainfall is largely the wheat zone. The dry regions of the country have their own specific dominant crop pattern and are generally dominated by millets, oilseed and pulses. But this does not mean that there are rigid demarcation lines between crop zones because there always exists a transitional zone between two crop zones. Moreover, after the introduction of the package technology interpenetration of crops in different zones can be witnessed. That is how Punjab has become important in the production of rice and West Bengal obtained high yield levels of wheat.

Rice

Rice is an important crop in India. It accounts for 29 per cent of the total area under rice in the world and contributes about one-third of the world's

total production of rice. India stands second to China in area and production of rice but ranks seventh in terms of yields. Rice occupies 22.4 per cent of the gross cropped area of the country rising from 388 lakh hectares in 1950-51 to 416.4 lakh hectares in 1992-93. The production also increased from 206 lakh tonnes in 1950-51 to 726 lakh tonnes in 1992-93. The increase in the production is not as much due to area effect as due to the increase in yield of rice. It has risen from 668 kg per hectare in 1950-51 to 1,744 kg per hectare in 1992-93. The increase in yield of rice has been more than two times during these years. In spite of the fact that the yield of rice has witnessed increase India still lags far behind in yield levels as compared to Korean Democratic Republic and Japan where rice yield recorded 6,670 kg/hectare and 6,220 kg/hectare, respectively.

Rice cultivation is widespread. It is cultivated in almost all the states except very dry regions of the country. It is a major crop in the eastern parts of the North Indian Plains, Coastal Plains, Himalayan valleys and terraced slopes and in other areas where means of irrigation are available. The eastern region accounts for about 67 per cent of the total area and 50 per cent of the total production of rice in the country. Higher yield levels of rice have been obtained in Punjab, Haryana, and western Uttar Pradesh. The major advantages in these regions are assured water supply and dry climate with low incidence of pests and diseases. Rice is a labour intensive crop because large-scale mechanisation in ploughing and transplanting is not possible as the fields are flooded.

Wheat

It is the second important crop in terms of area and production after rice. It accounts for about 13 per cent of the gross cropped area in the country. It occupied 244 lakh hectares in 1992-93 and contributed 568 lakh tonnes of production. It has

registered tremendous increase in area and production since 1950-51 when area under wheat was 98 lakh hectares and the production was 65 tonnes. After the introduction of the package technology, the increase in area and production was clearly registered in 1970-71 when it increased to 183 lakh hectares and 238 lakh tonnes, respectively. The increase in production may be distinctly attributed to the increase in its yield during the last 50 years. The average yield of wheat increased from 663 kg/hectare in 1950-51 to 1,307 kg/hectare in 1970-71 and 2,323 kg/hectare in 1992-93. The peak yield of 2,394 kg/hectare, however, was recorded in 1985-86.

Wheat is a *rabi* crop. It is extensively grown in North-Western India. It is mostly grown in the annual rainfall zone of 50-75 cm or in areas where irrigation water is available for supplementing soil moisture. It is sown, after the withdrawal of monsoons, in the last week of October or early November. Some quick-ripening high-yielding varieties of seeds are sown as late as December or early January. It occupies a tract covering Punjab, Haryana, western Uttar Pradesh, particularly Ganga-Yamuna *doab* and Gomati-Ganga *doab*, and some selected districts of Rajasthan and Gujarat.

About 69.4 per cent of the wheat production in the country is obtained from Punjab, Haryana, and Uttar Pradesh. The area under wheat has also been extended in some non-traditional areas like Bihar and West Bengal. Madhya Pradesh and Maharashtra also have substantial area under wheat. Bihar and West Bengal together produce about 7.1 per cent of the total production of wheat in the country. The yield of wheat per hectare in West Bengal is quite high. There has been a very significant contribution of agricultural universities and institutes in developing the high-yielding varieties of wheat in India. *Kalyan*, *Sona* and *Sonalika*, etc. have become household names in the villages of wheat-growing regions. The extension of area under high-yielding varieties

coupled with proper doses of fertilizers and efficient water management may enhance and stabilise the wheat production in the country.

Coarse Grains

Coarse cereals included here are *jowar*, *bajara*, maize and barley. About 348 lakh hectares are devoted to the cultivation of coarse grains 1992-93. The production was almost stagnant during seventies. It attained a peak production of 339 lakh tonnes in 1983-84. Since then it has again declined. This is mainly because of the decline in the cropped area due to preference for high value crops over these cereals.

Jowar is grown both as *kharif* and *rabi* crops. The area under *jowar* has been almost constant from 1950-51 to 1992-93. It was sown on 156 lakh hectares in 1950-51, 131 lakh hectares in 1992-93. The production of *jowar* witnessed an increase and it rose from 55 lakh tonnes in 1950-51 to 130 lakh tonnes in 1992-93. This increase has been made possible by the increase in yield per hectare which has risen from 363 kg per hectare in 1950-51 to 989 kg per hectare in 1992-93. Maharashtra is the largest *jowar*-growing state which accounted for about 45.2 per cent of the area and almost 52 per cent of its production in 1992-93.

Bajara is widely grown in Rajasthan, Gujarat, and southern Haryana. Area under *bajara* has also remained stagnant with some minor fluctuations here and there. It was grown over 90 lakh hectares in 1950-51 which increased to 106 lakh hectares in 1992-93. The production has risen from 26 lakh tonnes in 1950-51 to 37 lakh tonnes in 1992-93. It is a very hard crop and can survive in dry areas under moisture-stress conditions. *Bajara* is grown as fodder crop in Uttar Pradesh. Tamil Nadu is also a minor producer of *bajara*.

Maize is an important crop in eastern Rajasthan, Uttar Pradesh, Bihar, Punjab, and mountainous regions such as Jammu and Kashmir and Himachal Pradesh. The area under maize has

increased from 32 lakh hectares to 60 lakh hectares during the period 1950-51 to 1992-93. The production has also risen from 17 lakh tonnes in 1950-51 to 102 lakh tonnes in 1992-93. There has been very substantial increase in its yields. It has increased from a mere 547 kg per hectare in 1950-51 to 1,694 kg per hectare in 1992-93.

Barely is a hardy crop and can grow in varied agronomic conditions. It can successfully grow up to an altitude of 1,000 metres above the sea level. Its major demand comes from breweries. It is a staple diet of the people of the highlands. It is largely grown in eastern Rajasthan, Uttar Pradesh, Himachal Pradesh, and Kashmir Himalayas. It is grown on lighter soils. It can grow without irrigation. The importance of barley as a cereal has declined. About 54 per cent of the area under barley is unirrigated.

Coarse cereals are important items of consumption for the poor rural people of India. Since vast part of the cultivated land is rainfed there is need for stabilising the level of production of coarse grains. This is possible through conservation of soil moisture, adoption of dry-farming techniques and water shed management.

Pulses

Pulses are the major source of protein in the diet of predominately vegetarian population of India. The production of pulses has not kept pace with the increase in the production of cereals. The total area devoted to pulses in 1950-51 was 191 lakh hectares which accounted for about 15 per cent of the gross cropped area of the country. In 1992-93 pulses occupied 237 lakh hectares which accounted for about 15 per cent of the gross cropped area. It shows that share of pulses in the gross cropped area on the national level has remained constant. The production of pulses was 136 lakh tonnes in 1992-93 while in 1988-89 its production was 139 lakh tonnes. Thus it has registered a decrease. About 90 per cent of the area under

pulses is rainfed. It is widely produced in Madhya Pradesh, Rajasthan, Uttar Pradesh, Maharashtra, Orissa, Bihar, Haryana, Andhra Pradesh, Karnataka, Tamil Nadu, and West Bengal. Pulses are grown in *Kharif* as well as *rabi* seasons. *Arihar (tur)*, *moong*, *urad*, *moth*, etc., are the *kharif* crops while gram, peas, *masur* and *urad* are the *rabi* crops. *Arhar* is the main pulse crop in Uttar Pradesh, Karnataka, Gujarat, and Tamil Nadu and gram is the main pulse crop of Bihar, Haryana, Madhya Pradesh, Uttar Pradesh, Rajasthan, and Maharashtra. In order to increase the production of pulses, the National Pulses Development Programme (NPDP) was launched in 1986-87.

Oil-Seeds

Oil-seeds refer to the aggregation of nine different seeds, viz. groundnut, castor-seed, sesamum, rape-seed and mustard, linseed, nigerseed, safflower, sunflower and soyabean. There are many other seeds from which edible oil is extracted like coconut, *mahua* seeds and cotton seeds. Oil-seed is a dryland crop though some oil-seeds grow under irrigated conditions such as mustard. In 1992-93 oil-seeds were cultivated over 256 lakh hectares as against 107 lakh hectares in 1950-51. The total production of 207 lakh tonnes was obtained in 1992-93 as against 52 lakh tonnes in 1950-51. Despite the increase in the production of oil-seeds, the supply lags far behind the demand and hence edible oil has to be imported. Gujarat is the largest oil-seed growing state, followed by Andhra Pradesh and Uttar Pradesh, Madhya Pradesh, Maharashtra, Rajasthan, Karnataka, and Tamil Nadu are also important oil-seed producing states. A number of projects are being undertaken to enhance the oil-seeds production. Some of these are the National Oil-seeds Development Project (NODP) and Oil-seed Production Thrust Project (OPTP). The technology Mission on Oil-seeds has been

appointed to harness the production and processing technologies.

Sugarcane

India is supposed to be the original homeland of sugarcane. It is grown both in tropical and subtropical regions of the country. It is grown from Kanyakumari in the south to the northernmost districts of Punjab. The main states growing tropical varieties of sugarcane are Tamil Nadu, Karnataka, Andhra Pradesh, and Maharashtra. Major part of these states growing sugarcane is located south of 15°N latitude. The tropical varieties of sugarcane in south India give higher yield per unit area than the sub-tropical varieties of north India.

The sub-tropical regions growing sugarcane are Uttar Pradesh, Bihar, Haryana, and Punjab. Uttar Pradesh is the largest producer. Maharashtra has also become an important producer of sugarcane. While 10.5 lakh hectares are devoted to sugarcane cultivation in the tropical region, in sub-tropical region it occupies 25.7 lakh hectares. The area under sugarcane has increased from 17 lakh hectares in 1950-51 to 36.2 lakh hectares in 1992-93. The production has increased from 571 lakh tonnes in 1950-51 to 2,308 lakh tonnes in 1992-93.

Sugarcane is a fertilizer intensive crop which grows well on fertile soils. It requires high temperature and rainfall of about 100 cm. In areas having low rainfall, frequent irrigation is required. It grows well under frost-free conditions. In the northern plains, extreme weather conditions, i.e., very hot summer and very cold winter, are responsible for low yields of sugarcane. However, availability of irrigation facilities is a positive factor for the cultivation of sugarcane in this region.

Cotton

Cotton is used as a raw material in cotton textile industry. It grows well in areas having well-

drained deep soil, uniformly distributed light rainfall or irrigation during plant-growth and sunshine at the time of picking. Frost is very injurious to cotton. Hence it is grown in regions having more than 21° celsius temperature during the period of its growth. Cloudiness at the time of picking spoils the quality of cotton.

Cotton is associated with dry regions and black soil of the Deccan plateau. It is widely grown in Maharashtra, adjoining Madhya Pradesh and Gujarat. Punjab, Haryana and Rajasthan in the north and Tamil Nadu, Andhra Pradesh and Karnataka in the south are other important cotton growing states. It is sown in rotation with *jowar*, *maize*, *bajra* or wheat in different regions of the country.

In 1950-51, cotton occupied 59 lakh hectares which increased to about 70 lakh hectares in 1986-87 but declined to 65 lakh hectares in 1987-88 due to widespread drought in the cotton growing region. In 1992-93, cotton occupied 75.4 lakh hectares. The production of cotton has registered four-fold increase from 1950-51 to 1992-93. The production of cotton (lint) was 31 lakh bales (1 bale = 170 kg) in 1950-51. It reached production of 87 lakh bales in 1985-86. In 1992-93 the production of cotton increased to 115.8 lakh bales. The hybrid seeds have greatly helped in increasing production. There has been a quality improvement of cotton as the long staple cotton accounts for about 30 per cent of the total production.

Jute

Jute is also a fibre crop like cotton but unlike cotton it is grown in the heavy rainfall, high temperature region of eastern India, particularly in West Bengal, Assam, Bihar, Orissa and eastern Uttar Pradesh. It requires well drained alluvial loam/soils which is frequently renewed by floods. West Bengal is the leading producer of jute.

The total area under jute was 5.7 lakh

hectares in 1950-51. It was the highest in 1985-86 when it touched a peak of 12 lakh hectares but declined to 9.8 lakh hectares in 1992-93. Likewise it recorded a production of 33 lakh bales (1 bale = 180 kg) in 1950-51 which touched the peak in 1985-86 with the total production of 109 lakh bales. There has been a sharp decline in its production in 1992-93 (90 lakh bales). Out of the total production of jute, West Bengal contributed 68 per cent in 1985-86, 67 per cent in 1986-87 and 57 per cent in 1992-93. This progressive decline in the jute production in West Bengal is attributed to the decline in area.

Tea

India is the largest producer of tea in the world though areawise, China ranks first. Tea cultivation in India was started in Brahmaputra valley in Assam which now accounts for about 45 per cent of the total production in the country. Northern districts of West Bengal, namely Darjeeling, Jalpaiguri, and Cooch-Bihar are also important tea producers. Besides the important tea-growing region, some plantations have been developed in Ranchi plateau, slopes of Siwalik hills in Himachal Pradesh and Dun valley in Uttar Pradesh.

Another important tea-growing zone exists in South India, including Tamil Nadu, Kerala, and Karnataka. Nilgiris and the Ghats provide the requisite agronomic conditions for the cultivation of tea.

The tea production has increased from 3.0 lakh tonnes in 1950-51 to 7.0 lakh tonnes in 1987-88 registering more than two-fold increase over these years. While the area devoted to tea cultivation was 33.14 lakh hectares in 1950-51 it increased to 4.01 lakh hectares in 1992-93. Out of the total area in 1992-93, Assam accounted for about 55.0 per cent and contributed about 54.6 per cent of the total production. Besides the large plantations in Brahmaputra Valley, small holdings have also started growing tea which has largely

contributed to the increase in production in this region.

Coffee

Coffee in India is highly localised in Karnataka, Kerala and Tamil Nadu. India grows six commercially important varieties of coffee. These are Old Chiks, Coorgs, Kents, S-288, S-795 and S-1934. The coffee plantations have been developed on the red ferruginous clays occurring in Babadangiri in Karnataka and Nilgiris in Tamil Nadu. These soils are rich in organic matter. India largely grows *arabica* variety.

Karnataka accounts for 52 per cent of the area under coffee in 1991-92. The important coffee-growing districts are Chikmangalur, Coorg, Hasan, Mysore, Shimoga and Dakshin Kanara. Kerala accounts for 21 per cent of the coffee area in India and important coffee-growing districts are Idukki, Palghat, Kottayam, Quilon, Ernakulam, Trichur and Alleppey. Madurai, Tirunelveli and the Nilgiris are the important coffee-producing districts of Tamil Nadu. Coimbatore, Salem and Kanyakumari also grow some coffee. In 1950-51, India produced 18,893 tonnes of coffee which increased to 2.0 lakh tonnes in 1991-92. The production of coffee increased rapidly till 1970 but registered a declining trend during seventies. It has picked up in eighties but the increase is very gradual. India exported 98.4 thousand tonnes of coffee during 1991-92.

Spatial Pattern of Agricultural Development

Agricultural development provides the base for the development of other sectors of the economy as it serves a vast population size in rural area. The level of agricultural development reflected through the productivity levels have been shown in the Appendix-I. It is seen from the Appendix-I that 39 districts of the country recorded a productivity level of more than Rs. 1,750 per hectare, 50 districts have recorded productivity of Rs. 1,250 per hectare, medium productivity

level has been recorded in 108 districts while 84 districts have recorded low productivity. The high productivity districts are located in Punjab, Haryana, western Uttar Pradesh, Assam, West Bengal, coastal Andhra Pradesh, Tamil Nadu, Kerala, coastal Karnataka and Maharashtra. Srinagar division of Jammu and Kashmir, and a few districts in eastern Uttar Pradesh have also recorded high productivity. A large belt comprising Rajasthan, Madhya Pradesh, southern Bihar, southern Orissa, Maharashtra, and northern Karnataka have recorded low productivity. The rest of the country comprising southern Haryana, Uttar Pradesh, northern Bihar, Orissa, Andhra Pradesh, southern Karnataka, and Gujarat have recorded medium level of agricultural development. No data was available for Himachal Pradesh, Arunachal Pradesh and other states of North-east.

The main questions about Indian agriculture which are frequently asked are: What has transformed it? What are the factors which have been responsible for the agricultural

development?

The package technology generally termed as 'green revolution' has played a major role in transforming Indian agriculture. The package technology refers to the adoption of irrigation, bio-chemical fertilizers and the high-yielding varieties of seeds as the basic inputs in agricultural production. The development of high-yielding varieties and their areal spread has led to the increase in production of foodgrains. Amongst the crops, wheat was vastly affected by the green revolution technology. The gross irrigated area rose to 33.0 per cent. The use of fertilizer rose to 70.27 kg per hectare. The number of tractors has increased from 0.3 tractors per thousand hectares of cropped area in 1960-63 to 1.6 tractors in 1980-83. The number of pump sets increased from 5.8 per thousand hectare of cropped area in 1960-63 to 28.2 in 1980-83. The high productive districts use higher proportion of modern inputs. The districts which are lagging behind may improve their performance with the provision of higher input levels.

EXERCISES

Review Questions

- Answer the following questions briefly:
 - What is meant by intensity of cropping? Name the factors which affect the intensity of cropping?
 - How does a developed agriculture help the development of industrial sector?
 - What is *Zamindari* system? When was it abolished?
 - What do you mean by 'package technology'? Why is it known as 'package technology'?
 - 'Agriculture development in India has been the function of input intensity'. Discuss with examples of Punjab, Haryana, and Madhya Pradesh.
 - 'The traditional cropping pattern in the country was closely related with the pattern of rainfall distribution'. Discuss.
 - Why is the rotation of crops adopted?
- Differentiate between:
 - Mixed cropping and mixed economy
 - Primitive subsistence and intensive subsistence farming
 - Foodgrains and food crops

- (d) Wet and dry agriculture
- (e) *Kharif* crops and *rabi* crops

Activities

3. On outline maps of India show the following:
 - (a) Areas of sugarcane cultivation
 - (b) Areas of cotton cultivation
 - (c) Areas of jute cultivation
4. From the statistical abstract of India, find out the area, yield and production of wheat, rice and oil-seeds for the previous year. Represent them with the help of suitable cartographic method.
5. Organise a debate in the class on: "In the opinion of the house, the 'green revolution' in India has been 'grain revolution'". Speakers can speak *for* and *against*.

CHAPTER 3

Manufacturing Industries

THE STRENGTH of any country's economy is judged by the level of the development of its manufacturing industries. All the developed economies of the world such as the USA, former USSR, and Japan are highly industrialised nations. According to the World Development Report, 1994, manufacturing contributed 17 per cent of GDP (Gross Domestic Product) in India during 1992 while its contribution in Japan, USA, and France was 30, 26, and 19 per cent, respectively. Manufacturing industries have a major role in the utilization of resources as they transform these resources into more valuable goods. Hence countries incapable of manufacturing goods cannot utilise the available raw material resources, and they generally export these raw materials at much cheaper rates. On the other hand, they purchase finished goods from other countries at a much higher price. Industrial products generate more wealth. The Industrial labour, therefore, gets higher wages and enjoys higher standard of living. Due to its vast size of population, India has a large home market. It is, therefore, all the more important to increase the pace of industrial development and diversify its industries. Since independence, India has pursued the policy of rapid and broad-based industrial development as the most important element of its growth strategy.

It has been the endeavour of the country to transform its agricultural economy into an industrial economy through planning process. The State, as a policy matter, had to play a crucial role in industrial development by controlling the

key sectors. At the same time, private entrepreneurs have also been encouraged to share the responsibility of promoting industrial growth of the country. India has already achieved substantial progress in its industrial growth. The industrial growth during 1993-94 has been 4.1 per cent while manufacturing sector recorded a growth of 3.2 per cent. Just as the water has been the basic input in agricultural development, power has been the crucial input in the industrial development of the country.

Industries : A Historical Perspective

India has a long tradition of manufacturing. If the literal meaning of this word, 'to make by hand' is accepted. Much before the industrial revolution in Europe, Indian artisans and craftsmen knew to weave muslin, to make pottery, jewellery and metal wares which were demanded in foreign lands too. The industrial revolution in Europe provided the technology of mass factory production. This led to the colonisation by the European power to capture market as well as tropical raw materials. The British colonial rule in India adversely affected the handicrafts and household industries which the Indian craftsmen had perfected over the centuries. These products could not compete with the factory products either in quality or in price. Other impacts of industrial revolution were increase in the number of industrial workers, large scale migration of workers to urban areas and introduction of market economy.

In India, the modern industrial sector on an

organised pattern started with the establishment of cotton textile industry in Mumbai in 1854 with predominantly Indian capital and enterprise. In 1855 jute industry was started in the Hooghly valley near Calcutta largely with foreign capital and enterprise. It means that modern industrial sector had its beginning only after the middle of the nineteenth century. The two world wars gave impetus to the development of a number of industries such as chemical, iron and steel, sugar, cement, glass and other consumer goods industries. The industrial policy after independence emphasised the attainment of the socio-economic objectives such as employment generation, higher productivity, removal of regional imbalances in development, providing strength to agricultural base, promotion of export-oriented industries and consumer protection. A deliberate policy of locating the industries in economically backward areas has been pursued to reduce regional imbalances in development.

The industrial policies of 1948 and 1956 indicate the direction of the industrial development in India. The process of industrialisation started with the launching of the First Five Year Plan and continued through successive plan periods. During the First and Second Five Year Plans, emphasis was laid on growth as well as diversification of industries. While three new steel plants at Bhilai, Rourkela and Durgapur were set up in the public sector, the private sector plants were also encouraged to increase their capacity. Priorities were given to heavy and basic industries. As such heavy electrical, heavy engineering and machine tool industries were established. The chemical industry was provided sound footing for further expansion. There were setbacks to the pace of industrial development during the Third and the Fourth Plan periods due to the wars of 1962 and 1965 with China and Pakistan, respectively, as well as severe drought conditions in 1965-66 and

1966-67. Most of the industries suffered due to shortage of raw materials. The signs of recovery became visible only after 1968-69. Though there was substantial shortfall in the production of iron and steel some industries such as aluminium, textile machinery, machine tools, sugar, jute and petroleum performed well. The production of steel and fertilizers remained much below the installed capacity during the Fourth Five Year Plan too. Besides, the agro-based industries like sugar and textile showed erratic production. The other industries like alloys and special steel, aluminium, petroleum refinery products, tractors and heavy electrical equipments showed progress. The production of export-oriented goods and goods of mass consumption were emphasised during the Fifth Five Year Plan. This was the period when the rise in the petroleum prices created economic crisis throughout the world. This also adversely affected our investment target. The industrial policy during the Sixth Five Year Plan emphasised on optimum utilization of existing capacities, quantitative increase in the output of consumer and capital goods and improvement in productivity. The targets of capacity creation were achieved in aluminium, lead, zinc, electrical equipments and automobiles while production targets were achieved in machine tools, passenger cars, motor cycles, scooters and T.V. receivers, etc. Electronic industry witnessed very rapid development during this period. The country started production of micro computers, micro processors, communication equipments, broadcasting and T.V. transmission equipments, etc. The policy thrust during the Seventh Plan has been aimed at achieving growth with social justice and improved productivity. A lot of emphasis has been laid on capacity utilisation and maximisation of production with the existing assets. The electronic industry has been given due importance during this plan period also.

Besides large-scale industrial sector in the

country, encouragement has also been given to the medium and small as well as cottage industries. Village and small-scale industries have witnessed phenomenal growth and they together account for about 49 per cent of the total industrial production. Their major advantage is that they require less investment and generate more employment. These industries are being helped in improving and updating their technology in order to operate more efficiently.

On the basis of the size of our industry and the scale of its operation, we have large and medium scale industries such as jute, cotton textiles and a large variety of machine goods and engineering industries. Cottage and small-scale village industries are as widespread as agriculture. The number of people employed in the handloom and other small-scale village industries is still more than the number employed in large-scale factories, mines and plantations put together. Village industries characterise our rural economy vividly. The family members or hired labour are engaged in the processing of local raw materials with the simple techniques. This industrial activity is subsidiary to agriculture. These industries suffer from the lack of good raw material, improvement of technical skills and efficiency of organised marketing. That is why the village industrial products are mostly supplying the rural needs, particularly in inaccessible parts of the country. The idea of establishing industrial estates has been given some practical shape for the promotion and expansion of small-scale manufacturing units on modern and scientific lines.

Since the start of the planned development of Indian economy in 1951, from the viewpoint of structure, industry is divided into (i) public, (ii) private, and (iii) joint or cooperative sectors. The heavy and basic industries mostly fall into public sector, managed by the State. The consumer goods and light engineering works are largely under private management. But there are

no water-tight compartments and industries like iron and steel or fertilizers are included in both the sectors. There are broad categories of food, textiles, chemical, electrical, metallurgical, pharmaceutical and the handloom industries. Depending upon the raw materials, the industries are also classified as mineral-based and agro-based industries.

AGRO-BASED INDUSTRIES

These industries depend on the raw materials produced in the agricultural sector. These are mostly consumer goods industries which are important both in respect of their contribution to total industrial output as well as to employment. Textiles, sugar, vegetable oil, and leather are some important agro-based industries.

Textile Industry

Textile is a broad term which includes cotton, jute, wool, silk and synthetic fibre textiles.

Cotton Textiles

It is the largest industry in the country. Its origin dates back to 1818 when the first cotton textile mill was started at Fort Glaster near Calcutta. But this mill could not survive and had to be closed down. The first modern cotton textile mill was established in Mumbai in 1854 by local Parsi entrepreneurs. Location of the port, humid coastal climate, development of chemical industry, availability of capital and banking facilities were some of the advantageous factors favouring development of textile industries in and around Mumbai. Ahmedabad is another important centre of cotton textile industry. Although the size of the cotton mills are small here, they are known for the high quality goods. The cotton-growing regions of Gujarat and Maharashtra are the major source of raw materials for this industry.

The distribution of cotton textile mills is quite widespread because of the large home-

The production of cotton yarn increased from 53.4 crore kg in 1950-51 to 152.6 crore kg in 1991-92. The production of cotton cloth from the mill sector decreased from 340.1 crore metres in 1950-51 to 259 crore metres in 1986-87. This is the result of the sickness of the cotton textile mills and obsolete machinery. The bulk of cotton

Jute manufacturing existed in Bengal as handloom industry but the large-scale industry started in 1855 at Rishra, near Calcutta. In 1859, the first powerlooms were started in the same mill and the spinning as well as weaving were undertaken. It was an export-oriented industry and it made a rapid progress. The number of jute mills increased from 24 in 1884 to 76 in 1918-19 and to 116 in 1917. The partition of the

03440004 Survey of Inland Outline Map printed in 1947.
The territorial waters of India extend into the sea to a distance of twelve nautical miles measured from the appropriate base line.
The boundary of Maharashtra shown on this map is as interpreted from the North-Eastern Areas (Reorganisation) Act, 1971, but has yet to be verified.
Responsibility for correctness of internal details shown on the map rests with the publisher.

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Fig. 3.1

country in 1947 created a peculiar problem for the jute industry. Almost all the mills remained in India, but 80 per cent of the jute-producing area went to erstwhile East Pakistan (now Bangladesh). The import of raw jute from East Pakistan (Bangladesh) was cut off due to the political differences between the two countries. A consistent effort to increase the area under jute was able to correct the situation later. In 1950-51, India produced 837 thousand tonnes of jute textile which increased to 1,347 thousand tonnes in 1990-91. During 1986-87 production of jute textiles touched a peak of 1,393 thousand tonnes. Thus 1990-91 actually witnessed a decline in production. There are 69 jute mills, of which 6 belong to the National Jute Manufacturing Corporation (NJMC) under the Ministry of Textiles. These 6 mills account for 12 per cent of the total capacity.

A number of factors have been responsible for the concentration of jute mills in Hooghly basin (Fig. 3.2). Some of them are as follows:

1. The early arrival of British merchants under the aegis of the East India Company in Calcutta.
2. The favourable soil and agronomic conditions in the lower Ganga basin and the Brahmaputra valley.
3. Abundance of water for processing of jute.
4. Advantage of the Hooghly waterway connecting mills with jute-growing areas.
5. Humid climate and port facility of Calcutta for export.

Besides, cheap labour was abundantly available from densely populated states of West Bengal, Bihar, and Uttar Pradesh.

The modern jute industry has been facing a few serious problems. It faces a tough competition from synthetic packing materials of the western countries. As such the market for jute goods has shrunk. The newly established mills and improved machines in Bangladesh are able to produce better quality goods. Hence there is

need for replacing the old and obsolete machinery in order to compete qualitywise. The National Jute Manufacturing Corporation has undertaken the modernisation of its units. The attempts are made to diversify the product range, to improve the quality of goods, to reduce the cost and to develop new products.

Silk Textiles

India has been a well-known producer of silk since the ancient times. This industry got patronage of the rulers during the medieval period. The well-known silk route passed through India and the Indian silk found its place in the world market. India has the distinction of producing four varieties of silk (mulberry *tasar*, *eri* and *muga*). The tough competition with Italy and Japan caused a setback to Indian silk industry and it has declined considerably in recent years. The synthetic fibres and the artificial silk being less expensive and easier to be maintained have been responsible for reducing the popularity of silk.

Karnataka is the largest silk producer state of the country accounting for about 70 per cent of the total production. Assam, West Bengal, Bihar, and Jammu and Kashmir are other important silk-producing states. The Indian silk is demanded in European as well as Asian markets. The USA, UK, former USSR, Saudi Arabia, Kuwait, and Singapore are the major importers of silk dress materials and scarves.

Sugar Industry

The reference of sugar as *sharkara* exists in the Indian scripture which clearly indicates that the ancient people in India knew the art of sugar-making. India has the largest area under sugarcane in the world. It is also the largest producer of sugar in the world if we take *gur*, *khandasari* and sugar together. The modern sugar industry is not very old and was started during the first decade of the twentieth century. Sugar

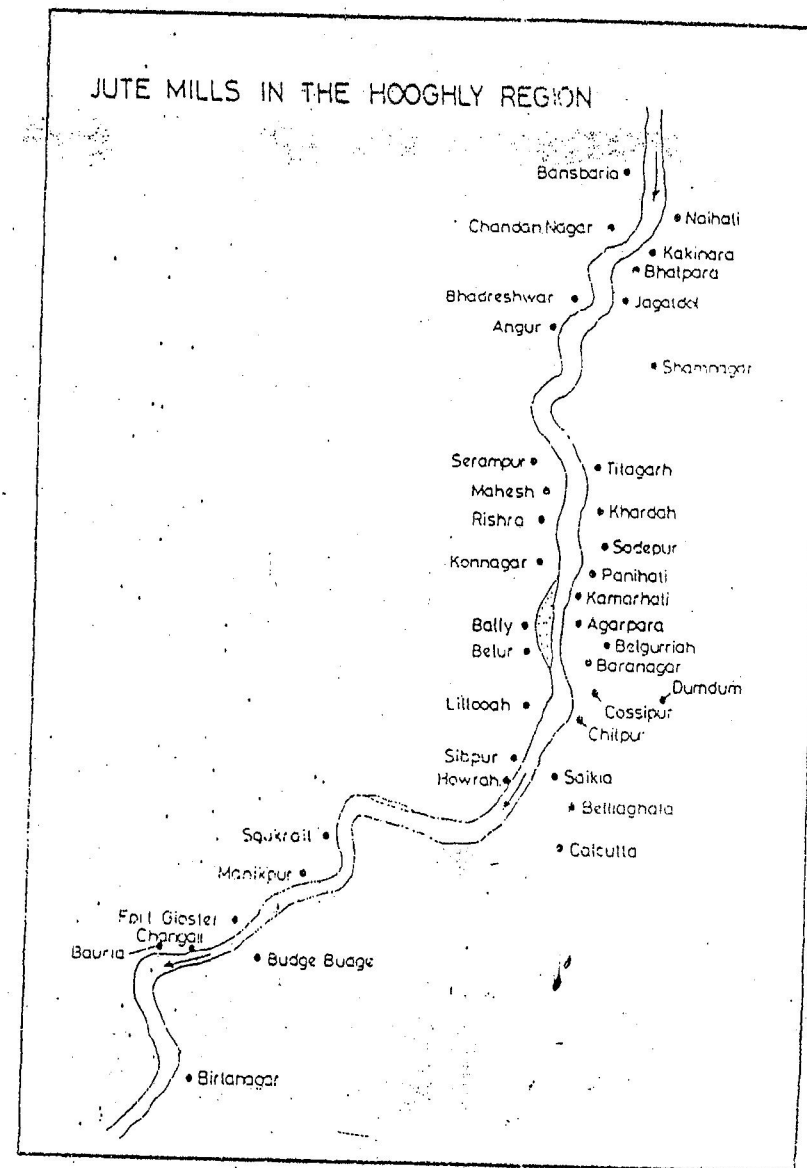


Fig. 3.2

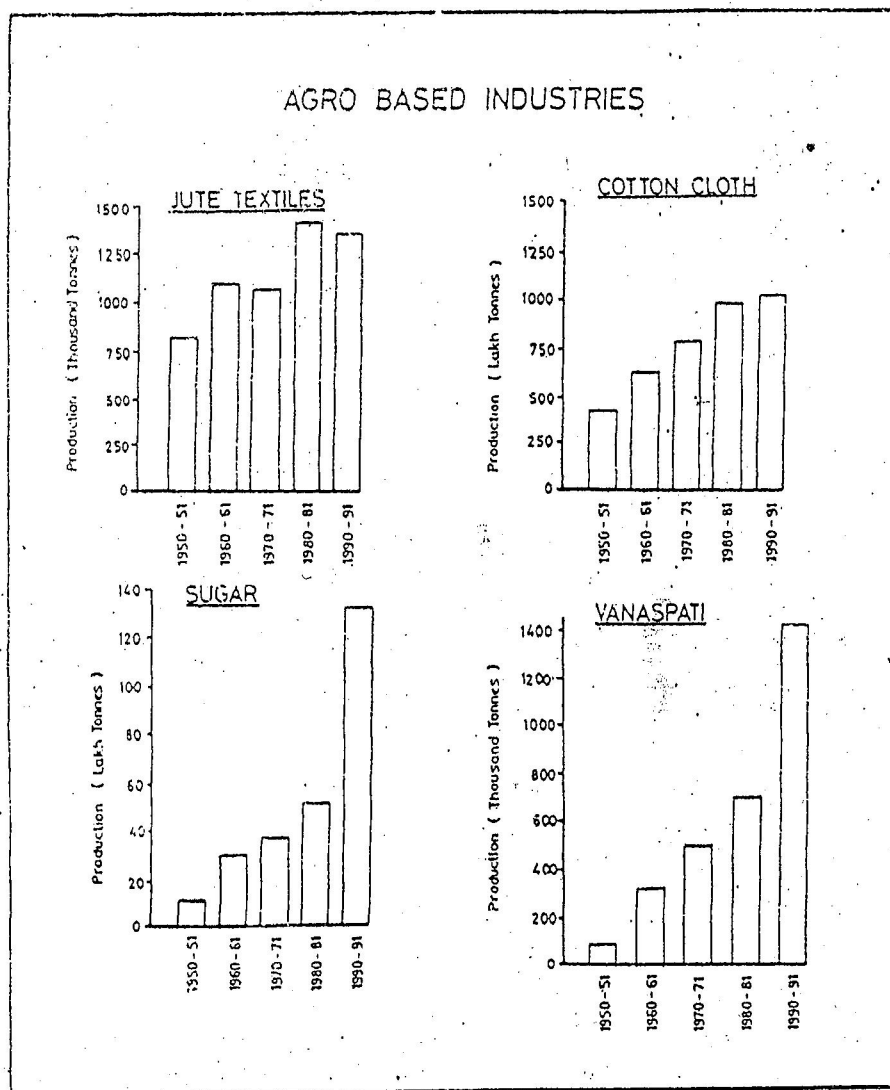


Fig. 3.3

industry in India is based on sugarcane which is a weight-losing raw material. Sugarcane cannot be stored for long as the loss of sucrose content is inevitable. Besides, it cannot be transported to long distances because any increase in transportation cost would raise the cost of production and the sugarcane may dry on the way. Therefore, the sugar industry is established in the regions of sugarcane cultivation. Since sugarcane is harvested in a particular season only, sugar mills are operative for a part of the year only, i.e., during the crushing season. As such, mills remain idle for a long time during off season. These difficulties restrict the production of sugar.

The sugar industry ranks second amongst the agro-industries in India. In 1950-51 there were 138 units producing 11.3 lakh tonnes of sugar. The number of units increased to 377 in 1991-92 producing 132.8 lakh tonnes of sugar.

Uttar Pradesh is the leading producer of sugar. There are two distinct regions of sugar production in this state. One region consists of Gorakhpur, Deoria, Basti, and Gonda in eastern Uttar Pradesh and the other lies in the upper Ganga Plains consisting of Meerut, Saharanpur, Muzaffarnagar, Bijnor, and Moradabad.

The belt of eastern Uttar Pradesh extends further east in Bihar and the districts of Darbhanga, Saran, Champaran, and Muzaffarpur are included in this belt. Sugar is also produced in Punjab. Here most of the sugar mills are located to the east and to the south of Chenab river. Main centres are Phagwara and Dhuri. Ambala, Rohtak, and Panipat are important sugar-producing centres in Haryana. In Rajasthan, sugar is produced in Ganganagar and Udaipur districts.

In peninsular India, Maharashtra is the most important state where sugarcane cultivation and sugar mills are integrated in cooperative system. Major centres of sugar production are Nasik, Pune, Satara, Sangli, Kolhapur, and Sholapur.

Tamil Nadu and Karnataka together have six sugar-producing centres. In Andhra Pradesh sugar mills are located in East and West Godavari, Vishakhapatnam, Nizamabad, Medak and Chittoor.

There are marked differences between the sugar industry of the northern and the peninsular India. The yield of sugarcane per unit area is higher in south than in north. The sucrose content is also higher in the tropical variety of sugarcane in south. The crushing season is also longer in south as it starts in October and lasts till May and June. On the other hand, the crushing season in north India is from November to February only. Development of sugar industry should be given attention as it earns foreign exchange. At present we face stiff competition from Cuba and Indonesia in the international market.

Vegetable Oil Industry

Vegetable oil is a major source of fat in the diet of the Indian people. It is a widely used cooking medium. The type of edible oil used in one part of India is different from the other. On the basis of the technology used, the oil industry can be divided into three groups. In the villages, *ghani* is the main technology for expelling oil. Local raw materials (oil-seeds), for example, groundnut in Gujarat, coconut in Kerala and mustard seed in Uttar Pradesh are used for this purpose. Factories using intermediate level of technology are located in towns. The raw materials (oil-seeds) used are region-specific. The third group comprises of large-scale sophisticated mills which located near big towns. They are oriented towards a bigger market. They may have to procure oil-seeds from a larger area. Although oil industry is scattered all over the country, their sizes differ from location to location.

Vanaspati is 'hydrogenated' oil and its production has increased more than eight times from 1950-51 to 1991-92. The total production

of *vanaspatti* in 1950-51 was 170 thousand tonnes which has increased to 14,169 thousand tonnes in 1991-92. In spite of the constant increase in the production of *vanaspatti*, it falls short of the country's requirements and, therefore, it has to be imported. India imported edible oil worth Rs. 248 crores in 1991-92. Maharashtra has the largest number of *vanaspathi*-producing units. Other important *vanaspathi*-producing states are Uttar Pradesh, Gujarat, Punjab, Andhra Pradesh, West Bengal, Karnataka, Rajasthan, Tamil Nadu, and Madhya Pradesh.

LIGHT INDUSTRIES

There are a few consumer goods industries which can be termed as light industries. These industries are: leather goods, paper, glass, and rubber.

Leather Goods Industry

India has a large flock of livestock and supports about 20 per cent of the total bovine population of the world. The bovine population increased from 22.7 crore in 1961 to 26.2 crore in 1982. Thus India produces large quantity of hide and skin from the dead as well as slaughtered animals. The Indian leather industry has two components: tanning and manufacturing of leather goods like shoes, belts, purses, etc. The tanned hides and skins are used for making shoes which are manufactured in small units spread all over the country. The major centres of footwear production are Kanpur, Agra, Calcutta, Mumbai, and Bangalore.

India was an important exporter of hides and skins but now she has become a leading exporter of finished goods. The leading buyers of Indian leather goods are the USSR, the UK, Japan, Italy and France. The USSR, the USA, Canada and some East European countries are major importers of footwear from India.

Paper Industry

The tradition of making paper is quite old in

India. The ancient people used to write on *bhojpatra* which is the bark of birch tree. The Muslims introduced the art of paper-marking. The first industry, of course, was established in 1832 at Serampore (West Bengal) which could not survive. In 1870, a fresh venture was started at Ballygunj near Calcutta. The planned development of paper and paper-board industry began after independence. There were 17 paper mills in 1951 and their installed capacity was 1.37 lakh tonnes. The increasing demand of paper and allied products led to its rapid progress. By the end of 1987 there were 299 units manufacturing paper and paper-board. India produced 24.3 lakh tonnes of paper and paper-board in 1991-92 which has increased from 8 lakh tonnes in 1970-71. The National Newsprint and Paper Mills at Nepanagar was the only unit in the country manufacturing newsprint till 1981. It had started production in 1955. Since 1981, three more units manufacturing newsprint have been started. India imported paper, paper-board and allied products worth Rs. 488 crores in 1991-92.

Bamboo, *sabai* and *salai* grasses, rag, waste paper and pulp are the main raw materials used in paper industry. The location of paper industry is very strongly influenced by the availability of raw material and to a lesser degree by the market. West Bengal had the advantage of early start of this industry. The paper industry in West Bengal is based on bamboo which is available locally or is obtained from Assam. Orissa and Bihar and *sabai* grass which is obtained from Madhya Pradesh. Titagarh, Kakimara, Naihati, Calcutta, and Baranagar are some of the important centres of paper manufacturing in West Bengal. Sirpur and Rajamundry are the important centres in Andhra Pradesh. Maharashtra is also a leading producer of paper and paper-board. While Vikhroli, Kalyan and Goregaon have paper-board mills, Pune, Mumbai, Ballarpur, and Kamptee have paper manufacturing units. Indore, Bhopal,

MANUFACTURING INDUSTRIES

Sehore, and Shahdol are the important paper manufacturing centres in Madhya Pradesh. Belagola Mill in Karnataka uses bagasse as the raw material for paper-making. Other states which have paper manufacturing units are Uttar Pradesh, Bihar, Haryana, Tamil Nadu, Gujarat, Orissa, and Kerala but the number of units in these states are not comparable with that of West Bengal and Maharashtra.

Rubber Goods Industry

The natural rubber is obtained from the rubber plantations of the three southern states, i.e., Kerala, Karnataka and Tamil Nadu. Another major source of the raw material for the manufacture of rubber goods is synthetic and reclaimed rubber. The development of automobile industry and increasing demand of vehicles has given impetus to rubber industry. The total demand for tyres during 1991-92 has been 260 lakhs. With the development of road transport, the tyre and tube industry is bound to grow. The synthetic rubber is an important substitute of natural rubber. The first synthetic rubber factory was started in Bareilly in 1955. Besides tyre and tubes, rubber is used in the production of a number of other items, e.g., footwear, fan belts, rubber hoses, surgical, and industrial rubber gloves, transmission belts, etc. The rubber industry is concentrated in the Hooghly belt and the hinterland of Mumbai.

Glass Industry

The basic raw materials used in glass industry are sand, limestone, feldspar, soda ash, silica, etc. Almost all the raw materials are available in India. Only a small quantity of soda ash is imported. The first glass industry in the country was established in 1941. Firozabad in Uttar Pradesh and Belgaum in Karnataka have units manufacturing bangles and beads. In north India, the glass industry is concentrated in Uttar Pradesh in a belt running from Bahjoi in Bijnore to

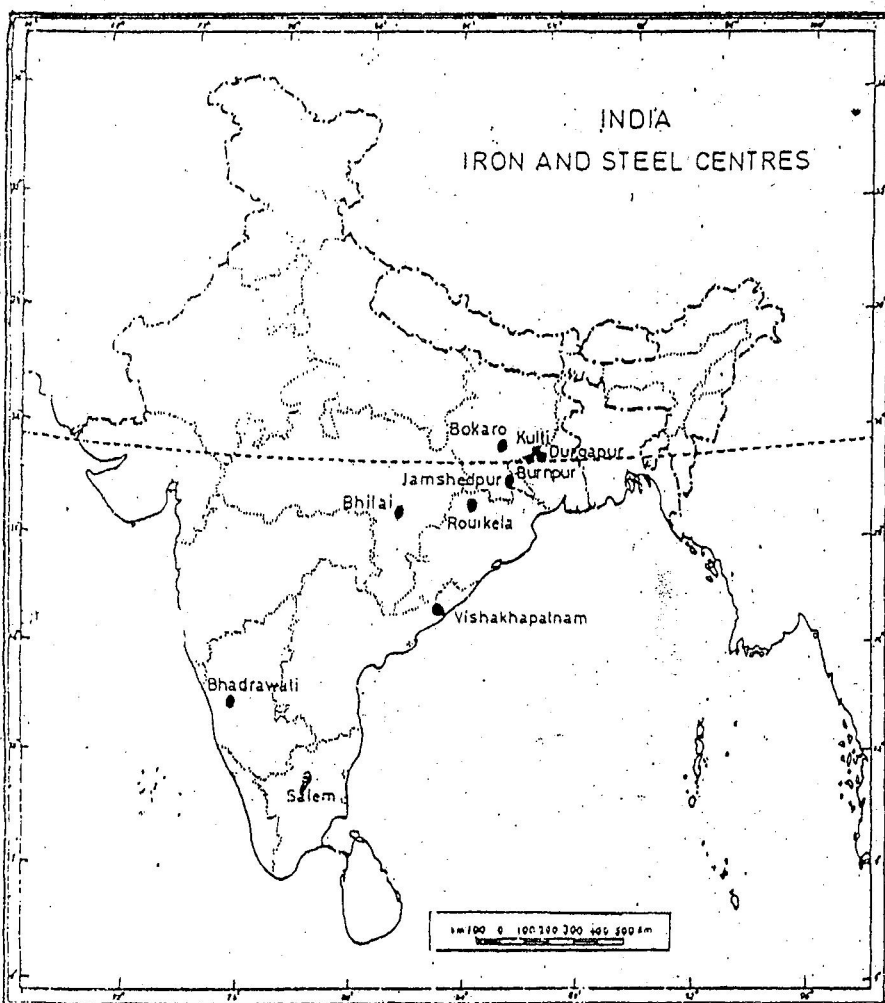
Shikohabad in Mainpuri district and thence to Allahabad district. Hathras, Sasni, Etmadpur, and Naini are other important centres lying in this belt. Pune, Mumbai, Satara, Nagpur, and Kolhapur are the centres of glass industry in Maharashtra. Bottles, glass sheets and lamps are the main products in Maharashtra. The other major region of glass industry lies in West Bengal which extends from Calcutta to Asansol. Belur, Belgachia, Rishra, and Durgapur are the main centres specialising in bottles, sheet glass, laboratory wares and flasks. Glass industry is also there in the cottage sector.

MINERAL-BASED HEAVY INDUSTRIES

Minerals are the natural means of production as they provide raw materials for many industries based on ferrous and non-ferrous metallurgical processes. Iron and steel industry is a basic industry and forms the backbone of industrial development of any country. In India it provides the basic support to its economic development.

Iron and Steel Industry

The science and art of making steel is very old in India. However, the modern industry had its beginning in 1870 when the Bengal Iron Works Company was established at Kulti in West Bengal. The large-scale industrial production of steel could be started only with the setting up of Tata Iron and Steel Company (TISCO) at Jamshedpur (Sakchi at that time) in 1907. The Indian Iron and Steel Company (IISCO) was set up in 1919 at Burnpur followed by the setting up of Mysore Steel Works at Bhadravati (now Visvesvaraya Iron and Steel Works) in 1923. Iron and steel industry witnessed rapid growth after independence. India produced 16.9 lakh tonnes of pig iron in 1950-51. The development of iron and steel industry was envisaged during the First Five Year Plan but it was during the Second Five Year Plan, that the three integrated steel projects were started in Bhilai, Rourkela and



Survey of India Outline Map printed in 1947.
The territorial waters of India extend into the sea to a distance of twelve nautical miles measured from the appropriate base line.
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Fig. 3.4

Durgapur. The production of pig iron increased to 92 lakh tonnes in 1990-91 and steel production increased to 96 lakh tonnes in 1990-91.

The oldest steel plant is located in Jamshedpur in the Singhbhum district of Bihar. It is a private sector enterprise. This plant obtains haematite iron ore from Gurumahisani mines of Mayurbhanj in Orissa and Noamundi mines of Singhbhum in Bihar. Manganese comes from the Joda mines of Kendujhar district in Orissa. Coking coal is obtained from Jharia mines located at a distance 177 kilometres. Dolomite, limestone and fire clay used as flux material are available from the Sundergarh district of Orissa. Calcutta, located at a distance of 250 km, provides port facilities and its industrialised hinterland provides market for the product. Steel plants require lot of water for cooling purposes. Jamshedpur is located on Subarnrekha river. Besides, the storage dam at Kharkai river also provides water. Jamshedpur is well connected with Calcutta, Mumbai and Chennai by road and rail. The highly populated regions of Bihar and Orissa supply cheap labour. The TISCO produced 22.76 lakh tonnes of crude steel and 19.1 lakh tonnes of saleable steel in 1987-88.

The three plants at Kulti, Burnpur and Hirapur have been merged together and are known as Indian Iron and Steel Company (IISCO). It was brought under the government control and management in 1976. The three plants are linked by Calcutta-Asansol railway line. Hirapur plant produces pig iron which is sent to Kulti for making steel. The rolling mills are located at Burnpur. The IISCO receives the ore from Guna mines. It used to receive coal from Jharia, located at a distance of 137 km but now the power from the Damodar Valley Corporation is extensively used. Manganese and limestone are obtained from the neighbouring mines of Bihar and Orissa. The rail and road links connect it to the port of Calcutta. While the saleable steel has shown decrease from 5 lakh tonnes in 1985-86

to 3.98 lakh tonnes in 1991-92, the crude steel has also recorded decrease from 5.65 lakh tonnes in 1985-86 to 3.63 lakh tonnes in 1991-92. The production of pig iron has increased from 90 thousand tonnes in 1985-86 to 4.3 lakh tonnes in 1991-92. The take-over by the government in 1976 does not seem to be so effective in the progress of the company as expected.

The Visvesvarayya Iron and Steel Ltd. is located at Bhadravati in Shimoga district of Karnataka State. This plant was brought under State control in 1962. It gets iron ore from the Kemmangundi mines located in Chikmagalur district. At the time of the setting up of the plant in 1923 the charcoal obtained from the forest-wood was used for smelting because coal was not available. Now it uses hydro-electric power obtained from Sharavati Power Project. Manganese and limestone are obtained from the neighbourhood within a radius of 50 km. This plant produces high quality chrome steel.

The three plants under the public sector, i.e. Bhilai, Rourkela and Durgapur came into operation during 1956-62. The capacities of these plants were expanded during the Third Five Year Plan and a proposal of setting up a steel plant at Bokaro was also made.

The Hindustan Steel Ltd., Bhilai was set up in Durg district of Madhya Pradesh which is an economically backward region. Its purpose was to bring waves of development. It is connected with Calcutta and Nagpur by railway. The plant at Bhilai was established with the technical and financial support of former USSR. It came into operation in 1959. It procures iron ore from Dalli-Rajhara range which has haematite ore. Coal is obtained from Korba and Kargali fields located at a distance of about 225 km. Bhandara and Balaghat mines supply manganese. Limestone comes from Nandini mines. The Korba Thermal Power Station is the main source of power. Bhilai plant produced 34.4 lakh tonnes of saleable steel during 1991-92.

The Hindustan Steel Ltd., Rourkela is located in Sundergarh district of Orissa. This plant has been established in collaboration with Germany. It also became operative in 1959. This plant uses the iron ore obtained from Sundergarh and Kendujhar district. These iron ore sources are located within a distance of 77 km, from the site of the plant. Coal is obtained from Jharia coalfields, located at a distance of 225 km, and Talcher, located at a distance of 169 km. Hydro-electric power is supplied from the Hirakud Power Project. The plant receives manganese from Barajamda, dolomite from Baradwar and limestone from Purnapani. These materials are located within a radius of 222 km in Orissa. Rourkela is linked by Bagpur-Calcutta railway line. Calcutta provides the port facilities and its hinterland serves as the market. It recorded a total production of 12.34 lakh tonnes of crude steel, 11.25 lakh tonnes of saleable steel and 41 thousand tonnes of saleable pig iron during 1991-92.

The Hindustan Steel Ltd., Durgapur has been set up with the help of the United Kingdom and the production started in 1962. It is located at Durgapur in Bardhaman district of West Bengal. The Calcutta-Asansol railway line links it with other parts. The plant obtains iron ore from Bolani mines in Kendujhar district, coal from Jharia coalfields and the hydro-electricity from the Damodar Valley Corporation. Limestone is obtained from Birmitrapur in Sundergarh and manganese from Jamda mines in Kendujhar district of Orissa. Calcutta is the nearest port and its hinterland provides the market. This plant produced 12.3 lakh tonnes of crude steel, 11.25 lakh tonnes of saleable steel and 69 thousand tonnes of saleable pig iron in 1991-92.

The Bokaro Steel Plant was set up during the Third Five Year Plan and the production started in 1972. The plant is located in Hazaribagh district of Bihar at the confluence of Bokaro and Damodar rivers. This is the second plant set up

in collaboration with the former USSR. The plant receives iron ore from Kiriburu mines in Kendujhar district of Orissa. Coal is obtained from Jharia coalfields located at a distance of 65 km. Hydro-electricity is obtained from the Damodar Valley Corporation. Limestone comes from the Palamau district of Bihar. Bokaro has a capacity of producing 40 lakh tonnes of crude steel and 32 lakh tonnes of saleable steel. It produced 34.17 lakh tonnes of crude steel and 27.3 lakh tonnes of saleable steel in 1991-92.

Three more steel plants were planned during the Fourth Five Year Plan in order to meet the requirement of steel during the Fifth Five Year Plan. These plants were located at Salem in Tamil Nadu, Vishakhapatnam in Andhra Pradesh and Vijayanagar (Hospet district) in Karnataka. The Salem Steel Plant has the capacity to produce 32 thousand tonnes of stainless steel sheets. It has started commercial production in 1982. The Vishakhapatnam Steel Project is an integrated steel project. A number of modern technological features have been incorporated in designing this plant. It has a capacity of 30 lakh tonnes in terms of liquid steel.

The Steel Authority of India Ltd. (SAIL) is responsible for the management of the integrated steel plants at Bhilai, Durgapur, Rourkela, Bokaro, and Burnpur Alloy Steel Plant at Durgapur and Salem Steel Plant, Salem. It is a government-owned undertaking which manages the production and sales both.

HEAVY ENGINEERING AND MACHINE TOOLS INDUSTRY

Engineering industries are a post-independence phenomena as India was totally dependent on other countries for her machine tools requirement before 1947. This industry has witnessed phenomenal growth and produces a whole range of capital goods and consumer durables. The capital goods required for textile industry, fertilizer plants, power projects, cement, steel

MANUFACTURING INDUSTRIES

and petro-chemical plants, mining, construction and agricultural machineries such as equipment for irrigation projects, diesel engines, pumps and tractors, transport vehicles, etc. are being produced indigenously.

The Heavy Engineering Corporation Ltd. was set up at Ranchi in 1958. It has three projects under its management: Heavy Machine Building Plant, Foundry Forge Plant and Heavy Machine Tool Plant. The Heavy Engineering Corporation fabricates huge machines required for the iron and steel industry. The Mining and Allied Machinery Corporation, Durgapur is the largest producer of coal-mining machinery and equipments. The Mazgaon Dock Ltd. is the only company which has developed the capability of the manufacturing of rigs used in off-shore drilling. On-shore drilling equipments are manufactured by the Bharat Heavy Electricals Ltd. (BHEL), Hyderabad. There are 14 units which manufacture wagons, of which four are in the public sector. These are Burn Standard Company Ltd., Braithwaite and Company, Jessop and Company, and Bharat Wagon and Engineering Company Ltd. Locomotives are manufactured by three units, viz. Locomotive Works, Chittaranjan (West Bengal), Diesel Locomotive Works, Varanasi (Uttar Pradesh), and Tata Engineering and Locomotive Co. Ltd. (TELCO), Jamshedpur.

The Hindustan Machine Tools Ltd. (HMT) is a major manufacture of a wide range of machines and tools. It has its units in Bangalore, Pinjore (Haryana), Kalamassery (Kerala), and Hyderabad. The HMT also produces a wide range of watches. The Praga Tools Ltd. also manufactures tool-cutters, tools, grinders, thread rolling machine and drilling machines. The Bharat Heavy Electricals Ltd. (BHEL) is a public sector undertaking which produces power generation equipments. Its manufacturing plants are located at Bhopal, Tiruchirappalli, Hyderabad, Haridwar, Ranipet, Bangalore, and Jagdishpur

(Uttar Pradesh). Hydroturbines are manufactured at the BHEL plants at Haridwar and Bhopal. M/s Jyoti Ltd., Vadodara, M/s Larsen and Toubro and Flovel are private sector units which produce hydroturbines. The Hindustan Aeronautics Ltd., Bangalore, has acquired capability of manufacturing aircrafts of different types. It has its manufacturing units at Bangalore, Kanpur, Nasik, Koraput, Hyderabad, and Lucknow.

Vishakhapatnam, Mumbai, Calcutta and Kochi are the major centres of ship-building industry. All major shipyards in India, viz. Hindustan Shipyard, Vishakhapatnam; Mazgaon Dock, Mumbai; Kochi Shipyard, Kochi are in the public sector.

CEMENT INDUSTRY

Cement is an important ingredient of modern construction industry. Its manufacturing was first started in Chennai in 1904. Now there are 144 cement factories with a total installed capacity of 5.45 crore tonnes per annum. The production of cement increased from 27.3 lakh tonnes in 1950-51 to 541 lakh tonnes in 1992-93. The cement industry uses limestone, clay and shale as basic raw materials. Besides, coal and gypsum are also used in cement manufacturing. The factories are located near the raw materials to minimise transportation cost of raw materials which are bulky. Tamil Nadu, Madhya Pradesh, Gujarat, Bihar, Rajasthan, Karnataka, and Andhra Pradesh are the leading producers. Distribution of cement industry is very uneven. The most important cement manufacturing belt runs from Bihar to Madhya Pradesh and then to southern Rajasthan. In this belt raw materials for cement industries are obtained from Vindhyan, Kaimur and Rajmahal ranges, sludge from the fertilizer plants and slag from iron and steel plants. The total installed capacity of about 82 major cement producing units is 44.33 million tonnes per annum.

CHEMICAL INDUSTRY

Chemical industry has an important place in the Indian economy. It is the fourth largest industry in size next to iron and steel, textile and engineering industries. Despite its recent origin in India, it has witnessed rapid growth, both in organic and inorganic chemical industries. This industry is responsible for producing a wide range of products like fertilizers, drugs, dyestuffs, pesticides, paints and plastics, etc. It is highly technology-oriented industry and, therefore, a lot of emphasis is laid on research and development.

Basic Chemicals

The chemicals produced on a large scale and which serve as raw materials in the manufacturing of other products are known as *heavy basic chemicals*. Sulphuric acid, soda ash and caustic soda, etc. are included in this category. Sulphuric acid is a basic component in the manufacturing of plastic paints, fertilizers, synthetic fibres, dyestuffs, and is used for leather tanning, etc. More than 80 per cent of the production of sulphuric acid comes from Kerala, Tamil Nadu, Maharashtra, Gujarat, Madhya Pradesh and West Bengal. Some of the important plants are located at Khetri (Hindustan Copper Ltd.), Alwaye (FACT), Mumbai (Dharamsi-Morjee Chemicals), Jamshedpur (TELCO), Burnpur (ISCO), Calcutta (Bengal Chemical and Pharmaceuticals Ltd.), etc.

Sodium chloride and limestone are major raw materials in the manufacturing of soda ash. Tata Chemicals, Mithapur (Gujarat), Dharangadhra Chemical Works, Dharangadhra (Gujarat) and Saurashtra Chemicals, Porbandar are important units. The production of soda ash has increased from 45 thousand tonnes in 1950-51 to 14 lakh tonnes in 1991-92. Caustic soda was originally obtained from soda ash through its chemical conversion. The units manufacturing soda ash also produced caustic soda. Beside the

three units mentioned above, J.K. Chemicals, Thane; Century Rayon, Kalyan, and Titagarh Paper Co., Titagarh also produce caustic soda. The production of caustic soda has recorded tremendous increase. While the total production in 1950-51 was 12 thousand tonnes, it increased to 958 thousand tonnes in 1987-88.

The Hindustan Organic Chemicals Ltd. (HOCL), is a public sector unit, incorporated in December 1960 for manufacturing chemicals required in drug, dyestuffs and rubber industries.

Alcohol-producing industry was started in 1940 mainly to utilise the molasses produce in sugar factories. A large number of alcohol-based chemical industries have developed during fifties and sixties. The oil crisis has revived the importance of renewable feedstock as alcohol. Major industries based on alcohol as the feedstock are acetic acid, acetone, butanol ethyl acetate, PVC, synthetic rubber, etc.

The importance of pesticides (which include insecticide, fungicide and rodenticide, etc.) in agriculture and public health, has led to a steady growth of pesticide industry in India. The Hindustan Insecticide Ltd. (HIL) is a public sector undertaking engaged in manufacturing of insecticides. It has three units, viz. Udyogmandal (Kerala), Rasayani (Maharashtra) and Delhi. Its subsidiary company, Southern Pesticide Corporation (SPC) has a factory at Kovur. The Hindustan Insecticide Ltd. produces BHC, DDT, Malathion and Endosulfan which are widely used in India.

Fertilizers

Fertilizer has become a key input in Indian agriculture, particularly after the green revolution. Its use has increased tremendously after its adoption as a strategy for agricultural development. There were 56 large fertilizer manufacturing units as on by 1993 which produce nitrogenous, complex and phosphatic fertilizers. Besides, there are about 80 smaller units

producing single superphosphate. The progress of fertilizer industry is evident from its production level. India produced 9 thousand tonnes of nitrogenous fertilizers (N) in 1950-51, which increased to 72.4 lakh tonnes in 1991-92. The production of phosphate fertilizers increased from 9 thousand tonnes in 1950-51 to 25.4 lakh tonnes in 1988-89. The setting up of Fertilizer Corporation of India (FCI) in 1961 and the National Fertilizers Ltd. (NFL) in 1974 provided a sound base to this industry. Later the FCI and the NFL were reorganised into four companies on the basis of feedstock and geographical considerations. The public sector factories are located at Sindri, Nangal, Bhatinda, Panipat, Trombay, Gorakhpur, Namrup (Assam), Durgapur, Barauni, Ramagundam (Andhra Pradesh), Talcher (Orissa), Udyogmandal (Kerala) Kochi and Chennai. Six large-sized nitrogenous plants are being set up which are based on the gas supplied through HBI pipeline. These are Bijaipur (Madhya Pradesh), Sawai Madhopur (Rajasthan), Aonla, Dabrala, Jagdishpur and Shahjahanpur (all in Uttar Pradesh). Another nitrogenous fertilizer plant is being set up at Kakinada (Andhra Pradesh).

Light Chemical Industry

Light chemical industry produce drugs, dyes, paints, plastics, varnishes, soaps, and cosmetics.

There are 250 drug manufacturing units in the organised sector. Five of them are in public sector and seven in the joint sector. Public sector companies are: the Indian Drugs and Pharmaceuticals Ltd. (IDPL), the Hindustan Antibiotics Ltd. (HAL), the Bengal Chemicals and Pharmaceuticals Ltd. (BCPL), the Bengal Immunity Ltd. (BIL) and the Smith Kline Beecham Pharmaceuticals Ltd. (SSPL). IDPL has its units at Rishikesh, Hyderabad, Chennai, Gurgaon and Muzaffarpur. It has its subsidiaries established in association with Punjab, Rajasthan, Uttar Pradesh and Orissa governments. The HAL

subsidiaries set up in collaboration with Maharashtra, Karnataka and Goa governments are located at Nagpur, Bangalore and Panaji respectively. The BCPL has four units, two in West Bengal, one in Kanpur and one in Mumbai. These public sector units along with other units in private sector produce a wide range of drugs, medicine and surgical instruments.

The petrochemical industries have revolutionised the industrial scene by providing products which are substituting the traditional raw materials like wood, glass and metals. Its range of product is very wide i.e., plastics, synthetic fibres, synthetic rubber, synthetic detergent, raw materials and a number of other products. Indian Petrochemical Corporation Ltd. (IPCL), Vadodara, has set up a huge petrochemical complex near Vadodara itself which produces a wide range of products.

Industrial Location

An iron and steel industry has been located at Jamshedpur, a glass industry at Firozabad, a sugar mill at Mawana (Meerut district) and a textile factory at Ahmedabad. The question is as to why these factories were located where they are. What factors were responsible for the decision making regarding locating an economic activity at a particular place. While some decisions are guided by comparative geographical advantages accrued from a number of factors, others may have socio-political considerations.

There are a number of geographical factors such as availability of raw materials, energy resources, water, labour, transport and markets which help in determining location of a particular industry. Besides these factors, there are historical, political and economic factors as well which influence the decision regarding location of an industry.

In the early stages of the industrial development, the availability of raw material

exerted greater influence on the location of industries. Hence location of textile factories in and around Mumbai and that of numerous jute mills on the banks of Hooghly river. The nature of the raw materials also influences the location. Industries based on raw materials which are either heavy and bulky and will lose weight in the process of manufacturing or are perishable, tend to locate near the source of raw materials. For example, jute mills in the Hooghly valley, sugar mills in Maharashtra and iron and steel industry in Bihar-West Bengal-Orissa belt are located near the source of their raw materials.

Besides raw materials, availability of energy is another important consideration in the location of industries. The modern factory production always requires some form of energy for moving the machines. The iron and steel industry which traditionally started with the use of cooking coal are source of energy has generally been tied with the coal-fields. The electro-metallurgical and electro-chemical industries are energy intensive industries. They are generally located in those areas where cheap electric power is available. Aluminium industry is an appropriate example of an energy-intensive industry which is located either in the regions of cheap hydroelectric or thermal power. Nevertheless electricity can be transmitted over longer distances and hence such industries can also be dispersed over space. For example, the industrial development in coal deficient peninsular India could be accelerated with the availability of cheap hydro electric power. Petroleum is another source of power which can be transported through pipelines. While the Tata Iron and Steel Company, Jamshedpur and Copper Melting Plant at Khetri were attracted by the presence of raw materials, the fertilizer plant at Nangal and aluminium-producing units at Korba (Madhya Pradesh) and Renukoot (Mirzapur, Uttar Pradesh) were located due to the availability of power.

Transport plays an important role in bringing

the raw materials at the site of processing and then taking the finished products to the market. The industrial development in India got concentrated in the hinterlands of three ports—Calcutta, Mumbai, Chennai—because the ports were connected with their hinterlands by railways and roads. Initially these rail and road links were provided by the colonial powers to suck the resources from the hinterlands for developing industries in their own countries. After independence, industries were attracted to these areas because of the existing infrastructure. Once few industries were set up, they further led to the development of infrastructures, particularly the transportation network. Besides, a number of transportation modes become complimentary to each other and enhance the efficiency. Railways, roadways, shipping and air transport together provide a composite network of transport in a region.

Labour is a very important factor of production and is a major component of the productive forces. Two aspects of labour supply are important for industrial development: (i) cheap labour should be available in abundance, and (ii) plenty of skilled and technically qualified personnel should be available. Advanced economies have tried to reduce the dependence of human labour by automated mechanisation. In the developing economies of the third world labour substituting mechanisation is not desirable because employment generation in some of these highly populated countries is a big problem. Unskilled labour is available in large numbers in the urban locations and thus, the problem of labour supply can be solved by locating industries near urban centres. Besides, labour is much more mobile than many other factors of industrial location. Nevertheless, there are some industries which are labour-specific and are attracted to those places where skilled and cheap labour is available in plenty; for example, the brassware industry in Moradabad (Uttar Pradesh), the

bangle industry in Firozabad (Uttar Pradesh), the utensils industry in Yamuna Nagar (Jagadhari, Haryana), manufacturing of Benarsi sarees in Varanasi (Uttar Pradesh), etc. are some of the industries which are labour-specific and have been developed traditionally in these locations.

Water is required for generating cheap hydro-electric power and also as an input in various industries. For example, iron and steel industry requires large quantities of water for cooling purposes and textile industries require it for bleaching and washing. Food processing, paper and pulp making, jute industry, chemical industry and atomic power plants require huge quantity of water. Hence all these industries are located at such places where water supply is plentiful.

Production of any commodity is meant for consumers. A large market with high demand and people with satisfactory purchasing power provide impetus to industrial development. There are some commodities have a national market. Most of the countries produce some items which are demanded in the international market. With the improvement in the transport system, the national and international markets get integrated. The producers try to reach the customers by advertising their products and thus, extend the horizons of their markets. The government policy helps and facilitates in the expansion of the markets.

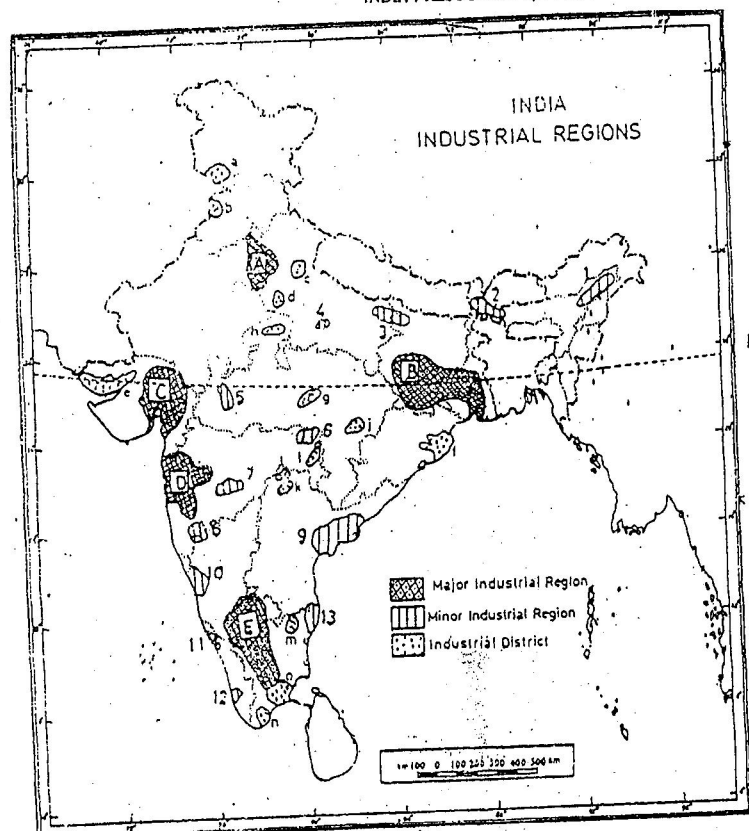
With the scientific and technological advancement, the role of the geographical factors has not remained rigid in the location of industries. Increasing mobility of labour, arrangement of power through long-distance transmission and availability of alternative raw materials have changed the scenario of industrial location. Moreover, there are a number of other factors which influence the industrial location such as availability of capital and financial resources, management skills and the industrial policy adopted by the government. In India, the

governmental interventions such as removing regional imbalances in development by locating industries in backward areas; conserving environments by checking pollution of water, air and land; and reducing overcrowding of industries in some developed regions by dispersal are also important considerations for locating industries. These aspects have been observed in planning public sector units. Location of a refinery at Mathura, a coach factory at Kapurthala and a fertilizer plant at Jagdishpur cannot be explained by traditional geographical factors of industrial location. The socio-political consideration sometime outweigh other traditionally relevant factors.

Industrial Clusters

Industries cannot be ubiquitously distributed because the factors which attract an industry to be located at a particular place are not the same at other places. In India, industrial clustering has taken place in only certain regions due to some advantages. It is evident from the map (Fig. 3.5) that there are three types of industrial clusters, viz. (i) major industrial regions, (ii) minor industrial regions, and (iii) manufacturing districts.

Industrial clusters are identified on the basis of the number of manufacturing units sited in close proximity or the quantum of industrial environment. Major industrial regions in India have developed in the immediate hinterlands of the ports of Calcutta, Mumbai and Chennai. This clustering was modelled by the British as the modern industry needed access to raw materials, to power and to markets. Ports provided access to the raw materials found in their hinterlands. They also provided access to the world market. Due to good transport connections some power resources like coal could also be brought easily. Thus, five major industrial regions emerged and got consolidated over time in India mainly in the hinterlands of the three ports. Amongst these



Based upon Survey of India Outline Map printed in 1947.
The horizontal waters of India extend from the sea to 15 degrees of Indian standard miles measured from the appropriate base line.
The boundaries of the States shown on the map are as interpreted from the North-Eastern Arcs (Reorganisation) Act, 1956, but have yet to be verified.
The boundaries of the Districts shown on the map are as interpreted from the North-Eastern Arcs (Reorganisation) Act, 1956, but have yet to be verified.
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INDUSTRIAL CLUSTERS

Major industrial Regions: A. Delhi and Adjoining Regions, B. Bihar-West Bengal Industrial Belt, C. Ahmedabad-Vadodara

Industrial Belt, D. Mumbai-Pune Industrial Belt, E. Bangalore-Coimbatore-Madurai Industrial Belt
Minor Industrial Regions: 1. Assam Valley, 2. Darjeeling Duars, 3. North Bihar and Eastern Uttar Pradesh Plains, 4. Kanpur, 5. Indore-Ujjain-Nagda, 6. Nagpur-Wardha, 7. Sholapur, 8. Kolhapur-Sangli, 9. Godavari-Krishna Delta, 10. Belgaum-Dharwar, 11. Malabar-Trichur, 12. Quilon, 13. Chennai

Manufacturing Districts: a. Jammu, b. Amritsar, c. Rampur, d. Agra, e. Kuchchh, f. Cuttack, g. Jabalpur, h. Gwalior, i. Bhandara, j. Raipur, k. Nizamabad, l. Adilabad, m. North Arcot, n. Tirunelveli, o. Ranunathpuram

Fig. 3.5

regions, the Hooghly industrial belt emerged as the most prominent, followed by Mumbai-Pune and Ahmedabad-Vadodara belt.

The river Hooghly provided a very good site for the development of a river port—Calcutta which acted as the nucleus for the industrial cluster of Hooghly belt. Calcutta emerged as a trading centre during the late seventeenth century. It expanded as an urban centre, about 97 km inland from the river mouth and became the hub of the present industrial development. Rivers like Ganga, Brahmaputra and their tributaries provided inland water-way connections with the rich hinterland as most of these rivers are navigable. Later, the links provided by navigable rivers were supplemented and strengthened by road and rail routes which further benefited the expansion of Calcutta port.

The development of the tea plantation in Assam and northern hills of West Bengal, the processing of indigo earlier and jute later coupled with the discovery of coal and iron-ore in the Chotanagpur plateau region contributed to the industrial development of the Hooghly Industrial Region. The thickly populated and out-migrating states of Bihar, Orissa and eastern parts of Uttar Pradesh provided cheap labour. Calcutta, having been designated capital city of the British India (1773-1912) attracted the British investment of capital in the vicinity. The establishment of first jute industry at Rishra, on the bank of the Hooghly, ushered in the era of modern industrial clustering in this region. The coal from the Damodar valley provided the source of power to the industries which started springing up on both banks of the river Hooghly. By 1921, Calcutta-Hooghly region was responsible for two-thirds of the factory employment in India.

The partition of the country in 1947 adversely affected this industrial region. India lost 80 per cent of her jute hectareage to erstwhile East Pakistan (now Bangladesh). This created the problem of jute shortage for the jute mills, almost

all of which were located along the Hooghly river in India. This called for the extension of area under jute in West Bengal, Bihar and Eastern Uttar Pradesh to meet the demand of the mills. The partition of the country also disrupted the direct inland water link with Assam. Silting of the Hooghly river has posed another major problem. Desilting of the channel is necessary to keep the Calcutta port alive. The Farakka barrage may help in flushing out the silts of the stream. Haldia port, constructed south of Calcutta, aims at reducing the pressure of cargo ships on the Calcutta port.

The Mumbai-Pune Industrial Region was also initially developed by the British. They obtained the Mumbai island-site for developing a port in 1774. The construction of a 34 km long rail track between Mumbai and Thane in April 1853 ushered in an era of developing link with the interior. The routes through the Bhor Ghat to Pune and through Thal Ghat to Nasik actually extended the influence of Mumbai towards its hinterland. The opening of the Suez Canal in 1869 provided impetus to the growth of Mumbai port. Mumbai region had a favourable environment for the development of cotton textile industry. The cotton was cultivated in the black soil area of the Narmada and Tapi basins. The coastal location ensured humidity in the air which is essential for spinning and weaving. Although this region it could develop hydro-electric power in the Western Ghat region. The port facilities for exporting cotton and importing machineries and other materials, linked the hinterland with the port more effectively and made Mumbai the 'Cottonpolis of India'. With the development of cotton textile industry, the chemical industry developed too. Now the industrial centres have developed from Mumbai in Kurla, Ghatkopar, Vile Parle, Jogeshwari, Andheri, Thane, Bhandup, Kalyan, Pimpri to Pune. Many textiles, engineering goods, leather, synthetic and plastic goods, chemicals, drugs, electricals, ship-

building, transport and food industries have dotted the landscape.

The partition of the country in 1947 adversely affected the textile industry as 81 per cent of the irrigated cotton area growing long staple cotton went to Pakistan. Today Mumbai region is facing the problem of industrial crowding and lacks space. Dispersal of industries from this region is essential to bring about decongestion. Reclaiming more land from the sea is not economical and, therefore, the future growth will have to be controlled.

The Ahmedabad-Vadodara Industrial Region has inland location. The industrial belt extends between Ahmedabad-Vadodara and Bharuch and coincides with the cotton-growing belt of Gujarat plains. This region became an important textile region with the decline of the cotton textile industry in Mumbai due to the higher transportation cost of bringing cotton from peninsular parts of India and also because of the congestion. This region lies within the zone of the production of cotton. It has the double advantage of the proximity of the raw material source as well as the densely populated areas of the Ganga plains providing extensive market. The discovery of mineral oil in the Gulf of Cambay led to the development of petro-chemical complexes around Ankaleshwar and Vadodara. The establishment of a new port at Kandla helped in the rapid industrialisation of this area. The industries are now diversified. Besides textiles and petro-chemicals, diesel engines, textile machinery, pharmaceuticals and food processing industries have also developed. Ahmedabad, Surat, Bharuch and Vadodara are important industrial centres of this region.

The Madurai-Coimbatore-Bangalore Region is predominantly a cotton-growing tract but this region has a large number of silk manufacturing units, sugar mills, leather industry, chemicals and machine tools, etc. The public sector units like Hindustan Machine Tools Ltd. (HMT),

Indian Telephone Industry, Bharat Electronics, Hindustan Aeronautics, and Visvesvaraya Iron and Steel Works are also located in this region. Madurai, Sivakasi, Tiruchirappalli, Coimbatore, Madukottai, Mettur, Bangalore, Mysore, and Mandya are important industrial centres. The availability of cotton and sugarcane in the region provided base for these two agro-based industries. The hydro-electric power generated at Mettur, Sivasamudram, Papanasam, Pykara, and Sharavati provided cheap energy resource as coal is not found in this region. Coimbatore in Tamil Nadu and Bangalore in Karnataka have witnessed rapid industrial growth in this region.

The Chotanagpur Plateau Industrial Region owes its development to the discovery of coal in the Damodar Valley and iron ore in the Bihar, Orissa mineral belt. Both these raw materials are found in close proximity which has facilitated their utilisation in the region. Besides raw materials, power is available from the dam sites in the Damodar Valley and the thermal power stations based on the local coal. This region is surrounded by highly populated states of Bihar, Orissa and West Bengal which provide cheap labour. The Calcutta region provides a large market for the goods produced in the Chotanagpur region. It also provides the port facility to the region. It has the advantages for developing ferrous metal industries. The Tata Iron and Steel Co., Indian Iron and Steel Co., Hindustan Steel Limited at Durgapur and Bokaro are the important steel plants located in this region. Heavy engineering, machine tools, fertilizers, cement, paper, locomotives and heavy electricals are some of the other important industries in this region. Important nodal centres of this region are Ranchi, Dhanbad, Chaibasa, Sindri, Hazaribagh, Jamshedpur, Daltonganj, Garwa and Japla.

A number of industrial clusters have assumed importance after independence. Once such industrial region has emerged between Agra-Mathura-Meerut and Saharanpur in U.P.

and another parallel belt extends between Faridabad-Gurgaon-Ambala in Haryana. Both these belts merge in an agglomeration in the vicinity of Delhi. The hydro-electricity from Bhakra-Nangal and thermal power from Harduaganj and Farida have very positively contributed to the industrial development of this region. Majority of the industrial units are agro-based, particularly sugar and textile mills. Glass, chemicals, engineering, paper, electronics, and cycle are other important industries of the region. Agra and its environs have glass industry. Mathura has an oil refinery with its petro-chemical complex. Gurgaon has a car factory as well as an unit of the IDPL. Faridabad has a number of engineering and electronics industries. Ghaziabad is a large centre of agro-industries. Saharanpur and Yamunanagar have paper mills. Modinagar, Sonapat, Panipat and Ballabgarh are other important industrial nodes of this region.

On the Path of Industrial Self-Reliance

The industrial policy enunciated in 1956 aimed not only at accelerating the growth of output and employment but also to plan the dispersal of growth, removal of regional imbalance in industrial development and development in village and small-scale industries. Self reliance was a major objective within the frame of the 'mixed economy'. The planned development has succeeded to the extent that India has now been able to produce a broad range of industrial products. The major break-through has been achieved in the production of the capital goods. The country has attained self sufficiency in the production of equipments used in mining, irrigation, power, transport and communication.

India has also generated one of the largest pool of skilled man-power in the third world countries which is well trained and equipped to provide human resource base to the industrial development. Public sector industries such as power, railways, petroleum, coal, steel and fertilizers have played crucial roles in the industrial development of our country. These public undertakings have served as powerful instruments of the development of backward regions where private entrepreneurs did never want to invest. During the Seventh Five Year Plan emphasis was laid on high technology, high value-added and knowledge-based industries like electronics, advanced machine tools and telecommunications. The Government of India has set up the Bureau of Indian Standards for maintaining a national standard in the quality of various products. The ISI mark is awarded to those goods which are produced following BSI's prescribed specifications.

The dispersal of industries over space is essential to reduce the industrial congestion in the highly industrialised belts so that the pressure on the infrastructure, land and civic amenities may be reduced. To encourage such dispersal, incentives in the form of concessions and subsidies have been provided. Special subsidy scheme has been introduced in the 'no industry' districts. The development of industrial estates in every district with adequate infrastructure facility may help in the growth of small scale industries generating more employment. The crux of the problem is to reduce the pressure of population on agriculture and make the industries absorb the surplus labour from the agricultural sector.

EXERCISES

Review Questions

1. Answer the following questions briefly:
(a) What do you mean by 'manufacturing'?

- (b) What are the major factors influencing the location of industries? Give examples.
 - (c) Name the iron and steel plants established after independence.
 - (d) What are the non-geographical factors of the location of industries? Illustrate your answer with examples.
 - (e) Evaluate the location of the Tata Iron and Steel Co. at Jamshedpur.
2. Differentiate between:
 - (a) Heavy and light industries
 - (b) Public and private sector industries
 - (c) Consumer goods and producer goods industries
 - (d) Pure and gross raw materials.
 3. Discuss the formation of industrial clusters in India. Name the important clusters and give reasons for their development.
 4. Why have the textile industries moved from Mumbai region towards Ahmedabad? Explain with the help of suitable examples.
 5. Why has the industrial development remained confined to the immediate hinterlands of the ports of Calcutta, Mumbai and Chennai?

Activities

6. Organise a visit to an industrial unit in your vicinity and observe the production process.
7. Organise a debate on: "In the opinion of this house, the industry in India should be more labour-absorbing and not labour-displacing."

CHAPTER 4

Transport Systems

Transport systems play an important role in linking production with consumption. The production itself is facilitated by the transport systems as processing site is linked with the sites of the raw materials. Similarly it is with the help of a developed transport system that goods and services are distributed in the local, national and international markets. It not only ensures the movement of people and materials but also the movement of ideas and skills from one region to the other. Human beings have been mobile, from the early phases of their economic development, as hunters, gatherers and nomadic herders. In the long history of their cultural development human beings used different modes of transport to move from one place to the another and in the process they have strived to achieve access over extensive space in the shortest time. The development of efficient transportation network reflects the development of economy.

India is a vast country with long distances from Kashmir to Kanyakumari and from Kandla to Kohima. She has great diversity in resource endowments, economic activities, ethnic and cultural structure and over-all geographical conditions. Its cultural plurality has been caused by long isolation of different parts and lack of communication amongst different regions in the absence of transportation links. It is India's most vital need to knit the far-flung regions together to strengthen the national economy and to bring about unity in diversity by inculcating the spirit of togetherness and belongingness amongst the people. Transportation network also helps in

reducing the centrifugal forces in a vast country like India. An efficient network of rails, roads, waterways and airways is essential for economic integration, social interaction as well as for the defence of the country.

RAIL TRANSPORT

Indian railway system is the main artery of the country's inland transport. It is the biggest in Asia and the fourth largest in the world. It has a route length of 62,458 km on which 12,670 trains run every day connecting 7,105 stations. Indian railways comprises three gauges: broad gauge (1.675 metres is the distance between both the lines); metre gauge (1.00 metre) and narrow gauge (0.762 and 0.610 metres). Its fleet of locomotives comprises steam, diesel and electric engines.

The pattern of railway network in India has been influenced by political, economic and geographical considerations. Before independence the pattern of the railway tracks was influenced by the policy of the British administration of expanding and consolidating the empire. The colonial policy of exploiting the resources was responsible for providing connecting-link between the port cities and the big regional centres of collection and production. The suction mechanism was evolved in such a way that the surplus production from villages reached the small towns and sub-regional centres. From there it was brought to the big towns which were connected with the ports by railway lines. Thus, the whole hinterland got connected with the ports. The other hurdle in uniform distribution of rail

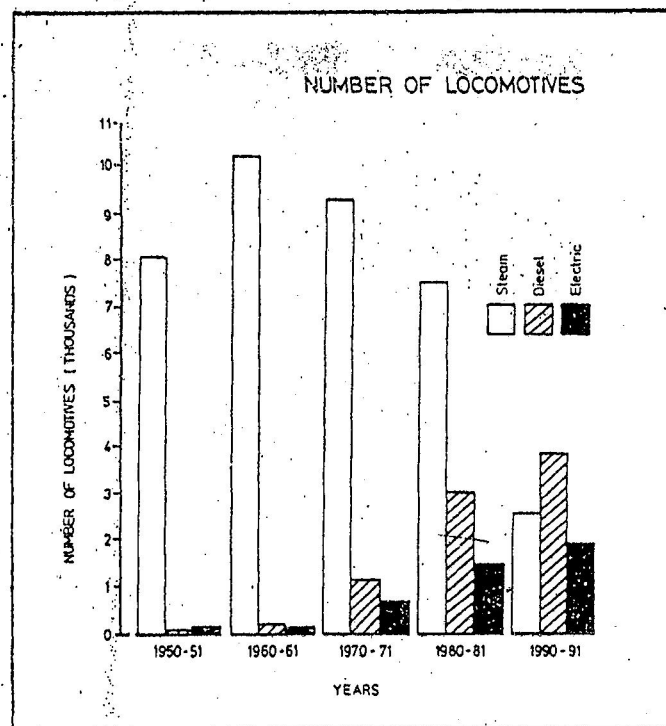


Fig. 4.1

tracks was the presence of enclaves ruled by other foreign powers like France and Portugal. Besides, there were autonomous princely states which managed their own transportation system. They put physical hinderance in the development of an integrated and unified transportation network.

The policy of the British administration of providing rail links to the large regional centres in the Calcutta hinterland led to the decay of a number of important trade centres in east India.

Some other unknown and insignificant centres became important because they happened to be railway junctions, e.g., Mughal Sarai, Tundla and Itarsi. The transportation through the navigable rivers in east India was also discouraged and, therefore, many nodes along the rivers and ferry-towns also decayed.

Besides these political and administrative considerations, the railway network in India has greatly been influenced by geographical factors.

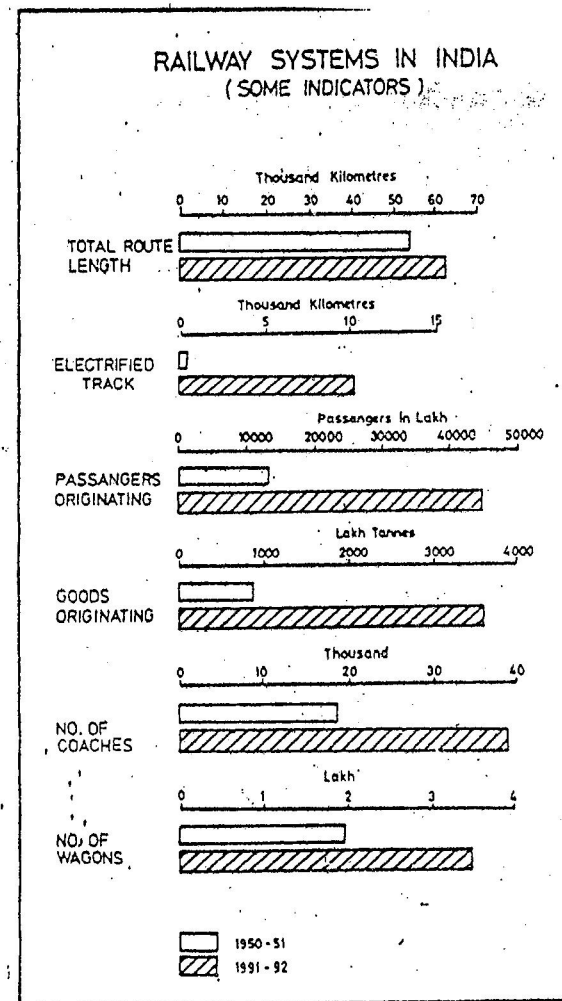


Fig. 4.2

The Northern Indian plains with its level and, high density of population and rich agriculture presented the most favourable conditions for the development of railways. The presence of large number of rivers was the only physical hinderance. Many bridges had to be constructed to link both the banks which involved heavy expenditure. The swift flow of water in the thalweg of the rivers and their wide beds created complications in constructing bridges across them. That is why the flood plains of many such rivers in Bihar and Assam, still do not have rail links.

The hilly terrain in the plateau region of the central India obstructed the direct rail links between two places. The railway track had to be laid through low hills or gaps or tunnels had to be constructed to provide the link. This was costly. The Himalayan ranges in the north have therefore been unfavourable for the construction of railway lines. It could be taken to some of the foothill towns like Jammu (earlier the track terminated at Pathankot), Kotdwar, Haridwar, Kathgodam, etc. A narrow gauge track links Shimla with Kalka and Silliguri with Darjeeling. A railway line between Jammu and Kashmir Valley is being planned. Likewise, it was difficult to lay railway track on the sandy plains of Rajasthan. There was no railway line between Jodhpur and Jaisalmer till 1966. The thickly forested tracts of Madhya Pradesh and Orissa and the deltaic swamps of West Bengal have also been unfavourable for the development of railway network. The hilly and forested tract of the Sahyadri is also devoid of a continuous railway link along the coast. The rail link penetrates up to the coast along the gaps. Mumbai, Vasco de Gama, Mangalore and Kochi are the examples of such rail heads.

A close look at the railway map of India in any atlas would reveal the following pattern of the railway network:

- (i) A dense network of railways has been

developed in the Northern Indian Plain from Amritsar to Howrah with a few focal points like Delhi-Kanpur-Mughal Sarai, Lucknow, Agra and Patna. The whole of Northern Plain is very well connected. While connectivity is more efficient in the north and south direction from the trunk routes. For example, one can reach Calcutta from Delhi within 17 hours though the distance between these two places is about 5,100 km. On the other hand, it takes about 10 hours to reach Dehradun from Delhi though the distance between these two places is not even one-third the distance between Delhi and Calcutta. The rail network in this plain is highly correlated to the level of agricultural and industrial development. Delhi is the focal point from where railway lines radiate in all directions. It is connected with ports through super fast trains.

- (ii) There are a few regions in which the railway network is sparse. The mountainous terrain of the Himalayas is such a noteworthy region. The rugged terrain, hill and valley topography, backward economy and sparse population are the factors responsible for the sparse rail network in this region. The other such region is western Rajasthan where a few metre gauge railway lines have penetrated the arid tract. The Brahmaputra Valley has two parallel lines but no railway line has been constructed on the Meghalaya plateau, or in Tripura, Mizoram, Manipur and Nagaland. The main reasons for the absence of a railway network are the hilly terrain and forested tracts. The cost involved in providing railway tracks in these regions is too high. The sparse population is another important aspect

TABLE 4.1

Railway Zones

S.No.	Zone	Headquarter	Total Route Length 1991-92
1.	Northern	New Delhi	11023
2.	Central	Mumbai VT	6942
3.	Eastern	Calcutta	4294
4.	Western	Mumbai (Churchgate)	9839
5.	North-Eastern	Gorakhpur	5165
6.	North-East Frontier	Malegaon, Guwahati	3858
7.	Southern	Chennai	6928
8.	South Central	Secunderabad	7249
9.	South-Eastern	Calcutta	7161

Source: India, 1991-92.

which has not encouraged this investment.

- (iii) The peninsular region, Gujarat and Tamil Nadu have a denser rail network as compared to other parts. The whole of the peninsular region has a hilly and plateau terrain. The concentration of population is moderate. Therefore, the rail network is also sparse. Trunk routes are aligned in such a way that there are efficient connections between Mumbai-Chennai, Chennai-Kochi, Chennai-Delhi, and Chennai-Hyderabad.

- (iv) There is a distinct contrast in the rail network between eastern coastal plains and western coastal plains. There exists a long trunk route all along the east coast but such a rail track is missing along the western coast from Mumbai to Kochi. The outcrops of the Western Ghats being

very close to the coast, restrict the extent of the coastal plain while the eastern coast is wider and the Ghats lie away from the coast.

The railway system in India is divided into nine zones for the purpose of management and development. The zones with route lengths are given in Table 4.1.

Study Table 4.1 and find out the zones which manage the longest and the shortest route lengths? Which are the two cities having headquarters of two railway zones?

Indian railways contribute to the national economy by transporting both people and material. Table 4.2 provides a glimpse of the magnitude of the service performed by Indian railway system.

Figures in Table 4.2 do not only show the freight handled by the railways but also reflect the level of economic development attained by the

TABLE 4.2

Major Commodities Transported by Railways (in million tonnes)

Commodity	1950-51	1970-72	1980-81	1991-92
Coal	30.9	65.0	64.00	157.73
Foodgrains	7.8	13.5	18.33	27.30
Cement	2.4	11.2	9.64	30.38
Fertilizers	0.6	5.2	8.11	18.94
Mineral Oil	2.7	10.1	14.95	26.41

country. The haulage of foodgrains has increased by about five times in 1992-93 over 1950-51. It shows that the agricultural production has registered a substantial increase. The movement of fertilizers has also registered a tremendous growth which shows that the input of fertilizer in agriculture has increased and thus has provided a base for the development of agriculture. Coal is handled by railways not only for its own use but also for thermal power stations generating power for industrial development. Note the growth of the movement of the mineral oil since 1950-51 till 1992-93.

We have already noted that Indian railways operate on three different gauges. This poses problems in the smooth flow of goods and passengers. The shift from one gauge line to the other involves unloading and transshipment which is time-consuming and expensive. The perishable commodities cannot withstand such a delay. Moreover, the passenger and freight traffic has been increasing day by day. The tracks are not suitable to take the heavy loads. Most of the bridges were constructed long ago and have outlived their life-span. Their repair and maintenance is important to avoid accidents. The lack of space and congestion in some cities has been responsible for the introduction of metro. A stretch of about 30 km of metro is already operative in Calcutta. Other metropolitan centres will have to follow suit in the near future.

ROAD TRANSPORT

Road transport plays a very important role in the transportation of goods and passengers for short and medium distances. It increases the efficiency of other systems of transport by backing up the linkages. It connects the farms and fields to the factories and provides door to door service. The main characteristics of road transport are its flexibility, reliability and speed. It is quite flexible in handling the passenger traffic as a vehicle on the road may be stopped anywhere for picking up

passengers whereas the trains stop only and particular stations. The share of road transport has been increasing constantly due to its advantages. The number of buses has increased from 34,000 in 1950-51 to 3,49,000 in 1991-92, registering annual growth of about 10 per cent, while within the same period the number of trucks has increased from 82,000 to 1,44,000, registering an annual increase of about 18 per cent. About 40 per cent of the bus services are under the public sector, run and managed by the state transport corporations, while the entire truck transport is run and managed by the private sector. The private sector also handles about 60 per cent of the passenger traffic.

The increasing pressure on road traffic cannot be handled only by putting more vehicles on the road but by extending and improving the road network as well. The road network in India is one of the largest in the world. The road length has increased from 4 lakh thousand kilometres in 1950-51 to 20.4 lakh kilometres in 1991-92. Of the total kilometrage, the length of the surfaced (metalled) roads increased from 156 lakh kilometres in 1950-51 to 10 lakh kilometres in 1991-92 while the unsurfaced (unmetalled) road length during the same period increased from 241.5 thousand kilometres to 940 thousand kilometres.

We have observed the development of railways from the coast towards the interior but the road development in India started by interlinking the important centres located inland and then extending them towards the coasts. Delhi-Agra, Delhi-Ahmedabad, Allahabad-Varanasi and Delhi-Lahore got interlinked quite early. A number of roads were laid during the Sultanate and Moghul periods. Most of the present trunk routes follow the Moghul routes. These routes were essential for strengthening and consolidating the empire.

The major roads which are laid and maintained, by the Central Public Works

Department (CPWD) are known as the National Highways. There was a road length of 19,700 km designated as National Highways in 1950-51 which has increased to 34,058 km in 1993-94. The states and Union territories also construct and maintain roads. The state capital is linked with the district headquarters by state highways. The rural areas are interlinked by rural roads, which are generally dusty tracks. It can safely be said that the lower the level of roads in its type-hierarchy the poorer the quality of the road.

Looking at the strategic importance of our border areas, the Border Roads Organisation was set up and entrusted with the construction and maintenance of roads in the border states of the country. These border roads have helped in accelerating the economic development in these areas by increasing accessibility besides helping in strengthening of the defence preparedness.

A glance at the pattern of the road network reflects a high density of roads (length of roads per 100 sq km of the area) in the Ganga, Punjab and Haryana plains. The Karnataka plateau and Tamil Nadu also have a high density of roads. The Deccan plateau has a moderate density of roads. The Himalayan region, western Rajasthan and North-eastern states have low to very low density of road network. Most of these parts are served by roads constructed by Border Roads Organisation.

The pattern of roads in India is highly influenced by the physiographic structure. Constructing and maintaining roads in hilly and arid tracts is difficult. Besides, lower economic development also restricts development of road network. It would also be evident from the map (Fig. 4.4) that Tamil Nadu has the highest density of surfaced road (81.5 km per 100 sq km) while the lowest density of surfaced road is found in Arunachal Pradesh (2.4 km per 100 sq km). Tamil Nadu is followed by Punjab and Kerala. In Assam, Manipur, Himachal Pradesh, Nagaland, Mizoram, Meghalaya and Jammu and Kashmir

the density of surfaced roads is less than 10 km per 100 sq km. It shows that the physiography has been the main determinant of the road density in these states. Amongst the Union Territories, Chandigarh has the highest road density (1291 km per 100 sq km of area).

A number of important National Highways in India run in north-south and east-west directions. They link one part with the other. Sher Shah Suri Marg is historically very important. It used to connect Calcutta with Peshawar. It is now known as National Highway 1, which links Delhi and Amritsar, and National Highway 2 which links Delhi and Calcutta. National Highway 3 runs between Agra and Mumbai via Gwalior, Indore and Nasik. National Highway 7 is the longest one which links Varanasi with Kanyakumari via Jabalpur, Nagpur, Hyderabad, Bangalore and Madurai. It traverses a distance of 2,325 km. National Highways 5 and 17 run along the eastern and western coasts respectively. National Highway 15 represents the border road in Rajasthan desert and runs through Kandla, Jaisalmer, Bikaner and joins the border road in the Punjab.

WATER TRANSPORT

Inland Waterways

Water transport is a cheaper means of transport and is suitable for carrying heavy and bulky materials. India is endowed with many navigable rivers and inland water bodies but the share of inland waterways is only one per cent in the country's transport system. A total river length of 5,200 km of major rivers is navigable by mechanised boats but only 3700 km of this length is utilised. We also have a network of about 4,300 km of canals, of which a stretch of 485 km is navigable by mechanised crafts but only 33.5 km is actually utilised. It shows that the inland waterways are greatly underutilised. Ganga, Brahmaputra and their tributaries are navigable.

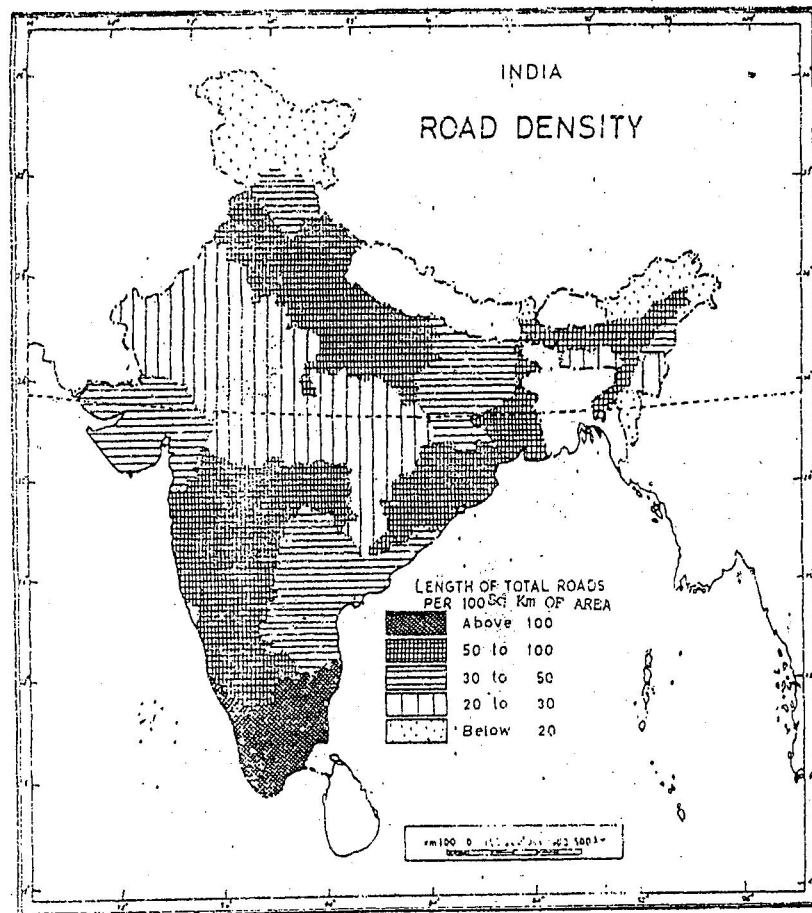
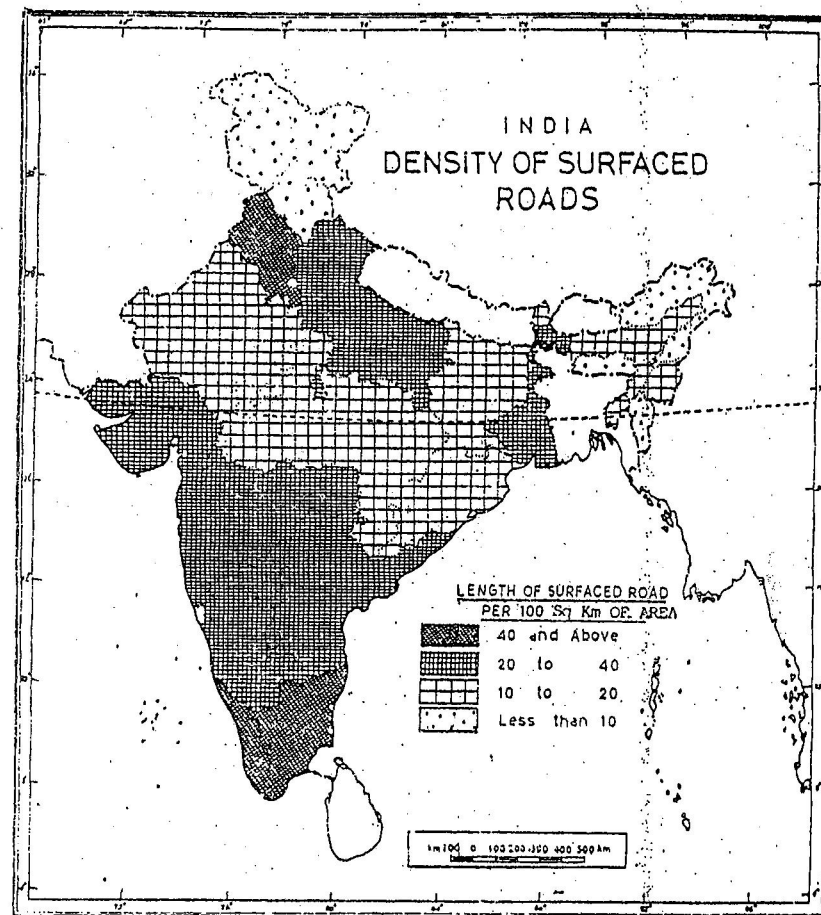


Fig. 4.3



Frontiers of India (British India) as defined in 1947.
The territory of India extends into the sea to a distance of twelve nautical miles measured from the appropriate base line.
The boundary of India shown on this map is as interpreted from the North-Eastern Areas (Regulation) Act, 1951, but has yet to be settled.
Responsibility for correctness of internal details shown on the map rests with the publisher.

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Fig. 4.4

The deltaic areas of the Godavari, the Krishna and the Mahanadi, lower reaches of the Narmada and the Tapi, backwaters of the Kera, the Mandovi and the Zuari rivers of Goa are some of the major inland waterways. Buckingham canal in Andhra Pradesh and Tamil Nadu and the Cumberjua canal are also important navigable canals. The policy for the development of inland waterways is formulated by Central Inland Water Transport Board, New Delhi. The national waterways are developed, maintained and managed by the Inland Waterways Authority of India (IWA) which was set up in 1986. The national waterways (Allahabad-Haldia stretch of Ganga-Bhagirathi-Hooghly River system) Act, 1982 has the provision that the regulation and development of this waterway is the responsibility of the Central Government. The river navigation services are operated for carrying goods between Calcutta and Assam, Calcutta and Farakka and Calcutta and Cachar, by Central Inland Water Transport Corporation, which is a Government of India Undertaking.

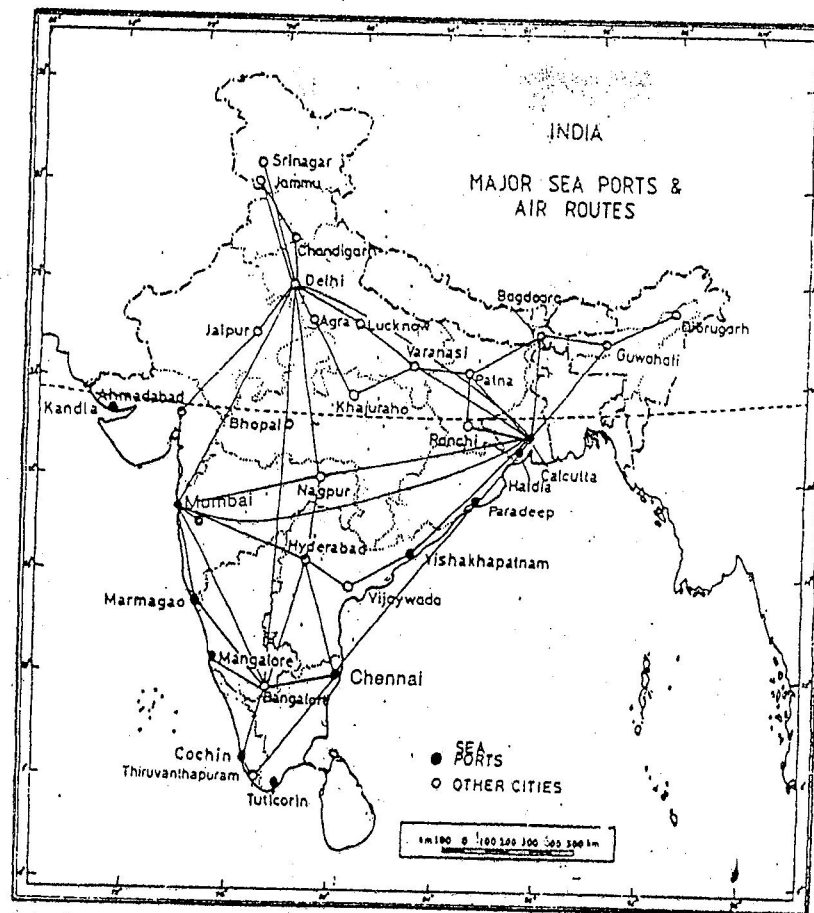
The navigability of rivers and canals is the function of regular flow with an appropriate depth in which the crafts can ply. The seasonal fluctuation in the level of water, presence of water falls and cataracts, silting of the river bed, reduction of water-level due to diversion of water for irrigation, increase in salinity particularly in the coastal water bodies are some of the major problems of the inland waterways.

Ports
India has a coastline of 7,517 km comprising the coastlines of the mainland, Lakshadweep and Andaman and Nicobar Islands. A glance at the map (Fig. 4.5) gives us an idea of the distribution of ports along the coastline of India. It is said that in ship transport nature provides the way and the governments or the companies provide the terminals. This statement very aptly differentiates between the harbour and a port. A harbour is a partially enclosed area in the sea, for example, a

creek, an estuary, or a sea-inlet providing shelter to the sailing ships. A port is that place on the coast, with docks, wharves and berthing facilities, where cargo in large quantities is received from oceanic routes and sent to the interior of the country through land routes and vice-versa. Natural harbours generally occur along a fairly indented coastline. If an inlet or a backwater bay penetrates inland for longer distance, it facilitates the transportation of the land-bound cargo further inland from the open sea board at cheaper rates. Some artificial or man-made harbours are constructed by dredging and erecting a wall against the sea along the coastline. The level of economic development of the hinterland is the major *raison d'être* for the development of the ports.

In India, Mumbai is a natural harbour and the biggest port which handles about one-fifth of the total traffic of the ports. The bulk of the commodities handled at Mumbai consist of petroleum products and dry cargo. Mumbai has developed as a port for historical reasons. The British colonial interests were the major forces for its development and the opening of the Suez Canal in 1869 brought it closer to western Europe. Besides Mumbai, a number of other major ports have developed along the western coast of India.

Kandla is a tidal port which is located at the western end of Rann of Kachchh. The traffic handled at Kandla consists of crude oil, petroleum products, fertilizers, foodgrains, salt, cotton, cement, sugar, edible oils and scrap. Kandla has a capacity of handling a total traffic of 23.2 million tonnes. Marmagao in Goa occupies the fifth position in terms of the total quantum of traffic handled. It has the capacity to handle 16.1 million tonnes of cargo traffic. For a long period, it handled the export of iron ore from Goa. New Mangalore port has facilities to handle the export of iron ore from Kudremukh in Karnataka. Mangalore also handles fertilizers, petroleum products, edible oil, granite stones, molasses and



Based upon Survey of India Outline Map printed in 1967.
The territorial waters of India extend into the sea to a distance of twelve nautical miles measured from the appropriate base line.
The boundary of Meghalaya shown on this map is as interpreted from the North-Eastern Areas (Reorganisation) Act, 1971, but has yet to be settled.
Responsibility for correctness of internal details shown on the map rests with the publisher.

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Fig. 4.5

other general cargo. Kochi is also a natural harbour on the western coast of India. It is located in Kerala. It has sheltered backwater bay. It handles petroleum products, fertilizers and raw materials. The Cochin oil refinery receives the crude oil through this port. A new port at Nhava Sheva is being developed off Mumbai port which will be a highly mechanised modern port. It will also ease out the pressure on the Mumbai port.

Tuticorin, Chennai, Vishakhapatnam, Paradwip and Calcutta-Haldia are the major ports, on the eastern coast of the country. Tuticorin handles coal, salt, foodgrains, edible oils, sugar and petroleum products. Chennai is one of the oldest ports like Mumbai and Calcutta. It mainly handles petroleum products, fertilizer, iron ore and general cargo. It has a capacity to handle a traffic of 21.37 million tonnes. Chennai is often hit by cyclones in October and November and shipping becomes difficult during this season. It is ill suited for large ships because of the lesser depth of water near the coast.

Vishakhapatnam is the deepest land-locked and protected port. An outer harbour has been developed to handle the export of iron ore. Elaborate arrangements have been made to handle crude oil and other petroleum products. It also handles fertilizers. It has a capacity of handling 16.7 million tonnes of cargo traffic. It also has the ship-building and ship-repair industry. Paradwip, which is located on the Orissa coast handles iron ore and coal along with some other dry cargo. It has a capacity of handling 6.05 million tonnes of cargo. Calcutta is actually a riverine port located about 128 km inland from the Bay of Bengal. Calcutta is located on the bank of the Hooghly river, which suffers from the problem of silting as tidal bores enter this part frequently. In order to remove the congestion of traffic at Calcutta, another port, Haldia has been constructed downstream at a distance of 105 km from Calcutta. Haldia has an oil refinery and receives larger vessels which otherwise would

have visited Calcutta. Calcutta has also developed historically and had the initial advantage of being the capital of British India. It has an economically rich hinterland. Besides agriculturally rich Ganga-Brahmaputra valleys, the mineral-rich belt of Chhotanagpur also lies in its hinterland. The industrial belt of Hooghly river-valley and Bihar-Orissa-West Bengal industrial clusters have provided sustenance to this port, which otherwise has many constraints.

The eleven major ports of the country handled a total cargo traffic of 1579 lakh tonnes during 1991-92. This cargo traffic was higher by 3.3 per cent over the traffic handled in 1986-87. The traffic in petroleum, oil and lubricants, coal, vegetable oil, and containerised cargo has substantially increased. The traffic in iron ore, fertilizers and raw materials for fertilizers has gone down as compared to 1990-91. The cargo handled at all the major ports in 1991-92 has increased except in the case of Mumbai.

Besides these major ports a number of minor ports also handle local traffic of cargo. Redi port in Maharashtra and Kakinada in Andhra Pradesh are the appropriate examples of such ports. Attempts are a foot in developing the port facilities in Andaman and Nicobar, Lakshadweep Islands and Pondicherry.

AIR TRANSPORT

Air transport is the fastest but costliest mode of transport. It is an important mode for a country of the size of India where the terrain and the climatic conditions are so diverse and important commercial and industrial centres are located at great distances. It is vital for our internal transport system as well as for the links with other countries. India occupies a central location between western Europe and Africa on the one hand and South-East and East Asia, on the other.

The air transport in India has two sectors. The Air India handles the foreign traffic, both passengers and cargo from four focal points,

Delhi, Mumbai, Chennai and Calcutta. It connects all the continents through its services. The Air India carried 22 lakh passengers in 1993-94.

The domestic traffic is handled by the Indian Airlines Corporation. It carries passengers, cargo and mail to different destinations within the country as well as to eight neighbouring countries. To augment the air transport in the country the Vayudoot airlines was set up in 1981. It generally provides links with remote and inaccessible areas which are not covered by the Indian Airlines. In 1985, the Pawan Hans Limited was established to provide helicopter services in order to link far-flung and inaccessible areas in hilly and forested regions.

PIPELINES

These are the most convenient mode of transport for petroleum, petroleum products and gas in large quantities from one place to the other, particularly over long distance. Now, it has been made possible to transport solids also after converting them into slurry. The pipelines have certain advantages over other transport modes. It can be laid through difficult terrains as well as under water. Its operation and maintenance costs are lower. It involves very low energy consumption. Its disadvantage is that it is not flexible. Its capacity cannot be increased once it is laid. The security of pipelines is also difficult. Underground pipelines cannot be repaired easily and detection of leakage is also difficult. In India, pipelines have been used for transporting crude oil, petroleum products and gas. In 1980, a pipeline network of 5,035 km existed in India which increased to 6,535 in 1985. Solids are transported through pipelines in two areas: iron ore in slurry form from Kudremukh to Mangalore port and rock phosphate concentrates from Maton mines to Debari Smelter plant in Udaipur district of Rajasthan.

The crude oil is transported from Kandla port to Koyali and Mathura refineries through a pipeline. Another prestigious pipeline known as

Hazira-Bijapur-Jagdishpur (HBJ) pipeline has been constructed between Hazira, on the west coast and Jagdishpur in Sultanpur district of Uttar Pradesh. It is a 1,700 km long pipeline which transports gas to a number of fertilizer plants, viz. Sawai Madhopur in Rajasthan, Auraiya (Etawah), Aonia (Bareilly) and Shahjahanpur in Uttar Pradesh.

Besides the oil pipelines in the Mumbai-Gujarat region, its network has also been developed between Assam oil fields and Guwahati, Barauni, and Kanpur. Haldia port refinery is also connected with Barauni through a pipeline. The economic feasibility of transporting coal in slurry form from the coal mines to the thermal power station through pipelines is being worked out.

The Integrating Role of Transport System

Transport plays an important role in strengthening the social, political and economic unity of a country like India, which is known for its vast size and diversity. An integrated and coordinated transport network reduces social distances, political fragmentation and economic isolation. It also helps in generating centripetal forces and minimising the centrifugal forces in society, polity and economy. In India, road and rail transportation are by far the most important modes which the common man widely uses. Like any technology, all modes of transport are also not uniformly available to all segments of the population. The national highways and railways are under social control and the central government is responsible for constructing and maintaining them. Both these modes provide very effective links between far-flung regions of the country. They are the basic economic arteries of the country.

Besides providing movement to people and materials, the roads and rails contribute very effectively in linking the points of production (agriculture, industry) with the points of consumption (markets). The raw materials are

carried to the industries. The agricultural inputs are transported to the villages. These modes provide relief at the time of any natural calamity. Earlier, in the absence of good roads and railways, the famines were frequent in one part of the country or the other. Now in spite of the natural calamities the magnitude of damage is greatly reduced. We do not fear of any famine in India though drought conditions take place in some parts of our country.

In the development of our transport system, 1947 is as important as watershed as the laying of the first rail track in 1853. With the partition of the country moderately integrated transport system which had developed over almost a century, was snapped and fragmented. A large territory extending in Jammu and Kashmir could remain connected through a chicken's neck. The same situation operated in north-eastern states which are connected with the country through a narrow territory. Many nodal points in Punjab, Rajasthan and Bengal became terminal points and lost their economic importance.

The most outstanding role of the transport network is to integrate the economy of the nation. In our country, production specializations exist at the local level. These specialized products have local markets. Such specializations in production as well as consumption get reflected in the differences found in our clothing, diet and artifacts. The transportation network performed the most crucial task of integrating these local markets into our national market. It further extended this integration to international markets. The roads, railways, airways, inland waterways, and ships, all are linked to expand the trade. The ports and airports act as the gateway of the country through which the marketable surplus is exported and the requirements of the national economy are imported. The railways, roads and inland waterways carry the goods inland and bring the surpluses to the ports. Thus, the remotest interior gets integrated with national economy. The

agriculture gets commercialized. The scale of industrial production gets enlarged. Urban centres emerge and mobility of human beings takes place through migrations. All this process is accelerated by transportation network.

The transport as a sector provides impetus for the development of a number of major and ancillary industries like iron and steel, locomotives, coaches and wagons, car, trucks, buses, ships and aircrafts. Thus, the industries based on the requirements of the transport sector get integrated with its growth.

Air transport has made it possible to reach the remote areas in shortest possible time where our forefathers would have reached in years. The distances have shrunk and the space dimension has lost meaning. But these facilities are available to a few only. The endeavour should be to strengthen it further so that at least a few from Leh may feel closer to Kanyakumari and a few from the arid Rajasthan may feel closer to the lush green north-east.

Much more important is the movement of goods and services than the movement of human beings themselves. The regional specializations may be encouraged which in reality is the sub-system of the national economy. The tea from Assam, Darjeeling and Nilgris, coffee from Karnataka, apples from Kashmir and Himachal Pradesh, spices from Kerala, and oil from Gujarat are different production systems integrated at the national level as the products of India.

The integrated transport system is the need for bringing about the balanced regional development. The road, rail, waterways, air and oceanic transport have to provide complimentary services. This sector requires a lot of capital investment. Various agencies looking after different modes of transport should plan in a coordinated manner. The transport network will generate growth impulses in backward regions by providing better opportunities for resource utilizations.

EXERCISES

Review Questions

1. Give brief answers:
 - (a) Why is the transport a vital sector of the economy?
 - (b) Why were the railways extended from the ports to the interior?
 - (c) What are the advantages and disadvantages of road transport?
 - (d) What is a sheltered back water bay?
2. Distinguish between:
 - (a) Broad gauge and metre gauge railway lines
 - (b) National highways and state highways
 - (c) A coach and a wagon
 - (d) A harbour and a port
 - (e) The fare and the freight.
3. Give reasons:
 - (a) The railway network in the North Indian Plains is dense.
 - (b) The water transport is preferred for carrying bulky materials.
 - (c) The Tamil Nadu has the highest density of roads.
 - (d) Very few roads and railways are found in the Himalayan region.
 - (e) Delhi has emerged as a focal point of rail and road transport.
4. Write short notes on:
 - (a) Development of pipelines as a mode of transport in India
 - (b) Inland transport in the Ganga and the Brahmaputra
 - (c) Integrating role of transport in India.

Activities

5. Examine the rail and road maps of India and show whether both networks are complimentary or competitive.
6. Visit the nearest mandi in your town or near your village and note down the goods arriving by trucks.

Regional Development

REGIONS AND REGIONALISATION

GEOGRAPHY is a science of space and is concerned with studying the variations in phenomena found in space. The space in which such variations are studied may be designated as area, zone or a region. Generally, all these three expressions are used to denote a segment of territory. An 'area' refers to the territory in which a particular phenomena is observed. The limits of an 'area' are demarcated by the presence or absence of the phenomena which is being studied. Thus, area should be understood as a territory characterised by availability of the phenomena. A 'zone' is a territory which is distinguished by a certain degree of intensity (density) of the phenomena under study. A 'zone' is characterised by availability as well as intensity (density) of the phenomena which is to be studied, e.g. climatic zone, maritime zone, railway zone. A 'region' is a more complex concept in geographical studies.

Definition and Bases of Formation

A region is a perceived segment of space differentiated from others on the basis of one or more defining characteristics. These characteristics may be of different types and so are the regions. For example, the defining characteristic may be natural (viz. natural vegetation), thus, the defined region will be a natural region (tropical rain forests region). If the defining characteristic is cultural (language) or economic (industrial clusters), the regions will

be identified as cultural regions (Tamil, Telugu or Kannad region) or economic regions (Mumbai hinterland).

The basic criterion in the delimitation of a region seems to be a relative uniformity of homogeneity of geographical phenomena over space. Thus, every region has a certain level of homogeneity of geographical phenomena over space. As such, within a region a certain level of homogeneity is found in the phenomena observed and this makes it distinct from other regions. The observed phenomena may be physical, economic or social, or other characteristics. All those contiguous territories over which the uniformity or homogeneity of the selected phenomena extends are included in one region. Contiguity, therefore, is an important attribute of a region but it is not a necessary condition for delimiting all types of regions. Sometimes non-contiguous spatial units are also put under one region. The United States of America is a political region with Alaska and Hawaii as its non-contiguous units.

The regions may be recognised as *naively given* and *instituted* or *denoted*¹. A *naively given* region refers to a territory as recognised by people or by the people who live outside this territory. For example, Avadh, Mithila and Mewar are *naively given* regions. Generally, these regions do not have sharply defined

¹ Schwartzberg, J.E. Prolegomena to the Study of South Asia Regions and Regionalism, in *Regions and Regionalism in South Asia Studies: An Exploratory Study*, edited by Robert I. Crane, Monograph No. 5, Duke University, 1973

boundaries as they are delimited on the basis of 'shared culture or history and a sense of belongingness amongst the people'. Instituted regions are delimited by human agency and, thus, have distinct limits, for example, states, districts and the administrative regions. Therefore, Uttar Pradesh, National Capital Region and Damodar Valley Corporation are instituted or denoted regions. The denoted regions are further classified as formal (uniform) regions and functional (nodal) regions. The formal region is a geographical area which is homogeneous in terms of selected geographical characteristics such as similar topography, climate, soil or natural vegetation as in the case of natural regions. The regions having similarity in social-cultural factors are designated as socio-cultural regions, for example, linguistic regions are based on similarity of language and tribal regions are based on ethnicity. If the homogeneity is observed in economic attributes such as production structure, income levels, etc., such regions are known as economic regions.

The functional regions are recognised on the basis of organisation, internal flows (of people, goods, services, communication) and the presence of a nodal place or a focus. Thus, functional regions emphasise interdependence (linkage) and may be composed of heterogeneous units such as cities, towns, and villages which get interlinked through flows in a system of interdependencies. The port-hinterland relationships and the city-untilands represent functional regions.

ECONOMIC REGIONS

Human beings have been pursuing different types of economic activities in different parts of the earth. In this economic pursuit they have modified the space. We cannot think of a natural space to exist in its virgin form, after it has been occupied by human beings. Rather we can think of humanised space. The level of economic

development can be ascertained by the capacity of human beings to use and transform resources. All resources are space-bound. Therefore, the homogeneity in the type of resource base and its utilisation has given rise to the need of identifying economic regions. Economic region is a segment of the territory representing the national economy. Economic region can be thought of only when we accept the organisation, location and distribution of production as well as other human activities in terms of a territory or space. Economic activities are dynamic in nature because they keep on changing with the change in technology. The formation of economic regions, therefore, is also a dynamic process and they change with the development of resources, changes with the demand of the products and improvement in the skills. The levels of economic development in a region is a function of its natural resource endowment and cultural development of the people which gets expressed in terms of human beings-nature-culture interaction.

The rate of the development of resources is not uniform in all the regions. It is largely due to the fact that their cultural attainments expressed in terms of technological development is not uniform. In any national economy, a few regions are economically more developed and some happen to be less developed. The economic regionalisation of the country is essential in order to plan economic development.

PLANNING REGIONS

A *planning region* is a segment of territory (space) over which economic decisions apply. The term 'planning' in the present context means taking decisions to implement them in order to attain economic development. The regions for planning purposes may be administrative or political regions such as state, district or the block. Since planning is based on statistical data which are generally collected at the level of

Elements of Integral Region

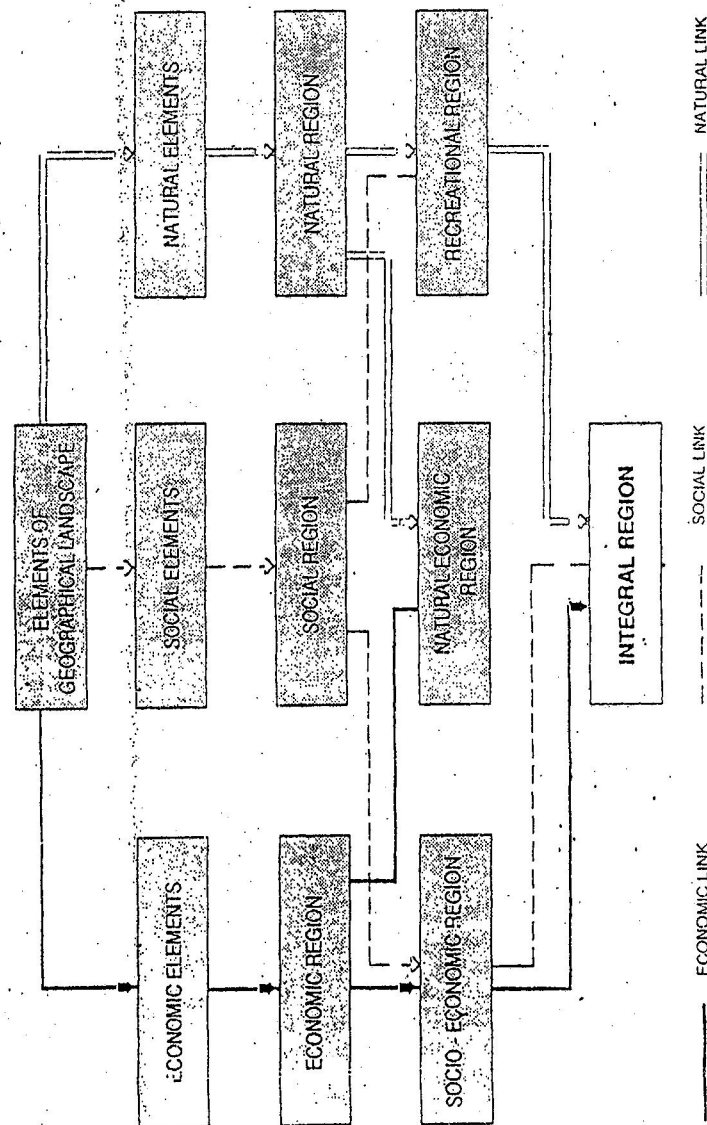


Fig. 5.1

administrative divisions, the planning regions, as a matter of fact, coincide with administrative regions. Thus, the whole country is a planning region for national plans, state is the planning region for state plan and districts or blocks are the planning regions for micro-regional plans. For proper implementation and realisation of plan objectives, a planning region should have fairly homogeneous economic structure as well as topographical and socio-cultural homogeneity. Therefore, a balance has to be struck between homogeneity, nodality and administrative convenience, while delineating the planning regions. A planning region should be large enough to contain a range of resources to provide it economic viability. It should be large enough to contain a range of resources to provide it economic viability. It should be internally cohesive. Its resource endowment should be such that a satisfactory level of product combination for consumption and exchange is feasible. It should also have a few nodal points to regulate the flows. Geographically, it should be contiguous areal unit.

Planning Regions of India

Economic regions provide the firm spatial base for economic planning. The general principles underlying the delimitation of regions according to their hierarchy are as under:

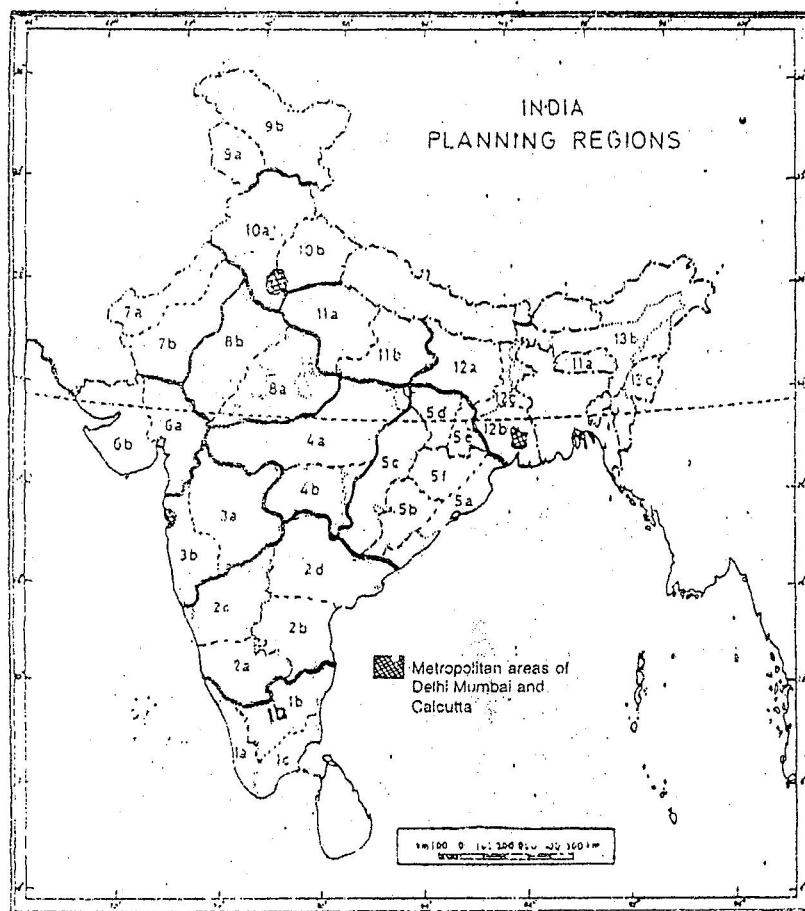
- (i) Production specialisation should provide the base for delimiting economic regions for planning purposes.
- (ii) Thorough understanding of the natural regions with their resource endowment is essential for economic planning.
- (iii) The hierarchy of economic planning regions exists within the frame of natural regions and sub-regions. Therefore, the country should be divided into natural regions as the first step of economic regionalisation.
- (iv) The carving out of the micro, meso and

micro regions should start from the delimitation of the planning unit at the lower order (micro) and then, by grouping and regrouping them, meso and micro regions may be obtained.

- (v) As a principle, the regional boundaries should not cut across various ranks of the regions. The regional boundaries at the micro level have to coincide with the administrative boundaries as these units are also the units of data collection.
- (vi) Meso economic regions for planning will emerge by combining the micro units representing areas of common sets of physical factors and resource endowment.
- (vii) The macro regions are delineated by grouping the meso regions. Generally, they should conform with the states with common sets of problems of utilising natural resources. These regions cover large areas having diversified natural resources which can help in developing a self-sustaining economy.

On the basis of above general principles India has been divided into 13 planning regions (see Fig. 5.2 and Table 5.1), though this is not a comprehensive list. In 1967, Galina Sdyasuk and P. Sengupta had identified 7 macro and 48 meso regions. Therefore, the number and the boundaries of these planning regions depend upon the criterion applied in their delimitation.

India is an agricultural country and development of this sector is very essential for the overall development of the economy. Recently the agricultural development planning based on agro-climatic zone has been considered more appropriate in order to reduce the regional imbalances and to realise the unexploited potentials. The main objectives of agro-climatic planning are to bring about a balance in demand and supply of major commodities by utilising the potential of each one of them; maximise the net



Based upon Survey of India Outline Map printed in 1957.
The national waters of India extend up to the sea in a distance of twelve nautical miles measured from the appropriate base line.
The boundaries of States shown on this map are as interpreted from the North-Eastern Areas (Reorganisation) Act, 1971, but have not been verified.
Responsibility for correctness of internal details shown on the map rests with the publisher.

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FIG. 5.2

income of the producers; generate additional employment; and provide the framework for sustainable use of natural resources, particularly land, water and forests.

The strategy of agro-climatic planning aims at more scientific utilisation of resources. The holistic approach of assessing climate, soil type, topography, water resources and irrigation facilities would provide base for exploiting potential for growth and diversification.

The country has been divided into 15 agro-climatic zones on the basis of homogeneity in factors like soil type, rainfall, temperature, water resources, etc. These are:

- (i) Western Himalayan Region
- (ii) Eastern Himalayan Region
- (iii) Lower Gangetic Plains Region
- (iv) Middle Gangetic Plains Region
- (v) Upper Gangetic Plains Region
- (vi) Trans-Gangetic Plains Region
- (vii) Eastern Plateau and Hills Region
- (viii) Central Plateau and Hills Region
- (ix) Western Plateau and Hills Region
- (x) Southern Plateau and Hills Region
- (xi) East Coast Plains and Ghats Region
- (xii) West Coast Plains and Ghats Region
- (xiii) Gujarat Plains and Hills Region
- (xiv) Western Dry Region
- (xv) The Island Region

The strategies for developing land and water as well as a suitable cropping pattern for each region have been worked out. The non-crop-based activities such as forestry, fisheries, animal husbandry and agro-processing activities have also been emphasised.

Besides the region, a number of other concepts are also to be understood in order to understand the regional development.

Concept of Development

The notion of development in the context of regional development refers to a value-positive concept which aims at enhancing the levels of the

living of the people and general conditions of human welfare in a region. It is a value positive concept because development is not only a change but a change for better, just as plant develops into a tree and a child into an adult and there is no reversal of the position attained. Economic development is reflected through growth of output and national income. Thus, an important indicator of economic development is the increase in per capita income. Development is neither class neutral nor it is uniformly available across the regions. The developmental process benefits some classes of the society more than other classes. It helps certain regions to attain higher levels of development than other regions. This gives rise to social disparities as well as regional disparities. Such a situation operates because of the behaviour of parameters of development.

Parameters of Development

Natural environment, technology and institutions are the three basic parameters of economic development. Natural environment indicates the direction of economic development. It simultaneously puts a limit on the extent of development (at the given level of technology). For example, the major economic activity has been agriculture in the river valleys, lumbering in forested regions and fishing in the coastal regions. Moreover, the extent of production levels in all these activity has been agriculture in the river valleys, lumbering in forested regions and fishing in the coastal regions. Moreover, the extent of production levels in all these activities are limited by the level of technology available to the people in the respective regions. Technology is the tool with which the human beings interact with the natural environment, but technology has its own characteristics. Primitive technology is size neutral and is available to all irrespective of their income levels. Intermediary technology is size-biased and is available only to those who have some investible surplus.

TABLE 5.1

Planning Regions of India

<i>Macro Region and Component States/Districts</i>	<i>Prominent Industrial and Urban Areas</i>	<i>Resources for Integrated Development</i>	<i>Unifying Elements</i>
1. South Peninsular (Incorporating Kerala and Tamil Nadu)	Coimbatore; Kochi, Chennai	Coastal fisheries; agriculture; mineral resources of Coimbatore Plateau; Forest plantations of Western Ghats and agriculture of plains; Water resources for irrigation and power generation; Thermal and atomic power.	Marked by physical, economic, cultural ties integrated through transport routes
2. Central peninsular (Karnataka, Goa and Andhra Pradesh except its northern part)	Hyderabad, Bangalore	Coastal fisheries; agriculture of Andhra Plains; Iron, manganese, bauxite of Karnataka and Goa, Singareni coal; Plantations in Malnad and Coorg; Water resources.	Multipurpose projects on Tungabhadra, historical cultural ties enforced by potential industrial development.
3. Western Peninsular (Western Maharashtra, its coastal and interior districts)	Mumbai, Pune, Sholapur, Nasik	Coastal fisheries; Cotton; Reserves of ferrous and non-ferrous minerals; hydel and atomic power.	Hinterland of Mumbai Port and metropolitan centre, close economic and cultural ties
4. Central Deccan (Eastern Maharashtra, Central and Southern Madhya Pradesh)	Nagpur	Horticulture; cotton; iron ore (Chanda); agro-industrial development; Narmada water power and Satpura thermal potential.	Homogeneity of physical features and soils and lesser exposition to external stimulus for development
5. Eastern Peninsular (Orissa, South Bihar, north-eastern Andhra Pradesh and parts of adjoining districts of Uttar Pradesh and West Bengal)	Rourkela, Janshedpur, Asansol, Bhilai, Durgapur, Sambalpur, Cuttack, Vishakhapatnam	Coastal fisheries; coal; iron ore, manganese, bauxite mica; forests; Agriculture of Mahanadi basin. Hydel and thermal power development; Steel plants and other basic industries	Complementarity of resources served by rapidly developing coastal belt
6. Gujarat (Gujarat State)	Ahmedabad, Vadodara, Surat, Porbandar	Petro-chemicals; Salt, limestone, bauxite; Promise of irrigated agriculture (Narmada) and fisheries.	Cultural unity and linkages through transport routes.

<i>Macro Region and Component States/Districts</i>	<i>Prominent Industrial and Urban Areas</i>	<i>Resources for Integrated Development</i>	<i>Unifying Elements</i>
7. Western Rajasthan	Jodhpur, Bikaner, Ganganagar	Lignite, coal, gypsum limestone, precious stones; Prospects of petroleum and atomic power development; Livestock farming and irrigated agriculture (Rajasthan canal)	High degree homogeneity of physical and climatic conditions; Development of Rajasthan canal; Social-cultural ties
8. Aravalli Region (Eastern Rajasthan and Western Madhya Pradesh)	Kota, Jaipur, Ajmer	Non-ferrous metals lead, zinc, copper, mica, limestone, marble and slate; Livestock farming and irrigated agriculture, hydel and atomic power (Chamba project)	Historical and cultural ties brought by Rajput dynasties
9. Jammu-Kashmir and Ladakh	Srinagar, Sopore	Forest resources; Horticulture; tourism; Hydel power development	Physical, social & cultural similarities, Border psychology
10. Trans-Indo-Ganga Plains and hills (Punjab, Haryana, Himachal Pradesh, Western U.P. and hill districts of Uttar Pradesh)	Delhi, Meerut, Ghaziabad, Ludhiana, Chandigarh, Gurgaon	High development of irrigated farming in Punjab plains (Wheat cotton, sugarcane, fodder crops). Agro-industrial, horticultural, forestry development in Himachal Pradesh and Uttar Pradesh hills; tourism	Comparative social stability, cultural influence of Ganga Yamuna rivers
11. Ganga-Yamuna plains of (Districts Uttar Pradesh and parts of Madhya Pradesh) (Eastern; central and south western Uttar Pradesh and northern districts of Madhya Pradesh)	Kanpur, Agra, Varanasi, Allahabad, Lucknow	Agricultural resources of Ganga plains (sugarcane, rice and wheat) Forests in Madhya Pradesh area. Agro-industrial and power possibilities	Comparative social stability, cultural influence of Ganga Yamuna rivers
12. Lower Ganga Plains (Almost whole of West Bengal and Bihar Plains)	Calcutta, Patna, Barauni	Agriculture in plains (tea, jute of national importance); Possibilities of petro-chemical industries around Barauni; Thermal and hydel power	Economic interdependence and influence of port on hinterland. Social-cultural similarity in large part

Macro Region and Component States/Districts	Prominent Industrial and Urban Areas	Resources for Integrated Development	Unifying Elements
13. North Eastern Region (Assam, other north-eastern states, Union territories and northern Bengal hill districts)	Digboi, Guwahati, Shillong, Tinsukhia	Tea, Jute, petroleum, silliminite mining and forest products. Hydel power potential; thermal power	Economic interdependence, cultural diversity leading to social interdependence among tribal people

Divisions of Major Regions

Name of Meso Regions	Resources Available	Economic Specialization
1a. Kerala	Plantations, teak, coconut, thorium, hydro potential.	Plantation economy and associated industry, fishing, forest-based industries, ship-building, light engineering
1b. Chennai-Coimbatore industrial region	Neyveli lignite, iron ore, magnesite, cotton, coconut, sugarcane, cash crops of industrial importance.	Light engineering, ceramics, cement, Potential for ferrous metallurgy industry, Textiles, sugarcane and oil seeds crushing
1c. Tamil Nadu coastal plain region	Cultivation of rice, cotton and millets, marine fisheries, salt, limestone.	Agriculture of Delta region, agro-industries, fisheries, tourism
2a. Karnataka coastal and interior industrial region	Rich forest, hydro power resources, plantations, iron ore, manganese, gold.	Forest-based industry, engineering and aeronautical industries
2b. Rayalaseema and adjoining coastal plain region	Potential irrigation (Tungabhadra), potential iron ore reserves, precious stones	Irrigated agriculture, mixed farming, light engineering industry
2c. Bellary-Hospet Mining industrial region.	Large potential for ferrous and non-ferrous minerals (iron ore, manganese, bauxite, China clay).	Iron and steel industry, live-stock farming, irrigated agriculture (Krishna Valley Development)
2d. Telengana and adjoining coastal plains	Coal, hydro power, ferrous and non-ferrous minerals, food crops, tobacco.	Industries based on Nagarjun Sagar Dam, coastal plain intensive cultivation. Food processing and tobacco industry
3a. Mumbai-Deccan (Marathwada) and Deccan trap agro-industrial region	Mainly cotton, millets.	Cotton processing, tourism

Name of Meso Regions	Resources Available	Economic Specialisation
3b. Konkan and agro-industrial Deccan region	Power, cotton, horticulture	Cotton processing, light engineering, fisheries
4a. Narmada Valley region of Madhya Pradesh	Cotton, millets.	Cotton processing, Narmada power potential for the development of heavy machines, fertilisers ceramics and chemicals
4b. Khambesh-Betar region	Cotton, coal, iron	Cotton processing, potential for ferrous and metallurgical industries
5a. North-east Deccan and coastal plains	Manganese, Food crops, fisheries	Agriculture (Mahanadi Delta), Agro-processing fisheries
5b. Dandakaranya	Forest, Iron ore	Forest-based industry, Iron and steel
5c. Mahanadi Basin	Power, rice	Rice Bowl, Industrial development based on minerals for adjoining regions
5d. Son Valley region	Proximity to Rihand Dam, power and minerals of Chhotanagpur.	Possibility of mineral-based industries
5e. Chhotanagpur industrial region	Power resources, ferrous and non-ferrous minerals	Heavy engineering, coal and chemical industries
5f. Brahmani industrial region	Iron ore	Metal-based industry
6a. Gujarat Plain and Hills region	Rich in power resources, petroleum and cotton	Cotton processing, petro-chemical industry
6b. Kathiawar-Kachchh region	Limestone, salt, bauxite, cotton, oil-seeds	Cotton processing, livestock farming, chemical industry, possibility of irrigation in Kachchh (Narmada Valley)
7a. Desert region	Gypsum, Limestone, lignite, irrigated agriculture, (Great Rajasthan canal).	Animal husbandry, cotton-sugarcane in irrigated area. Industry based on gypsum, limestone, lignite
7b. Semi-desert	Livestock, marble	Animal husbandry and limited cultivation
8a. Kota industrial and Chambal Valley region	Rich in power, non-ferrous metals, limestone and salt	Non-ferrous metal industries, irrigated agriculture (Chambal Project)
8b. Jaipur, Udaipur	Copper (Khetri)	Mixed farming, tourism
9a. Jammu and Kashmir	Forest, horticulture.	Forest-based industry and horticultural industry, tourism
9b. Ladakh	Forest, horticulture	Forest-based industry and horticultural industry.

Name of Meso Regions	Resources Available	Economic Specialisation
10a. Bhakra Nangal Agro-industrial region	Fertile land for wheat, sugarcane, fodder stock farming, horticulture in hills.	Agriculture, wheat specialisation Agro-processing, textiles, light engineering, tourism
10b. Delhi, west Uttar Pradesh plains and Uttar Pradesh hills region	Wheat, sugarcane, horticulture, hydro power	Agriculture, light engineering, tourism, agro-industry, horticulture
11a. Kanpur-Agra industrial region	Sugarcane, cotton, wheat, oil-seeds	Agriculture, agro-based and light engineering industries
11b. Eastern Uttar Pradesh Baghelkhand region	Sugarcane, wheat	Agriculture, agro-based industry
12. North Bihar Agro-industrial region	Rice, sugarcane, oil	Agro-based and petro-chemical industry
12b. Calcutta-Hooghly industrial region	Rice, jute and proximity to power resources	Industries resulting from higher technical skills
12c. North Bengal Plain	Rice cultivation	Agro-based industry
13a. Lower Brahmaputra Shillong plateau region	Jute, tea, sillimanite, horticultural produce, forest resources and coal.	Jute cultivation, coal, chemical industry
13b. Upper Brahmaputra and Hill region	Tea, petroleum, timber, coal, natural gas	Natural gas and petro-chemical industries
13c. Eastern Hills and plains regions	Tea, jute, forest	Forest-based industry

Note: No scheme of India's economic regionalis is comprehensive. Each has its good and weak points. The above table is only illustrative of the working of the idea and its scope for national planning.

Sophisticated and large scale technology is so costly that it has to be brought under social control and any technology which is under social control, becomes available to all irrespective of their size after a nominal payment. Thus, the intermediary technology creates income disparities within a social group and across the regions. The institutions have been created by human beings for accelerating the pace of economic development. But when these institutions become rigid, they become a cause of deceleration rather than acceleration of the pace of economic development. That is why the institutions are modified or changed with the passage of time.

Thus, the level of economic development is the function of the harmonious interaction between natural environment, technology and the institutions created in a region.

Multi-Level Planning in India

Planning concerns itself in identifying clearly defined national goals and objectives and to frame overall policies in order to realise those goals and objectives. It attempts at working out rational solutions to economic problems by coordinating means and the ends. Temporally, planning may be short-term or long-term. It may attempt to develop the sectoral aspects of the economy or

the spatial aspects. When we talk of sectoral planning, it means that the resources are allocated keeping in view the overall requirements of sectors like primary, secondary and tertiary. The spatial or regional plan takes into account the balanced development of regions in order to reduce economic disparities. The planning in India, initially, has been attempted at national level and state level. Districts and blocks have been taken as spatial units for planning at a later stage. In the national level planning, the key role is played by the Centre. The first three plans were formulated by the Centre and it was only during the Fourth Five Year Plan, that states formulated their plans. It is at the implementation stage that other spatial units like states, districts, etc. enter into the planning process.

A scheme for strengthening the planning machinery at the state level was launched by the Planning Commission in 1972 and the guidelines for district plans were issued in 1969. The planning for target areas and target groups was a major strategy for removing poverty and unemployment and this called for more decentralised planning at the grassroots level. Block level planning was introduced during the plan period 1978-83, which aimed at complementing 'rural development efforts through better utilisation of local resources. This provided the experience of planning from below and thus planning at the lower order spatial units became a major component of regional planning.

District planning is the sub-system of multi-level planning which has to be handled by a single planning agency at the district level. The district planning has to be linked with the block level planning as well as the state planning. The blocks and villages are basically the levels of plan implementation rather than plan formulation. The *panchayat samitis* look after the developmental tasks at the block level.

The need for regional and decentralised

planning and the popular participation of people in the planning process has increasingly been recognised in the last decade. The Sixth Five Year Plan was heavily oriented towards rural planning and rural development and, therefore, the plan document laid emphasis on strengthening the levels below the state (specially district and block levels). The Dantwala Working Group on 'Block Level Planning' and the Ashok Mehta Committee on 'Panchayati Raj Institutions' were appointed by the Planning Commission to suggest ways and means to accomplish the tasks set forth by the Sixth Plan document. The devise to revitalise the planning process at the block level was the result of the belief of the Planning Commission that block is the primary unit for local planning and is very useful for adopting "programmes suitable to local environment and local capacity".

According to the Dantwala Working Group, the following activities can be planned and executed at the block levels:

- (i) Agriculture and allied activities
- (ii) Minor irrigation
- (iii) Soil conservation and water management
- (iv) Animal husbandry and poultry
- (v) Fisheries
- (vi) Forestry
- (vii) Processing of agricultural produce
- (viii) Organising input supply
- (ix) Cottage and small-scale industries
- (x) Local infrastructure
- (xi) Social amenities:
 - (a) drinking water supply
 - (b) health and nutrition
 - (c) education
 - (d) housing
 - (e) sanitation
 - (f) local transport
 - (g) welfare programmes
- (xii) Training of local youth and upgrading skills of local population.

The main problem of block level planning is the absence of any planning machinery at this level. The block development agency has been responsible for carrying out directions given from higher levels in implementing the plan proposals. It does not have the proper expertise to formulate plans. Moreover, all block/talukas may not be viable economic units for planning due to resource constraints. The *Panchayat Samitis* have also not been able to manage development and ensure equitable distribution of fruits of development. The planning at the lowest level may be attempted after creating economically viable unit (may be cluster of villages), selecting dynamic clusters and locating growth centres in such dynamic clusters.

CASE STUDIES

1. THE DAMODAR VALLEY CORPORATION (DVC)

The Damodar river is a tributary of the Hooghly and flows across Bihar and Bengal for about 541 km from its origin in the hills of Chotanagpur to its confluence with the Hooghly. Out of this course, 270 km lies in Bihar and the rest lies in West Bengal. In its upper reaches, it is known as the Debnadi. The Damodar drains Ranchi, Hazaribagh, Dhanbad and Santhal Parganas districts of Bihar and Bankura and Bardhaman districts of West Bengal. After emerging from the Chotanagpur hills, it flows for about 40 km and forms the boundary between Hazaribagh district and West Bengal. After emerging from the Chotanagpur hills, it flows for about 40 km and forms the boundary between Hazaribagh district and West Bengal. After emerging from the Chotanagpur hills, it flows for about 40 km and forms the boundary between Hazaribagh district and West Bengal. After emerging from the Chotanagpur hills, it flows for about 40 km and forms the boundary between Hazaribagh district and West Bengal.

The Damodar flows across the major coal belt of India. It used to be a notorious river due to its floods which caused damage in Bihar and West Bengal. It was known as the 'sorrow of the region'. Its notoriety was demonstrated by the devastating floods in 1823, 1848, 1856, 1859, 1863, 1882, 1890, 1898, 1901, 1905, 1907, 1913, 1916, 1923, 1935 and 1943. These frequent floods attracted the attention of the Governments of Bengal and Bihar and the need was felt to control the floods, conserve and regulate the water and generate power. The Damodar Flood Enquiry Committee suggested a comprehensive plan for the development of the Damodar basin on the model of the Tennessee Valley Authority in the U.S.A.

Physical Setting

Damodar Valley has occupied a sunken trough in the middle of Chotanagpur extending in an east-west direction between plateaus of Chotanagpur and Hazaribagh in the north and Ranchi in the south. The average elevation of this plateau complex varies between 300 and 600 metres above the mean sea level. The river originates at an altitude of 510 metres above mean sea level and discharges its water in Hooghly at an altitude of less than 30 metres above the mean sea level. This difference in elevation gives an idea of its gradient and also about its erosive power. The river leaves the plateau at a height of about 150 metres and reaches the plains in Bardhaman district.

The topography in its course is varied and undulating. Its descent from one surface level of the plateau to the other is sudden. Most of its major tributaries join the mainstream on its left bank. The confluence of the tributaries with the mainstream has provided break points which are suitable sites for locating hydel-power stations. The undulating nature of the topography and the faulted nature of the strata have not only favoured the extraction of coal but also provided suitable sites for damming the river.

Climatic Characteristics and Water-Power Development

The average annual rainfall experienced in the region is about 125 centimetres which is concentrated between June and September. Sometimes the region experiences cyclonic storms accompanied by heavy rainfall. The source region of the river receives higher rainfall than the lower reaches. The incidence of flooding is higher during the stormy rainfall when the channel is unable to accommodate the rush of water. The weathered rocks and the erosive power of the river add to the load of debris which often chokes the channel and thus the flood situation is aggravated. The deforestation in the upper hills has further accentuated the erosion. As soon as the river emerges through a narrow passage near Asansol its flow is burst open. The plains below Bardhaman get submerged under flood waters, sometimes to a depth of 2 to 2.5 metres and the crops and settlements are devastated. While major floods occur at intervals, minor floods are experienced almost every year. The sediments brought by the Damodar create the problem of sedimentation in the Hooghly which in turn endangers the Calcutta port.

In order to control floods and other related problems, the Central Government in

consultation with the Governments of Bihar and West Bengal worked out a unified development project for Damodar basin on the basis of the memorandum submitted by W.L. Voorduin, an engineer with the TVA. The Damodar Valley Corporation (DVC) became a reality on 18 February 1948, when the draft of its constitution was passed by the parliament.

The original memorandum envisaged the construction of seven major dams: Aiyar and Paanchet Hill on the Damodar river; Maithon, Belpahari and Tilaiya on the Barakar river; Konar on the Konar river; and Bokaro on the Bokaro river. The statutory functions of the DVC are: promotion and operation of schemes of irrigation; water supply and drainage; generation, transmission and distribution of electrical energy and flood control; production and control of navigation in the Damodar river, its tributaries and channels; promotion of afforestation and control of soil erosion in the Damodar valley and promotion of public health, agricultural, industrial and general well-being of the Damodar valley. Thus, it became a multipurpose project with major objectives of flood control, irrigation, generation and transmission of HIP, and promotion of year-round navigation. The DVC has implemented the construction of four multipurpose dams as against

TABLE 5.2

Salient Features of Four Dams in the Damodar Valley

Salient Features	Dams			
	Tilaiya	Konar	Maithon	Paanchet
River	Barakar	Konar	Barakar	Damodar
Type of dam	Concrete	Earthen dam with Concrete spill-way	Barakar Earthen dam with concrete Spill-way	Earthen dam with concrete spill-way
Length (in metres)	366	3549	994	2545
Maximum height above river bed	30	49	49	49
Gross storage capacity (m.cu.m.)	395	337	1357	1497
Live storage capacity (m.cu.m.)	321	276	—	1307
Year of start	1950	1950	1951	1952
Year of completion	1953	1955	1958	1959

Voorduin's proposal of seven dams. These four dams are Tilaiya, Maithon, Konar and Panchet. Three thermal power stations at Chandrapura, Bokaro and Durgapur with a network of transmission and distribution lines have also been completed. Table 5.2 provides the salient features of the dams in the Damodar Valley.

The estimated capacity of generating hydel power at different dam sites is 260,000 kw. Bokaro, Chandrapura and Durgapur thermal power stations produce another additional power of 1,545 mw.

The Durgapur barrage located at about 23 km from Raniganj has been created for the storage of irrigation water. It is 831 metres long and about 12 metres high. It stores the water from Konar, Tilaiya, Maithon and Panchet Hill dams. The bulk of the water for storage is provided by Maithon and Panchet hill dams. This irrigation water is regulated through a network of canals extending over an area of about 5,000 sq km in Bankura, Bardhaman, Hooghly and Howrah districts in West Bengal. The barrage was completed in 1955. About 4 lakh hectare will be irrigated mainly along the left bank in Bardhaman and Hooghly districts. The hilly nature of the terrain in Bihar has restricted the irrigated area.

The left bank Damodar canal is navigation-cum-irrigation canal connecting Calcutta with the Damodar valley coalfields.

Soil Conservation and Afforestation

Soils in the Damodar valley are heavy clays and loams. They are deep and heavy on flat coal layers of low-lying tracts and light, coarse and thin in the uplands. Most of the land in the upper part of the basin in Chotanagpur region of Bihar is of relatively low fertility. The terrain is undulating and lacks irrigation facilities. The population is not very high but limited nature of arable land available to the peasants has brought down the land-man ratio. The coal-mining activity heaps of removed over burden, mining

settlements, dense network of transportation lines, thick forest cover and obliterated local drainage have constrained the agriculture in the region. The forest cover and obliterated local drainage have constrained the agriculture resources of the region. There are rich *Sal* (*Shorea robusta*) forests. The hill slopes are covered with poorer vegetation like palm, bersabal, grass, bamboo and thorny plants.

Agriculture in the Damodar Basin is not different from the prevailing patterns in other parts of the Chotanagpur plateau. Generally, one crop is produced in one agricultural year. Lowland rice, maize, pulses and ragi are important crops.

The DVC has also been entrusted with the responsibility of soil conservation and afforestation. The main objectives of soil conservation and afforestation in the catchment area is to reduce the soil erosion and save the reservoirs from heavy siltation. The problem of soil erosion is being tackled on watershed basis. The measures adopted for soil conservation are survey of soils taking into account the various 'physio-chemical properties of the soils, degree of slope, extent of erosion, present land use and suitability of Irrigation', demonstration of better methods of land management and assessing the soil fertility.

Afforestation within the catchment of Damodar valley is being carried out by the forest division of the Corporation as well as the forest departments of the state governments of Bihar and West Bengal.

Mineral Resource Base

The Damodar valley region is a highly mineralised region in India. The Gondwana sedimentary rocks in the valley contain rich coal deposits. The richest, largest and most productive coalfields lie in this region. Jharia and Chandrapura coalfields are located in Dhanbad. Jharia is the most important coalfield with a

reserve of about 1862 crore tonnes of good grade bituminous coal. It spreads over an area of about 440 sq km. Chandrapura is the second important coalfield in Dhanbad district. Its coal is used in the Chandrapura thermal power station. East and West Bokaro, Giridih, North and South Karanpura and Ramgarh coalfields lie in Hazaribagh district. The kargali seam of East Bokaro Coalfield is of 30 metres thickness. Karanpura coalfields spread over 1560 sq km and in production they rank next to Jharia and Raniganj coalfields.

Raniganj coalfields spread over 1067 sq km across Burdwan, Purulia and Bankura in West Bengal. A large quantity of coal from Raniganj is used for producing thermal power at Bandel, Durgapur, and New Kashipore.

Fire clay, graphite, limestone, quartz, bauxite, copper, and manganese are other minerals which are found in the Damodar valley. Besides, the surrounding regions also have rich mineral deposits. The Damodar valley itself has abundant forest resources, from where lac and grasses for manufacturing paper are extracted.

The richness of the region in mineral and forest resources coupled with the hydro-thermal power development has been the basis of the economic development of the Damodar valley.

Development of Transport Infrastructure

Transport is vital for regional development as it provides outlet for flows of both human beings and goods. The lower basin of the Damodar has dense rail network where railways from north, north-west, west, south-west and east converge. It has the locational advantage of lying near Calcutta, one of the prominent port towns of the country. Dhanbad has become the foci of convergence of road and rail networks. The grand chord line joining Delhi and Calcutta passes through the northern part of the Damodar valley. This line is now fully electrified. Besides this, many short railway lines criss-cross this

area. A number of routes diverge towards west of Asansol. The watershed between the Ajai and the Damodar rivers is not very prominent hence the railway link to Patna follows it and a branch line links Giridih. The railway line linking Calcutta-Asansol to Gaya-Patna passes through the upper Barakar river valley.

A railway line from Dehri-On-Son via Daltonganj runs along the coalfields belt. A branch line of this links Jamshedpur via Muri. The scarp-slope of Ranchi plateau has receded and this has provided gap through which the routes to Jamshedpur have been laid. The western part of the Damodar valley is hilly, forested and thinly populated. Therefore, it represents an undeveloped country-side while eastern part has recorded economic development.

The rail network is supplemented by road network in the region. In more difficult terrain where rail links cannot be provided, roads have been constructed negotiating the scarps. Sher Shah Suri Marg runs almost parallel to the Grand Chord Railway line in the Dhanbad section of the region. The industrial towns, collieries and washeries have been linked by local roads. The transportation infrastructure has helped not only in the utilisation of the natural resources of the region but has linked this region with the national market.

Industrial Development

The Damodar valley has developed a mineral based industrial landscape in the country. It has played an important role in promoting industrial development. The region's natural resources provided base for rapid industrial development once power and other infrastructural facilities were developed. A number of public sector undertakings also sprang up. Durgapur and Bokaro Steel complexes, Heavy Engineering Corporation Ltd. at Ranchi, Sindri Fertilizer Plant and Indian Explosives near Hazaribagh provide some such examples. Six industrial

complexes have emerged over time in the Damodar valley region. These are: (a) Durgapur industrial complex having thermal power plant, coke oven, iron and steel, mining machinery and cement machinery and electrical industries, (b) Asansol-Kulti-Burnpur industrial complex with steel factory at Burnpur, Chittaranjan locomotives, Kulti foundry works, and Kurnardhubi engineering works, (c) Dhanbad-Sindri-Jharlia industrial area having Sindri fertilizer industry, chemical and coal-based industries, (d) Bokaro industrial area consisting of steel plant, thermal plants at Bokaro and Chandrapura along with coal washeries, (e) Ramgarh-Patratu area with Indian explosives and thermal power plants, and (f) Ranchi Industrial township with H.E.C., H.M.T. and foundry plants.

The preponderance of mining and industry can be seen from the structure of the workforce in various districts in the valley. 8.7 per cent of the main workers in Giridih, 4.8 per cent in Dhanbad, 9.8 per cent in Hazratnagar, and 6.3 per cent in Santhal Parganas are engaged in mining. About 16 per cent of the main workers in Dhanbad are engaged in other than household industries.

With the availability of hydro-electric power aided by thermal power plants, more power intensive industries may emerge. Steel plants, coal washeries, industries based on coal by products and forest-based industries will ensure a large size industrial zone in this valley.

The People

One notices large variations in the population density in the Damodar valley. While the upper catchment, which is hilly and forested, has low density, the lower part of the valley is thickly populated and more urbanised. Since the processes of urbanisation and industrialisation are closely interlinked, the districts having concentration of industries witnessed rapid

urbanisation. The figures of 1991 census showing proportion of urban population to total population clearly depict this trend. 52.9 per cent of the total population in Purbi Singhbhum has been recorded as urban followed by Dhanbad 51.3 per cent and Bardhaman 35.4 per cent. Garhwa and Dumka have low proportion of urban population, which have recorded 2.8 and 6.1 per cent urban population, respectively.

A major part of the Damodar valley, especially lying in the Chotanagpur plateau region, has higher proportion of tribal population. Development has its own course. It does not help all the classes uniformly. This has caused social tensions and one often reads reports about the operations of the anti-social elements and mafia gangs. The benefits of development will have to be channelised by institutional intervention. The weaker and exploited sections of the society will have to be given social protection by developing their own organisations.

The Problems

The major objective of the Damodar valley project was to control floods. The project has not been able to eliminate floods altogether. The DVC has constructed four dams instead of seven suggested by Voorduin. Heavy floods did occur in 1959, 1970-71 and 1978; though their ferocity has been greatly reduced. The vegetal cover in the upper catchment is a great regulator of the flow of monsoonal rain-water. The dams and reservoirs provide the second line of defence. The over-utilisation of forests and lack of corresponding afforestation have aggravated siltation in the dam. The generation of hydro-electricity is being complemented by multiplying thermal plants because the flood-control dams cannot be taken as power-generating dams in view of the creation of flood cushion before monsoon every year. However, the DVC has been an important example of integrated regional development. Its efficiency can be improved with

better management and foresight.

2. A TRIBAL DEVELOPMENT BLOCK: BASTAR

India has a pluralistic society. Many communities co-exist here. Amongst these some have been living in the hills and forests with varying concentrations in different parts of the country and are known as tribes. It is difficult to define a tribe but they are differentiated from the non-tribes on the basis of some characteristics of their habitat, cultural traits like language, beliefs, customs and institutions. The tribals accounted for about 8.0 per cent of the total population of India in 1991. Geographically, their population is found scattered in any parts of the country but they exhibit concentrations in three broad zones, viz. north-eastern hills and forested areas; hills and forest stretches in central India extending from east to west; and in the island chains, particularly Andaman and Nicobar Islands.

Tribal societies are different from the non-tribal societies in many ways. Though many changes are taking place in tribal societies also yet a number of differentiating characteristics still exist. In a tribal community the means of production are generally owned collectively, hence, the social and economic disparities are not as glaring as in the non-tribal communities. The level of technology in tribal communities is low. They directly depend upon their immediate environment and have harmonious relation with it. The external influences are reaching in tribal areas also but the development strategy should be adopted according to the specific needs of the people. The Government of India as well as the State Governments have launched a number of programmes during different five year plans in order to ameliorate the socio-economic conditions of the tribals without altering their cultural ethos. The Tribal Development Block Project was one such strategy adopted for the development at the block level. It was designed

on the pattern of the SFDA (Small Farmers Development Agency) and the MFALA (Marginal Farmers and Agricultural Labour Agency) projects in rural areas. Six such pilot projects were launched in 1971-72 on experimental basis. These were in Srikakulam district of Andhra Pradesh, Singhbhum district of Bihar, Dantewara and Kanta tehsils of district Bastar in Madhya Pradesh and Ganjam and Koraput districts in Orissa. The jurisdiction of the project extends only in the selected block where the concentration of tribal population is high. The Tribal Development Agency's major attempt was to develop the infrastructure in the area in respect of land development, irrigation, communication, credit and marketing. It also made attempt in locating and developing the potential growth centres.

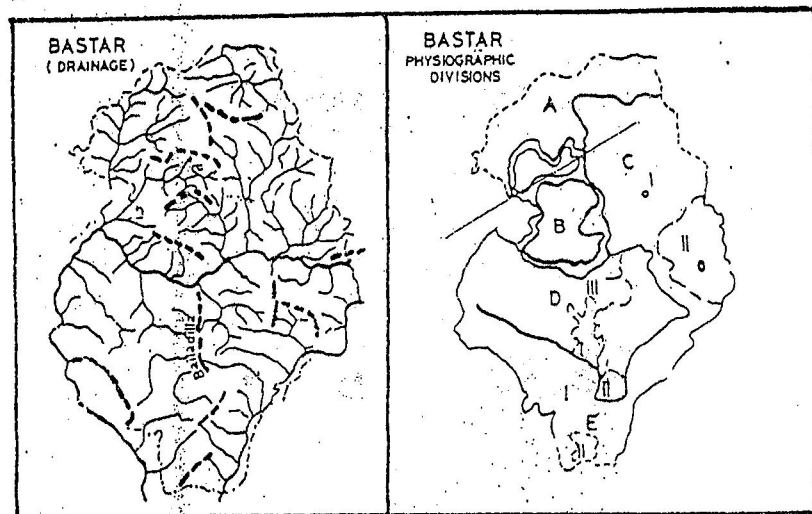
The Bastar block represents a typical tribal scenario in a predominantly tribal district of Bastar in Madhya Pradesh. More than 65 per cent of the total population of Bastar district is tribal. Some of these tribes occupy a well-defined territory.

The Physical Setting

Location and Space Relations

Bastar district is situated in the south-eastern corner of Madhya Pradesh. It is bounded by Orissa in the east, Maharashtra in the west and Andhra Pradesh in the south. It is located at a distance of about 640 km from Bhopal, the State Capital of Madhya Pradesh, 160 km from the port of Vishakhapatnam on the Andhra Coast along the Bay of Bengal and 88 km from Raipur-Bhilai industrial complex in the north. It lies on the leeward side of the Eastern Ghats and, therefore, is devoid of any oceanic influences from the east. It, thus, has an interior location. In size, it is one of the largest districts of India and is larger than the state of Kerala.

The Bastar tribal block extends between 1



A. Northern Mahanadi Plains B. Abujhmar Hills
C. (i) North Eastern Plateau (ii) Indravati Plains
D. Southern Plateau (i) Bailadilla Hills (ii) Tikan Palli Hill
(iii) Dantewara E. Godavari-Sabari Lowlands

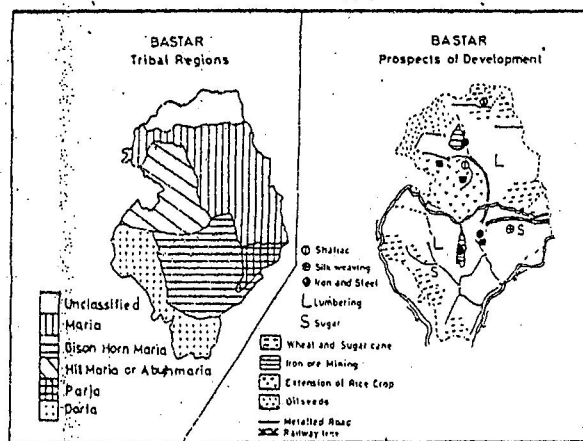


Fig. 5.3

REGIONAL DEVELOPMENT

95

and 20° north latitude and 80° to 82° east longitude. Climatically speaking it lies in the hot tropical zone which is thickly forested with very few small plain areas.

Physiography

The greater part of the Bastar district as a whole is plateau having a general elevation of 600 metres above the mean sea level. The Mahanadi valley lies in the north and the Godavari valley lies in the south forming narrow plain areas. The general terrain is hilly. Indrawati and Sabari are the major tributaries of the Godavari. Indrawati is the major river which flows towards west in the middle of the district. Sabari flows along its south-east boundary. Though these streams are small, they are perennial. The volume of water fluctuates according to the season.

Physiographically, Bastar is divided into five distinct divisions:

- (i) The northern Mahanadi plains slopes northward and merged into the Chattisgarh plains of Durg and Raipur districts. Its general elevation varies between 300 and 450 metres above the mean sea level.
- (ii) The Abujhmar hills present high ridge and deep valley topography. Thus, it is highly rugged and undulating region criss-crossed by small stream. The general elevation of the area varies from 450 to over 750 metres above the mean sea level. The hills and valleys have created effective physical barrier from all sides and thus, have accentuated isolation in the area;
- (iii) The north-eastern plateau is marked by steep scarps to its north, south and west. Indrawati plain lies towards its south. Its general elevation varies between 450 and 750 metres above the mean sea level.
- (iv) The southern plateau has the Bailadilla

and Tikampali hills in its middle. The small Dantewara plain lies in the north. Bailadilla means 'hump of a bullock' which is the highest hill in the Bastar district. It rises up to 1,200 metres above the mean sea level. It has two parallel ridges, which form physical barrier due to its height. The general height of the southern plateau ranges from 300 to more than 750 metres above the mean sea level.

- (v) The southern plains of Godavari and Sabari rivers have general level of about 150 metres to 300 metres. It is a rolling plain with only two hills in its south and south-west part. It extends up to the base of the southern plateau.

The Resource Base

The Bastar district is endowed with two major natural resources: forests and minerals. The cultivable land is limited. The soil cover in the district is thin and the fertility status is low. The metamorphic and granite rocks form the parent material for red and lateritic soils. Soils are deeper in the lowlands only. These have been thinned on the slopes due to erosion. The shifting cultivation in different parts, particularly on the Abujhmar hills, has further added to the loss of vegetation and soil erosion. Agriculture is the main occupation in the lowlands and river valleys.

The forests in Bastar form the most extensive resource. These are mostly moist deciduous forests consisting of hardwoods. Teak, Sal and laurels account for about 80 per cent of the volume of wood found in these forests. The forests have not only provided protection to tribals of Bastar, but have also provided them with sound economic base for carrying out wood-based activities. Besides timber, these forests are the source of gum, leaves, fruits, flowers and roots which are gathered by the tribal people.

Bastar has rich mineral potential particularly rich iron ore deposits. There are three vast tracts containing large quantities of iron ore. These are: (i) Raoghat hills in Narayanpur tehsil, (ii) Chargaon-Kondapakha-Halliladdi hills in the north west. Bailadila range runs north-south along the western boundary of Dantewara tehsil. It is a 34 km long and 10 km wide range varying from 300 to 900 metres in altitude. It has an estimated iron ore deposit of 1,153 million tonnes with 60 to 70 per cent iron content. This iron ore area is now opened up and linked with Vishakhapatnam port through which it is exported to Japan.

Besides iron ore, Bastar has deposits of limestone, bauxite, manganese, clays, glass sand and building stone. The utilisation of most of these mineral resources is not being done due to low level of technology and the lack of modern skills in the tribal people.

The Environment and Human Interaction

The environment has clear influence on distribution of population and human activities. The lowlands, offering better agricultural opportunities, have comparatively higher density of population. The forests occupy the uplands but some of the uplands also have imprints of human activity in spite of their hilly and undulating terrain. The southern plateau has been cleared off the forests for extending cultivation. The Abujhmaria tribes have settled on the lower margins of the upper hill slopes because the movement of air is more free on the hill slopes as compared to the valley bottom. These sites offer advantages of nearness to forests, better drainage around the settlements as well as water-points. The topography has restricted the availability of underground water, hence no wells can be dug up particularly on higher slopes. Tanks, therefore, are the only sources of collecting and storing water. High hills and steep slopes do not favour the construction of roads.

Moreover, construction and maintenance of roads is very costly.

The roads follow the narrow gaps in the plateau scarps and hill passes. The low level of the development of transportation network explains the comparative isolation of this region.

The climate of Bastar is hot tropical monsoon type with a mean annual temperature of 24.5° Celsius and average annual rainfall of about 120 cm. It has no dry summers, rainy season and dry winter season. There is not much regional variation in climatic conditions but some pockets, like south-west and north-west receive higher rainfall. The seasonal variations are quite pronounced. Agriculture is largely rainfed, therefore, 90 per cent of the net sown area is confined to the *kharif* season. Soil moisture for crop production is available during rainy season and due to lack of irrigational facilities, the area under *rabi* crops is limited. The winter temperatures are high in the Southern Godavari lowlands hence, *jowar* is cultivated both as *kharif* and *rabi* crops. Fodder is available in the wet season and tribals keep their flock of animals. They also do a limited fishing in the water bodies.

The population in the Bastar district is concentrated in the lowlands or in basin-shaped regions bordered by hills to provide them natural protection. The hills and forests are devoid of any population. The physical isolation created by difficult terrain has led the different tribal communities to live in their own worlds developing their own customs, rituals and beliefs. Each one of the groups wants to preserve his identity and way of life.

The population is predominantly rural living in small hamlets in separate clearings in forests. The higher population concentrations are found in the Mahanadi basin (Kankar tehsil), Indrawati basin (Jagdalpur), Kotri plain (Bhanupratappur), Dantewara plains (northern Dantewara) and Sabari plains (northern Konta). People are also concentrated in Kandagoan (north-eastern

plateau) and southern Dantewara because these tracts are isolated basins providing a sort of privacy to the tribals.

All the tribal population in Bastar is not homogeneous. The numerically important tribes are concentrated into seven isolated pockets. The seven major cultural sub-regions differ amongst each other in respect of house types, food, dress, beliefs, language, customs and techniques and tools which they use in the production process.

The land of Abujhmaria tribe is extremely remote and rugged. 'Abujhmar' means 'the unknown highland'. These highlands are located in the middle of the district. The ruggedness of the terrain, the thinness of soil and lack of rich resource base, have kept these tribes economically very backward. Their cultural advancement has been slowed down and they have not been able to cross the 'stone-age culture' even in the present century. They meet their economic needs from the local products and have very few material possessions.

They depend on shifting cultivation (*penda*). They do not use plough or any other agricultural implements. They cultivate the thin and poor upland soils and frequently shift the site of cultivation as deteriorating soils cannot sustain them for long. Their needs are small and population density is low. They are, therefore, averse to the modern development like roads, markets and other infrastructure. They are favourably inclined to accept such type of facilities as dispensary, poultry schemes and approach roads. There is a cultural barrier to change and it may take time to accept such changes.

The Maria tribal region is a large tribal region of Bastar. The region extends over north-east plateau and its adjoining areas. Their major economic activity is subsistence agriculture and they produce rice and millets on which they subsist. Kosra is the most important millet crop. They also gather forest produce from their surrounding forests. The Marias in central

Jagdalpur and southern Kondagoan tehsils are culturally more advanced. They are known as 'Raj Maria' tribes. These tribes are changing fast. They are more open to the forces of market and their demands now include cloth, utensils, and ornaments.

The Bhatri tribal region is almost a flat lands. It has good soils and better means of transportation. Since they are receptive to innovations and change, they are culturally more advanced. They practise agriculture and grow rice, oilseeds and sugarcane. The proximity to Jagdalpur, the district headquarters of Bastar, has also influenced the life style in this region.

The Doria tribal region consists of the Godavari-Sabari lowlands along the boundary of Andhra Pradesh. They are culturally more advanced than the Bhatri tribe. They have started using coconut oil which they obtain from the market. They do not cultivate any oilseed but rather collect *Mahua* seeds from the forests to obtain oil.

The Dhurwa (*parja*) tribal region extends over the southern part of Jagdalpur tehsil and lies between north-eastern plateau and Sabari lowlands. The difficult terrain and thick forests have restricted the internal communication. Culturally these tribes are less advanced than Bhatri and Maria. They have developed high skills in the bamboo work.

The bison-horn Maria tribe region is a backward tract in Bastar district. They live in Dantewara tehsil and parts of Bijapur east and Konta north tehsils. They use bison horns at the time of dancing and that is how they have got this name. The Dantewara basin is partly plain and partly plateau. They do not practise shifting agriculture but follow a system of rotation which they practise on the hill slopes and permanent cultivation on the valley floor. The construction of a railway line between Kirandul and Vishakhapatnam and mining of the iron ore in Bailadila are two important developments in this

Region.

An unclassified Gond tribal region exists in the Mahanadi basin in the north extending over the tehsils of Kankar and Bhanupratappur. It lies on the margins of Chhattisgarh plains and has better communication facilities. This has provided contacts from outside. Its accessibility, low land relief, good soils have helped in its cultural and economic advancement. The main economic activity pursued in this region is agriculture. Rice is the dominant crop. The Kankar and Bhanupratappur are two nodal points which are connected with Raipur and Jagdalpur.

Planning the Development

Bastar had attracted the attention of the planners from the beginning of the five year plan strategy. The two Special Multipurpose Tribal Blocks set up in the district for intensive development of tribal areas in 1956-57 were renamed as Tribal Development Blocks during the Third Five Year Plan period. This strategy envisaged an integrated intensive programme covering all aspects of tribal life. The tribal people as target groups and the tribal areas as target areas have special needs which require proper planning. The concept of tribal development block laid emphasis on soil conservation, afforestation, social welfare, education, health, cooperation and communication. The programme is implemented by the District Collector under the direction of the Tribal Welfare Department of the State Government.

The opening of the Bailadila iron ore mining and laying of railway and road network have ushered the era of opening the economy of barter which has for long been a closed economy. A closed economy based on the barter system hardly requires organised markets or means of transportation to take the produce to the market. The production specialisation will require both because the barter system will have to be replaced by the monetary system of transactions.

It is indicated that tribal people have welcomed the health services. Some changes in their consumption pattern are also noticed. The two economic activities with which the tribals are familiar are agriculture and forestry. These will have to be strengthened by introducing suitable skills as well as inputs. The developmental processes may be induced from outside but it has to be sustained by the local people themselves.

The Tribal Development Block could not deliver the desired goods because blocks have been found to be too small an area for purposeful planning by the *Shilu Ao Committee*. Moreover, the developmental planning has been fragmented and some of the schemes which were introduced in tribal areas were actually meant for advanced communities. The employment-generating activities have not been taken up properly. The local people's participation has been missing in formulating the plans and tailored programmes are introduced which have little impact. Moreover, a large area in Bastar district has remained unsurveyed hence the real potential of the region cannot be worked out. The land records should be updated backed up by cadastral mapping. The land laws formulated by the states legislature must accommodate some of the provisions of the tribal system of communal ownership so that alienation of the tribal is minimal. The tribal areas should be opened up with some protection so that non-tribals with their better skills and technology are not allowed to exploit the tribal people. Unfortunately the developmental schemes are so designed that tribals become suspicious and indifferent.

3. METROPOLITAN REGIONS

(i) NATIONAL CAPITAL REGION

Delhi is a National Capital Territory. It has witnessed a very high growth rate of its population in the decades after independence. It offers vast economic opportunities, and, has thus

created very strong attractive force pulling migrants not only from the immediate neighbourhood but also from the far-off places in the country. The population of Delhi has grown at the rate of 64.2, 54.6, 57.1 and 50.6 per cent during 1951-61, 1961-71, 1971-81 and 1981-91 respectively. Delhi registered the third largest decadal growth rate amongst the metropolitan centres during 1971-81 after Bangalore and Jaipur. The phenomenal growth rate of the city has disturbed the government as well as the planners. It has to be contained in order to keep the city of Delhi a healthy city. Any strategy of containing the growth of Delhi within limits will have to be taken within the regional frame in which Delhi exists. The region in the immediate hinterland of Delhi within which the development had to be planned in order to release pressure from Delhi is known as 'National Capital Region'. The genesis of the concept may be traced from the Master Plan of Delhi which was prepared in 1959 and finally approved by the Government of India in 1962. The Master Plan contained amongst others a recommendation of setting a statutory NCR Planning Board. Initially, this board was constituted as an advisory body which was reconstituted in 1973. Its task was to coordinate the development of urban and rural areas in the National Capital Region under a comprehensive regional plan and to secure the collaboration of the concerned state governments in implementing the plan.

The Physical Extent of NCR

The National Capital Region extends over the National Capital Territory of Delhi and adjoining parts of Haryana, Uttar Pradesh and Rajasthan. The administrative units constituting the NCR are as under:

- (a) National Capital Territory of Delhi (1483 Sq km)
- (b) Haryana sub-region comprising Faridabad, Gurgaon, Rohtak, Sonapat

districts, Rewari and Bawal tehsils of Mahendragarh district and Panipat tehsil of Karnal district (13,413 sq km)

- (c) Uttar Pradesh sub-region with districts of Meerut, Ghaziabad and Bulandshahar (10,853 sq km)
- (d) Rajasthan sub-region comprising Alwar, Ramgarh, Behrod, Mandawar, Kishangarh, and Tijara tehsils of Alwar district (4,493 sq km)

Thus, the NCR covers an area of 30,242 sq km. Figure 5.4 shows the physical extent of the NCR.

The objectives of NCR Regional Plan

The basic objective of the NCR Regional Plan is to regulate the population and the urban area and keep it within manageable limits so that the quality of life in the city does not deteriorate. It was, therefore, envisaged that a chain of ring towns is identified and the population is diverted to these ring towns according to their potential. The plan also advocated decentralisation of economic activities away from the metropolis of Delhi and generate economic opportunities in the ring towns within the National Capital Region. This was to be accomplished through checks on the location of large industries in Delhi and encourage the dispersal of industries and other job opportunities elsewhere in the NCR. It was also suggested to decentralise the selected government offices which have concentrated in Delhi over time. The regional plan also aimed at an integrated development of infrastructures like transport network, water supply, power, housing, and other social amenities and facilities. An integrated urban development in priority towns was also envisaged.

These objectives have to be realised by evolving a coordinated administrative structure mutually agreed upon by the states of Haryana, Uttar Pradesh, Rajasthan and the National Capital Territory of Delhi. The National Capital Region

Planning Act was passed by the Parliament in January 1985. It is a statutory coordinating board responsible for planning, monitoring and development of the National Capital Region at the regional level. The board is entrusted with the duties of monitoring the regional plan and to evolve policy for regulating land use and development of infrastructure in the NCR.

The Tasks Ahead

Distribution of Population

In order to achieve the major objectives of the NCR and to arrest the growth of Delhi in terms of its population size, it is necessary to induce developmental processes in some selected nodal points in the region. Some such centres have been identified which have already shown significant trends of growth and have the potential to absorb the increase in population by offering economic opportunities. These centres are Meerut, Hapur, Bulandshahr, Khurja, Palwal, Rewari-Bhiwadi-Dharuhera Complex, Rohtak, Panipat and Alwar. These centres have been selected for providing and strengthening their economic base providing more employment opportunities to attract the migrants. The population policy of the NCR is geared to control the population in the towns of Delhi Metropolitan Area (DMA). The Interim Development Plan 2001 of NCR envisages to restrict the population of the towns of Delhi Metropolitan Area to 37 lakh by 2001, distributed in Ghaziabad including Loni (11 lakh), NOIDA (5.5 lakh), Faridabad (10 lakh), Gurgaon (7 lakh), Bahadurgarh (2 lakh) and Kundli (1.5 lakh). The priority towns will accommodate about 50 lakh people by 2001 according to the NCR Planning Board, Interim Plan. The distribution as envisaged is as under. Meerut (13 lakh), Hapur (6 lakh), Bulandshahr-

Khurja (10 lakh), Palwal (3 lakh), Alwar (5 lakh), Rewari-Bhiwadi-Dharuhera Complex (5 lakh), Rohtak (5 lakh), and Panipat (5 lakh). The plan also suggests the evolution of a four-tier settlement system comprising the regional centres, sub-regional centres, service centres and villages.

Dispersal of Economic Activities

As a strategy for reducing the population pressure on Delhi and for inducing growth of population in the NCR, the adjustment of employment generating activities has been suggested. These activities are location of industries, dispersal of Central Government and public sector offices and dispersal of wholesale and distributive trade and commerce. The location of medium and large-scale industries has to be restricted in Delhi and a policy of incentives and facilities has to be adopted for locating the industries outside the Delhi Metropolitan Area and within the National Capital Region. The towns selected for priority development should be provided with industrial estates to attract the large, medium and small-scale industries. It is proposed to shift those offices which do not perform ministerial functions, protocol functions and liaison functions, outside Delhi. Any office of public enterprises which does not perform the above mentioned functions should also be shifted outside Delhi. If the offices performing the above-mentioned functions want to expand, they should be encouraged to locate the expanded offices in the Delhi Metropolitan area rather than in the National Capital Territory.

The wholesale trade which does not serve the consumers in Delhi should also be shifted elsewhere in the NCR. The wholesale trade, at least 60 per cent of which is consumed in Delhi, and which are not hazardous and which do not require large space for their operation be allowed to remain in Delhi. The wholesale trade of plastics, chemicals, timber and other volatile

* NCR Planning Board: Interim Development Plan 2001, Ministry of Urban Development, GOI, 1987.

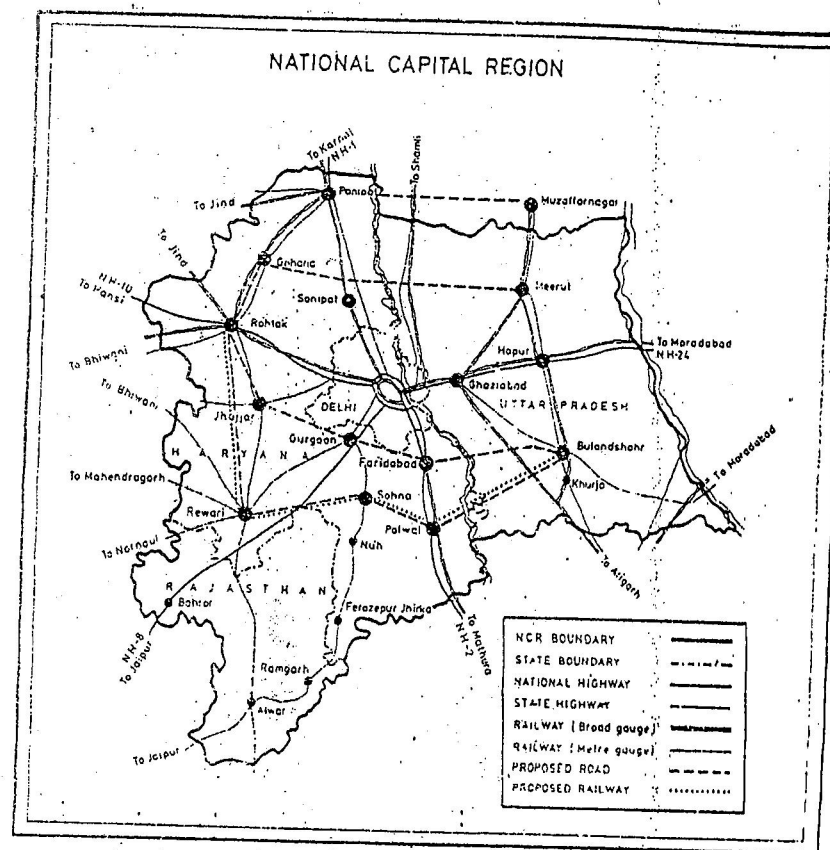


Fig. 5.4

materials which are hazardous or those materials which require extensive space, e.g., iron and steel and building materials may be encouraged to locate in the DMA. The regional towns in the NCR should be provided with infrastructural facilities in order to attract the wholesale trade.

Land Use in the NCR

Agriculture is and will remain to continue as the major economic activity in the NCR. About 80 per cent of the total area of the NCR is used for agriculture and about 50 per cent of the work force is engaged in the primary sector for their sustenance. The NCR concept of development envisages the generation of employment in the non-agricultural sector leading to the population concentration in selected settlements. The extension of urban areas is further going to eat up the agricultural land. Wherever possible, the settlement be permitted to expand on less fertile, barren or wastelands. In any case the reduction in agricultural land will take the place with non-agricultural uses expanding in the NCR. Intensification of agriculture will be the only alternative to keep up the quantum of food production. The land will be allowed to be brought under plough wherever it does not come in conflict with conservational aspects. The development and conservation of forest area will be encouraged. The social forestry has to be encouraged for enhancing the production of fodder and fuel. The land requirement for urban development in priority towns and DMA towns in 2001 as allocated by the NCR Board is given in Table 5.3. The increasing urban population will be accommodated by extending the urban areas but adjustments to certain extent are possible by redensification of the urban population. It is also realised that the development should proceed along with environmental protection and conservation. The site of scenic beauty, archaeological sites, parks, national parks, bird sanctuaries within the region

will be developed and strengthened in order to provide recreational avenues. A buffer zone of green between Delhi Urban Area and Delhi Metropolitan Area has been proposed to be created. The Aravalli hills extending from Delhi to Alwar provides ideal extent for developing a natural forest through conservation.

Regional Transport system

Transportational network increases the efficiency of flows. An integrated road and rail network is essential to regulate flows within the NCR. It is proposed to have one inner grid of roads connecting Sonapat-Bagpat-Meerut-Hapur-Bulandshahr-Sikandarabad-Faridabad-Rohatak-Gurgaon-Jhajjar-Gohana-Sonepat. The outer grid is envisaged to link Panipat Muzaffarnagar-Meerut-Hapur-Bulandshahr-Khurja-Palwal-Rewari-Jhajjar-Gohana-Rohatak Panipat. The transport system will evolve to adjust itself to the four-tier of settlements planned by the NCR Board.

It is proposed to develop regional rail bypass connecting Meerut-Hapur-Bulandshahr-Khurja-Palwal-Sohna-Rewari-Jhajjar and Rohatak. The metre gauge railway line in Rajasthan and Haryana sectors, particularly between Delhi and Alwar, will have to be converted into high capacity system. The EMU services on the ring system of rail tracks may increase the flow of commuters and materials. In order to achieve the highest level of coordination, the formation of a single Unified Metropolitan Transport Authority has also been planned.

Planning the Physical Infrastructure

If the National Capital Region is to function as one integrated region, the deficiencies in infrastructural facilities will have to be reduced. Uninterrupted supply of power is pre-requisite for economic development. It should be available in adequate quantity for industrial development. The atomic power plant at Narora is likely to augment

TABLE 5.3
Land Requirement for Urban Development by 2001 in NCR

Town/Urban Complex	Existing Area in Hectare	Population (in lakh) 1981	Population Density per Ha. 1981	Assigned Population-2001 (in lakh)	Additional Population to be Accommodated (in lakh)	Total Land Required in Ha.	Additional Land Required in Ha.
1. Priority Towns/Urban Complex							
(i) Meerut	8082	5.37	66	13.00	7.63	10400	2818
(ii) Hapur	583	1.03	176	6.00	4.97	4800	4217
(iii) Bulandshahr-Khurja Complex	1975	1.70	86	10.00	8.30	8000	6025
(iv) Palwal	552	0.47	85	3.00	2.53	2400	1848
(v) Panipat	2082	1.38	66	5.00	3.62	4000	1918
(vi) Rohatak	2205	1.67	76	5.00	3.33	4000	1797
(vii) Rewari-Dharuhera-Bhiwadi Complex	606	0.52	85	3.00	2.48	2400	1997
(viii) Alwar	8000	1.46	18	5.00	2.54	4000	Nil
Sub-total 1	24083	13.60	56	50.00	35.40	40000	20620
2. DMA Towns							
(i) Ghaziabad including Loni	6840	3.00	44	11.00	8.00	8800	1960
(ii) NOIDA	600	0.75	125	5.50	4.75	4400	3800
(iii) Faridabad	17824	3.31	18	10.00	6.69	8000	Nil
(iv) Gurgaon	2413	1.00	41	7.00	6.00	5600	3200
(v) Bahadurgarh	900	0.37	41	2.00	1.63	1600	700
(vi) Kundli	200	0.25	125	1.50	1.25	1200	1000
Sub-total 2	28777	8.68	30	37.00	28.32	29600	10660
Grand Total	52860	22.28	42	87.00	64.72	69600	30577

Note: Density assumed 125 persons per hectare

Source: Interim Development Plan 2001, NCR Planning Board, p.45.

the power supply. The power tariff will have to be adjusted in a way that Delhi becomes a less favoured area for industrial and commercial power. Around-the-clock power supply in all the urban and rural areas of the NCR should be ensured for rapid economic transformation.

Supply of drinking water to urban and rural areas is becoming difficult in view of the increasing demands for water. An integrated water supply scheme consisting of surface flow and ground water in the priority centre in the first phase and to other towns and rural areas in the second phase will have to be undertaken. The strict enforcement of Water Pollution Control Act, 1974 and Environmental Protection Act, 1986 may go a long way to restrict the wastage of this cyclic resource.

The problem of sanitation, sewerage disposal and rain-water drainage will have to be tackled in the urban areas as a first priority. Congestion always leads to the deterioration of sanitation. The congestion in the urban and rural settlements has to be reduced and corrected, if it is there. The urban areas where sewerage disposal schemes are absent, low-cost sanitation systems may be introduced. The NCR Planning Board may consider the feasibility of introducing the model of Sulabh International for the disposal of sewerage and provide facilities to the community as a whole.

The NCR will be an experience in metropolitan and regional development planning. It will witness high growth of urbanisation in an agriculture-based economy. It will result in an integrated urban system reducing the pressure of population of Delhi. The process has already started with land prices sky-rocketing in the whole NCR. The NCR as a concept will have to be implemented swiftly lest the haphazard development takes over the planned development.

(ii) MUMBAI METROPOLITAN REGION

'Metropolis' literally means 'the mother city'

Any city having a population size of 1 million is referred to as 'metropolis'. The metropolisation in India is a phenomena of the present century. While the urban population in India increased from 25.85 million in 1901 to 217.18 million in 1991, the population of metropolitan cities for the same period has increased from 1.49 million to 70.66 million. There has been a eight-fold increase in the urban population during 1901-1991, the increase in the population of metropolitan cities has been forty-seven-fold.

Mumbai has been one of the major ports amongst the three ports developed by the British, i.e., Mumbai, Calcutta and Chennai. A port has a locational advantage of being on the coast. Mumbai has the additional advantage of being located on the coast of the Arabian sea and is closer to the Suez canal linking Western Europe. Mumbai has a rich hinterland growing cotton and oilseeds. It served as a suction point for a siphoning the resources from the hinterland as well as bringing the finished products and send it through the port to the inland markets. The establishment of cotton textile industries with the help of the imported machinery through Mumbai port and linking it with railways to the interior gave impetus to the growth of Mumbai as an urban centre. As it became a focal point offering economic opportunities, people started migrating to Mumbai from different parts of the country.

The economic advantages have led to the rapid growth of Mumbai. The concentration of industries, commerce, trade and other economic activities have accelerated the process of metropolisation of Mumbai. The pull factor generated by the economic opportunities attracts great influx of people which becomes a major problem of metropolitan centres. It puts great pressure on space, civic amenities, housing, transport and also on the employment avenues. The great demand for housing pushes up the land prices not only in the city limits but also in its immediate hinterland. Congestion and

competition lead to social tensions and disparities become glaring.

Mumbai starting as a port city on a small island known as 'Salsette', separated from the mainland by Thane and Bassien creeks, grew in a large city and expanded further to become a metropolis. The island could not accommodate the growing population, increasing industrial activity and influx of people. The shortage of space, high land prices, higher costs of living and due to increased connectivity provided by road and rail network resulted in outward growth of the city. The railways and roads provided corridors of development and growth of settlements. The city fringe started expanding. Industrial activity got dispersed to the towns in the hinterland. The city of Mumbai thus expanded to become Greater Mumbai's metropolitan region. It covered an area of 603 sq km in 1981, which was about 10 times of the area of the old city of Mumbai. In 1991, five urban areas from Thane have been added to Greater Mumbai. While in 1981 its population was 8.2 million in 1991, it rose to 12.6 million. If the present trend continues, the metropolitan area may further be extended engulfing more rural areas. Its size calls for scientific planning as in case of the metropolitan area.

The Geographical Personality

Mumbai city was initially established as a port town in 1774 on one of the islands out of seven islands formed of Deccan Lava. All the seven islands have since been joined together by reclamation. The Salsette island was separated from the Mumbai island by the Mahim river. As the port of Mumbai was established on this island, it was known as Mumbai Island. The Thane creek separated the group of island from the mainland.

The island site of the metropolis is protected by a distant mountain wall of Western Ghats. The island itself has three hills lying in the form of local eminences. These are Malabar hills, Pali

hills and Antop hills. The island is elongated but its harbour with 192 sq km of protected deep water makes it an unique harbour in India. Greater Mumbai extends over a wedge-shaped area of land and extends towards Thane district. The whole area is a continuous built up area along the rail-road corridors.

Industrial Development

After independence, Greater Mumbai witnessed a fast industrial growth. A number of industrial units have emerged in the industrial areas of Thane-Belapur strip and Talaja (Fig 5.5) during the last 15 years. The Nhava-Sheva port on the mainland across the Thane creek will be serving the industrial area developed in its immediate hinterland. The new bridge across Thane creek has provided accessibility with the south and south-eastern part and linked Greater Mumbai, with New Mumbai. Thus, Greater Mumbai, Thane, and New Mumbai areas have developed into a large urban agglomeration.

Mumbai port has a large hinterland, almost extending up to Delhi, Jabalpur, Nagpur and Hyderabad but as the distance increases, its influence decreases. It, however, exerts great influence up to Matheran in the east. It is a hill-station located on the Western Ghats at a height of 760 metres above the mean sea level. The western side of the Ghats are linked with Mumbai as the hydro-electric power is transmitted from these areas. Panvel, on the Mumbai-Pune route marks the south-eastern limit of the metropolitan area.

There is great diversification of industry in this metropolitan region. Textile is the most dominant and the oldest industry. A large number of cotton textile factories are located in Parel where the land was cheaper in the olden days. The engineering industry occupies the second place. These are located closer to Mazgaon. Many engineering industries manufacture textile machinery, and printing machinery. Chemicals,

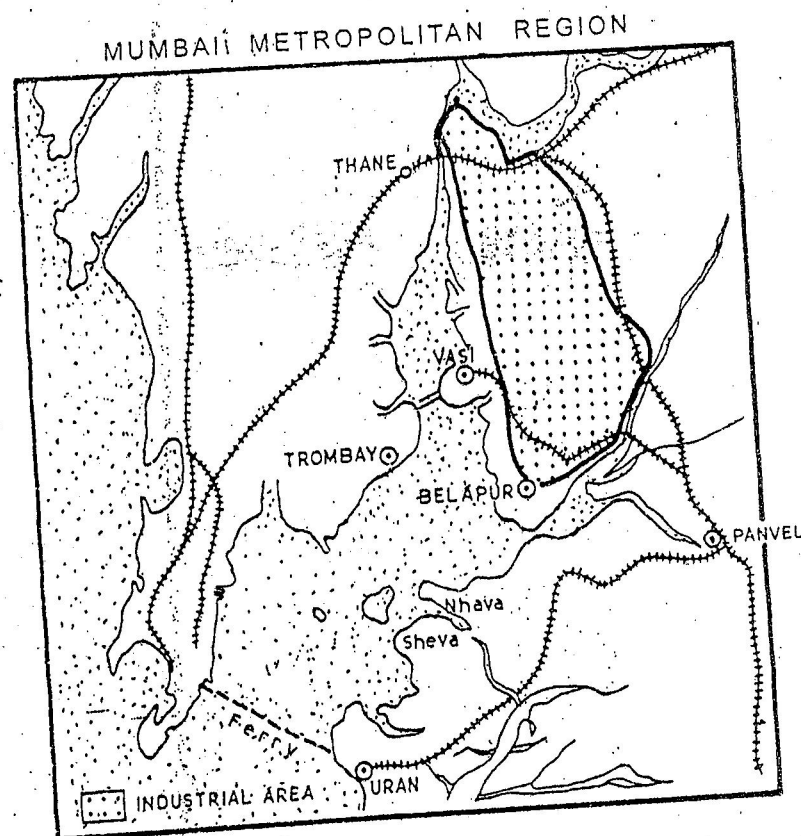


Fig. 5.5

drugs, and food industries also dot the industrial landscape. Away from the city, the metals, pharmaceuticals, chemicals, dairying and leather industries extend almost up to Kalyan. The film industry is located in the northern suburb of Mumbai.

The major advantage to this industrial development has been the availability of hydro-electric power, in an otherwise coal-deficient region. Hydro-electrical schemes were developed in 1927 in order to meet the power needs of the industry and the railways. There are three very old power projects of Lonavala, Nila Muja, and Andhra Valley. The water of east-flowing small stream has been stored in reservoirs and has been lead through tunnels on reverse slopes of the Ghats to the western foot of the hill ranges at three power stations at Khopoli, Bhivpuri, and Bhira. Some new projects like Koyna project in Ratnagiri district, have also been started.

The Port

Mumbai still remains the most important port of the country on the west coast. A number of docks are located on the eastern side of the island. An eight kilometre long stretch has series of docks. The port handles a variety of items like oil tankers, cotton, cotton goods, oilseeds and manganese, grains, machinery, and constructional goods. The three important and busy docks are: Prince, Victoria and Alexandria. They have sufficient depth of water, a long water front, various infrastructures and installations and are served by 193 km of port trust railways. This port also provides docks for the naval ships of Indian Navy.

Planning the Metropolitan Mumbai

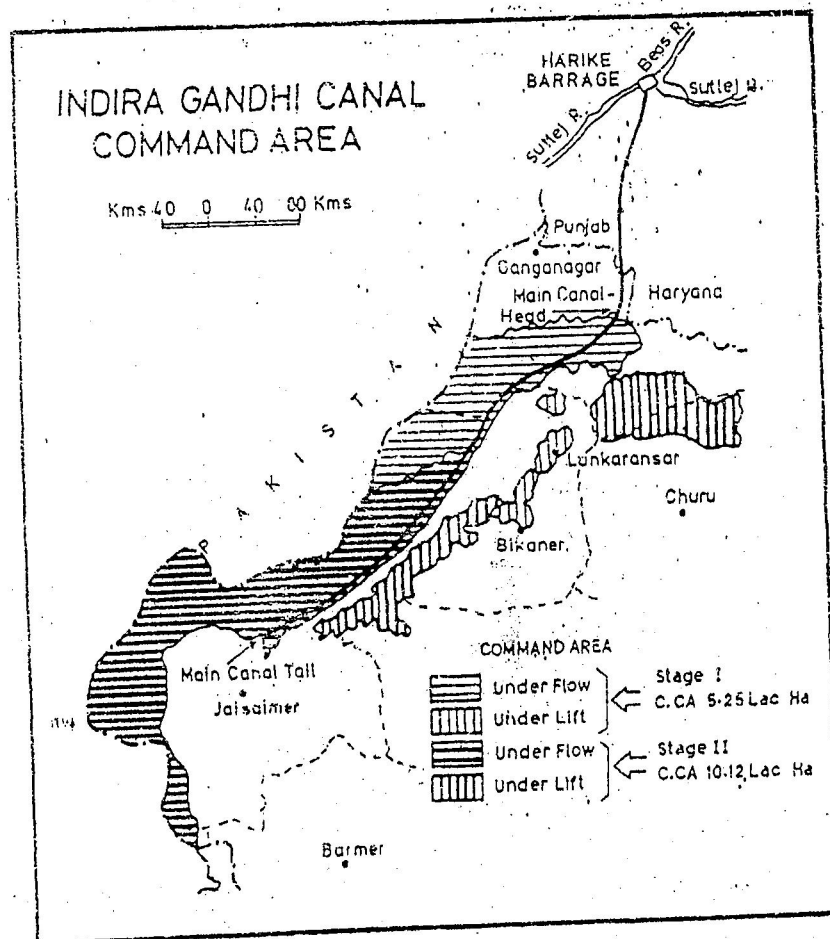
Metropolitan planning in India is a recent practice, though Master Plans of some cities were prepared by the planners. Metropolitan planning has been attempted in the four major cities of India, viz. Delhi, Calcutta, Mumbai, and Chennai. It has been necessitated due to the

problems faced by the large cities. The problem of absorbing growing population, providing infrastructural facilities, generating employment, reducing congestion, providing housing and preserving the quality of life called for an integrated planning strategy for these cities. The concepts of the NCR with which you are already familiar, Calcutta Metropolitan Organisation (CMO), etc. were introduced in response to this need of planning the metropolitan regions.

Mumbai city has witnessed unchecked industrial and urban growth leading to the great increase in numbers from 8 lakh persons in 1901 to 126 lakh (12.6 million) persons in 1991. The first Greater Mumbai plan in 1948 proposed a gradual removal of factories from the central part of the city outside along the Agra road and along the railway track of the western railway. In 1948, the limit on population was put at 3.7 million which was exceeded in 1958 itself. The other plan fixed a population size of 8 million people in 1964 for Greater Mumbai which has already been surpassed in 1981. Putting a ceiling on the population size of metropolitan areas throughout the world has been a futile exercise except in some socialist countries. The population of Mumbai exceeded 12 million in 1991 making it the largest city of the country.

The industrial agglomeration which developed near Mumbai due to certain initial advantages cannot be dismantled. New industries will have to be planned outside the metropolitan area. Bandra, Kurla area may not accommodate large number of industries due to lack of space and difficulty in reclaiming more land for the sea.

A new satellite metropolitan city is developing on the mainland known as New Mumbai. It is not far away from the old city and is connected with it by road and rail links. A comprehensive transport plan has been drawn up to provide inter-city and intra-city services. This plan has to be implemented in a phased manner. It was started in 1972 and the bus services at



Based upon Survey of India map with the permission of the Surveyor General of India
© Government of India, 1990

Fig. 5.6

present link New Mumbai with Thane in the north Mumbai and Dadar in Central Mumbai. A ferry service operates between ferry wharf at Mumbai and Uran in New Mumbai. The plans to introduce services to other areas in New Mumbai are under preparation. Fast ferry services are also being considered to link up the commercial parts in Fort area in old Mumbai and the commercial area of Belapur in New Mumbai. Thane creek separates the two. It has two natural harbour sites and a port has been proposed at Nhava and Sheva. The industries have already taken route in the Thane-Belapur belt and Taloja area. It is also proposed that some of the Government offices of Maharashtra Government should be shifted. It will help in decongesting the old city and give prestige to New Mumbai. The development of New Mumbai may call for a new adjustment in the land use pattern. It is also necessary for the conservation and control of pollution. Besides planning the city region, dispersal of industries to other regions of Maharashtra and development of rural areas are also essential. This will create more jobs in other parts of the state and the development of the rural areas will reduce the push factor and check the migration of rural population to urban areas. Besides, steady and continuous rebuilding is an absolute necessity for all metropolitan cities. According to La Corbusier (the planner architect of Chandigarh) "cities, that do not rebuild themselves continuously, die". Therefore, redevelopment is a pre-requisite along with the development.

4. INDIRA GANDHI CANAL COMMAND AREA

Indira Gandhi Canal Project is a gigantic human effort to transform a part of desert land into a land of prosperity and plenty. It is one of the largest canal systems of the world. The command area of Indira Gandhi Canal is located in north-western part of the Thar desert of Rajasthan in the districts of Ganganagar, Bikaner, Jaisalmer, Barmer,

Jodhpur, and Churu. It is stretched over an approximate area of 525×45 sq. km along the border of Pakistan. The Indira Gandhi Main Canal runs parallel to the Pakistan border for an approximate distance of 38 km from north-east to south-west.

Environmental Characteristics of the Command Area

Relief

The Canal Command Area consists of alluvial land of Indo-Gangetic plain overlain by sand. The upper part of the Command Area has extensive alluvial plain of Ghaggar river interrupted by small sand dunes of less than two metres in height. The canal comes across the real desert south of Suratgarh town. Extensive undulating sandy plains, sand dune ridges rising to the height of 60 metres above the surface and desert plain or depressions are major relief features of the Indira Gandhi Canal Command Area in Bikaner, Jaisalmer and Barmer districts. Density and size of sand dunes increases towards middle and tail reaches of the canal. Near the tail of the canal in Jaisalmer and Barmer districts, about 80 to 100 per cent of land area is covered by sand dunes. Most of the sand dunes in the lower parts of the Command Area are longitudinal. In the upper command sand dunes are transverse. Sand dunes are generally unstable in lower and middle command and direction of their movement is from south-west to north-east. This region slopes towards south-west. Height of the head of the main canal is about 200 metres above sea level which lowers down to less than 200 metres near the tail.

Drainage

The area lying under the Canal Command Area does not have any perennial river. Ghaggar is the lonely river of the region. It originates from the Shivalik range of the Himalayas and traverses

south-west through Punjab and Haryana before entering Rajasthan near Hanumangarh town. The tract of this river is easily traceable till Anupgarh. It is a seasonal river. It is lost on the way and does not fall in a lake or sea. The lower parts of the Command Area have internal drainage system. Small streams occasionally collect water in the low-lying area of depression basin and form brackish water lakes or *playas*. These lakes are locally known as *rauns* and dry up during summer season.

Climate

This region has very harsh climatic conditions. It has hot desert type of climate having high range of seasonal and diurnal temperature. Moreover, rainfall is very scanty and erratic. Heat waves or *loo* and dust-storms sweep the region during summer, and cold waves blow occasionally during winter. Mercury soars up to 49°C in summer and drops down to 2°C in winter. The mean annual temperature of the Command Area varies between 26°C in the north and 28°C in the south-west. Average annual rainfall in the region varies from 30 cm in the north to 8 cm in the south-west. About 90 per cent rainfall occurs in south-west monsoon season. Drought is a common climatic phenomena. Severe drought occurs twice during a period of five years. Temporal variability of rainfall is very high. Variability of annual rainfall ranges between 50 per cent near the head of the main canal and 80 per cent near the tail. The wind speed remains very high during summer. The mean daily wind speed of June is about 27 km per hour at Jaisalmer. This region has moisture-deficient soil throughout the year. Even during south-west monsoon, demand for soil moisture by plants exceeds the rainfall.

Soils

Soils of the Command Area are sandy, particularly in the districts of Jaisalmer,

and Barmer. These soils are of recent origin and soil structure is not developed. In Ganganagar district sandy soils are blended with alluvial soils of Ghaggar basin and are comparatively more fertile. Sandy soils are deficient in organic carbon and potassium and rich in phosphorus. Soils are alkaline in nature and have high concentration of soluble salts. Concentration of soluble salts is specifically higher in interdunal plains and areas having impeded drainage in the middle and the lower parts of the Command Area. These areas are underlain by hard pan of calcium carbonate, clay and silt at a depth of few centimetres to few metres, below surface. Hence, there is a possibility of developing perched water table.

Natural Vegetation

The Command Area of the Indira Gandhi Canal is practically devoid of forest cover because of extreme aridity and man-induced process of desertification. Natural vegetation of the region includes xerophytes, thorny bushes and scrubs. This region has sparse population of *Acacia nilotica*, *Prosopis cineraria*, *Zizyphus nummularia* and *Leucenea leucoccephala* trees. One of the most nutritious grass of the world, *Sewan* (*Lasiurus sindicus*), grows in the desert land of Bikaner, Jaisalmer, and Barmer districts. This region supports a high density of livestock which depend on extensive pastures and grazing land. These pastures dry up once the rainy season is over, and grass is eaten up by livestock leaving the land exposed to the process of desertification.

Origin of the Canal

Work on the Indira Gandhi Project began on 31 March 1958. This canal originates from Harike barrage near the confluence of Satluj and Beas rivers in Ferozepur district of Punjab. It is 40 metres wide at bottom and 6.4 metres deep. The carrying capacity of canal is 18,500 cusecs of water at its head. According to a proposal in 1981, Rajasthan was allocated 8.6 million acre

feet of Ravi-Beas surplus water. The Indira Gandhi Canal envisages the utilisation of 7.6 million acre feet of water allocated to Rajasthan.

The Indira Gandhi Canal is feeder up to a length of 204 km and traverses for a length of 150 km in Punjab and 19 km in Haryana where it does not have any outlet. The head of the main canal is located near Masitanwali in Hanumangarh tehsil of Ganganagar district. The tail of the 445 km long main canal is located near Mohangarh in Jaisalmer district. The Command Area of the canal is further extended till Garda road in Barmer district, through Sagarmal Gopa branch. Construction work of the project is in progress and is being carried out in two stages. Water was released in the main canal on 11 October 1967 and reached its tail on 1 January 1987. The main canal has two kinds of branches and distributaries. All the right bank branches of the canal are flow channels as the land west of the main canal slopes down gently towards Pakistan border. Whereas all the left bank branches of the canal are lift channels except Rawatsar branch which takes off from the head of the main canal.

The Command Area lying east and south-east of the main canal slopes towards the canal. Hence, water has to be lifted against slope gradient of land.

Stage I

Construction work of Stage I is over. It included the construction of 204 kilometres long feeder, 189 kilometres of the main canal and 2,960 kilometres long distribution system. Stage I has five flow branches and one lift canal covering south and south-western part of Ganganagar district and north and north-western part of Bikaner district. Other details about the stage are given in Table 5.4. The Project plan of Stage I envisages intensive irrigation with an irrigation intensity of 110 per cent. Irrigation intensity is expressed as percentage ratio between gross irrigated area and culturable command area of the

project. Water allowance or volume of water allocated per 1000 acres of land is higher for this part of command area, that is 5.23 cusecs.

Stage II

Construction work of Stage II is in progress. Although according to the original plan it was supposed to be over in 1978. Construction of this stage includes 256 km long main canal and the distribution system having a length of 4,800 km. The irrigation plan of this project has been revised many times and it envisages extensive irrigation. Extensive irrigation means reducing per acre allowance of water and providing irrigation to maximum cultivated area. Irrigation intensity of this region is 80 per cent that amounts to provide irrigation to 80 per cent of culturable command area. Water allowance of Stage II is 3.50 cusecs which is less than that of Stage I. Basic objectives to design extensive irrigation for this region is to provide irrigation facility to maximum area in the desert, grow light irrigated crops, prevent water logging and soil salinity and provide benefits of irrigation to maximum number of people. Stage II proposes to develop irrigated pastures on an area of about 3.66 lakh hectares. This would help in providing benefits of irrigation to aboriginal nomadic communities, develop animal husbandry and arrest desertification.

Command Area Development Programme

The Command Area Development Programme is an integrated area development approach towards the command areas of major and medium irrigation projects in the country. This programme is aimed at bridging the gap between created irrigation potential and its utilisation in the command areas of major and medium irrigation projects. The Fifth Five Year Plan document emphasised the need of implementing this programme in all the command areas of major and medium projects in the country. The CAD programme was introduced in the Indira

TABLE 5.4

Salient Features of Indira Gandhi Canal Project

S.No	Particulars	Unit	Stage I	Stage II	Total
1.	Length of the Main Canal:				
	(i) Indira Gandhi Feeder	km	204		204
	(ii) Indira Gandhi Main Canal	km	189	256	445
	Total	km	393	256	649
2.	Length of Distribution System	km	2960	4800	7750
3.	Culturable Command Area:				
	(i) Under flow irrigation	Lakh	4.79	7.00	11.79
	(ii) Under lift irrigation	Lakh ha	0.46	3.12	3.58
	Total	Lakh ha	5.25	10.12	15.37
4.	Irrigation Potential on Full Development	Lakh ha	5.78	8.10	13.88
5.	Irrigation Intensity	Per Cent	110	80	90
6.	Water Requirement	Million Acre Feet	3.59	4.00	7.59
7.	Drinking and Industrial Use of Water	Cusecs	300	900	1200
8.	Cost	Crone Rs	246	1420	1666
9.	Annual Food Production	Lakh tonnes	14.50	22.50	37.00

Gandhi Canal Command Area in 1974. It is one of the major irrigation projects in India where this programme was introduced at the earliest. The importance of this programme is all the more in this command area because it requires efficient utilisation of irrigation water and overall economic and ecological development for the following reasons:

- Conveyance loss of water is about 30 to 50 per cent below outlet level in sandy soils. This results into not only under-utilisation of scarce resource like water but also leads to water-logging and soil salinity and hence it adversely affects crop yield.
- This is a newly settled area and, therefore, requires civic amenities, infrastructural facilities and supply of modern agricultural inputs.
- Wind erosion and desertification cause siltation in canal and its distributaries and water courses. Besides,

culturable land is also eroded.

The Command Area Development Programme was introduced in the Indira Gandhi Canal Command Area in 1974 and it was entrusted with following tasks:

- On-farm development which includes surveying and planning water course lining, land levelling, shaping and reclamation of degraded lands
- Afforestation and pasture development which includes canal side and roadside plantation, block plantation near new settlements, sand dune stabilisation and pasture development on culturable waste land
- Providing communication and civic amenities which includes construction of roads, connecting the settlements with markets, construction of new markets and supplying drinking water
- Availability of modern agricultural inputs including ensuring supply of

HYV seeds, chemical fertilizers, insecticides and pesticides and providing agricultural extension and training facilities to the farmers.

Implementation of this programme has helped in bringing the land under irrigation rapidly, increase in water-use efficiency, agricultural production and productivity.

Agricultural Development

Deficiency in soil-moisture has been a limiting factor for agricultural development in western Rajasthan. Farmers can raise crops during *kharif* season only and a large tract of cultivable land lies uncropped in the form of culturable waste land and fallow land. Introduction of irrigation has helped in increasing the net sown and double cropped areas as shown in Table 5.5.

TABLE 5.5

Indira Gandhi Canal Command Area, Stage I
Percentage of Net Sown Area in Total Geographical Area and Double Cropped Area to Net Sown Area

Year	Percentage of NSA in total Area	Percentage of Area Sown More than Once in NSA
1971-72	21.70	8.00
1972-73	22.32	9.89
1973-74	24.16	12.92
1974-75	26.67	14.57
1975-76	29.28	17.17
1976-77	28.48	16.18
1977-78	30.05	19.10
1978-79	31.52	22.20
1979-80	29.08	25.45
1980-81	32.85	32.25

In this region before introduction of irrigation, drought-resistant crops such as *bajra*, *guar*, *moong*, *moth* and gram occupied about 95 per cent of the gross cropped area. The cropping pattern of the region has changed drastically with the introduction of irrigation. As shown in Table 5.6, commercial crops such as cotton, groundnut,

TABLE 5.6

Indira Gandhi Canal Command Area, Stage I

Percentage of Area Under Selected Crops in the Gross Cropped Area

Crops	1974-75	1980-81	1984-85
Cotton	9.08	19.51	19.16
Guar	15.29	17.80	16.21
Groundnut		0.31	6.61
Paddy	2.59	1.96	2.05
Pulses (Kharif)	0.58	0.99	0.37
Bajra	5.74	0.94	0.97
Sugarcane	0.79	0.37	0.57
Wheat	19.65	18.32	24.64
Gram	26.24	26.50	10.75
Mustard	12.95	8.14	16.37

wheat and mustard have come up rapidly and occupy about 65 per cent of the gross cropped area in Stage I of the Canal Command Area. Wheat occupied about one-fourth of the gross cropped in the Canal Command Area in 1984-85 followed by cotton, mustard and *guar*. Groundnut is coming up as a major irrigated crop in *Kharif* season in the lower parts of the command area.

Agricultural production and productivity per hectare has increased rapidly in the command area of Indira Gandhi Canal.

Table 5.7 shows that the per hectare yield of cotton, groundnut, paddy, and wheat is

TABLE 5.7

Indira Gandhi Canal Command Area, Stage I

Yield Level of Some Selected Crops

Crops	1976-77	1981-82	1986-87
Cotton	890	1015	1274
Groundnut	NA	1465	1593
Paddy	2987	3344	3500
Guar	NA	957	746
Wheat	1596	2038	2039
Gram	972	647	564
Mustard	688	904	835

NA - Data not available
Yield level in 1985-86