

BGGET - 141



Indira Gandhi National Open University
School of Sciences

GEOGRAPHY OF INDIA



Vol. II

GEOGRAPHY OF INDIA

BGGET-141

GEOGRAPHY OF INDIA

VOLUME - II

“शिक्षा मानव को बन्धनों से मुक्त करती है और आज के युग में तो यह लोकतंत्र की भावना का आधार भी है। जन्म तथा अन्य कारणों से उत्पन्न जाति एवं वर्तमान विषमताओं को दूर करते हुए मनुष्य को इन सबसे ऊपर उठाती है।”

इन्दिरा गांधी



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“Education is a liberating force, and in our age it is also a democratising force, cutting across the barriers of caste and class, smoothing out inequalities imposed by birth and other circumstances.”

– Indira Gandhi

VOLUME - 2

BLOCK 3
ECONOMY

BLOCK 4
POPULATION AND SETTLEMENT

BLOCK 5
REGIONAL APPROACHES TO GEOGRAPHY OF INDIA

GEOGRAPHY OF INDIA: INTRODUCTION

Till now, you have studied the core courses in the first four semesters of your B.Sc. General Geography programme. The last two semesters are devoted for the study of Discipline Specific Elective Courses. We have taken up Geography of India in fifth semester and Economic Geography in sixth semester. This course is designed to give you an overall understanding of the multifarious physical and human characteristics of Geography of India. By now, you are well aware that Geography studies the plethora of human and physical themes along with their multitude of sub-themes to discern a pattern, interrelationship and associations etc., in a spatial and temporal dimension. You will be able to comprehend the strengths as well as weaknesses keeping in consideration the resource endowment, opportunities and myriad of constraints. Study of this course may help you to paint a broad geographical picture to understand the prevalent binaries in terms of developed and underdeveloped regions.

This course is printed in two volumes. Volume-1 consists of first two blocks and the other three blocks (3 to 5) are arranged in volume-2.

Geography examines the distribution, spatial variation, and relationships between physical and cultural characteristics in a spatial and temporal dimension. India is a multicultural nation. This course examines the physical environment, resource base, economics, population, and settlement of India. The course lays the groundwork for further study in regional or systematic geography in India. One of the primary goals of the course is to investigate India's physical environment, including its physiography, drainage, climate, soil, and vegetation. These critical qualities are thoroughly discussed in **Block 1** spread over five Units.

The availability of natural resources in an area, such as land, water, forest, mineral, and energy, is critical for a country's growth and development. **Block 2** is devoted to the study of India's resource base aimed for the economic development in five Units. The availability of resources and the economics of a place are inextricably linked. Land and water are used for agricultural products as well as other economic and cultural purposes. A region's forest resources not only provide livelihood opportunities for local inhabitants, but also provide energy and matter to all living species. Resources such as minerals and energy can be used to measure a country's economic development. In order to comprehend how a community or a country as a whole experiences economic progress, it is crucial to appreciate the significance of natural resources.

Block 3 describes India's economy. India has one of the world's fastest expanding economies. The Indian economy is mostly based on agriculture, which is regarded as the country's backbone due to the country's rich deltas and river valleys. The Green Revolution has enabled academicians/researchers to investigate the peculiarities of Indian agriculture, as well as agricultural land usage and cropping patterns. Aside from agriculture, industry and transportation growth in India have offered a plethora of opportunities for the betterment of the country's landscape. The placement of industries and industrial corridors in India is also influenced by the availability of raw materials, labour, climate, market, transportation, capital, and banking facilities, among other factors.

The study of population, including size and growth, distribution and density, age and gender ratio, religious and linguistic makeup, castes and tribes, and so on, helps you to understand the value of population as a human resource in India. The features of India's rural and urban

settlements will also give information on the country's urbanisation process. **Block 4** introduces you about India's population, socioeconomic structure, and settlement trends. Regional approaches to India's geography, with a focus on physiographic approaches, socio-cultural approaches, and economic approaches developed from a variety of aspects, which may include historical, regional, cultural, and demographic considerations. **Block 5** of this course goes into further detail.

Overall, this course will be beneficial to grasp India's geography in a broader context. We hope that after taking this Geography of India course, you will be able to describe geography as an interdisciplinary field of study that explores numerous aspects of both physical and human features.

In this quest, our warmest wishes are always with you. If you need assistance with this course, please contact us at: vishalwarpa@ignou.ac.in and knrao@ignou.ac.in



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BLOCK**3****ECONOMY**

UNIT 11**AGRICULTURE**

UNIT 12**INDUSTRIES**

UNIT 13**TRANSPORT**

GLOSSARY

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GEOGRAPHY OF INDIA

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BLOCK 3: ECONOMY

India is one of the fastest growing economies in the world. In order to comprehend the factors and characteristics of the Indian economy, we have introduced three major sectors of the economy in this Block: agriculture, industry, and transportation. India has enormous agricultural potential, and the agriculture industry is regarded as the backbone of the Indian economy. The fertile deltas and river valleys provide numerous opportunities to grow agriculture in the country. The expansion of industrial enterprises and transportation facilities can indicate the progress of any region or country. The amount of industrial progress and a country's economic success are inextricably linked. Because of its systematic planning and transportation, India has become an exporter of various materials and goods to many nations. These changes occurred as a result of numerous five-year plans and recent government efforts that focused on regional balances through the creation of industrial areas and industrial corridors. The development of dedicated freight corridors also aids in the transit of commodities from one location to another at high speed and capacity.

This block introduces you to the economy, dealing with the agriculture, industries, and transportation sectors spread across three units.

Unit 11: Agriculture

This unit discusses the current circumstances pertaining to Indian agriculture. It helps to understand the importance of agriculture in the Indian economy. Studying the characteristics of Indian agriculture and agricultural land use and cropping patterns is essential for a better understanding of the Indian economy. The Green Revolution and its implications are also explained in this unit.

Unit 12: Industries

The manufacturing of goods with the help of the availability of raw materials in a country plays an important role in assessing the development and growth of a region. A number of factors, including raw materials, labor, climate, market, transport, capital, banking facilities, etc., influence the location of industries. In this unit, we have introduced historical perspectives on industrial development and the classification of industries followed by industrial corridors in India.

Unit 13: Transportation

This unit focuses on transportation. Transportation is a means of transferring people and goods. We have explained the development of the transport network, various modes of transport, the dedicated freight corridors, the rapid mass transport systems, and urban transport in this unit.

We hope that after studying this block, you will better understand the role and importance of agriculture, industry, and transportation in the Indian economy.

Our best wishes are with you in this endeavour.

We suggest for any assistance regarding this course, you can contact at:

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UNIT 11

AGRICULTURE |

Structure

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11.1 INTRODUCTION

In Block 2, you have learned about resources such as land, water, forest, minerals, and energy. In this Unit 11 of Block 3, you will learn about agriculture and its importance in the Indian economy. Since time immemorial, the Indian subcontinent is known for its unparalleled agricultural potential. Large scale agriculture was the backbone of the economy of the great civilizations. The highly fertile plains river valleys, deltas and hill slopes of the region provided ample opportunities to grow a variety of crops. The history of the subcontinent also contains evidence that suggests a flourishing trade linkage between this region with Africa, the Middle-East, Europe, China, and East and South-East Asia involving agricultural commodities. During the British rule, Indian agriculture acquired two distinctive features. One was the introduction of new commercial crops, promoting plantation cropping in Indian agriculture. This was further patronised after Independence during the Green Revolution. The second feature was an asymmetrical land distribution, in which around 95% of the cultivated land remained in possession of only around five per cent of the landlords. The issue of asymmetrical land distribution was addressed by the government after Independence through the Land Ceiling Act, the Land Consolidation Act, and the Bhoodan Movement of Acharya Vinoba Bhave.

Since the last quarter of the 20th century, unprecedented changes have been taking place in the occupational structure and land utilization pattern in the country. In terms of changing occupational structure, the proportion of primary sector workers, particularly the agricultural, is steadily decreasing. With respect to the changes in the patterns of land utilization, expansion of land

under urban-industrial use and infrastructural projects have been taking place by encroaching upon agricultural lands. Similarly, the exit of workers from the primary sector may be ascribed to the decreasing economic returns from agricultural operations, uncertainties in weather patterns, and/or its increasing mechanization. The distressed and/or surplus agricultural workforce, in turn, has been trying to find avenues in the secondary and tertiary sectors of the economy.

It is pertinent for us to develop our understanding of the current circumstances pertaining to Indian agriculture. In this unit, we shall try to address the importance of agriculture in the Indian economy in Section 11.2 and the characteristics of Indian agriculture in Section 11.3. Following that, we will study agricultural landuse and cropping patterns, the Green Revolution, and the problems of Indian agriculture in Sections 11.4, 11.5, and 11.6, respectively.

Expected Learning Outcomes

After completing the study of this unit, you should be able to:

- explain the importance of agriculture in the Indian economy;
- describe the distinctive features of Indian agriculture;
- elaborate the agricultural landuse and cropping pattern;
- explain about the Green Revolution; and
- elucidate the problems of Indian agriculture.

11.2 IMPORTANCE OF AGRICULTURE IN INDIAN ECONOMY

You might be aware that agriculture has remained the backbone of the Indian economy since the beginning. Even today, agriculture not only accommodates the maximum proportion of workers but also is the largest landuse in the country. Although the Indian economy is fast becoming diversified and a significant proportion of workers are shifting to the industrial and service sectors. According to the 2011 Census records, 54.6% of the working population of the country is still engaged in agriculture. It was much higher (69.7%) at the time of Independence. It is important for you to note that agriculture not only includes cultivation of crops, but also animal husbandry, horticulture, pisciculture, sericulture, silviculture and allied activities. Taken together, all these activities occupy about 50% of the country's reported area. However, among all these activities, cultivation of crops stands out as the most dominant in terms of coverage of area, commonly known as **net sown area**. Of the total geographical area of 328.73 million hectares, the country has a reported area of 307.8 million hectares for land utilization. As per the latest information (2015-16), the net sown area of the country is estimated at 139.51 million hectares or 45.33% of the total reported area, and the gross cropped area at 197.06 million hectares.

In the context of the economy of the country, you may note the following aspects to comprehend the importance of agriculture.

- I. First and foremost, the contribution of Indian agriculture to the Gross Domestic Product (GDP) of the country has been about 17-18% in recent years, which remains one of the highest in the world.
- II. The agricultural sector of the country generates the highest proportion of employment opportunities. Gradual diversification of the Indian economy has, of course, caused a shift of workers from the agricultural sector to the industrial and service sectors. Comparing the share of workers in agricultural activities of India with that of the developed countries, you would notice that India still has a much higher share (more than 50%) of agricultural workers.
- III. Agriculture is the most important source of food grains. Increasing demand for food due to an increase in the number of people is satisfied by increasing crop production. Although an increase in the level of production cannot be achieved in most cases through the horizontal expansion of land under cultivation, modern farming techniques have enabled vertical expansion, i.e. by increasing production per unit area.
- IV. Agriculture plays a very significant role in capital formation. Agricultural operations should be oriented towards the formation of capital in a developing country like India. Failing to do so not only thwarts agricultural development, but also negatively affects the economy in general.
- V. You are aware of the fact that many industries make use of agricultural products, such as sugar, jute, cotton and oil industries etc. The food processing and agro-based industries cannot thrive without agriculture.
- VI. You may be aware that many agricultural operations rely on industrial products. In this way agriculture happens to be a very large market for industrial products. The implication is that with the progress of agriculture, demand for the tools and implements used in agricultural operations also increases, triggering the growth of the industrial sector.
- VII. Further, both raw and processed agricultural products promote internal as well as international trade. Consequentially, the service sector of the country expands. Agriculture also plays a very important role in India's foreign trade. India earns a significant amount of foreign exchange from the exports of products like tea, coffee, rubber, jute, cotton, sugar, and dairy products etc.
- VIII. Being the largest sector of the country's economy, agriculture contributes a significant chunk to the government's exchequer. The transport sector, particularly the Indian Railways, earns huge tariffs by transporting raw, semi-processed, and processed agricultural produce from one part of the country to the other. Products of allied activities such as dairy farming, fishing, and poultry farming also contribute a huge amount of revenue to the exchequer.
- IX. As you are aware, farmers in large parts of the country, particularly where almost complete dependence on rainfall permits only one crop in a year, or engagement in agriculture is only for a part of the year, experience seasonal and distressed migration of labour from agriculture to the urban unorganized sector. As a result, the agricultural sector serves as a significant source of labour for the urban-industrial sector.

From the above points of consideration, you must have realized by now that agriculture's contribution to the country's economy is very significant. Let us now study the important characteristics of Indian agriculture.

SAQ I

Why India does still has a much higher share of agricultural workers in the total workforce?

11.3 CHARACTERISTICS OF AGRICULTURE

Being the backbone of the economy of an ecologically as well as culturally heterogeneous society, Indian agriculture is marked by a wide range of characteristics. You will understand by studying some of the broad characteristics of Indian agriculture given below:

1. A large proportion of the farmers practice intensive subsistence agriculture. The majority of farmers choose crops with the goal of meeting their own needs rather than producing for the market. It is only recently that some farmers with large land holdings have adopted commercial agriculture, helping the country to secure a position among the agricultural produce exporting countries.
2. Now you can understand that the production of food grains is a predominant phenomenon of Indian agriculture. A variety of cereals and pulses, which together are called food grains, account for about 65% of the cultivated area in the country. Total production of food grains in the country has significantly increased from 74.23 million tonnes in 1966-67 to 284.95 million tonnes in 2018-19 after the introduction of the Green Revolution.
3. Around two-third of the working population is engaged in agriculture and allied activities. This indicates the heavy pressure of the population on the land resources of the country. The per capita availability of agricultural land in India is 0.12 hectares, which is much below the world average of 0.29 hectares. Heavy pressure on land resources beyond its carrying capacity is causing land degradation in the country.
4. Multiple/mixed cropping is another characteristic feature of Indian agriculture. Farmers, depending on the mercy of the monsoon rains and without any assured irrigation facility, generally sow more than one crop in the same field to ensure success in the production of at least some of the crops during unfavorable weather conditions. However, you should note that such practice results in lower production and yield.
5. India has a very large proportion (46.26%) of its area under cultivation. Other countries comparable to India in this context include Bangladesh, Ukraine, Hungary, and Denmark, etc. The monsoon climate and temperature conditions help in providing a long growing season. To cope with the pressure of population, vast plain areas of the country and vast tracts of cleared forests have been brought under the plough through land reclamation and land conservation.

6. Landholding size in India is generally small and is gradually increasing in number as well as in area coverage. More than 85% of the landholdings are marginal and small in size. This characteristic of landholdings is directly related to physical, economic and social factors. Many of these factors are not suitable for modern methods of agriculture.
7. A large proportion of the cultivators practice intensive subsistence or traditional methods of farming. Consequently, per-hectare yields of different crops are much lower compared to those of other countries, and total production also remains low. After implementation of innovations in all possible fields of agriculture, there is an increase in productivity of crops such as wheat (from 663 kg/ha in 1950-51 to an average of 3096 kg/ha during 2017-18), rice (from 668 kg/ha in 1950-51 to an average of 2455 kg/ha during 2017-18), maize (from 547 kg/ha in 1950-51 to an average of 2727 kg/ha during 2017-18) and groundnut (from 775 kg/ha in 1950-51 to 1616 kg/ha during 2017-18).
8. The use of draught animals like bullocks, buffaloes, and camels, etc. in agricultural operations is significantly high in the country. This is primarily because agricultural operations like tilling, sowing, weeding, sprinkling of insecticides/pesticides, harvesting and threshing, etc. are carried out manually. But, gradually, the use of animal and human power is being replaced by machine power.
9. Indian agriculture is mostly dependent on monsoon rainfall. Despite having irrigation facilities on almost half of the cultivated land, the vagaries of the monsoon affect agricultural production to a great extent. Nevertheless, there is ample scope for increasing agricultural production by creating irrigation facilities in the areas of rain-fed agriculture in the country.
10. The physical factors of the country, particularly the climatic and edaphic ones, are by and large favorable for the cultivation of a variety of crops. Consequentially, in areas with adequate moisture, crops are cultivated three to four times in a year, either through rainfall or irrigation. The vagaries of the monsoon, of course, do play a decisive role. Failure of the monsoon results in a reduction in production or failure of crops. In areas with less moisture or irrigation facilities, it becomes difficult to cultivate even a single crop.
11. India has the second largest number of cattle (after Brazil) and the largest share of buffaloes in the world. But very little importance is given to fodder crop cultivation in the country, with only around four percent of the cropped area devoted to the purpose. This, along with lack of good pasture lands, exerts detrimental effects on dairy farming in the country.
12. In India, unlike in developing countries, incentives to farmers such as remunerative prices for agricultural products, subsidies, restoring tillers' rights over land, and insurance schemes, among other things, have been insufficient. The incentives given to the farming sector compare very poorly with those given to the sectors concerned with the urban-industrial development sector.

13. The agrarian economy of the country is highly structured. It still remains mostly traditional and more lands with landlords thwart the prospects of modernization of agriculture.
14. It is characterized by small land holdings, traditional methods of farming, fewer irrigation facilities, less use of chemicals, bio and natural fertilizers, greater vulnerability to pests and diseases, less remunerative prices for agricultural products, the poverty of the farmers, and lack of proper infrastructural facilities, Indian agriculture has not been able to reach an expected level as compared to the other developed countries.

SAQ 2

Why do farmers without assured irrigation facility prefer multiple/mixed cropping?

11.4 AGRICULTURAL LANDUSE AND CROPPING PATTERN

You have studied about the nine-fold landuse classification adopted in the country in Unit 6 of Block 2. The area under these nine-landuse categories adds up to the total reported area, which is generally less than the total geographical area. While the total geographical area is fixed, the reported area is derived from revenue records and keeps changing depending on the changes in the economic activities of the region. It is important to note here that changes in economic activities take place because of the factors mentioned below:

- (i) **the size of the economy**, which is measured in terms of the value of all goods and services produced in the economy and it grows as the population grows, income level rises and new technology is introduced;
- (ii) **the economic composition**, it results in a shift in landuse from primary, particularly agricultural to secondary and tertiary activities; and
- (iii) **the pressure on land**, which increases with the growth of population.

11.4.1 Agricultural Landuse

From the above discussion, it is obvious to you that changes in agricultural landuse would also be affected by such changes. First of all, you should know that agricultural land, or total cultivable land, includes the following:

- (i) net sown area,
- (ii) cultivable waste land,
- (iii) current fallow, and
- (iv) fallow other than current fallow.

Agricultural landuse, like any other landuse, displays wide regional variation. These variations ought to be because of the terrain conditions, differences in rainfall and moisture content in the soil, the characteristics of the soil, and irrigation intensity/efficiency which plays significant roles in the context of

agricultural landuse. Besides, human and economic factors produce differential patterns of agricultural landuse as it is primarily a product of human decisions. Nevertheless, unlike for other sectors of the economy, the availability and quality of land remains the most crucial requirement for the agricultural sector. Leaving aside the aspect of quality of land for the time being, you can try to develop an understanding regarding the aspect of availability of agricultural land and its dynamics in the country. It is expected that this understanding will help you to conceptualize the future prospects of agriculture in India.

If you analyze the temporal data presented in Table 11.1, you can see an apparent decline in the total cultivated area, particularly since the early nineties, in spite of a corresponding decline in the area under the cultivable waste land category. The gradual reduction of the area under cultivable waste land indicates the declining scope of bringing more land under cultivation. You can also notice the decrease in net sown area over the last two and a half decades. From this trend of decrease in total agricultural land, cultivable waste land, and net sown area, it is easy for you to relate it to the gradual diversification of economy of the country and the resultant conversion of agricultural land for other purposes, particularly urban-industrial. Therefore, there is an urgent need for the application of modern technologies designed to increase crop production per unit area and per unit of time. In other words, sufficiency in food production can be achieved by adopting modernization in agriculture by way of (i) improvements in multiplicity of cropping, i.e., vertical expansion of the net sown area, and (ii) adoption of high-yielding crops plus soil-enriching crop-sequences.

Table 11.1: Dynamics of Agricultural Landuse in India.

Agricultural Landuse Category	Percentage to Reported Area				Percentage to Total Cultivated Land			
	1960-61	1990-91	2005-06	2015-16	1960-61	1990-91	2005-06	2015-16
Culturable waste land	6.23	4.92	4.31	3.99	10.61	8.28	7.37	6.88
Fallow other than current fallow	3.50	3.17	3.49	3.67	5.96	5.33	5.97	6.33
Current fallow	3.73	4.49	4.63	5.01	6.35	7.56	7.93	8.33
Net sown area	45.26	46.86	46.00	45.33	77.08	78.83	78.73	78.15
Total agricultural land	58.72	59.45	58.54	58.00	100.00	100.00	100.00	100.00

(Source: Agricultural Statistics at a Glance 2019, Directorate of Economics and Statistics, Govt. of India)

On the other hand, the proportion of both types of fallow land has registered a significant increase during the period under reference. By **fallow land**, we mean land which was under cultivation but is left uncultivated or put to rest for some time. It is necessary for you to note the difference between the two types of fallow lands. While all land which was taken up for cultivation but is temporarily out of cultivation for a period of not less than one year and not more than five years is referred to as 'fallow land other than current fallow', 'current fallow' represents cropped area which is kept uncultivated during the current year.

11.4.2 Cropping Pattern

Let us study the cropping pattern of Indian agriculture. **Cropping pattern** refers to the proportion of an area under different crops in a region at a given point of time. The types of crops cultivated in a region are closely related to its geographical, social, political and economic characteristics. The cropping pattern also keeps altering over time and space.

We can observe three main cropping seasons in India. These include the **Kharif**, **Rabi**, and **Zaid** seasons. A large variety of crops are cultivated during its three agricultural seasons. The kharif season corresponds to the South-West Monsoon (June–September), the rabi season corresponds to the winter season (October–November to March–April), and the zaid season corresponds to the brief summer season between the rabi and kharif seasons. These distinct crop seasons are specific to the northern and interior parts, while in the southern parts of the country, temperatures remain invariably high all through the year without much of seasonal variation. Thus, farmers in the southern part of the country generally grow the same tropical crops thrice in a year depending on the availability of soil moisture. Crop sequencing is followed in the northern and interior parts, where farmers cultivate tropical crops like rice, cotton, jute, jowar (sorghum), bajra (bulrush or pearl millet), ragi (finger millet) and tur or arhar (split pigeon or cajan peas) in the *kharif* season, subtropical crops like wheat, gram and mustard in the *rabi* season, and watermelon, cucumber, vegetables and fodder crops in the *zaid* season. Irrigation not only works as a supplementary source of water over and above rainfall, but also helps in the cultivation of crops that are not traditional to an area. Cultivation of rice in the Punjab-Haryana region is an apt example in this context. Let us study the crops grown in different parts of the country under three main categories such as cereals, pulses and oilseeds.

(A) Cereals

Indian agriculture is known for its emphasis on food grains, which includes both cereals and pulses. As you are aware, among all the countries in the world, India ranks third in the production of cereals, after China and the USA, and first in the production of pulses. Cereals occupy more than 50% of India's gross cropped area, which accounts for about 11% of the world's total cereal production. A variety of cereals are cultivated in the country. The most prominent among them are fine food grains such as rice and wheat, and coarse food grains such as jowar, bajra, maize, and ragi.

(i) Rice: Basically, rice is a crop of the tropical humid regions. More than 3,000 varieties of rice are cultivated in different agro-climatic regions. The traditional home land of rice lies in the eastern and southern states of the country, where agro-climatic conditions permit cultivation of rice two to three times in a year. In the Himalayan states, rice is cultivated only in the *kharif* season. However, development of irrigation facilities has put a substantial proportion of the cultivated area in Punjab, Haryana, western Uttar Pradesh, and northern Rajasthan under rice.

India happens to be the second largest producer of rice after China in the world with about one-fourth (22.3%) of its gross cropped area under rice cultivation. The country produced around 22% of the world's total rice in 2017. A

noteworthy increment was registered in case of the sown area (from 34.13 mh to 43.77 mh), production (from 34.58 mt to 112.76 mt), yield (from 1013 kg/ht to 2576 kg/ht) and irrigated area under the crop (from 37% to more than 60%) between 1960-61 and 2017-18. West Bengal, Punjab, and Uttar Pradesh were the leading rice-producing states in the country, contributing 13.27, 11.87, and 11.77 percent of the total production, respectively. The yield levels of rice remained high in Punjab (4366 kg/ht), Andhra Pradesh (3788 kg/ht), Tamil Nadu (3630 kg/ht), Telangana (3192 kg/ht), Haryana (3181 kg/ht), and West Bengal (2926 kg/ht). With the help of irrigation, rice cultivation has become possible in the non-traditional rice-growing areas of Punjab and Haryana as well as the interior parts of other states. Rice yield remains below 2500 kg/ht in the states of Bihar, Uttar Pradesh, Madhya Pradesh, Chhattisgarh, Assam, and Odisha.

(ii) Wheat: India is second to China in the world in wheat production and contributes around 13% of the world's total wheat production. It is the second most important crop in the country after rice, accounting for 16.2 percent of the total cropped area. It is a temperate and *rabi* crop, cultivation of which is mostly confined to the north and central states, parts of Himalayan states up to 2,700 m altitude. Being a winter crop, it is mostly cultivated with the help of irrigation, except in the Himalayan states and in parts of the Malwa Plateau, where it is a rain-fed crop.

Being the first crop under the target of the Green Revolution, wheat cultivation has displayed record progress. During the 1960-61 agricultural year, wheat was cultivated over 12.93 mh, producing a meagre 11 mt with a yield level of only 851 kg/ht. Only about one-third (32.74%) of the wheat area was irrigated. The respective figures increased to 29.65 mh, 99.87 mt and 3368 kg/ht during 2017-18. Today, almost the entire wheat producing area (more than 95%) is facilitated with irrigation.

Although wheat occupies a lesser proportion of the country's gross cropped area, second to rice, the yield levels of wheat are very high (more than 4,000 kg/ht), particularly in the core wheat-growing states of Punjab (5,077 kg/ht), and Haryana (4,412 kg/ht). While neighboring Rajasthan (3,334 kg/ht), Uttar Pradesh (3,269 kg/ht), Madhya Pradesh (2,993 kg/ht), Bihar (2,905 kg/ht), Gujarat (2,898 kg/ht), and Uttarakhand (2,749 kg/ht) have moderate yield levels. It remains below 2,000 kg/ht in Maharashtra, Himachal Pradesh, and other states.

(iii) Jowar: In 1960-61, Jowar (Sorghum) was the third most important crop in India in terms of area (18.41 mh) and production (9.81 mt). Unfortunately, unlike rice and wheat, the jowar crop land occupancy has decreased to 5.02 mh, and the output has reduced to 4.80 mt. This is despite a substantial increase in the irrigated area from 3.55% to 10.26% during the two reference periods, and an increment in yield from 533 kg/ht to 956 kg/ht. Overall, there has been a substantial decrease in area under jowar from 12.1% in 1960-61 to 5.02% in 2017-18.

Jowar is a coarse variety of cereal, grown in both the *kharif* and *rabi* seasons under rain fed agriculture in the interior semi-arid parts of peninsular India. Among the peninsular states, Maharashtra (33.45%), Karnataka (23.74%),

Madhya Pradesh (11.87%), Tamil Nadu (8.96%), Rajasthan, and Andhra Pradesh (6.26% each) are the major contributors to jowar. In north India, jowar is grown only in the *kharif* season, mostly as a fodder crop.

(iv) Bajra: Similar to jowar, bajra (Bulrush Millet) has lost area to other food grains in recent decades. With an 11.47 mh area, India produced only 3.28 mt of bajra during 1960-61. Despite a decline in area to 7.48 mh, bajra production almost tripled to 9.21 mt in 2017-18. The increase in irrigated area from 2.79% to 10.54% resulted in a nearly fourfold increase in bajra yield levels between the two reference years, from 286 kg/ht to 1231 kg/ht under bajra has decreased from 7.5% in 1960-61 to 3.8% in 2017-18. Drought-prone areas of Rajasthan (40.76%), Uttar Pradesh (19.49%), Gujarat (10.48%), Haryana (7.83%), and Maharashtra (7.28%) are the major contributors of bajra. It is grown under a rain-fed system as the crop has the quality to sustain itself under frequent dry and drought conditions.

(v) Maize: Unlike jowar and bajra, the area of maize cultivation in the country has increased over the last five decades, from 4.41 mh (2.9%) to 9.38 mh (4.4%). Besides the increase in area, the increase in irrigated area from 12.63% to 26.73% and the cultivation of improved varieties have helped the country achieve a more than fivefold increase in maize production, from 4.08 mt to 28.75 mt during the same reference period. The national average yield has almost tripled from 926 kg/ht to 3065 kg/ht. Maize cultivation is not concentrated in any specific region. It is cultivated all over the country, except in the eastern and north-eastern regions. However, the most prominent maize producing states are Karnataka (13.40%), Madhya Pradesh (12.30%), Maharashtra (10.61%), Tamil Nadu (9.01%), Telangana (8.89%), Andhra Pradesh (8.08%), Rajasthan (6.24%), Uttar Pradesh (5.56%), and West Bengal (3.95%). It is cultivated under semi-arid climatic conditions and in areas of inferior soils as a food as well as fodder crop.

(B) Pulses

Pulses are extremely important because they enrich the human body with protein and improve the natural fertility of soils through nitrogen fixation. A variety of pulses are common to India. India ranks first in pulse production, contributing 24.2% of the total pulses produced in the world. Pulses occupy the third largest area after rice and wheat in India. The area under pulses has marginally increased from 23.56 mh in 1960-61 to 29.81 mh in 2017-18, accounting for around 15% of the total cultivated area. The main areas of pulse cultivation in the country are dry lands of the Deccan, the central plateaus, and the northwest. Being the rain-fed crops of dry lands and with about only 20% of the irrigated area, the yield of pulses has remained low, fluctuating between 539 mt and 853 mt/h over the last 65 years. The different varieties of pulses grown in India include: Chana (Bengal Gram/Desi Chick Pea), Tur (Pigeon Peas), Moong (Green Beans), Kabuli Chana (Chick Peas), Urad (Black Gram), Rajma (Red Kidney Beans), Lobiya (Black Eyed Peas), Massor (Lentils) and Matar (White Peas). Chana and Tur are the most important.

(i) Chana: It is a subtropical crop grown during the rabi season with little or no irrigation. Chana Gram (Bengal Gram) cultivation is mostly confined to the central and north-western states and the major producers are Madhya

Pradesh (40.38%), Maharashtra (16.12%), Rajasthan (14.84%), Karnataka (6.88%), Andhra Pradesh (5.17%), Uttar Pradesh (5.09%), Gujarat (3.31%), Chhattisgarh (2.82%), and Jharkhand (2.51%). Despite having around 40% of the irrigated area under it, the yield of gram has increased marginally from 674 kg/ht in 1960-61 to 1078 kg/ht in 2017-18. The crop has lost its area to other crops, particularly wheat, and has been fluctuating between 9.28 mh in 1960-61 and 10.56 mh in 2017-18. With about 67.8% of area under chana in the country, the three states i.e. Madhya Pradesh, Maharashtra, and Rajasthan contributed around three-fourth (71.34%) of the country's total chana production in the year 2017-18.

(ii) Tur: Tur is a rain-fed crop in the dry areas of Maharashtra, Karnataka, Madhya Pradesh, Gujarat, Uttar Pradesh, Jharkhand, Telangana, Odisha, Tamil Nadu, and Andhra Pradesh. The state of Maharashtra alone, with around 28% of the total area of the country, produces a similar (26.29%) proportion of crop in the country. The three major tur-producing states are Maharashtra, Karnataka (19.94%), and Madhya Pradesh (14.58%), which together account for 62.47% of the area and contribute 63.6% of the total production of the crop in India. Like chana, the yield of tur has also remained low and fluctuating over the years. Although the area under tur has almost doubled from 2.43 mh to 4.44 mh between 1960-61 and 2017-18, the yield of the crop has only increased marginally from 849 kg/ht to 967 kg/ht during the same reference period.

(C) Oilseeds

Indian farmers grow mainly nine types of oilseeds that are used as the major source of vegetable oil in the country. These nine primary sources of oilseeds, namely groundnut, soyabean, rapeseed-mustard, sesame, sunflower, safflower, niger, castor, and linseed, fulfill more than 70% of the domestic requirement for edible vegetable oil. The remaining 30% of the requirement is extracted from secondary sources of vegetable oils such as palm, coconut, cotton seed, rice bran, tree borne oilseeds and solvent extracted oil. India has experienced a substantial increase in oilseed cultivation during the last decades. The area under oilseeds has increased from 13.77 mh in 1960-61 to 24.51 mh in 2017-18. The proportion of irrigated area has also increased tenfold from about 3% to about 30%, with a corresponding increase in yield from 507 kg/ht to 1284 kg/ht and production from 6.98 mt to 31.46 mt during 1960-2018. Together, oilseeds cover around 14% of the total cultivated area in the country today. The core region of oilseed cultivation includes the dry lands of Malwa Plateau, Marathwada, Gujarat, Rajasthan, Telangana, Rayalaseema and Karnataka Plateau. The most important sources of edible oil in the country are groundnut, rapeseed-mustard, sesame, and soybean.

(i) Groundnut: After China, India is the world's second largest producer of groundnuts, accounting for 19.49% of total global production in 2017. Generally, the crop is grown as a rain-fed *kharif* crop in the dry lands. However, it is also grown as a rabi crop in south India. Significant proportion of the area under groundnut in Rajasthan (87.5%) and Telangana (91.6%) is irrigated. Groundnut occupies around 5% of the total cultivated area of the country. The area under groundnut cultivation has decreased from 6.46 mh in 1960-61 to 4.89 mh in 2017-18. Despite this decrease in area, total

production of the crop has increased from 4.81 mt to 9.25 mt due to a substantial increase in yield, from 745 kg/ht to 1893 kg/ht during this period. The crop was mostly cultivated as a rain-fed crop with only 3.02% irrigated area. Today, almost 30 percent (28.9%) of the area under the crop is irrigated. Leading producers of groundnut are Gujarat (42.55%), Rajasthan (13.61%), Andhra Pradesh (11.33%), Tamil Nadu (10.89%), Karnataka (5.97%), Telangana (4.02%), Madhya Pradesh (3.77%), Maharashtra (3.72%) and West Bengal (1.79%).

(ii) Rapeseed and Mustard: Rapeseed and mustard are classified as rai, sarson, toria, and taramira. These are subtropical crops cultivated during the *rabi* season. India occupies third place in the world in rapeseed production, after Canada and China, with 10.38 per cent of the world's total production. The area under these crops has increased from 2.88 million in 1960-61 to 5.88 million in 2017-18, accounting for about 6% of the total cropped area of the country. Production of the crops has increased markedly from 1.35 mt to 8.43 mt, with a corresponding increase in the yield from 467 kg/ht to 1,410 kg/ht during the two periods in reference. Substantial expansion of irrigation from a meagre 12% to about 80% and the use of improved seeds seem to have played a positive role in this context. Rajasthan (42.01%), Haryana (13.14%), Madhya Pradesh (11.58%), Uttar Pradesh (11.21%), West Bengal (8.57%), Gujarat (4.74%), Jharkhand (2.59%), Assam (2.22%), Bihar (1.17%), and Punjab (0.54%) are the major producers of these crops. Rajasthan is the most important contributor in terms of area (37%) and production (42%) of rapeseed and mustard in the country. Covering 80.32 per cent of the rapeseed and mustard area, the first five states of Rajasthan, Haryana, Madhya Pradesh, Uttar Pradesh, and West Bengal together produce 86.51% of the total production in the country.

(iii) Soyabean: In the 1960s, soyabean was a very minor crop. Of late, it has gathered importance and is cultivated at about 10.33 mh. With the yield of 1098 kg/ht, India produces around 10.98 mt of soyabean (2017-18). The major soyabean producing states are Madhya Pradesh (48.67%) and Maharashtra (38.8%). Together, these two states account for 84.27% of the area and 83.47% of soyabean production in the country. Rajasthan also accounts for 8.58% of the area and 9.79% of soyabean production. The crop is also produced in the states of Karnataka (2.31%), Telangana (2.26%), and Gujarat (1.06%) as a minor crop.

(iv) Sunflower: Sunflower is grown in 0.25 mh of land area in the country, yielding 0.22 mt at a yield of 782 kg/ht. The yield of sunflower has not changed significantly over the years, and the crop's area and corresponding production have fluctuated. It was only during the 1990s and the first decade of the current century that the sunflower area crossed 2 mh and production by 1 mt marks. The crop is mostly concentrated in Karnataka, which accounts for 61% of the area and 48.24 percent of the total production of sunflowers in the country. The crop is also grown in Odisha, Haryana, Bihar, and Andhra Pradesh. Together, these five states account for 70.7% of the area and 73.63% of the production of sunflowers in the country.

(D) Fiber Crops

As the name suggests, these crops produce fiber. The most important of these are cotton and jute. Mesta is another fiber crop grown all over the country, unlike jute, which is concentrated in the eastern and northeastern states. Fibers produced from these crops are used for making clothes, bags, sacks, etc.

(i) Cotton: India is the world's second largest producer of cotton after China. About one-fourth (24.43%) of the total world cotton production comes from India. Cultivation of cotton has increased substantially from 1960 to 2018. While the area has increased from 7.61 mh to 12.59 mh, the yield level has increased from 125 kg/ht to 443 kg/ht, with a corresponding increase in production from 5.60 million barrels to 32.81 mb. Cultivation of cotton under an irrigated system has also expanded from around 13% to 33%. Although, Gujarat ranks second after Maharashtra in terms of area (20.85% and 34.57% respectively), it ranks first in the country in terms of production of cotton, contributing around one-third (31%) of the total production. Maharashtra (18.58%) and Telangana (15.84%) also contribute significantly to the production of the crop. Together, these three states account for about two-third (65.5%) of all cotton production in the country. The crop is grown as a minor crop in Andhra Pradesh (6.36%), Rajasthan (5.77%), Karnataka (5.62%), Haryana (4.96%), Madhya Pradesh (4.94%), and Punjab (3.91%).

(ii) Jute and Mesta: Despite losing large jute-growing areas to Bangladesh, India is still the most prominent jute producer, contributing 55.6% of total jute production in the world. Although the area under jute and mesta has decreased from 0.9 mh in 1960-61 to 0.73 mh in 2017-18, total production has almost doubled from 5.26 mb to 10.03 mb during this period due to a substantial increase in yield from 1049 kg/ht to 2435 kg/ht. Jute is mostly confined to the three eastern states i.e., West Bengal, Bihar, and Assam, with respectively 70%, 84%, 14.05% and 9.89% of area and 76.13%, 12.76% and 8.59% of production, respectively. These crops occupy only around 0.38% of the total cropped area in the country.

(E) Other Crops

(i) Sugarcane: Being a tropical crop, sugarcane is cultivated under sub-humid and humid conditions, Brazil and India account for almost 60% of the world's sugarcane production. India is the second largest producer after Brazil. India's contribution to world total sugarcane production was 16.6% in 2017, much less compared to Brazil's contribution of 41.2%. India devotes only around 2.4% of its total cropped area to the crop. Sugarcane cultivation in India has registered significant progress since 1960-61 in terms of area (from 2.42 mh to 4.74 mh), production (110 mt to 379.90 mt) and yield (45,549 kg/ht to 80,198 kg/ht). This has been possible through improved cultivation practices, including the expansion of irrigation facilities to the crop areas. Major states of sugarcane production are Uttar Pradesh (46.6%) and Maharashtra (21.8%), which account for a similar proportion of sugarcane area (47.2 and 19%, respectively) in the country. Karnataka (8.2%), Tamil Nadu (4.52%), Bihar (3.64%), Gujarat (3.18%), Haryana (2.54%), Punjab (2.11%), Andhra Pradesh (2.04%), Uttarakhand (1.85%), Madhya Pradesh (1.43%) and Telangana (0.89%) are the other leading producers of the crop. It is interesting to note

that yield levels of sugarcane are significantly higher than that of the largest producing state of Uttar Pradesh (79,245 kg/ht) in Tamil Nadu (99,814 kg/ht), Maharashtra (92,000 kg/ht), Haryana (84,499 kg/ht), Karnataka (84,081 kg/ht), and Punjab (83,580 kg/ht).

(ii) Tea: Tea cultivation in India was started by the British in the 1840s as a plantation crop. Originally, tea was an indigenous crop of northern China. India is the third largest tea producer in the world after China and Sri Lanka, contributing around 28% of the total world tea production. Undulating and well drained topography of hilly areas with humid, sub-humid tropical and sub-tropical climatic conditions without water logging provide suitable conditions for the cultivation of tea. Initially introduced to the Brahmaputra valley of Assam, tea is now being grown in the hill districts of West Bengal, Arunachal Pradesh, Meghalaya, Nagaland, Himachal Pradesh, Sikkim, Tripura, Uttarakhand, Bihar, Karnataka, Kerala, and Tamil Nadu. Total production of tea in India was 1,325 mkg in 2017-18. Assam ranks first in the country in terms of area (53.2%) as well as production (51%). Assam, together with West Bengal (29.3%) and Tamil Nadu (12.4%), produces about 93% of the tea in the country.

(ii) Coffee: Coffee is also a plantation crop grown in the tropics. Coffee seeds are roasted and grounded to produce coffee. Out of the three varieties of Arabica, Robusta and Liberica, only the first two varieties are grown in India. The country ranks seventh in the world with only 3.2% of production, after Brazil, Vietnam, Colombia, Indonesia, Ethiopia, and Mexico. Traditional areas of coffee cultivation in India are the highlands of the Western Ghats in Karnataka, Kerala, and Tamil Nadu. With Karnataka in the lead with about 55% of the area, these three states account for 83.5% of the total area under coffee in India. Non-traditional areas include Andhra Pradesh, Odisha, and some areas in the northeast. Andhra Pradesh includes a substantial (14.85%) proportion of the total coffee area in the country. More than 70% of India's coffee production comes from Karnataka. Together, the three traditional coffee-growing states produce 96.7% of India's coffee.

SAQ 3

- a) Agricultural land area or total cultivated land area is estimated by considering the area under which types of land use?
- b) Match the following:

1. High yield of wheat producer	a) Uttar Pradesh
2. Largest rice producer	b) West Bengal
3. Major contributor of jowar	c) Gujarat
4. Largest producer of Bengalgram	d) Maharashtra
5. Largest producer of groundnut	e) Rajasthan
6. Major contributor of mustard	f) Madhya Pradesh
7. Major producer of sugarcane	g) Punjab

11.5 GREEN REVOLUTION

Although the term Green Revolution was introduced in 1968 by William S. Gadd, steps towards increasing the level of crop productivity had started much earlier in Mexico in the 1950s. It all began with the introduction of a new high-yielding dwarf variety of wheat seed developed by the 'Father of the Green Revolution', Dr. Norman Ernest Borlaug, who was in charge of the Wheat Development Programme of Mexico. Under the auspices of the Intensive Agriculture Development Programme (IADP) of 1961, Indian scientists under the leadership of Dr. M. S. Swaminathan introduced the **HYV** (High Yielding Variety) seeds and other components of the Green Revolution in 1963. The first field tests of rice and wheat were conducted during 1963-64.

To start with, a pilot project was launched in seven districts of seven different states. Out of these, four were rice-producing, two were wheat-producing, and one was a millet-producing district. These districts were Shahabad of Bihar, Thanjavur of Tamil Nadu, Aligarh of Uttar Pradesh, West Godavari of Andhra Pradesh, Ludhiana of Punjab, Raipur of Chhattisgarh, and Pali of Rajasthan. Later, eight more districts were selected under the programme. Following the success of these experiments, the Green Revolution strategy was introduced in its right earnest with the import of 16,000 tonnes of seeds for the cultivation of about four lakh hectares of land. Today, as you are aware, India has achieved the status of not only a surplus food grain producing country but also a food grain exporting country.

The first Independent Indian Census of 1951 reported a total population only of about 361 million in the country, which could not be fed properly with the country's meagre food grain production of 50 million tons. The country had to rely heavily on imports, exhausting a huge proportion of its financial resources. The 2019-20 estimate of food grain production in the country is 305 million tons. Green Revolution has not only helped in multiplying the production of several crops, but also enabled India to secure a prestigious position in the world with regard to the production of some important crops.

The main objectives of the Green Revolution were:

- (i) to address India's hunger crisis;
- (ii) modernising Indian agriculture through rural development, industrial development, infrastructure development, raw materials, and other means;
- (iii) to create job opportunities in the country's agricultural and industrial sectors;
- (iv) developing stronger crop varieties that can withstand extreme climates and diseases through scientific research; and
- (v) to globalize agriculture through the adoption of modern technology and the setting up of different corporations.

Major aspects of the modern methods and technology adopted were HYV seeds, tractors, irrigation facilities, pesticides, and fertilizers, which converted Indian agriculture into an industrial system. It was funded by the US, the Indian government, and the Ford and Rockefeller Foundations. The Green Revolution in India was largely the Wheat Revolution as wheat production

increased by more than three times between 1967-68 and 2003-04, while the overall increase in the production of cereals was only two times.

The Green Revolution could be achieved by addressing multiple components of agriculture in the country. These include high yielding varieties (HYV) of seeds, irrigation-both surface and underground, use of chemical fertilizers, use of insecticides and pesticides, command area development, consolidation of holdings, land reforms, supply of agricultural credit, rural electrification, rural roads and marketing, farm mechanization, establishment of agricultural universities, etc.

Let us now study some of the positive and negative impacts of the green revolution as summarized below.

a) The Positive Impacts of the Green Revolution

- i. It led to a very significant increase in crop production. The increase in crop area under high-yielding varieties of wheat and rice resulted in a record production of 131 million tonnes of grain during 1978-1979, i.e., within ten years of introduction of the Green Revolution.
- ii. The country became self-sufficient in food-grains, per capita net availability of food-grains increased, imports of food-grains were reduced, sufficient surplus stock could be stored, and the country was able to achieve a position among food-grain exporting countries.
- iii. The Green Revolution benefited farmers in terms of income. In particular, large farmers with more than 10 hectares of land could invest large amounts of money in various inputs like HYV seeds, fertilizers, machines, etc., and could start capitalist farming.
- iv. The Green Revolution boosted agricultural machine manufacturing industries, fertilizer, pesticide, insecticide, and weedicide industries, as well as food processing and agro-based industries in the country.
- v. There was an overall increase in employment opportunities, not only in the agricultural, but also in the industrial and energy sectors.

b) The Negative Impacts of the Green Revolution

- i. The High Yielding Variety Programme (HYVP) targeted only the five food-grains i.e. wheat, rice, jowar, bajra and maize, while other coarse cereals, pulses, and oilseeds, as well as commercial crops like cotton, tea, and sugarcane, were not covered under the programme, resulting in stagnation in their level of production.
- ii. The Green Revolution strategies benefited the majority of large farmers while largely ignoring small and marginal farmers.
- iii. Except Punjab, Haryana, and western Uttar Pradesh in the north and Andhra Pradesh and Tamil Nadu in the south, the rest of the states remained by and large untouched, giving rise to large-scale regional disparities in the levels of agricultural development. It has so far affected only 40% of the total cropped area and 60% is still untouched by it.

- iv. Use of chemical fertilizers, pesticides, and insecticides by farmers without proper training has adverse effects on crops. The environment, particularly the soil, and human health.
- v. The HYV crops introduced during the programme were water-intensive. Resultantly, the soil turned alkaline in areas of excessive use of water for irrigation.
- vi. Areas where irrigation pumps were used to suck out groundwater experienced a depletion of underground water.
- vii. Repeated crop cycles in order to ensure increased crop production resulted in depleting the nutrients of the soil.
- viii. Farm mechanisation has created widespread unemployment among agricultural labourers. The worst affected were the poor and the landless labourers.

Nevertheless, the Green Revolution was a major achievement for the country, with which it could come out of the clutches of utter food deficiencies and poverty. The country could now give proper attention to the development of other sectors of the economy. Definitely, however, much less attention was paid to factors other than ensuring food security such as the natural environment, the farmer's education pertaining to adoption of the modern techniques of farming. The Father of the Green Revolution, Dr. M. S. Swaminathan, in India, imagined the "Evergreen Revolution," which was much more holistic in nature, encompassing increased agricultural productivity, environmental safety, economic viability, and social sustainability. It also envisages a reduction in socio-spatial disparities that have been aggravated due to the introduction of the Green Revolution. The Evergreen Revolution involves integration of ecological principles in technology development and dissemination.

Several steps have been taken by the Indian Government to achieve the objectives of the Green Revolution. The most important among them is the introduction of the Green Revolution Krishonnati Yojana in 2005 to boost the agriculture sector. Through the scheme, the government planned to develop agriculture and related sectors in a holistic and scientific manner to increase the income of farmers. This single umbrella scheme comprises 11 schemes and missions, which are; Mission for Integrated Development of Horticulture (MIDH), National Food Security Mission (NFSM), National Mission for Sustainable Agriculture (NMSA), Sub-Mission on Agriculture Extension (SMAE), Sub-Mission on Seeds and Planting Material (SMSP), Sub-Mission on Agricultural Mechanization (SMAM), Sub-Mission on Plant Protection and Plant Quarantine (SMPPQ), Integrated Scheme on Agriculture Census, Economics and Statistics (ISACES), Integrated Scheme on Agricultural Cooperation (ISAC), Integrated Scheme on Agricultural Marketing (ISAM), National e-Governance Plan in Agriculture (NeGP-A).

SAQ 4

- a) Who and when are credited with introducing Green Revolution strategies in India?
 - b) Write any one of the positive and negative effects of green revolution.
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11.6 PROBLEMS OF INDIAN AGRICULTURE

The following are some of the significant issues that have been considered in this section along with some suggested solutions. Indian agriculture encounters problems emanating from both natural and human-made factors.

1. Small and Fragmented Land Holdings

The country has extensive areas suitable for crop cultivation. Despite this, it fails to achieve the desired level of crop production. Fragmentation of operational holdings is considered to be one of the main causes for this situation. During 1970-71, the average holding size was 2.28 hectares, which decreased to 1.08 hectares in 2015-16. With the limitless sub-division of land holdings, the size of the holdings will shrink even further. Furthermore, the proportion of smaller-sized holdings in the total number of holdings has always been greater and is gradually increasing. One of the key causes of our low agricultural output and backward position is the sub-division and fragmentation of holdings. Moving seeds, manure, implements, and animals from one piece of land to another becomes possible, but at the cost of a lot of time and effort, hence uneconomical. Irrigation is very difficult in such small and fragmented areas.

The only solution to this vexing situation is to consolidate holdings, which necessitates the reallocation of fragmented holdings and the creation of only one or a few parcels instead of several patches of farm land.

2. Seeds of Good Quality

Seed is a key and basic ingredient for increasing crop yields and maintaining the growth of agricultural production. The distribution of high-quality seed is just as important as its manufacturing. Unfortunately, the majority of farmers, particularly marginal and small farmers, cannot afford to purchase good quality seed due to their exorbitant costs.

In order to solve this problem, the Government of India established the National Seeds Corporation (NSC) in 1963 and the State Farmers Corporation of India (SFCI) in 1969. Thirteen State Seed Corporations (SSCs) were also established in different parts of the country to supply HYV seeds to farmers. Besides, appropriate policies are designed from time to time by the Government to make adequate quantities of superior quality seeds available to the Indian farmer at an affordable price so as to meet the country's food and nutritional security goals.

3. Issues with Manures, Fertilizers, and Biocides

Over thousands of years, Indian soils have been used to cultivate crops with little regard for replenishment. As a result, soils have been depleted and exhausted, resulting in low productivity. Almost all crops that are grown in the country have the lowest average yields in the world. This is a serious problem that can be solved by increasing the use of manure and fertilizer. Increased fertilizer application is thought to be responsible for around 70% of the rise in agricultural production. However, there are practical difficulties in providing sufficient manures and fertilizers in all parts of the country, where peasants and farmers are mostly poor.

The government has provided substantial incentives, particularly in the form of heavy subsidies, to encourage the use of chemical fertilizers. At the time of Independence, chemical fertilizers were almost never used. The consumption of fertilizers has increased dramatically as a result of government initiatives and a shift in mindset among certain large and progressive farmers.

4. Irrigation

Despite the fact that, India is the world's second-largest irrigated country after China, only about one-third of its agricultural area is irrigated. In a tropical country like India, where rainfall is irregular and erratic, irrigation is the most critical agricultural input. India will not be able to make sustained progress in agriculture unless more than half of the planted area is irrigated. This is testified by the success story of agricultural progress in Punjab, Haryana, and the western part of Uttar Pradesh, where over half of the cropped area is under irrigation.

However, extreme caution must be exercised to avoid the negative impacts of over-irrigation, particularly in areas irrigated by canals. Faulty irrigation has left many cultivated areas of Punjab and Haryana uncultivable. Intensive irrigation in the Indira Gandhi Canal command region has resulted in a significant rise in sub-soil water levels, resulting in water-logging, soil salinity and alkalinity.

5. Soil Erosion

Excessive soil erosion in India, combined with a consequently high rate of sedimentation in reservoirs and decreased soil fertility, has led to grave environmental problems. Around 29% of the eroded soil ends out in the sea, while around 61% is simply moved. Soil erosion is a major problem in both irrigated and rain-fed areas in India.

6. Agricultural Marketing

In rural India, farmers mostly rely on local traders and middlemen for the trade of their farm produce, which is sold at a low price in the absence of adequate marketing facilities. These farmers are forced to carry on distress sales of their produce. In most of the villages, the farmers sell their produce to the money lender from whom they usually borrow money.

The government has created regulated markets in order to protect farmers from the clutches of money lenders and middlemen. These market places typically establish a competitive buying system, aid in the elimination of malpractices, secure the use of standardized weights and measures, develop appropriate equipment for dispute resolution, and ensure that producers are not subjected to unfair competition.

7. Lack of Investment in Agriculture

There has been a paucity of fresh investments in the agriculture sector. Several economists believe that land inequality is the root cause of agricultural stagnation. It is argued that under the landlord-tenant farming arrangement, all production expenses are borne by the latter because of the competition to secure tenancy, and he/she is left with very little or no investible resources, which adversely affects agricultural productivity. On the

other hand, the landlord prefers to engage in other high-return enterprises like usury, which provides guaranteed returns instead of investing in agriculture. Consequentially, investments in the agricultural sector in the country remain much lower, impeding overall progress of the sector.

Apart from the issues discussed above, there are several other problems also affecting agriculture in India, including the negligence and improper management of natural resources, over dependency on rainfall, commercial risks due to volatile prices, and restrictions on the movement of farm produce, lack of mechanization, lack of affordable and efficient transportation, and lack of access to global markets, which need to be addressed with corrective measures.

SAQ 5

List out the important problems of Indian agriculture.

11.7 SUMMARY

In this unit, you have studied so far:

- India has remained since ancient times an agricultural country. Indian agriculture witnessed a transformation with the introduction of plantation crops and other food crops. Now, India has entered the international market for agricultural produce.
- Agriculture has remained the backbone of the Indian economy since the beginning. Even today, agriculture not only accommodates the maximum proportion of workers but also is the largest landuse.
- Despite the remarkable progress in Indian agriculture, sizable proportions of the country's farmers are marginal and small farmers, who encounter myriad social and economic constraints in adopting modern farming practices.
- Agricultural landuse in India is fast changing due to gradual diversification of the economy. The introduction of modern farming techniques, the development of infrastructural facilities, and the influence of market forces have changed the cropping patterns of the country in favour of commercial crops.
- The Green Revolution has helped the country to come out of the clutches of utter food deficiencies and poverty. However, the improvements brought about by the Green Revolution came at the cost of adverse environmental effects in areas subjected to intensive farming.
- Some of the major issues in Indian agriculture are the shrinking size of land holdings, the difficulties faced by small land owners in accessing modern farming techniques, an over-reliance on the monsoon, and a lack of proper transportation facilities. Although concerted institutional planning measures are being undertaken to overcome these difficulties, much remains to be done.

11.8 TERMINAL QUESTIONS

1. Explain the importance of agriculture in the Indian economy.
2. Describe the characteristics of Indian agriculture.
3. Explain the cropping pattern of Indian agriculture.
4. Explain the positive and negative effects of the Green Revolution in India.
5. Describe any four problems of the Indian agriculture.

11.9 ANSWERS

Self Assessment Questions (SAQ)

1. Although the Indian economy has started getting diversified, other sectors have failed to generate much employment opportunities for the growing worker population in the country.
2. To ensure success in the production of at least some of the crops during unfavourable weather conditions.
3. a) Agricultural land or total cultivable land includes, is the summation of area under (i) net sown area, (ii) cultivable waste land, (iii) current fallow and (iv) fallow other than current fallow.
b) 1-g, 2-b, 3-d, 4-f, 5-c, 6-e, 7-a
4. a) Under the auspices of the Intensive Agriculture Development Programme (IADP) of 1961, the Indian scientists under the leadership of Dr. M.S. Swaminathan introduced the high yielding variety (HYV) seeds and other components of Green Revolution in 1963.
b) The positive impact is a significant increase in crop production; while increase of fertilizers and pesticides affected the soil health is the negative impact.
5. The problems are small size land holdings, quality of seeds, soil erosion, irrigation, over dependency on rainfall, lack of mechanization, lack of access to global markets etc.

Terminal Questions

1. Refer to Section 11.2.
2. Refer to Section 11.3.
3. Refer to Sub-Section 11.4.2.
4. Refer to Section 11.5.
5. Refer to Section 11.6.

11.10 REFERENCES AND SUGGESTED FURTHER READING

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UNIT 12

INDUSTRIES |

Structure

12.1	Introduction Expected Learning Outcomes	12.3	Factors Influencing Location of Industries
12.2	Historical Perspectives Industrial Development in the Planning Era Recent Trends in Industrial Sector Recent Developments in Industrial Sector	12.4	Classification of Industries
		12.5	Industrial Regions and Industrial Corridors of India
		12.6	Summary
		12.7	Terminal Questions
		12.8	Answers
		12.9	References and Suggested Further Reading

12.1 INTRODUCTION

You have studied about the role of agriculture in Indian economy in the previous unit. In this Unit, we will mainly focus on the manufacturing industries, which fall under the secondary sector. Manufacturing is the process in which goods are produced by processing raw materials into more valuable products. Growth of any country can be measured in terms of development of manufacturing industries. In the process of manufacturing, the natural resources are converted into more useful items or finished products from the raw materials. You will study about historical perspectives of industrial development in Section 12.2. There are several factors including raw materials, labor, climate, market, transport, capital, banking facilities, etc., which influence the location of industries. All these information you will learn from the Section 12.3. On the basis of the availability of raw materials, the amount of capital investment, the function, and the ownership, the industries can be divided into different types. Section 12.4 explains you the classification of industries followed by industrial regions and corridors of India in Section 12.5. Further, you will learn about the importance and development of transport facilities in Indian economy in the next Unit 13.

Expected Learning Outcomes

After completing the study of this unit, you should be able to:

- understand the historical development of industries in India;
- describe the factors influencing the location of the Industries;
- classify the industries on the basis of different criteria; and
- explain the industrial regions and industrial corridors of India.

12.2 HISTORICAL PERSPECTIVES

You might be aware of that the history of industry in India can be traced back to the history of humankind. India's handicrafts were quite valuable to foreign countries. Village artisans used to produce high quality products with locally available raw materials and skills acquired by their forefathers. In this direction, India's cotton textile industry is of prime importance for India and the world.

Modern industry in India can be traced back to 1830 when first charcoal fired iron making was attempted in Tamil Nadu. Therefore, the real beginning of modern industry in India is recognized with the establishment of the cotton textile industry. The first cotton mill was set up in Kolkata in 1807 and subsequently in 1854 at Mumbai. The first jute mill was established in 1855 at Rishra near Kolkata. Jute industry flourished in the Hugli basin due to favorable geographical conditions.

Coal mining was started in 1772 at Raniganj of West Bengal. In 1854, railways were introduced. Majority of the industries were confined to the Ahmadabad, Kolkata, and Mumbai region. In 1874, iron was produced at Kulti in West Bengal. Tata Iron and Steel Plant was established in 1907 at Jamshedpur in erstwhile Bihar which became a large scale producer of steel in India. Several medium and small scale industries such as cement, glass, jute, sugar and paper were also established in some parts of the country. The industries in the pre-independence era were not diversified.

Industries such as steel, chemicals, cement, plastic, tea, cotton, electrical equipment, and paper industries flourished during World War II, whereas jute and sugar industries suffered a declining trend. During partition and post-World War II, there has been a fall in the cotton textiles, sugar, cement and steel industries in India. One of the worst sufferers was jute and cotton industries. Skilled labour migrated to Pakistan after the partition. After setting up Industrial Finance Corporation, the situation of the industries in India improved.

12.2.1 Industrial Development in the Planning Era

Manufacturing sector is considered as backbone of the Indian economy. It ensures employment in the secondary and tertiary sector by reducing the dependence on agriculture. It aims to reduce regional imbalances by setting up industries in backward areas. It helps in reducing poverty and eradicating unemployment. Industries which involve in producing goods, and value added products are manufacturing industries. As we know that the development of

industry depends mainly on raw materials. Raw materials can be in natural form such as cotton, iron, etc., or in semi processed form like pig iron, etc., which are used for making valuable goods. There is a direct relationship between the level of industrial development and the economic prosperity of a country. Economic development can only be achieved by developing its industrial sector as it serves as an input material for another industry. Countries which are economically weaker import finished goods at high prices and export raw materials from their country. Developed countries such as United States of America, Russia, and Japan focus mainly on development of the industries. Industries are a major source of employment to about 28 million people in India. It contributes around 29% of the gross domestic product (GDP).

We shall now discuss the industrial development of India in different periods of time. These are explained below:

1. The First Phase (1951-65)

Initially, the investments were made in industries like iron and steel, fossil fuel, fertilizer industries, heavy engineering, cotton, jute, woolen, cement, paper, medicines, paints, etc. This phase is considered the solid industrial base as the annual growth rate of industrial production in India moved from 5.7% to 9.0%. Industrial Policy Resolution, 1956 was regarded as the “Economic Constitution of India” or “The Bible of State Capitalism,” which emphasized expanding the public sector and encouraged the growth of the cooperative sector. The aim was to remove the regional disparities by infrastructural development of more minor industrialized areas.

2. The Second Phase (1965-80)

During this period, the annual growth rate of industrial production declined to 4.1% (1965) to 9.0% (1976) during the Third Plan. The annual growth rate was 6.1% in 1976-77 and (-) 1.6% in 1979-80. Industrial growth decelerated due to the 1962, 1965, and 1971 wars; 1965-67 and 1971-73 droughts, the oil crisis of 1973, etc. The growth rate declined as more ferrous metals, mechanical engineering goods, and construction materials were produced during the second phase. In addition, the Industrial Policy of 1973 emphasized foreign companies to establish the new capacity to produce mass consuming products.

3. The Third Phase (1981-91)

During 1981-85, the annual growth rate was 7.0%, which increased to 8.6% during 1985-90. It covered the sixth and seventh five-year plans. In 1990-91, the annual growth rate was 9.0% of the industrial sector. The production of chemicals, petrochemicals, and allied industries grew at a faster pace. This phase focused on the electronic industries, pharmaceutical drugs, television and electronics, automobiles, jute, railway wagons, sugar industries, self-employment, and exploitation of local resources.

The iron and steel industry recorded 5.15% growth, and metal recorded 4.94%. Thus, a shift in the pattern of industrial development during the eighties is witnessed compared to the two earlier phases. The industrial growth revived during this phase mainly due to the new industrial policy of

1980, which focused on increasing the investment limit, investment in renewable and sustainable processes, and efficiency of Public Sector Units (PSUs).

4. The Fourth Phase (1991-98)

During this period, there has been a sharp industrial retrogression from 1991-92 to 1997-98, followed by sudden industrial growth of the country. In 1990-91, it was 8.5% whereas (-) 0.10% growth was recorded in 1991-92. It increased to 7.1% in 1996-97 and further 8.6% in 1997-98. The Industrial Policy of 1991 focused on abolishing licensing, encouraging foreign investment, foreign trade companies, disinvestment of Public Sector Units share and reducing custom duties.

5. The Period Since 2000

Due to structural and cyclical factors, the industrial sector's growth rate was lowest during 2000-02. As a result, the manufacturing, electricity, and mining sectors slowed down during this period. The year from 2003 remarks a revival of the industrial sector. Initially, during the Tenth Plan, the industrial growth rate was 5% which crossed 7% in 2003-04, 8% in 2004-05, and 11% in 2006-07. The industrial growth during this period can be attributed to the manufacturing sector. The significant contributor to the economic development of the country is the capital goods sector. During the Eleventh Plan, the industrial growth collapsed in 2008-09 to 2.8% due to the Global Financial Crisis in 2008. The industrial growth resumed in 2009-10 and touched 10% and reached 8.2% in 2010-11. The focus was on consumer goods, electricity, refinery, cement, coal, crude oil, and infrastructural development. This period emphasized on industry, infrastructural development, and employment generation. The process of industrial growth slowed down after 2011 due to the following major reasons:

- Decreasing domestic demand,
- High Inflation,
- Global financial crisis,
- Failure of various private sector projects,
- European debt crisis, and
- Decreasing commodity prices in the foreign market.

12.2.2 Recent Trends in Industrial Sector

You will understand some of the significant trends in industrial sector by studying the following:

- a) **Cloud Computing:** It delivers different services through the internet, including tools and applications like data storage, servers, databases, networking, and software. It is cost-effective, increases productivity, speed, performance, and security. In addition, it uses cloud solutions such as performance benchmarking, remote services, etc.
- b) **Internet of Things (IoT):** The Internet of Things (IoT) is the network of interrelated computing devices, software, sensors, and other technologies

for connecting and exchanging data with other devices and systems over the internet without human-to-human or human-to-computer interaction.

- c) **Cyber Security:** Cyber security or information technology security protects computers, servers, programs, devices, and data from malicious attacks. It aims to reduce the risk of cyber-attacks and protect against unauthorized systems, networks, and technologies.
- d) **Industrial Internet of Things (IIOT):** It is the Industrial Internet of Things whereby many devices, people, data, and machines are connected and synchronized through third platform technologies in a machine-to-machine and Internet of Things (IoT) context.

12.2.3 Recent Developments in Industrial Sector

We have given some of the developmental programmes towards the industrial growth.

1. Make in India

In September 2014, “Make in India” programme was launched to transform India into a global design and manufacturing hub. It encourages the latest technology, research, and development within the country. In addition, it aims to attract foreign companies in India to invest in the country's infrastructure and set up factories amidst the crisis.

2. Skill India

The Ministry of Skill Development and Entrepreneurship on World Youth Skills Day launched this program in 2015. The objective is to provide market-relevant skills training to more than 40 crore young people by 2022.

3. Digital India

Digital India is a flagship program implemented by the Department of Electronics and Information Technology (DeitY) to transform India into a knowledge economy and a digitally empowered society. It provides practical solutions and innovative ideas by providing opportunities for all citizens.

4. Startup India

Startup India Mission was being implemented by the Department of Promotion of Industry and Internal Trade (DPIIT). It aspires to build an ecosystem for startups and innovation in the country, generating large-scale employment opportunities.

5. Startup India Seed Fund Scheme

It funds startups to enable them to a level where they can raise investments from financial institutions. It will also assist in prototype development, market entry, and commercialization.

6. Cottage Industry

Cottage Industry or Small Scale Industries (SSIs) is an unorganized sector where the production of goods takes place in the houses involving fewer people as laborers with fixed capital of Rs. 1 crore invested in plant and machinery and providing employment promoting economic development.

7. Micro Small and Medium Enterprises (MSMEs)

Micro Small and Medium Enterprises (MSMEs) or the Small Scale Industries or SSIs are the backbones of the economy, as it is the second-largest employment generating sector after agriculture employing approximately 120 million persons (CDA, 2020). Campaigns like Skill India, Startup India, Digital India, and Make in India aim to provide MSME players with a level playing field and a final push towards enhanced productivity.

8. SFURTI (Scheme of Fund for Regeneration of Traditional Industries)

Scheme of Fund for Regeneration of Traditional Industries (SFURTI) was launched in 2005 by the Ministry of MSME to promote cluster development. The plan aims to organize traditional Indian industries and artisans into clusters for sustained employment opportunities.

- **Udyami Mitra' Portal**

Udyami Mitra Portal is a universal portal launched by SIDBI to provide easy access to various financial and non-financial services to MSMEs.

- **Gramodyog Vikas Yojana**

Gramodyog Vikas Yojana aims at creating employment for migrant workers and the unemployed by increasing domestic agarbatti production. In addition, the center has started the 'Khadi Agarbatti Atma Nirbhar Mission.'

- **Honey Mission**

Honey Mission was launched to promote beekeeping activities that employ rural & urban unemployed youth. In addition, it supports self-sustaining employment opportunities among farmers, local rural community people, etc.

SAQ I

What are manufacturing industries mainly focused during the initial stage of industrial development?

12.3 FACTORS INFLUENCING LOCATION OF INDUSTRIES

Factors affecting the location of industry can broadly be divided into two types such as geographical factors and non-geographical factors.

1) Geographical Factors: Following are the important geographical factors influencing the location of industries.

- i. **Raw Materials:** In early times, industries in India were located near the source of raw material. Diversified raw materials are required for the development of industries in modern times to match the international level of production. Sometimes, finished goods of one industry are raw materials to another industry. Weight losing industries are mainly located in the regions of raw materials. Industries which are located close to raw material sources are sugar mills in Maharashtra and western Uttar Pradesh; iron and steel industry in West Bengal-Bihar-Orissa region; jute mills in Hugli region; textile mills in Bombay. Bombay had a supply of cotton coming from Gujarat and Vidarbha region; pulp industry, and copper smelting industries are located near the source of raw materials. Most of the iron and steel industries are located near the source of raw material as both iron ore and coal are weight losing in nature. Therefore, most of the iron and steel industries are either located near the source of iron ore (e.g. Bhilai, Rourkela) or near coalfields (e.g. Bokaro, Durgapur).
- ii. **Labour:** Labour in India is quite mobile and easily available. Due to large size of population in India, labour forces are easily available. One of the characteristics of labour is mobility. In spite of mechanization, industries in India still require large number of workers. Agro-based industries and light consumer industries require labour force for their operation. Industrial belts around Delhi, Mumbai, and Kolkata attract labour from different parts of the country.
- iii. **Energy:** Industrial development is only possible when there is energy available. Industries like iron and steel, electro-chemical, and electro-metallurgical require electricity. The location of the aluminum industry Bharat Aluminum Company Ltd. (BALCO) at Korba (Chhattisgarh) and Hindalco Alumina Refinery at Renukoot in Uttar Pradesh is located near the source of electricity power.
- iv. **Water:** Water is also an important factor affecting location of the industries. Industries like iron and steel, textile and chemical industries require large amount of water for functioning of the industries. Therefore, many industries are located near sources of water such as rivers, lakes, canals or coastal areas etc.
- v. **Climate:** Climate is one of the important factors contributing to the location of industries as industries cannot develop in the regions of extreme climate. Temperature and humidity can influence the working condition of labor, and performance of machinery and equipment, etc. For instance, cotton textile industries are located in Maharashtra-Gujarat region as it requires humid type of climatic conditions.
- vi. **Market:** It is an essential factor for the disposal of finished goods. Industries located close to the market reduce the cost of transportation and price of the product. For instance, petroleum refineries are located near the market for easy transportation of crude oil.
- vii. **Transport:** Transportation by land or water is necessary for the marketing of finished goods. Industries located near the nodal transport links such as Mumbai, Kolkata, Delhi, and Chennai connect the towns and ports with their hinterlands. Transport infrastructure was developed

after independence and industries got diversified and were shifted to the interior parts of the country.

2. Non-Geographical Factors: The non-geographical factors for the location of industries are economic, political, historical, and social in nature. Non-geographical factors influencing the location of industries mainly are:

- i. **Capital:** Industries require huge capital investment which is available in major cities like Delhi, Kolkata, Mumbai, Chennai, Bangalore, etc. Modern industries are capital intensive which is easily available in urban centers.
- ii. **Banking Facilities:** Industries are established in the regions where banking facilities are easily available.
- iii. **Government Policies:** Government policies are essential for establishing industries which often facilitates this setting process through various kinds of incentives and subsidies. The policies also help in reducing the regional imbalances, decongestion of big cities, and reducing the level of pollution in any region. The example of location of industries on the basis of government policies are oil refinery at Mathura in Uttar Pradesh and fertilizer plant at Jagdishpur (Uttar Pradesh), etc.

SAQ 2

What are the geographical factors influencing the location of an industry?

12.4 CLASSIFICATION OF INDUSTRIES

Classification of Industries can be done in various ways. Industries play an important role in economic growth. Economic development of any country depends on industrialization. Economic activities which are involved in the process of raising, producing and processing of goods and services are manufacturing industries. Industries provide employment, increase per capita income, and infrastructural facilities.

Industries can be classified on the basis of raw material, size, function, ownership, and the weight of materials. These are explained below:

1. Raw Material

On the basis of raw materials used, industries can be classified as:

- a) **Agro-based industries:** Raw materials in these industries use plants and animal-based products. Examples of agro-based industries are cotton textile, woolen, jute, tea, coffee, sugar, rubber, food processing, paper, dairy products, and leather industries.
- b) **Mineral-based industries:** In mineral-based industries, mineral ore is used as raw material. Minerals can be metallic and non-metallic. Metallic can be further divided into ferrous (iron and steel) and non-ferrous (copper, aluminum, and gems). These industries form the base to other industries. Minerals are used for heavy machinery and building materials. Examples of mineral based industries are iron and steel, cement,

aluminum, petrochemicals, automobiles, ship building, and chemical fertilizers, etc.

- c) **Marine-based industries:** Industries which are based on the raw materials from sea or ocean. An example of marine based industry is fish oil. The marine based industries may also include naval shipbuilding, commercial ports, aquaculture, and energy.
- d) **Forest-based industries:** Raw materials in these industries are derived from the forest like wood and other forest produce. Examples of forest based industries are lac, timber, paper, pharmaceutical, and furniture.

2. Size

On the basis of size, industries can be divided into small scale, large scale and household or cottage. These are based on the amount of capital investment, number of employees, and volume of production of goods.

- a) **Cottage industries:** These are the smallest manufacturing units which produces goods for local markets or self-consumption. These are owned by the family members and the artisans produce goods in their homes with simple tools. Examples of cottage industries are leather products, pottery, furniture, fabrics, mats, tools, foodstuffs, and jewelries, etc.
- b) **Small-scale industries:** Small-scale industries use local raw material, semi-skilled labor, and simple power driven machines. These are practiced in countries with high populations like China, India, Indonesia, Brazil, etc. The small scale industries are considered to be the lifeline of economy to any country or region. Though they are labor-intensive industries but these can be established with less capital investment. Therefore, they can create much employment. Examples of small scale industries are basket weaving, pottery, bakeries, paper bags, printing, water bottles, and handicrafts.
- c) **Large-scale industries:** Large scale industries involve huge capital investment, skilled labor, advanced technology, mass level of production, and large market. Examples of large scale industries are automobiles manufacturing, instruments, chemicals, heavy machinery, information and technology (IT), etc. The employment opportunities created by large scale industries are huge.

3. Function/Role

- a) **Basic or Key industries:** These industries are those which supply finished products as raw materials to manufacture other goods. Examples, iron and steel smelting, copper smelting, aluminum smelting, etc.
- b) **Consumer industries:** Consumer industries are those which produce goods for the direct use by the consumers such as toothpaste, paper, soap, sugar, home appliances, cosmetics, food and beverages, etc. These are finished goods which are to be used directly by the consumers.

4. Ownership

- a) **Public sector:** Industries which are of national and strategic importance are mainly owned and managed by the government agencies. Example, Hindustan Aeronautics Limited (HAL), BHEL (Bharat Heavy Electricals Limited), SAIL (Steel Authority of India Limited), etc.
- b) **Private sector:** Private industries are businesses that are owned and operated by an individual or group of individuals. The private sector is recognized as an important sector which plays a significant role in both urban and economic development. It provides employment and contributes national development through the raising of income levels. For example, Bajaj Auto Ltd., Dabur industries, Reliance Industries Ltd., Tata Consultancy Services (TCS), Hindustan Unilever Limited and so on.
- c) **Joint sector:** These industries are jointly owned and operated by the state and individuals or a group of individuals. Example, Maruti Udyog; and Oil India Ltd., are jointly owned by the public and private sector.
- d) **Cooperative sector:** Cooperative industries are owned and operated by the producers and suppliers of raw material, or workers. Members are the producers of raw materials. For example, sugar industry in Maharashtra, coir industry in Kerala, Anand Milk Union Limited in Gujarat, etc.

5. Weight of Raw Materials

- a) **Heavy industries:** Heavy industries are large scale businesses covering large areas of land and require huge capital investment. Examples of heavy industries are iron and steel, ship building, etc.
- b) **Light industries:** Light industries are those which use light raw materials and produce light goods. These are small in scale, and require less capital investment. These are mostly consumed by the customers or individuals. For example, electrical goods.

SAQ 3

Discuss the five criteria for classification of Industries in brief.

12.5 INDUSTRIAL REGIONS AND INDUSTRIAL CORRIDORS OF INDIA

Till now, you have studied the historical perspectives of industrial development in India, various factors influencing the location of industries, and the industries classified based on raw material, size, function, ownership, and the source of materials. You will now study the important industrial regions and industrial corridors that are established in India for economic growth.

12.5.1 Industrial Regions of India

Industrial regions emerge when there is a concentration of industries in any area where geo-economic conditions are favorable. They share the benefits of being located close to each other. Manufacturing in these industries is

carried out on a relatively large scale. Industrial regions are connected by well-developed transportation and communication systems. The presence of minerals, especially coal and iron ore, availability of raw materials, favorable climate, flat land, transportation facilities, use of machines, and human skills are some of the important factors that may help in the growth of industrial regions.

Within such broad industrial regions or elsewhere, sometimes comparatively small but more closed and compact industrial areas develop wherein factories and urbanization continue for miles together almost without any break. Such smaller areas are better termed as industrial districts. The delimitation of industrial regions is based on certain factors. Hence classification of the industrial regions are based on:

- Number of factories
- Number of persons employed
- Use of power
- Number of workers engaged in the production
- Percentage of the working population involved in the industry.

Major Industrial Regions

According to B.N. Sinha's classification, major industrial regions can be defined as those in which a minimum of 1,50,000 workers are engaged. There are eight major Industrial regions in India (Fig. 12.1), which are as follows:

1. Mumbai-Pune Industrial Region
2. Bangalore-Tamil Nadu Industrial Region
3. The Hugli Industrial Region
4. Ahmedabad-Vadodara Industrial Region
5. Chotanagpur Plateau Industrial Region
6. Vishakhapatnam-Guntur Industrial Region
7. Gurgaon-Delhi-Meerut Industrial Region
8. Kollam-Thiruvananthapuram Industrial region

1. Mumbai-Pune Industrial Region

Mumbai-Pune Industrial Region extends from Mumbai-Thane to Pune and in the adjoining districts of Nashik and Solapur. This region originated during British rule in India and it grew at a rapid pace in the districts of Sangli, Satara, Ahmednagar, Kolaba, and Jalgaon. Mumbai is also known as the '*Cottonopolis of India*'. Growth of the Mumbai region is related to cotton textile industry in India. The main reasons for the development of this industrial region are as follows:

- Easy access of hydel power from the Western Ghats;
- Cheap labour force from its hinterland;
- Port facilities on the west coast for import-export;

- Black cotton soil of the Narmada and Tapi basin for cotton cultivation;
- Ideal coastal humid climate for weaving and spinning.

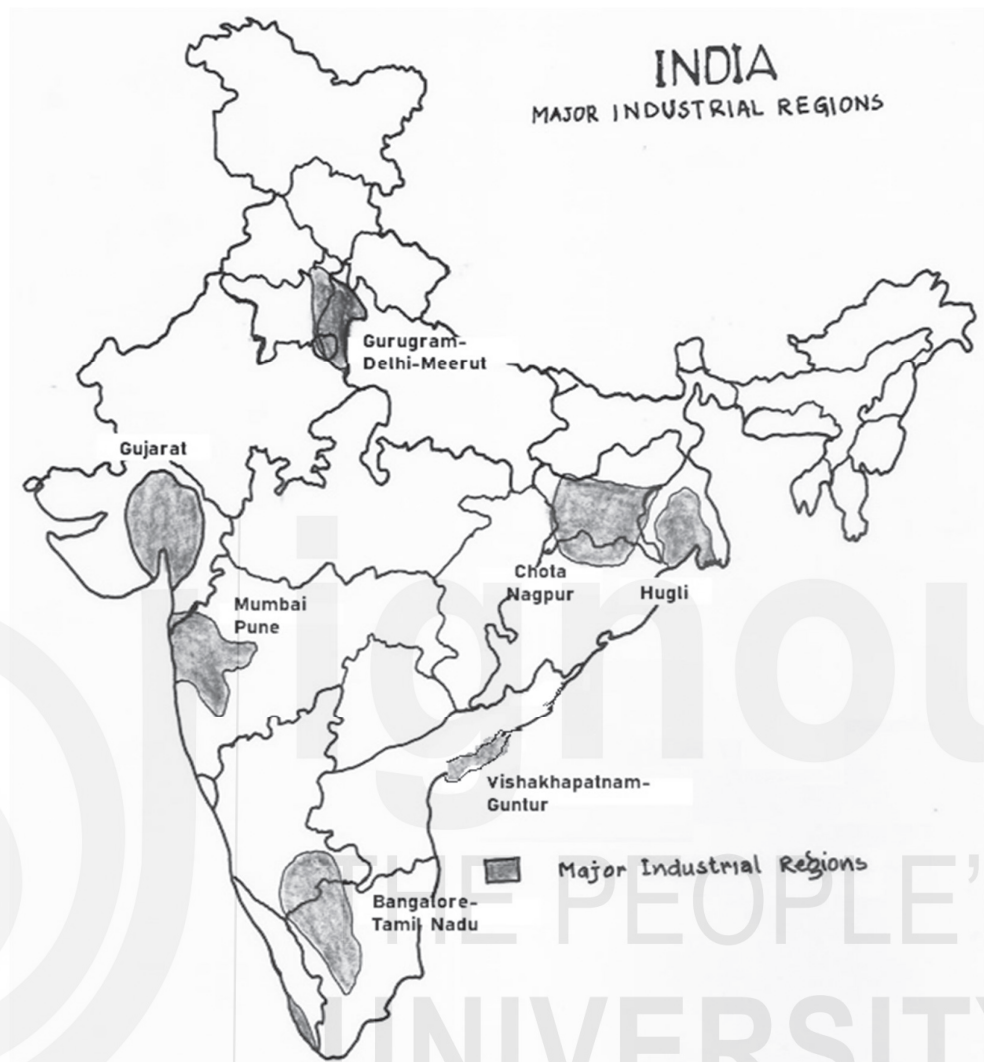


Fig. 12.1: Major Industrial Regions of India.

Industrial centers such as Thane, Nashik, Pune, Solapur, Ahmednagar, Satara, Sangli, Pimpri, Kolaba, Ville Parle, Ghatkopar, Kurla, Kalyan, Bhandup, Jogeshwari, and Andheri have developed within this region. Engineering goods, oil refineries, petrochemicals, synthetic and plastic goods, transport and food industries, electrical and electronics, ship-building, software and drugs have also developed apart from cotton textile industries. Around 81% of the total irrigated cotton area went to Pakistan after partition of the country in 1947. In recent years, the Mumbai region has faced a shortage of space with expanding industries.

Development of Mumbai by the Britishers in 1774 by acquiring the island of Mumbai and its connectivity with other regions of India after the opening of the routes through Bhorphat and Thal Ghat in 1853, and opening of the Suez Canal in 1869 established links with Europe supported to the initial growth of this industrial region.

2. Bangalore-Tamil Nadu Industrial Region

This region extends in the states of Karnataka and Tamil Nadu. Except Villupuram, the industries are confined to all the districts of Tamil Nadu and Karnataka. Madurai is famous for cotton textiles. Cotton textile industry was first set up in this region and is dominated by cotton growing tracts. Other important industries of this region are silk-manufacturing units, sugar mills, leather industry, chemicals, radio, medicines, aluminum, glass, paper, machine tools, cigarette, rubber products, light engineering goods, diesel engines, and rail wagons.

Sivakasi, Tiruchirapalli, Madukottai, Mettur, Mysore, and Mandy are some of the important industrial centers in this region. Iron and steel plants of Salem; Visvesvaraya Iron and Steel Works of Bhadravati, and petroleum refineries of Chennai and Narimanam are some of the important industries in this region. Hydroelectric power is easily available from Mettur, Sivasamudram, Papanasam, Pykara, and Sharavati dams. Factors such as cheap and skilled labour, good climate, and proximity to the local market favored the concentration of industries in this industrial region. Coimbatore as an industrial centre grew due to Pykara hydro electrical power plant, local cotton, coffee mills, oil mills and cement works. Coimbatore is known as Manchester of Tamil Nadu as there are a large number of cotton textile industries. The growth of this region is attributed to the public sector units at Bangalore such as Hindustan Aeronauticals, Hindustan Machine Tools, Indian Telephone Industry, and Bharat Electronics, etc.

3. The Hugli Industrial Region

The Hugli Industrial Region extends from Bansberia in the north to Birlanagar in the south and is located along the river Hugli. It developed around the city of Kolkata and Howrah. A port has been developed at the mouth of Hugli River and it is well connected with rail and road networks with other parts of the country. Industrialization of this region took place mainly due to following reasons:

- From 1773 to 1911, Kolkata was the capital of British India which favoured capital investment on a regular basis.
- The Hugli industrial belt developed due to close proximity of iron ore and coal mines in the Chota Nagpur plateau, tea plantations in Assam and Bengal, and jute industries located in the region.
- The region developed due to easy accessibility of cheap labour from the surrounding region of Bihar, Orissa, and eastern Uttar Pradesh.

Industries of jute, textile machinery, electrical, chemicals, oil refining, consumer goods, heavy engineering, iron and steel, fertilizer, petrochemical, engineering, paper have developed in this region. Important industrial units such as Hindustan Motors Limited at Konnagar and diesel engine factory at Chittaranjan are located here. Some of the important industrial centers of this region are Kolkata, Naihati, Kakinara, Bansberia, Belgharia, Budge Budge, Rishra, Serampore, Triveni, Hugli, Belur, Shibpur, and Titagarh, etc. Some of the major problems faced by this region after independence are as follows:

- i. After partition, 80% of the jute producing industries went to Bangladesh and the rest of them were located on the banks of Hooghly.
- ii. The siltation of Kolkata port is a major concern, therefore, Haldia port is built to relieve the pressure.
- iii. Decline of Jute producing areas is also a major issue.
- iv. The direct inland link with Assam was lost after partition of Bangladesh.

4. Ahmedabad-Vadodara Industrial Region

The nucleus of this region is between Ahmadabad and Vadodara and it extends upto Valsad and Surat in the south and Jamnagar in the west. Industrial centers of this region are Ahmadabad, Vadodara, Koyali, Surat, Rajkot, Surendranagar, Khera, Anand, Jamnagar, and Valsa, etc. Important industries such as petrochemicals, heavy and basic chemicals, sugar, dairy products, food processing, motor and tractor manufacturing are located in this region, etc. The region became an important industrial hub because of the following factors:

- i. Kandla Port is nearby and is an obvious advantage.
- ii. Easy access to the market in the nearby densely populated northern plains region.
- iii. Petroleum refinery at Koyali provided raw materials to a host of petrochemical industries.
- iv. With the decline of the cotton textile industry of Mumbai, this region became quite important as the raw materials and market were located close to each other.

5. The Chota Nagpur Plateau Region

This region is popularly known as 'Ruhr of India' and is located in Chotanagpur plateau and extends over the region of Jharkhand, northern Orissa and western part of West Bengal. The region owes its development due to iron ore from Jharkhand-Odisha and coal from Damodar Valley. The region is known for heavy metallurgical industries. Industries like iron and steel, heavy engineering, fertilizers, cement, paper, locomotives, heavy electrical are found here. Six integrated iron and steel plants at Jamshedpur, Burnpur-Kulti, Durgapur, Bokaro, and Rourkela are located in this belt. Some of the important industrial centers of this region are Ranchi, Dhanbad, Chaibasa, Sindri, Hazaribag, Jamsedhpur, Bokaro, Rourkela, Durgapur, Asansol, and Dalmianagar.

Localization of the industries in this region is mainly due to following reasons:

- i. Easy access of power from Damodar Valley Project and thermal power plants.
- ii. Cheap labour from the densely populated surrounding areas.
- iii. Port and market facilities in the nearby region are also an advantage.

- iv. Availability of coal and iron ore from the Bihar-Odisha belt.

6. Vishakhapatnam-Guntur Industrial Region

The region from Visakhapatnam in the north-eastern part to Kurnool and Prakasam districts in the south of Andhra Pradesh state is the extension of this industrial region. Visakhapatnam, Kakinada, Machilipatnam and Krishnapatnam Port facilities have been favorable for development of the industries of this region.

Coal derived from the Godavari basin has been supporting the industrial growth of this region. In 1941, Hindustan Shipyard Ltd. was set up at Visakhapatnam for ship building. The industrial growth in this region can be attributed to the development of agriculture and mineral resources in the hinterlands of these ports. Lead-zinc smelter in Guntur; petroleum refinery at Visakhapatnam facilitated the growth of petrochemical industries in this region. High quality iron ore from Bailadila region of Chhattisgarh has supported the development of iron and steel plant of Vishakhapatnam.

Industries like sugar, textiles, paper, cement, aluminium, fertilizers and light engineering goods and other types of industries including aqua related processing units are established in this region. Important industrial centers are Vishakhapatnam, Vizaynagaram, Rajamahendravaram, Kakinada, Eluru, Vijayawada, Guntur, Ongole, and Kurnool. The growth of this industrial region can be attributed to the discovery of natural gas in Krishna-Godavari basin.

7. Gurgaon-Delhi-Meerut Industrial Region

After independence, this region became one of the fastest growing industrial regions of India. This industrial region has a lot of light and market oriented industries. It is located far away from the mineral and power resources but its development and growth has been attributed to the availability of hydroelectricity from Bhakra-Nangal and thermal power from Harduaganj, Faridabad, and Panipat in the beginning.

Important industries in this industrial region are sugar, agricultural implements, vanaspati, textile, chemicals, engineering, paper, electronics, glassware, and cycle. Information and technology industries have recently developed in and around this region. With in this region oil refineries of Mathura and Panipat have been developed supporting to a variety of petrochemical products.

Agro-based industries of Ghaziabad, paper mills of Saharanpur and Yamunanagar, engineering and electronic industry of Faridabad, and car factory in Gurgaon boosted the industrial growth of this industrial region. Some important industrial centers are Meerut, Modinagar, Sonipat, Panipat, Faridabad, and Ballabgarh.

8. Kollam-Thiruvananthapuram Industrial Region

The Industrial region of Kollam-Thiruvananthapuram is smaller and it spreads over the districts of Kollam, Alwaye, Alappuzha, Ernakulam, and Thiruvananthapuram of Kerala. The industries in this region are based on agricultural products and market oriented light industries. Plantation agriculture, hydroelectricity and oil refineries provide industrial bases to this

region. Textiles, sugar, rubber, glass, food and fish processing, chemical fertilizers, paper, coconut coir products, aluminum and cement are the main industries of this industrial region. Important industrial centers are Kollam, Alluva, Kochi, Alappuzha, Thiruvananthapuram, and Punalur. You will also find the list of minor industrial regions from the Figure 12.2. The minor industrial regions are those employing at least 25,000 workers per day. Besides all these industrial regions, some of the minor industrial regions are as follows:

1. Ambala-Amritsar in Haryana-Punjab
2. Saharanpur-Muzaffarnagar-Bijnor in Uttar Pradesh
3. Indore-Dewas-Ujjain in Madhya Pradesh
4. Jaipur-Ajmer in Rajasthan
5. Kolhapur-South Kannada in Maharashtra-Karnataka
6. Northern Malabar in Kerala
7. Middle Malabar in Kerala
8. Adilabad-Nizamabad in Telangana
9. Allahabad-Varanasi-Mirzapur in Uttar Pradesh
10. Bhojpur-Munger in Bihar
11. Durg-Raipur in Chhattisgarh
12. Bilaspur-Korba in Chhattisgarh
13. Brahmaputra Valley in Assam



Fig. 12.2: Minor Industrial Regions of India.

12.5.2 Industrial Corridors of India

Let us understand what is an industrial corridor? An industrial corridor is a corridor that passes through states comprising multi-modal transport services. It is a cluster of manufacturing industries created in areas that have pre-existing infrastructure, such as ports, highways, and railroads. It aims to stimulate industrial development in any geographical area, and lower cost of logistics. It offers urban development, increase in export, employment opportunities, socio-economic development, etc. Industrial corridor is a very significant government policy initiative for boosting economic development of the country. The important industrial corridors identified in the country, (Fig. 12.3), which are as follows:

1. Delhi-Mumbai Industrial Corridor (DMIC)
2. Amritsar-Delhi-Kolkata Industrial Corridor (ADKIC)
3. Chennai-Bengaluru Industrial Corridor (CBIC)
4. Bengaluru-Mumbai Industrial Corridor (BMIC)
5. Hyderabad-Bengaluru Industrial Corridor (HBIC)
6. Vizag-Chennai Industrial Corridor (VCIC).

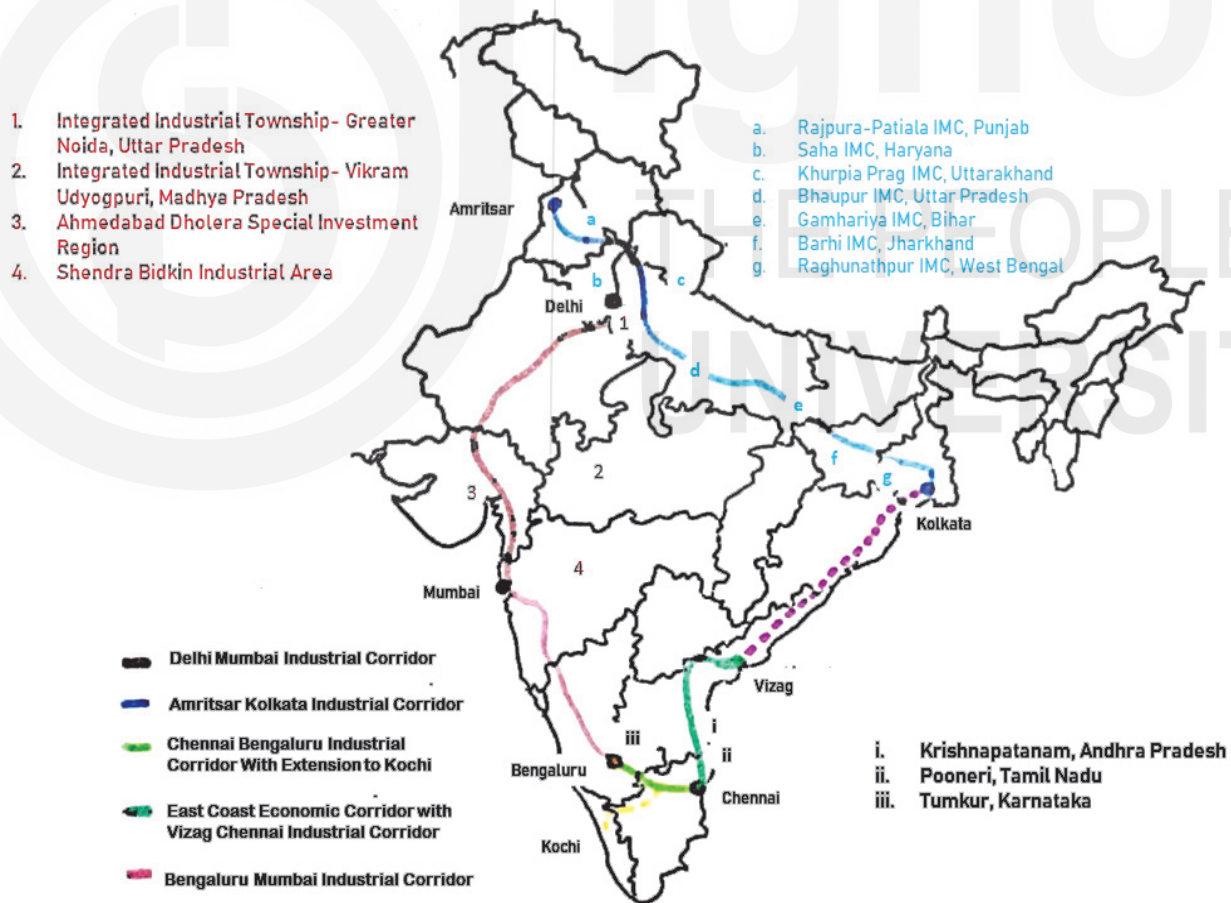


Fig. 12.3: Industrial Corridors of India.

1. Delhi-Mumbai Industrial Corridor (DMIC)

Delhi Mumbai Industrial Corridor (DMIC) covers the states and UTs of Delhi, Uttar Pradesh, Madhya Pradesh, Gujarat, Maharashtra, Rajasthan, and Haryana (Fig. 12.3). It was launched in 2006 by the support of Government of Japan with an aim to enhance India's competitiveness in the manufacturing sector by leveraging the 'High Speed-High Capacity' connectivity provided by the Western Dedicated Freight Corridor (DFC). The total length of the corridor is about 1504 km between Delhi and Mumbai. The project aims to develop smart cities that can compete with the best international manufacturing and industrial regions.

Total area of this project is about 4,36,486 sq. km acquiring about 13.8% of land. Rajasthan and Gujarat constitute 77% of the total length of the freight corridor followed by Haryana and Maharashtra (10%), Uttar Pradesh, and NCT Delhi (15%). Industrial areas in this corridor are Meerut- Muzaffarnagar (Uttar Pradesh), Faridabad-Palwal (Haryana), Jaipur-Dausa (Rajasthan), Vadodara-Ankleshwar (Gujarat), and Alewadi-Dighi Port (Maharashtra).

2. Amritsar-Delhi-Kolkata Industrial Corridor (ADKIC)

It was approved by the Government of India in 2014. It extends from Amritsar in Punjab to Dankuni in West Bengal with a total length of 1839 km. The Eastern Dedicated Freight Corridor (EDFC) is the backbone of the economic corridor and it is being developed along with Amritsar-Kolkata Industrial Corridor (AKIC). It covers the states of Punjab, Haryana, Uttarakhand, Uttar Pradesh, Bihar, and West Bengal. It is one of the most densely populated regions covering the major cities such as Amritsar, Jalandhar, Ludhiana, Ambala, Delhi, Roorkee, Moradabad, Bareilly, Saharanpur, Aligarh, Kanpur, Lucknow, Allahabad, Varanasi, Patna, Hazaribagh, Dhanbad, Asansol, Durgapur, and Kolkata.

3. Chennai-Bengaluru Industrial Corridor (CBIC)

The Chennai-Bangalore Industrial Corridor (CBIC) covers the states of Tamil Nadu, Andhra Pradesh and Karnataka and it is being funded by the Japan International Cooperation Agency (JICA). It is 560 km long corridor between Chennai-Bengaluru-Chitradurga. It will boost trade with eastern and western countries. Industries such as steel, cement, food processing, automobiles, petroleum, chemicals, petrochemicals, and readymade garments will get benefited from this corridor. It serves 3.7% of the total population of the country.

4. Bengaluru-Mumbai Industrial Corridor (BMIC)

It is being developed between Bengaluru and Mumbai as it will have influence over the state of Maharashtra and Karnataka. It was taken up in 2013 and it is being developed with the help of the United Kingdom. The aim is to ensure world class infrastructure in these states along the corridors which may result in increasing regional development and global competitiveness of local manufacturers. It is intended to bring innovation, job creation, and sustainable connectivity infrastructure.

5. Hyderabad Bengaluru Industrial Corridor (HBIC)

Hyderabad Bengaluru Industrial Corridor (HBIC) covers the states of Telangana, Andhra Pradesh and Karnataka. It will act as an extension of Hyderabad Nagpur Industrial Corridor which will be developed between Hyderabad and Bengaluru. It will connect the central southern parts of the country.

6. Vizag-Chennai Industrial Corridor (VCIC)

The Visakhapatnam-Chennai Industrial Corridor (VCIC) is a key part of The East Coast Economic Corridor (ECEC). It is India's first coastal economic corridor covering a coastline of 2500 km. It is being developed by the Asian Development Bank (ADB) between the states of West Bengal, Odisha, Andhra Pradesh, and Tamil Nadu. Phase 1 of this corridor is Visakhapatnam-Chennai Industrial Corridor (VCIC) running along the east coast of India from Kolkata to Kanyakumari. It will link backward regions and will create jobs for the poor people. It will also strengthen the Make in India and Sagar Mala initiative launched by the Government of India. It also plays a critical role in the "Act East Policy" of India. The Odisha Economic Corridor is also being developed as part of the East Coast Economic Corridor.

7. National Industrial Corridor Development Programme

This program focuses on developing new "Smart Cities" and is often regarded as one of the ambitious infrastructure projects. It will develop futuristic industrial cities in India and will create employment opportunities and economic growth. Some of these are:

- a) **Integrated Industrial Township- Greater Noida:** It is a flagship project for Delhi Mumbai Industrial Corridor, designed with world-class standards envisioned as a sustainable and smart community.
- b) **Integrated Industrial Township- Vikram Udyogpuri:** The site for the proposed project "Vikram Udyogpuri" is located at village Narwar about 8 km far from Ujjain and 12 km far from Dewas, and has a total area of 442.3 ha (1,096 acres). The Vikram Udyogpuri project will have a sustainable economic base primarily driven by manufacturing product mix and institutional (Public and Semi-Public Land use) and supported by residential and commercial activities.
- c) **Ahmedabad Dholera Special Investment Region:** The Dholera Special Investment Region (DSIR) has been planned over an area of 920 sq. km. It is a planned, innovative, sustainable community envisaged to be a world-class destination with efficient infrastructure opportunities for setting up manufacturing units, which will help increase the country's industrial output.
- d) **Shendra Bidkin Industrial Area (SBIA):** It is located approximately 15 km from downtown of Aurangabad and is 8 km east of the Aurangabad Airport. It is planned as a new industrial corridor extending from the existing Maharashtra Industrial Development Corporation's

(MIDC) Shendra Industrial Park to the town of Bidkin. The total area of SBIA is approximately 84.17 sq km.

SAQ 4

- a) List out different industrial corridors of India.
 - b) Discuss about Delhi-Mumbai industrial corridor of India.
-

12.6 SUMMARY

In this unit, you have studied so far:

- Manufacturing is the process in which goods are produced by processing raw materials into more valuable products.
- There is a direct relationship between the level of industrial development and the economic prosperity of a country.
- The geographical factors which influence the industrial location are raw materials, labour, energy, water, climate, market, and transport. Non-geographical factors are government policies, capital and banking facilities.
- India is exporting goods to different countries mainly due to systematic industrial planning over the various five-year plans which focused on removing regional imbalances.
- Industrial regions can be referred to as the spatial distribution of manufacturing units in a specific area.
- Industrial corridor is a cluster of manufacturing industries created in areas that have pre-existing infrastructure, such as ports, highways, and railroads.
- There are different industrial corridors established for the country's economic development.

12.7 TERMINAL QUESTIONS

1. Explain the industrial development in five year plans of India.
2. Describe various factors influencing the location of industries in an area.
3. Explain the classification of industries based on raw materials and size.
4. What is an industrial corridor? Discuss any three industrial corridor projects of India in brief.
5. Differentiate between industrial regions and industrial corridors with suitable examples.

12.8 ANSWERS

Self Assessment Questions (SAQ)

1. Iron, steel, and heavy engineering machines.
2. Raw materials, labour, power, transport, and market, etc.
3. Industries can be classified on the basis of raw material, size, function, ownership, and the weight of materials.
4. a) DMIC, ADKIC, CBIC, BMIC, HBIC, and VCIC
b) Delhi Mumbai Industrial Corridor of India launched in 2006 and it covers the states and UTs of Delhi, Uttar Pradesh, Madhya Pradesh, Gujarat, Maharashtra, Rajasthan, and Haryana.

Terminal Questions

1. Refer to 12.2.
2. Refer to 12.3.
3. Refer to 12.4.
4. Refer to 12.5.
5. Refer to 12.5.

12.9 REFERENCES AND SUGGESTED FURTHER READING

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UNIT 13

TRANSPORT |

Structure

13.1	Introduction	13.5	Rapid Mass Transport System
	Expected Learning Outcomes	13.6	Urban Transport
13.2	Development of Transport Network	13.7	Summary
13.3	Modes of Transport	13.8	Terminal Questions
	Roadways	13.9	Answers
	Railways	13.10	References and Suggested Further Reading
	Airways		
	Waterways		
13.4	Dedicated Freight Corridors		

13.1 INTRODUCTION

In the previous unit, you have studied about industrial development and the establishments of industrial regions as well as industrial corridors of India. This unit focuses on transportation and its significance as a foundation for economic development. Transportation is a medium of transfer of people and goods.

You will study about the development of transport network in India in Section 13.2, followed by various modes of transport such as roadways, railways, airways and waterways explained in Section 13.3. The dedicated freight corridors, rapid mass transport system and urban transport are explained in Sections 13.4, 13.5 and 13.6, respectively.

Expected Learning Outcomes

After completing the study of this unit, you should be able to:

- describe the development of transport system in India;
- classify different modes of transportation;
- explain dedicated freight corridors and its significance; and
- understand the urban transport system of India.

13.2 DEVELOPMENT OF TRANSPORT NETWORK

You might be aware of the importance of resources for economic development of a country. As we know that the resources are unevenly distributed over space. Not every spatial unit is bestowed with all types of resources. Some regions are resource rich whereas some of them are not. Humans need various modes of exchanges for movement of goods and services. These exchanges are fulfilled by transportation. It acts as linkage between regions of production and consumption. For easy exchange of goods and services, transport and communication is important. Transportation influences the living standard and quality of life in a region in this era of globalization. It acts as a link through which trade and communication takes place. Transportation deals with spatial constraints and attributes of the origin, destination, and routes between two regions. Countries development does not depend on agriculture, industries or mines alone but on the development of transportation and its various modes. Now you have understood the importance and role of transportation. **Transport system** simply refers to the different modes of carrying human and material from one location to another. It is the base of economic infrastructure. It helps in the development of a region and reduces regional disparities. It acts as nerves and veins of the economy, thus, it is referred to as the symbol of civilization. You now know some of the advantages of transport system as noted below:

Advantages of Transport:

- It helps in better production in agriculture and industrial sector.
- It reduces the cost of production.
- Transportation reduces scarcity in a region.
- It encourages trade and tourism.
- Transportation helps in increasing the linkage between the market and its catchments as well as between the ports and its hinterland.
- It encourages the mobilization of resources and labor.
- Transport system creates employment opportunities in a region.
- It acts as a link between core and periphery of a region.
- Transportation also helps in exchanging the social and cultural linkages between different regions.

Let us now study how the transportation system has developed over a period of time in India? In the growth and development of any region, it is the transportation system which plays a vital role. It helps in the development of different sectors of economy such as agriculture, industries, administration, trade, commerce, communication, and education, etc. **Transportation Network** is a spatial network which helps in movement of goods, services and freight from one location to another. It takes into account the spatial structure and organization of transport infrastructure and terminals, along with people and freight movement.

India has great diversity in terms of social, economic, geographic, cultural and political aspects within the country. A well connected transport network is important for the integration of this diverse country. Let us briefly study the development of different types of transportation network developed during the course of time in India.

a) The Development of Roadways

The earliest attempt to develop the road network in India was made in the 1943 Nagpur Plan, which could not be implemented due to lack of coordination between princely states. The targets were achieved after the re-organization of the states by 1961. Post-independence, under the First Five-Year Plan (1951-56), roads were categorized into National Highways, State Highways, District Roads, and Village Roads. In 1961, Twenty-Year Road Plan (Bombay Plan) aimed to increase road length from 6.56 lakh kilometers to 10.60 lakh kilometers. The Indian Roads Congress (1984) suggested a road classification system as (1) Primary System, consisting of Expressways and National Highways; (2) Secondary System, consisting of State Highways and Major District Roads; and (3) Tertiary System (Rural Roads), consisting of other District Roads and Village Roads.

b) The Development of Railways

The first passenger train in the history of Indian Railways ran between Bombay to Thane (34 km) on 16 April 1853. This train included the three locomotives named; Sahib, Sultan, and Sindh and had thirteen carriages. In 1862, the first Railway Workshop was established at Jamalpur, near Munger, Bihar. It gradually became one of the major industrial units of India, with iron and steel foundries, rolling mills, and more. In 1880, The Darjeeling Steam Tramway (later the Darjeeling Himalayan Railway) started its first section from Siliguri to Kurseong, further extended to Darjeeling in 1881. Kalka-Shimla Railway (KSR) joins Kalka, the foothill town near Chandigarh, to Shimla at 2,276 meters. The Nilgiri Mountain Railway, which opened in 1899, is among the first outstanding examples of a Hill Passenger Railway, extended up to Ooty in 1903.

c) The Development of Waterways

Before independence, there were many private shipping companies. However, eastern and western shipping corporations were established initially in 1950 and 1956, respectively. These two corporations were later merged to form Indian Shipping Corporation in 1961. During the First Five Year Plan (1951-56), the Ganga-Brahmaputra Water Transport Board was set up as a Joint Venture of the Central Government and State Governments of Uttar Pradesh, Bihar, West Bengal, and Assam. Subsequently, the Government of India established the Inland Water Transport Directorate under the Ministry of Shipping and Transport in 1965. Finally, the National Transport Policy Committee (NTPC) pursuance led to the Inland Waterways Authority of India (IWAI) being set up on 27 October, 1986. To develop, maintain, and regulate National Waterways for shipping and navigation in the country, the Inland Waterways Authority of India Act was enacted in 1985.

d) The Development of Airways

In 1911, the first operational airmail commenced a 10 km distance between Allahabad (Prayagraj) and Naini of Uttar Pradesh. Later, in 1912, Indian State Air Services, jointly with Imperial Airways (U.K), opened the first domestic air route between Karachi and Delhi. In 1924, the construction of civil airports began at Dum Dum (Kolkata), Bamrauli (Allahabad), and Gilbert Hill (Mumbai). Tata Air Services flew its inaugural flight from Karachi to Bombay (Mumbai) in October 1932. Post-Independence, the Government of India renamed Tata Airways as Air India and the airline started its first international flight from Mumbai to London in 1948. In 1953, air transport was nationalized, and two corporations, Air India International and Indian Airlines were established for international and domestic air transport, respectively. Later in the year, civil helicopter services were introduced in the country.

After private airlines came into the picture, traveling by air in India has endured a revolutionary change. In 1994, the Air Corporations (Transfer of Undertaking and Repeal) Act enabled private airlines to operate scheduled services and commence domestic operations. These include Jet Airways, Air Sahara, Modiluft Airlines, Damania Airways, NEPC, and East-West Airlines, laying the foundation for the current Indian aviation sector. The 2000s marked the beginning of India's aviation boom. Low-cost airlines like Indigo, Spice Jet, Go Air, and Air Asia India heavily challenged the full-service carriers like Air India and Jet Airways. Pawan Hans is the helicopter service operating in hilly areas and is widely used by tourists in the north-eastern sector.

13.2.1 Factors Affecting the Development of Transport Networks in India

Many forces and factors act together for the development of a transport network. The factors which influence the development of transportation networks are as follows:

(i) Historical: The historical factors include settlement or location and systems, technological development, institutional development and settlement, and land-use patterns. The processes of colonialism and imperialism have shaped the development process in the colonized world.

(ii) Environmental: Environmental factors like hydrological and geomorphological at the local level and climatic factors at the regional level are necessary conditions for transportation construction and operations.

(iii) Economic: The economic processes shape the transportation network, supporting economic activities and interactions. Employment and distribution (at the local level) and markets (as transnational) require coordinated supply strategies. At the global level, comparative advantages and interdependency influence major freight flows.

(iv) Physical: Transport facilities' physical motives include route selection and geological and climatic influences.

(v) Political: The political motives for transport facilities at the global level are multilateral agreements, government involvement in the capital, monopolies, competition, safety, working conditions and coordination between

modes, transport as an employer, and social consequences of transport developments. At the national level, trade agreements and taxation and regulations at the regional level are the factors that influence the transport network.

SAQ I

- a) What are the advantages of transportation?
 - b) List any four important factors that affects the development of transport network of India.
-

13.3 MODES OF TRANSPORT

Till now, you have studied the historical development of transportation network in India. Now you will understand by studying different modes of transport which play an important role in infrastructure and economic development of the country.

Various modes of transport are designed to carry passengers or freight. These are roadways, railways, airways, waterways, etc. Cost, the value of goods, urgency of the shipment, size, and the weight of the goods are essential for determining the form of transportation. Due to varying geographical terrain across the globe, different modes of transportation are required for efficient transport of goods and services. In India, the Ministry of Ports, Shipping and Waterways and the Ministry of Road Transport and Highways are responsible for managing and formulating rules and development of transportation. Let us study various modes of transport one by one in following sub-sections.

13.3.1 Roadways

We all know the importance of road network whether it is rural or urban area, or mountainous terrain or plain regions. The roadways are the ideal mode of transport for the movement of goods and services for long, short, and medium distances. India recorded the second largest road network in the world with 59 lakh km after the United States of America which has a road network of 66.5 lakh km. Roads are easy to construct and maintain when compared to railways. It offers door to door services and these are economically viable. Indian roads are mainly concrete which are durable and all weatherproof. One of Government programmes of ***Bharatmala Pariyojana*** which aims to focus on bridging the gap of infrastructure and road traffic management. The maintenance and construction of roads are managed by various agencies, state and central governments. The main agencies are State Public Works Department, National Highway Authority of India, State Forest Department, Railways, Municipal Corporations, PSU, Border Roads Organization, National Highway Infrastructure Development Corporation, etc.

The Ministry of Road Transport and Highways is responsible for the development and maintenance of National highways. The National Highways in India increased from 70,934 km in 2010-11 to 1,14,158 km in 2017 (Table 13.1). You will also find the freight and passenger movement by road

transport from Table 13.2. The freight transport accounts nearly 1287 BT/km in 2010-2011 which increased almost by double to 2260 Billion tonnes/km in 2016-2017. At the same time, the passenger movement increased from 8,409 to 17,832 Billion passengers/km increased by the road transport.

Table 13.1: Category-Wise Road Length of India in 2017.

Road Category	Road Length (km)	Percent share of Total Roads
National Highway	1,14,158	1.94
State Highway	1,75,036	2.97
District Roads	5,86,181	9.94
Rural Roads	41,66,916	70.65
Urban Roads	5,26,483	8.93
Project Roads	3,28,897	5.58
Total	58,97,671	100

(Source: Road Transport Yearbook-2016-17; Transport Research Wing of the Ministry of Road Transport & Highways, New Delhi)

Table 13.2: Freight and Passenger Movement by Road Transport during 2010-2017.

Year	Freight (Billion Tonnes Km)	Passenger (Billion Passengers Km)
2010-11	1,287.3	8,409
2011-12	1,407.8	9,478
2012-13	1,516.2	10,469
2013-14	1,652.1	11,742
2014-15	1,823.2	13,393
2015-16	2,027.4	15,428
2016-17	2,260.2	17,832

(Source: Road Transport Yearbook-2016-17; Transport Research Wing of the Ministry of Road Transport & Highways, New Delhi)

The development of roads in India can be classified into:

- i. **National Highways:** These are maintained by the central government which connects major cities, ports, railway junctions, etc. These are maintained, developed and operated by National Highway Authority of India (NHAI). NHAI is under the administrative control of the Ministry of Road Transport and Highways. Some of the major national highways include Golden Quadrilateral, North- South Corridor, and East-West Corridor, etc.

- ii. **State Highways:** These are managed by the state government and it connects the national highways joining the state capitals and important places and towns.
- iii. **District Roads:** These roads connect the district headquarters and state highways. These are maintained by the Zilla Parishads (District Councils).
- iv. **Border Roads:** Border Road Organization (B.R.O) was set up in 1960, which constructs and maintains these roads. These roads are of strategic importance which strengthens defense and economy of the country. BRO has constructed the world's highest road joining Chandigarh and Leh in Ladakh.
- v. **Rural Roads:** These roads link the rural parts of the country, where the topography and terrain doesn't permit building big highways. It connects major towns and cities in the neighbouring region.

The important National Highway Projects are listed below for better understanding.

- a) **Golden Quadrilateral National Highway:** It connects India's top four metropolitan cities, namely, Delhi, Kolkata, Mumbai, and Chennai, thereby forming a Quadrilateral. In 2001, it was launched as a part of the National Highway Development Project (NHDP).
- b) **North-South Corridor:** It aims to link Srinagar (Jammu and Kashmir) to Kanyakumari (Tamil Nadu) with a road length of 4,076 km.
- c) **East-West Corridor:** It connects Silchar (Assam) with the port town of Porbandar (Gujarat), having a length of 3,640 km long.
- d) **Coastal Highway:** The 382 km coastal highway project proposed by the Odisha government will originate from Tangi in Khurda to bypass Chilka lake and culminate at Digha touching Brahmagiri, Puri, Konark, Astarang, Naugaon, Paradip Port, Ratanpur, Satabhaya, Dhamra, Basudevpur, Talapada, Chandipur, and Chandaneswar. The project is a part of the Centre's Bharatmala Pariyojana.
- e) **National Highway 66:** It is a four-lane 1,608 km long highway that runs roughly parallel to the Western Ghats, connecting Panvel (south of Mumbai) and Cape Comorin (Kanyakumari), passing through the states of Maharashtra, Goa, Karnataka, Kerala, and Tamil Nadu.
- f) **Bharatmala Pariyojana:** This is an ambitious project of the Government of India initiated in 2016, which aims at optimizing the efficiency of road traffic movement across the country by bridging infrastructure gaps. The objectives are to:
 - develop the connectivity in backward areas,
 - develop the multi-modal logistics parks,
 - take initiation for elimination of choke points,
 - use of scientific and technological planning,

- improve the connectivity in the north-east region of India in particular and also improve the quality of roads in all parts of the country.
- g) Rashtriya Rajmarg Zila Sanjoyokta Pariyojna:** A total of 6,600 km of highway roads are designed to develop to connect 100 district headquarters across the country.
- h) Setu Bharatam:** This project aims to build bridges for smooth travel on National Highways. The program aims at making all national highways railway level crossing accessible and construct and widen the new or existing "road over bridges/road under bridges".
- i) Char Dham Pariyojana:** It connects Kedarnath, Badrinath, Yamunotri and Gangotri in Uttarakhand by covering an entire length of 889 km under the Chardham Project.
- j) Pradhan Mantri Gram Sadak Yojana (PMGSY):** This scheme is aiming to provide connectivity to unconnected settlements as a poverty reduction strategy. The plan offers all-weather rural road connectivity to all habitations.

13.3.2 Railways

India has the fourth largest railway network in the world after the USA, Russia, and China. The railway network spread over 1,19,630 kms in length. It is the most common mode of transportation for longer distances at low cost. It integrates the country and has played an important role during war, natural calamities, and epidemics. As we know that the network of railways also helps in easy movement of people and freight at cheaper rates. Indian railways are operating in four different gauges. These are Broad Gauge with the width of 1.676 meter, Meter Gauge (width 1 m), Narrow Gauge (0.762 m) and Lift Gauge with a width of 0.610 m. The distribution pattern of railways in India is uneven due to its topography, terrain, population density, and productivity of that area. It has been observed that the density of railways is higher in northern plains than other parts of the country because of its topography. The length of railways of top five states in India are given in Table 13.3.

Table 13.3: Length of railways in India.

State	Length (in Km)
Uttar Pradesh	9,077
Rajasthan	5,893
Maharashtra	5,745
Gujarat	5,259
Madhya Pradesh	5,000

(Source: <https://indianrailways.gov.in/>)

Railway Zones of India

There are 16 railway zones in India as of 2010, which are managed by the Railway Board (Table 13.4). You will be astonished to know that the Indian Railways has two world heritage sites recognized by UNESCO. These include: 1) Mountain Railways of India (Darjeeling Himalaya Railway, Kalka-Shimla Railway, and Nilgiri Mountain Railway); and 2) Chhatrapati Shivaji Terminus, Mumbai.

Table 13.4: Railway Zones of India.

Zones	Headquarters
Northern	Delhi
North Central	Prayagraj
North-Eastern	Gorakhpur
Northeast Frontier	Guwahati
North Western	Jaipur
Central	Mumbai
East Central	Hajipur
East Coast	Bhubaneswar
Eastern	Kolkata
South Central	Sikanderabad
Southeast Central	Bilaspur
South-Eastern	Kolkata
South-Western	Hubli
Western	Mumbai
Southern	Chennai
West Central	Jabalpur

(Source: <https://indianrailways.gov.in/>)

Apart from these, Indian Railways has the credit of maintaining so many notable trains including Palace on Wheels, Deccan Odyssey, Thar Express, Fairy Queen, Mumbai-Pune Deccan Queen, Himsagar Express, Gatimaan Express, Rajdhani Express, Shatabdi Express, Dibrugarh-Kanyakumari Vivek Express, Lifeline Express, Samjhauta Express, Bhopal Shatabdi Express, Duronto Express, and Humsafar Express.

The main advantages of railways are cheapest and fastest mode of transport. It connects hinterland with seaports, and helps to develop peripheral areas, and agriculture sector. It can also help in integration of the country, and maintains law and order. While the disadvantages include heavy pressure of passenger, accidents, revenue and cost problem, social burden, competition with road transport, high energy cost, faulty planning and slow decision making process.

Government Initiatives

The Government of India has taken the following initiatives recently:

- The Central Government has approved the implementation of a 235 km semi high-speed rail corridor between Pune and Nashik in Maharashtra in June 2021. The cost of this project is estimated to be Rs. 16,039 crore.
- In April 2021, Indian Railways completed the arch closure of the under-construction Chenab Bridge (1315 m long), which is the world's highest railway bridge, about 35 meters taller than the Eiffel Tower in Paris.
- The Government will develop a National Rail Plan to enable the country to integrate its network of railways with other modes of transport and create a multi-modal transportation network.

13.3.3 Airways

Airways are the fastest and costliest mode of transport. It carries goods and passengers by air through aircraft, helicopters, etc. It plays an important role during times of emergency like wars, calamities, and evacuation by the country. It connects remotest, inaccessible and hostile parts of the world within a shorter time frame. It is efficient for carrying low weight high value cargo. It also plays an important role in the tourism sector.

Air transport in India was first started between Allahabad and Naini in 1911. There are 486 airports in India, 34 of them are International, and 123 are commercial in nature. The Airport Authority of India which was set up on 1st April, 1995 is responsible for the safe, efficient international and domestic air transportation which is controlled by the Ministry of Civil Aviation. India has the third largest domestic civil aviation market in the world which has grown 16% annually over the past decade.

The domestic air transport helps in the movement of goods and cargo within the country whereas the international air transport carries goods and passenger between two nations. The international airports in India are in Jaipur, Hyderabad, Guwahati, Varanasi, Port Blair, Bhubaneshwar, Imphal, Delhi, Vasco da Gama, Ahmedabad, Bangalore, Mangalore, Kochi, Kozhikode, Mumbai, Thiruvananthapuram, Tiruchirapalli, Lucknow, Nagpur, Amritsar, Kolkata, Coimbatore, and Chennai. Major airlines in India are Air India, Jet Airways, Vistara, IndiGo, Go Air, Spice Jet, and Air Deccan, etc. The Indira Gandhi International Airport in Delhi, Chhatrapati Shivaji International Airport in Mumbai, and Kempegowda Bengaluru International Airport handle more than half of the air traffic in the country (Fig. 13.1).



Fig. 13.1: Major International Airports in India.

There are several advantages and also disadvantages of air transport. The advantages of air transport are: it is a fastest mode of transport, connects remotest parts of the country, connects the nation with other parts of the world, saves the time, helpful during wars, and natural calamities. The disadvantages are including poor infrastructure, expensive mode of transport, affected by weather conditions, rising fuel prices, poorly managed, and frequent strikes by the workers.

13.3.4 Waterways

Water transportation is an important and cheapest mode of transportation for both passengers and cargo traffic for short and long distances. It is the suitable means of transportation for carrying heavy and bulky material. This mode of transport is eco-friendly and fuel-efficient in nature. India has a long coastline and a major proportion of International trade is carried out through ships which accounts for 95% of the country's trade volume. The different kinds of waterways are explained below:

1. Inland Water Transport

India has an extensive network of inland water transport in the form of boats, launches, streamers, etc. for the movement of goods and passengers in rivers, canals, and backwaters. The total length of navigable river in India is 14,544 kilometres, out of which 5,200 km is river length and 4,000 km is of canals. Inland water transport mainly covers the states of West Bengal, Andhra Pradesh, Assam, Kerala, Karnataka, etc. Ganges, Brahmaputra, Godavari, and Krishna rivers are navigable in nature. Inland Water transport is managed by Inland Waterways Authority of India (IWAI) in our country, which was created in 1986. The details of the national waterways of India are given in Table 13.5.

2. Oceanic Transport

It is the movement of goods and passengers through ships through sea or ocean. India's international trade is carried out through oceanic means of transport. There are 12 major and 200 minor ports in India. India's 95% foreign trade and 70% trade value are carried out through oceanic transportation. India focuses on developing the shipping sector and shipbuilding industry for easy foreign trade and export and import.

3. Coastal Transport

In coastal transportation, the movement of ships takes place between ports along the coastal regions of the country. India has a long coastline which is 7,516 Km long. Therefore, it is the most efficient means of transport for cargo and passengers in coastal areas. The twelve major ports are Kandla Port in Gujarat, Mumbai Port in Maharashtra, Jawaharlal Nehru Port in Maharashtra, Mormugao Port in Goa, Paradip Port in Odisha, New Mangalore Port in Karnataka, Kochi Port in Kerala, Visakhapatnam Port in Andhra Pradesh, Kolkata Port in West Bengal, Chennai Port and Ennore Ports in Tamil Nadu (Fig. 13.2).

Table 13.5: National Waterways of India.

Waterway	Location	Details	Year
NW1	Prayagraj-Haldia Stretch (1,620 km)	- One of the significant waterways in India. - It is navigable by motorized boats up to Patna and ordinary boats up to Haridwar. - It is divided into three parts for developmental purposes: Haldia-Farakka (560 km) Farakka-Patna (460 km) Patna - Prayagraj (600 km)	1986
NW2	Sadiya-Dhubri Stretch (891 km)	The river Brahmaputra is navigable by streamers up to Dibrugarh (1384 km), India	1988
NW3	Kottapuram-Kollam Stretch (205 km)	It includes 168 km of west coast canal along with Champakara canal (23 km) and Udyogamandal canal (14 km)	1991
NW4	Kakinada-Puducherry (1,095 km)	Stretch of canal and Kaluvelly Tank stretch of river Godavari and Krishna.	2008
NW5	Talcher-Dhamra (623 km)	Stretch of east coast canal and Matai rivers; Brahmani-kharsia-Dhamra Rivers; and Mahanadi delta rivers (consisting of Hansua river, Nunanala, Gobrinala, Kharnasi river, and Mahanadi river)	2008
NW8	Alappuzha-Changanassery Canal	Kuttanad River	2016

(Source: Inland Waterways Authority of India, Ministry of Ports, Shipping and Waterways, Govt. of India)

The Government of India has taken several initiatives for developing waterways in different parts of the country. The three important projects are explained below:

- a) **Sagarmala Project:** The project is Initiated in 2015 with an aim of comprehensive development of India's 7,500 km long coastline, and 14,500 km of potentially navigable waterways. It is the major initiation of the concept of port-led development. Port-led development focuses on logistics-intensive industries where transportation represents high costs and mostly on time bound.
- b) **Sethu-Samudram Project:** It is the most ambitious maritime project of India. It creates a new shipping lane connecting the Gulf of Mannar and Bay of Bengal through the Palk Strait and Palk Bay. The project was financed through equity contributions from state-run firms, including Sethusamudram Corporation Ltd. It is an artificial 167 km long, 300 m wide, and 12 m deep channel for the passage of ships with 10,000-12,000 gross tonnage across Adam's Bridge. This project was known to

be the Sethusamudram Canal project declared by the Government in 2005.

- c) **Jal Marg Vikas Project:** A Project on the river Ganga is called Jal Marg Vikas Project (JMVP). The time line set for the project completion is March 2023. The salient features of this project are the development of various infrastructure like construction of multi-modal terminals at Varanasi, Sahibganj, Haldia, Ro-Ro terminals and navigational lock at Farakka.

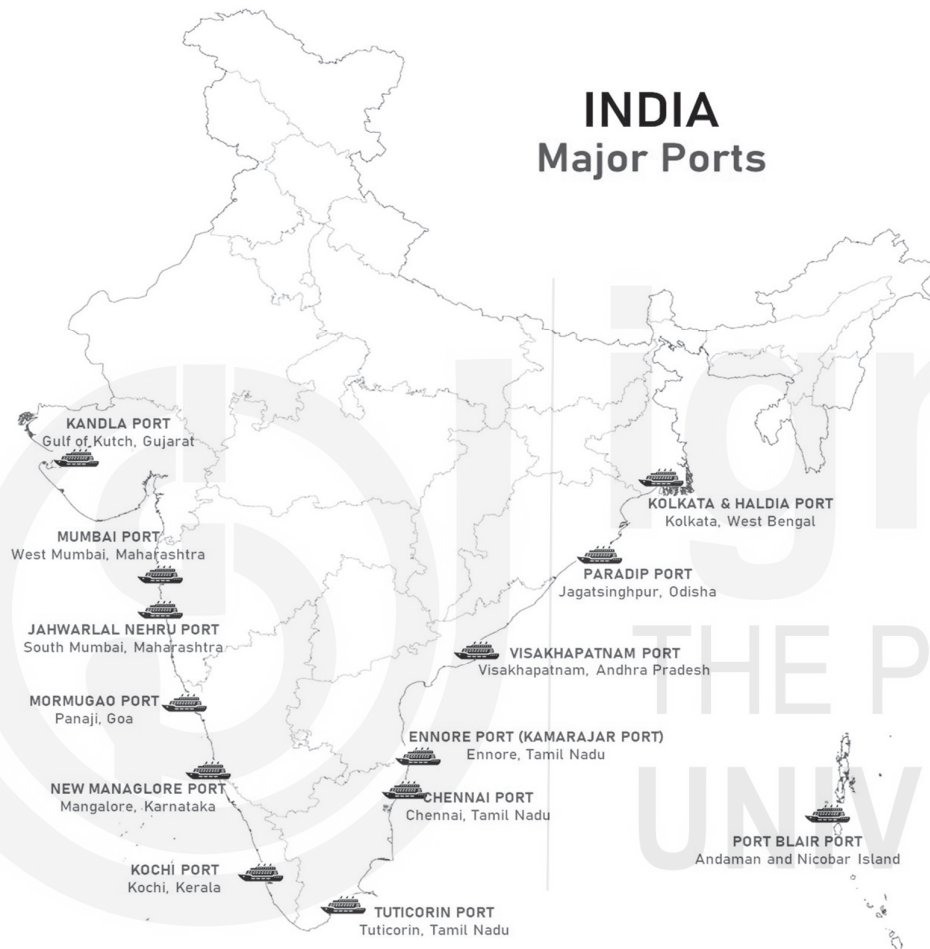


Fig. 13.2: Major Ports in India.

The main advantages of the water transport are energy efficiency, cheaper means of transport, engages in foreign trade, easy transportation of heavy and bulky material, low maintenance cost, and beneficial during natural calamities. Environmental impact of this transport system is slower than other means of transport. Water transport is able to cover only limited area, hence, it is the main disadvantage.

SAQ 2

Name the different kinds of waterways in India.

13.4 DEDICATED FREIGHT CORRIDORS

You have understood different types of modes of transport developed and are being utilized over a period of time in India. You will now study about dedicated freight corridors. **Dedicated freight corridors (DFCs)** are the high speed and high capacity railway corridors for freight transportation. It integrates better infrastructure and state of the art technology. It allows fast movement of goods from one location to another.

It is managed by the Ministry of Railways, Government of India. The main objective of DFCs is to provide an efficient freight transportation system. These are developed to meet the needs of growing movement of freight. The Dedicated Freight Corridor Corporation of India (DFCCIL) is now monitoring the dedicated freight corridors. It can broadly be divided into two types 1) Eastern Dedicated Freight Corridors and 2) Western Dedicated Freight Corridors. The DFCs have an automatic signaling process for every 2 kms, double line and absolute block system on single line.

1. Eastern Dedicated Freight Corridor

It connects Sahnewal (Ludhiana) in Punjab to the Dankuni in West Bengal with a length of 1839 km. It is being funded by the World Bank and it covers the states of Punjab, Haryana, Uttar Pradesh, Bihar, Jharkhand, and West Bengal. The route is connected as it has coal mines, thermal power plants and industrial cities around them. The major towns of the route are Dankuni, Gomoh, Sonnagar, Pandit Deen Dayal Upadhyaya Nagar, Kanpur, Khurja and Ludhiana.

2. Western Dedicated Freight Corridor

It is 1,500 kilometers long running from Dadri in Uttar Pradesh to Jawaharlal Nehru Port Trust in Mumbai along all major ports on its way. It runs through the states of Haryana, Rajasthan, Gujarat, Maharashtra, and Uttar Pradesh. It is being funded by the Japan International Cooperation Agency. The total length of this corridor is around 1516 km connecting Jawaharlal Nehru Port Trust- Ahmedabad-Palanpur-Rewari-Tughlakabad-Dadri urban centers.

There are other four corridors including North-South, East-West, South-South, and East-South planned for construction (Fig. 13.3).

You can understand by studying the salient features of dedicated freight corridors, which are given below:

- **Decongestion:** These routes will help in decongestion of the increased transportation demands and allow fast transportation within time.
- **Punctuality:** The freight services will be more punctual than before as passenger trains will be separated from the freight routes which will leave scope for better movement of goods and services.
- **Increased Capacity:** The DFC will change the scenario for freight movement as passenger trains movement hinders the efficiency of the freight movement. The goods will be moved without any restrictions and delay.

- **Business Generation:** DFC will be able to generate its own freight business as they are made to carry heavier loads than Indian Railways.
- **Revenue Generation:** These corridors will generate revenue and employment. The investment in DFC will allow infrastructural development around the corridors such as logistics parks, etc.

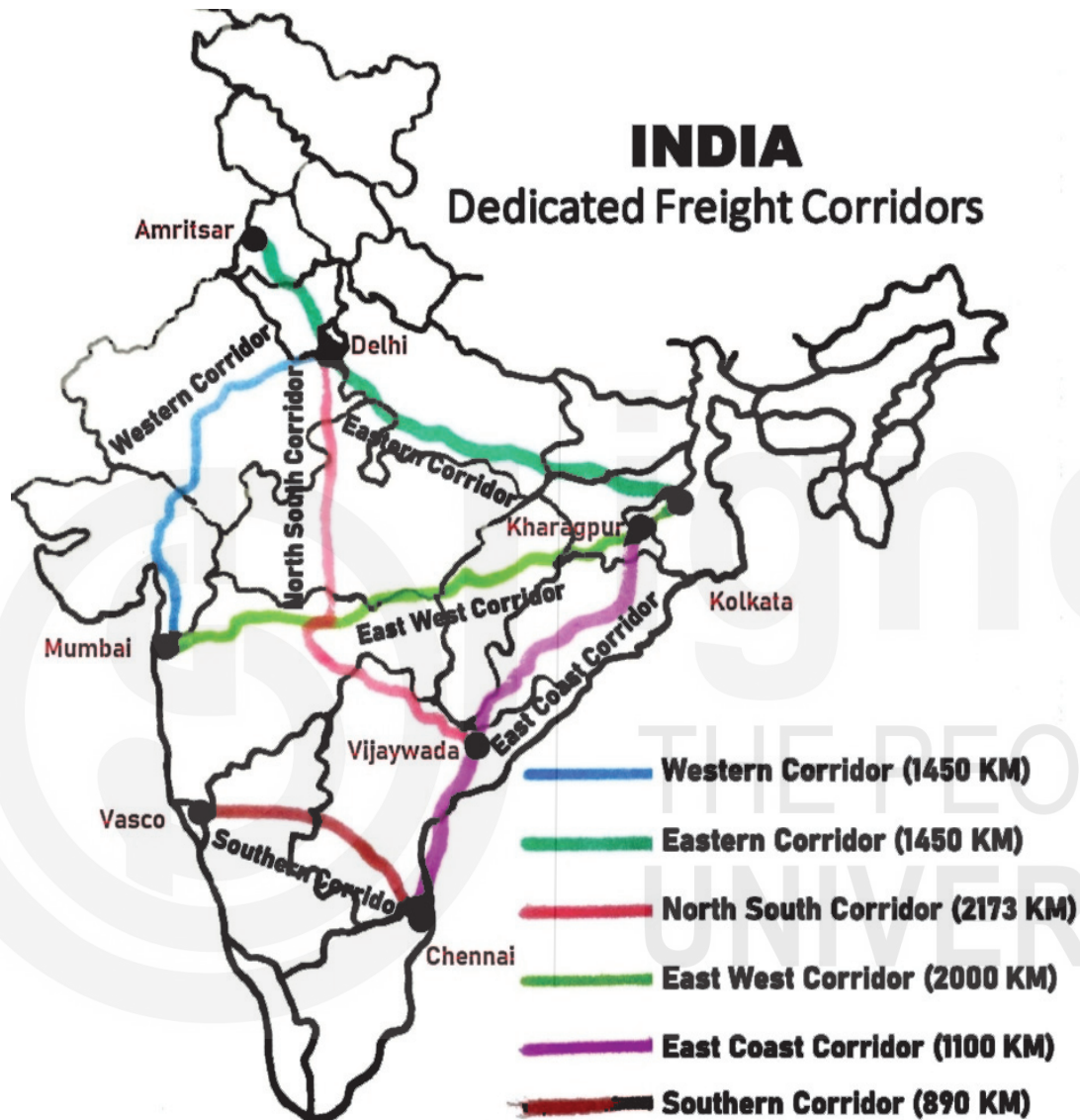


Fig. 13.3: Dedicated Freight Corridors of India.

SAQ 3

What are dedicated freight corridors?

13.5 RAPID MASS TRANSPORT SYSTEM

The **rapid mass transport system (RMTS)** is the movement of people using efficient and environmentally sustainable transportation systems that use personal rapid transit, metro rail, monorail, bus rapid transit system, etc. It makes transportation more efficient and cost-effective as it helps to move

people faster from one place to another. These corridors are seen as modes of urban mobility that can help the cities inclusive growth. It connects the peripheral areas or the zone of influence of the transport system. Cities or urban centers are zones of economic regions, which need massive investment in the transit system as they have a direct or indirect impact on the regional and national level development process. In India, the investments in RMTS are pretty low, which possess substantial environmental and economic cost to the country.

The rapid mass transit system can be classified into the following categories:

- **Bus-ways and Bus Rapid Transit System (BRTS):** These are the bus lanes dedicated for the movement of buses. It is an enhanced form of busway in which buses are given priority over other modes of transport.
- **Light Rail Transit (LRT):** LRT is an urban rail transit system focused on medium capacity local transportation in urban areas.
- **Tramways:** It is an environmentally friendly and reliable mode of transport in some cities but are often seen moving in mixed traffic situations. It is concerned with road safety issues and protection to passengers.
- **Metro Rail:** These are very high-capacity transport systems that are run electrically in a metropolitan region. Metro rails can be elevated or underground carriers for carrying approximately 10 to 40 lakh passengers in a day. However, Metro rails also include monorails with high maintenance costs and low capacity compared to metro rails.
- **Regional Rail:** It connects the peripheral region of the urban area. It gives service to passengers within the city and the outskirts of metropolitan area. It covers long distances with shorter halts. The speed of regional rail is comparatively higher than other RMTS.

The main advantages of Rapid Mass Transit System include the reduction in congestion, time saving, cost-effective, economic and viable, low environmental impact and social impacts while the disadvantages are expensive, labor strikes can cause dis-functioning of the system, safety concern, and diseases can spread quickly and accidents can cause casualties.

SAQ 4

What are the advantages of the Rapid Mass Transit System?

13.6 URBAN TRANSPORT

As you aware that the urbanization provides better facilities, but at the same time, we have also noted multiple problems resulting from the urbanization. The urbanization process has introduced several issues in the cities, especially transportation. As more and more populations migrate and live in cities, the importance of urban transport increases manifold to support these populations, leading to an increase in demand for efficient urban transport facilities. Urban transport is complex because of the mixture of modes and

infrastructure involved and a variety of traffic. Cities and urban centers are essential for consuming and producing goods and services, commercial activities, and leisure/cultural activities. We will study the spatial constraints of urban transportation and challenges of urban transport.

13.6.1 Spatial Constraints of Urban Transportation

During the pre-automobile era, about 10% of urban land was devoted to transportation that pedestrians occupied. Then, people started to migrate, contributing to the increase in urban transport infrastructure. Types and amounts of transit systems can vary from city to city and within cities. The major component of spatial constraints of urban transportation is as follows:

1. **Pedestrian Area:** The urban space allocated for walking is often more significant in the central part of the city and decreases away from the city's center.
2. **Roads and Parking Areas:** It covers moving road transport and parked road transport. In many cities, roads and parking areas account for 30% to 60% of the total surface of the urban transport area.
3. **Cycling Areas:** The cycling areas occupy the pedestrian and road space in urban areas. Many implementations have been done to make separate lanes for bicycling and parking facilities.
4. **Transit Systems:** The efficiency of the transport system in urban areas is impacted due to the heterogeneity of the transit system. Many infrastructural developments, such as subways, tramways, road lanes, etc., have been made to decongest the cities during peak hours.
5. **Transport Terminals:** It refers to the amount of urban space allocated to the terminal facilities such as ports, airports, rail yards, etc. With the opening up of the borders around the world, mobility increased manifold. The mobility of freight and passengers in the globalization era has impacted the urban share of transportation land.

13.6.2 Urban Transport Challenges

The transportation facilities in most of the cities pose an unhappy picture as they are engaged in heterogeneous economic activities. The urban areas are composed of a complex transportation system and infrastructure which is the major concern for the city expansion. When complexity increases, it brings a number of other problems too. In order to serve the urban areas more efficiently, the urban transport system has to be efficient enough to cater to the needs of the consumers. Some of the urban transport challenges are listed below:

- traffic congestion may lead to accidents;
- uncontrolled hawking on the roads;
- illegal encroachments cause to decreasing public spaces;
- parking difficulty due to mixture of vehicles;

- inadequacy of public transport and longer commuting hours;
- increasing of land footprint and difficulties for pedestrians;
- high energy consumption and environmental pollution;
- non-motorised transport infrastructure; and
- increase in motorization and high maintenance cost of transport infrastructure.

SAQ 5

What are the common urban transport challenges in any country?

13.7 SUMMARY

In this unit, you have studied so far:

- Transportation is the movement of goods and services from one place to another and it plays an important role in sustainable and efficient economic growth of a country.
- Many factors combined together influence the development of transportation networks in a region.
- Different modes of transportation in India are roadways, railways, airways, and waterways.
- Roadways are the cheapest and the fastest mode of transport over a short distance.
- Railways are the cheapest and fastest mode of transport over long distances at low cost.
- Airways connect the remotest and the inaccessible parts of the world within a shorter time frame. It is the fastest and the costliest mode of transportation.
- Waterways are suitable for the transportation of passengers and cargo traffic for shorter and longer distances. It is fuel efficient in nature.
- Dedicated freight corridors are for freight transportation at high speed and capacity. It helps in the faster movement of goods from one location to another.
- There are several challenges being faced by the urban transport system in India.

13.8 TERMINAL QUESTIONS

1. What is transport? Explain the development of transport network in India.
2. What are the different means of transportation in India? Give advantages of each one of them.

3. What are the spatial constraints and common urban transport challenges in any region?

13.9 ANSWERS

Self Assessment Questions (SAQ)

1. a) Historical, environmental, economic, physical, and political.
b) It helps in better production in agriculture and industrial sector, and reduces the cost of production and encourages trade and tourism.
2. Roadways, railways, waterways, and airways.
3. Dedicated freight corridors are the high speed and high capacity railway corridors designed for freight transportation.
4. It makes transportation more efficient and cost-effective.
5. Traffic congestion, uncontrolled hawking on the roads, and illegal encroachments, etc.

Terminal Questions

1. Refer to Section 13.2.
2. Refer to Section 13.3.
3. Refer to Section 13.6.

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9. <https://transportgeography.org/contents/chapter8/urban-transport-challenges/>; <https://indianrailways.gov.in/>



GLOSSARY

Cooperative Sector Industries	: These are owned and operated by the producers and suppliers of raw material, or workers.
Current Fallow	: It represents crop land which is kept uncultivated during the current year.
Dedicated Freight Corridor	: It is a high speed and high-capacity railway corridor that is exclusively meant for the transportation of freight.
Fallow Land	: The land which was under cultivation for certain time period.
Forest-based Industries	: Raw materials in these industries are derived from the forest products.
Green Revolution	: The cultivation started by adopting the modern agricultural methods and techniques including use of High Yield Variety seeds, pesticides, and fertilizers, and irrigation facilities.
HYV	: It stands for High Yield Variety which is related to high yielding seeds for example wheat, rice, jowar, bajra, and maize.
Industry	: Industry is concerned with the conversion of raw materials and manufacture of finished goods in factories.
Industrial Corridor	: It is a corridor that passes through states comprising multi-modal transport services.
Industrial Region	: The spatial distribution of manufacturing units in a specific area is called industrial region.
Kharif Season	: It corresponds to South-West monsoon during June to September.
Manufacturing	: It is the process in which goods are produced by processing raw materials into more valuable products.
Mineral-based Industries	: The industry which uses mineral ore is used as raw material.
Marine-based Industries	: Industries which are based on the raw materials from sea or ocean.
National Highway	: It connects major cities/ports/railway junctions and is controlled and governed by the National Highway Authority of India.
Net Sown Area	: The total proportion area under cultivation in a region.
Private Sector Industries	: These are owned and operated by an individual or group of individuals.

Public Sector Industries	: These are mainly owned and managed by the Government agencies for national and strategic importance.
Rabi Season	: It corresponds to winter season during October to March.
Rapid Mass Transit	: It is a system of urban transportation that can carry a large number of passengers quickly from one location to another.
State Highway	: It connects the national highway joining state's capitals and other towns that are managed by the respective State Governments.
Transport	: Transport is the movement of goods, animals, or humans from one location to another.
Zaid Season	: The season corresponds to summer months between rabi and kharif seasons.



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