

Civil Services

CHRONICLE

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VALUE Addition SPECIAL

INDIAN INDUSTRY

INFRASTRUCTURE

AND RESOURCES

For UPSC/State PSCs General Studies Prelims & Mains



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VALUE ADDITION SPECIAL

Indian Industry, Infrastructure & Resources



VALUE Addition SPECIAL

INDIAN INDUSTRY INFRASTRUCTURE & RESOURCES

For UPSC/State PSCs General Studies
Preliminary & Main Examinations

- This book offers a comprehensive coverage of various aspects related to three important segments of Indian Economy: Industry, Infrastructure and Resources.
- In all Prelims and Mains exams, questions are invariably asked from these segments.
- The content provided herein arms the readers with valuable, exam-oriented insights that will add significant value to their preparation.
- The inputs from different facets/dimensions will help write high-scoring answers in the Mains exams.

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Compiled by

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INDIAN INDUSTRY

- **Industrial Evolution in India**
- **Major Industries in India**
- **Micro, Small and Medium Enterprises in India**
- **Special Economic Zones**

Industrial Evolution in India

Industrial evolution in India refers to the country's gradual transformation from an agrarian to an industrial economy. This transformation began during the colonial era when India served as a raw material supplier for the British Empire.

- ❑ The first phase of industrialization in India started in the mid-19th century with the establishment of the textile industry. The industry was set up by British entrepreneurs who brought in modern technology and capital to set up textile mills in Bombay, Ahmedabad, and other cities.
- ❑ During the early 20th century, Indian entrepreneurs also began to invest in the industrial sector. The government of India also played a significant role in promoting industrialization by setting up infrastructure, providing financial assistance, and implementing policies that supported the growth of industry.
- ❑ After independence in 1947, the government of India adopted a policy of planned development, with a focus on industrialization.
- ❑ The establishment of public sector enterprises, development of basic industries like steel, coal, and power, and the liberalization of trade policies in the 1990s further accelerated the pace of industrialization in India.

Today, India is one of the fastest-growing economies in the world, with a diversified industrial base that includes sectors like information technology, pharmaceuticals, automobiles, textiles, engineering goods and many more. The country has also emerged as a major exporter of goods and services and has attracted significant foreign investment in recent years.

Meaning of Industrialization

Industrialization is the process by which an **economy is transformed from being primarily agricultural to one based on the manufacturing of goods.**

- ❑ In this process, manual labour is often replaced by **mechanized mass production**, and craftsmen are replaced by assembly lines.
- ❑ Characteristics of industrialization include:
 - economic growth,
 - more efficient division of labour, and
 - use of technological innovation to solve problems as opposed to dependency on conditions outside human control.

- ❑ Industrialization is most commonly associated with the **European Industrial Revolution** of the late 18th and early 19th centuries.
- ❑ The **onset of the Second World War also led to a great deal of industrialization**, which resulted in the growth and development of large urban centres and suburbs.
- ❑ **Industrialization is an outgrowth of capitalism**, and its effects on society are still undetermined to some extent; however, it has resulted in a lower birth-rate and a higher average income.

Industrial Revolutions: Shaping the World

The Industrial Revolution involved technological, socio-economic and cultural changes. The technological changes included the following:

1. Use of new basic materials, chiefly **iron and steel**,
2. Use of **new energy sources**, including both fuels and motive power, such as coal, the steam engine, electricity, petroleum, and the internal-combustion engine,
3. **Invention of new machines**, such as the spinning jenny and the power loom that permitted increased production with a smaller expenditure of human energy,
4. A new organization of work known as the **factory system**, which entailed increased division of labour and specialization of function,
5. **Important developments in transportation and communication**, including the steam locomotive, steamship, automobile, airplane, telegraph, and radio, and
6. Increasing **application of science** to industry.

These technological changes made possible a tremendously increased use of natural resources and the mass production of manufactured goods. Right now, we are going through the fourth industrial revolution (Industry 4.0). Given below is a brief account of all the four industrial revolutions:-

I. The First Industrial Revolution

- The first industrial revolution (1780s to 1850s) followed the **proto-industrialization** period.
- The biggest changes came in the industries in the **form of mechanization**. Mechanization was why agriculture started to be replaced by the industry as the backbone of the economy.

Major Industries in India

Industry refers to an economic activity that is concerned with production of goods, extraction of minerals or the provision of services. India is a diverse and dynamic country with a thriving industrial sector that contributes significantly to its economic growth and development.

The country has a vast array of industries that caters to domestic and international markets, ranging from traditional industries such as textiles and food processing to modern industries such as information technology and biotechnology.

India's Major Industries

Some of the major industries in India include the following:

- ❑ **Textiles:** The **textile industry is one of the oldest** and most important industries in India, contributing significantly to the country's export earnings. India is the world's second-largest producer of textiles and garments, with a wide range of products ranging from cotton, silk, and wool to synthetic fibers.
- ❑ **Food Processing:** The food processing industry in India includes a wide range of activities, such as the **processing, packaging, and distribution of food products**. The industry covers a variety of products, including fruits and vegetables, meat and poultry, dairy products, confectionery, snacks, and beverages.
- ❑ **Information Technology (IT):** The IT industry is a **rapidly growing sector** in India, contributing significantly to the country's GDP and providing employment to millions of people. India is a global leader in IT services, software development, and back-office operations.
- ❑ **Automotive:** The automotive industry is one of the fastest-growing industries in India, driven by rising demand and increasing consumer purchasing power. India is one of the world's largest producers of two-wheelers, and it is also a significant producer of passenger vehicles, commercial vehicles, and tractors.
- ❑ **Pharmaceuticals:** The pharmaceutical industry is a crucial sector of the Indian economy, providing affordable healthcare solutions to people in India and other countries. **India is the world's largest producer of generic drugs** and a significant player in the global pharmaceutical market.
- ❑ **Energy:** The energy sector is critical to India's economic growth and development, and the country is one of the world's largest consumers of energy. India has made significant progress in renewable energy, particularly solar and wind energy, in recent years.

Classification of Industries

Industries can be classified on the basis of source of raw materials, size, ownership, finished products etc.

On the Basis of Source of Raw Materials

- ❑ **Agro based Industries:** This type of industries use plant and animal based products as their raw materials. Food processing, vegetable oil, cotton textile, dairy products and leather industries are examples of agro-based industries.
- ❑ **Mineral based Industries:** These are primary industries that use mineral ores as their raw materials. The products of these industries feed other industries. Iron made from iron ore is the product of mineral based industry. This is used as raw material for the manufacture of a number of other products, such as heavy machinery, building materials and railway coaches.
- ❑ **Marine based Industries:** These industries use products from the sea and oceans as raw materials. Industries processing sea food or manufacturing fish oil are some examples.
- ❑ **Forest based Industries:** These industries utilize forest produce as raw materials. The industries associated with forests are pulp and paper, pharmaceuticals, furniture and buildings.

On the Basis of Size

- ❑ **Small Scale Industries:** Small scale industries use lesser amount of capital and technology as compared to large scale industries that produce large volumes of products.
 - **Cottage or household industries** are a type of small scale industry where the products are manufactured by hand, by the artisans.
 - **Basket weaving, pottery and other handicrafts** are examples of cottage industry. Silk weaving and food processing industries are small scale industries.
- ❑ **Large Scale Industries:** Investment of **capital is higher and the technology used** is superior in large scale industries. Production of automobiles and heavy machinery are large scale industries.

Micro, Small and Medium Enterprises in India

MSME stands for Micro, Small and Medium Enterprises. It refers to businesses that fall within a certain size range in terms of their investment and number of employees. The definition of MSMEs may vary from country to country.

Micro, Small and Medium Enterprises (MSMEs) are an essential component of the Indian economy, contributing significantly to employment generation and economic growth. The MSME sector comprises a vast network of businesses, ranging from small cottage industries to large-scale manufacturing units.

- ❑ These enterprises play a crucial role in driving innovation, promoting entrepreneurship, and enhancing competitiveness in the Indian economy. MSMEs also contribute significantly to exports, with many businesses in this sector exporting their products to various parts of the world.
- ❑ The Indian government has recognized the importance of MSMEs and has taken several measures to promote and support their growth.
- ❑ The Micro, Small, and Medium Enterprises Development (MSMED) Act, 2006, was enacted to provide a legal framework for the promotion and development of MSMEs in India.
- ❑ The Act defines MSMEs based on their investment in plant and machinery or equipment and provides various benefits to these enterprises, such as easier access to credit, preference in government procurement, and subsidies on technology upgradation.
- ❑ In addition to the MSMED Act, the Indian government has launched several schemes and programs to support MSMEs, such as the Prime Minister's Employment Generation Programme (PMEGP), Credit Guarantee Fund Trust for Micro and Small Enterprises (CGTMSE), and Technology Upgradation Fund Scheme (TUFS). These schemes provide financial assistance, training, and technology upgradation support to MSMEs.

Evolution of MSMEs in India

The evolution of MSMEs in India can be traced back to the pre-independence era when small-scale industries were prevalent in the country. However, it was only after independence that the government started taking measures to promote and support the growth of MSMEs.

- ❑ **In the 1950s**, the government launched the Industrial Policy Resolution, which aimed to develop a strong and

self-reliant industrial base in the country. As part of this policy, the government provided various incentives and subsidies to small-scale industries.

- ❑ **In the 1970s**, the government introduced the Small Industries Development Organization (SIDO) to promote the growth of MSMEs.
- ❑ **In the 1980s**, the government launched the National Small Industries Corporation (NSIC) to provide marketing support and technological assistance to MSMEs. The government also introduced the Credit Guarantee Fund Scheme for Small Industries to provide collateral-free credit to MSMEs.
- ❑ **In the 1990s**, the government initiated economic liberalization policies, which led to the entry of foreign companies into the Indian market. To promote the growth of domestic MSMEs, the government introduced the Technology Upgradation Fund Scheme to help them upgrade their technology and become more competitive.
- ❑ **In 2006**, the government enacted the Micro, Small and Medium Enterprises Development (MSMED) Act to provide a legal framework for the promotion and development of MSMEs in India. The Act provided various benefits and incentives to MSMEs, such as easier access to credit, preference in government procurement, and subsidies on technology upgradation.
- ❑ **In recent years**, the government has launched several initiatives to support the growth of MSMEs, such as the Prime Minister's Employment Generation Programme (PMEGP) and the Startup India programme. These initiatives aim to promote entrepreneurship, innovation and create employment opportunities in the country.

Phases of MSMEs' Evolution in India

State intervention in the development of small sector industries after independence may be broadly divided into the pre-liberalization period (1948 to 1991) and the post-liberalization period (1991 onwards).



Although a kind of restrictive and protective policy was maintained for more than half of a century for the country's industrial sector until the process of economic liberalization was initiated in 1991, the small scale industry sector was always given due importance in all the industrial policy resolutions.



Special Economic Zones

A Special Economic Zone (SEZ) is a specifically delineated duty-free enclave, deemed to be foreign territory for the purposes of trade operations, duties and tariffs. It is a geographical region that has economic laws that are more liberal than a country's domestic economic laws. It is a policy tool used by governments to attract foreign investment and boost exports by providing businesses with incentives and facilities to operate in a more favourable environment.

- ❑ SEZs are typically created in order to facilitate rapid economic growth by leveraging tax incentives to attract foreign investment and spark technological advancement.
- ❑ SEZs in India are designed to provide world-class infrastructure, state-of-the-art facilities, and a conducive business environment to attract foreign investment and boost exports. They offer various incentives such as tax holidays, duty-free imports of capital goods and raw materials, and exemption from various taxes and duties.
- ❑ They also provide several other benefits, such as simplified procedures for setting up and operating businesses, and streamlined regulatory processes.
- ❑ SEZs in India are developed and managed by private players or public sector undertakings, and they typically focus on specific sectors such as manufacturing, IT, and biotechnology.

Need for SEZs

The prime objective behind establishment of SEZs is to **augment foreign investment** in the country while providing an internationally competitive & hassle-free environment for the exporters in India.

- ❑ The presence of **SEZs in a country not only promotes export from a country** but also ensures a level playing field for domestic enterprises and manufacturers, for them to be able to scale to the global competition.
- ❑ SEZs help in balancing the growth of the economy and enhance economic activities such as:
 - ❑ Rapid economic growth,
 - ❑ Better employee opportunities,
 - ❑ Improved foreign export,
 - ❑ Enhanced brand value, and
 - ❑ Better revenue collection.

Different Types of SEZs

Export Processing Zones (EPZ)

- ❑ It refers to an area that **allows aggressive economic activity** in the form of tax cuts, fiscal incentives, and other benefits to revive weakening export business.

Free Zones (FZ)

- ❑ It is an area where immigration, visa, customs and taxation are relaxed.

Free Trade Zones (FTZ)

- ❑ It refers to a particular area within a country **where normal trade requirements such as taxes, tariffs, and quotas** are either reduced or relaxed to attract investment.

Industrial Parks or Industrial Estates (IE)

- ❑ Also known as trading estate, it is an **area planned for industrial development**.
- ❑ A lighter version of industrial park is the business park or the office park, where there are lighter industries such as offices.
- ❑ These areas are located away from the city's main residential area but close to transport facilities such as highways, airports, railroads and ports.

Free Ports (FP)

- ❑ It refers to a **special customs area** with relaxed customs regulations or no customs duties or controls for transshipment.

Urban Enterprise Zones (UEZ)

- ❑ It refers to an **area free of certain local, state and federal taxes and restrictions**.
- ❑ Located in the industrial or commercial areas of a city, the sales tax rate within this zone would be half compared to other parts and the incentives would be much higher.
- ❑ This is done to revive the business climate of a city that has been shattered by economic problems.

Evolution of SEZs in India

Phases of Development of SEZs in India

- ❑ **India was one of the first in Asia to recognize the effectiveness of the Export Processing Zone (EPZ) model in promoting exports, with Asia's first EPZ set up in Kandla in 1965.**
- ❑ These were **manufacturing-based zones of EPZ variety**, all created by the central government. Their primary objective was to promote exports and earn foreign exchange in an import substituting regime.
- ❑ India's SEZ programme largely stagnated in the 1960s and the 1970s. In the 1990s, in the context of economic liberalization, many of the controls that had stymied SEZ operations were removed.

INFRASTRUCTURE

- **Infrastructure**
- **Transport Infrastructure in India**
- **Communication Infrastructure in India**
- **Social Infrastructure**
- **Digital Infrastructure in India**
- **Space Infrastructure in India**

Infrastructure

Infrastructure refers to the basic physical and organizational structures and facilities needed for the efficient functioning of a society. It includes transportation systems, power supply, communication networks, water supply, and housing, etc. In India, infrastructure has been a critical factor in promoting economic growth, creating employment opportunities, and improving the standard of living.

- ❑ India has made significant progress in developing its infrastructure over the past few decades. The country has undertaken massive infrastructure development programs, including the construction of highways, railways, airports, ports, and power plants. These efforts have been aimed at creating a modern and robust infrastructure network that can support sustained economic growth and development.
- ❑ In recent years, the Government of India has launched several initiatives and programs aimed at addressing these challenges. These initiatives include the Atal Mission for Rejuvenation and Urban Transformation (AM-RUT), Smart Cities Mission, Bharatmala Pariyojana, and Sagarmala Project, among others.
- ❑ These programs aim to improve infrastructure in different areas, such as urban development, transportation, and ports.
- ❑ Improving infrastructure is a critical component of India's development agenda. A modern and robust infrastructure network is essential for attracting investment, creating employment opportunities, and improving the standard of living of the people. Therefore, it is important to understand the challenges and opportunities in India's infrastructure sector to fully appreciate its impact on the country's economic growth and development.

Concept of Infrastructure

Infrastructure refers to the fundamental facilities and systems serving a country, city, or other area, including the services and facilities necessary for its economy to function.

- ❑ Infrastructure means those **basic facilities and services** which facilitate different economic activities and thereby help in economic development of the country. Education, health, transport and communication, banking and insurance, irrigation and power and science and technology, etc. are the examples of infrastructure. These are also called **social overhead capital**.
- ❑ Infrastructure is composed of **public and private physical components** such as roads, bridges, tunnels, water supply, sewers, electrical grids, and telecommunications (including Internet connectivity and broadband speeds).
- ❑ **In general, it has also been defined as “the physical components of interrelated systems providing commodities and services essential to enable, sustain, or enhance societal living conditions”.**

Types of Infrastructure

Broadly speaking, infrastructure can be divided into two categories:

- ❑ **Economic Infrastructure:** Economic infrastructure means those basic facilities and services which directly benefit the process of production and distribution of an economy. Irrigation, power, transport and communication are the examples of economic infrastructure.
- ❑ **Social Infrastructure:** Social infrastructure means those basic activities and services which, in addition to achieving certain social objectives, indirectly help various economic activities.

Benefits of Infrastructure		
	Economic Growth	Poverty Reduction
Transportation	Faster access to destinations, increase in productivity	More reliable access to markets so that fresher goods can be sold at lower wastage levels
Water and Sanitation	Incentives for construction of facilities and residential infrastructure, which in turn promote economic growth	Improved health, reduction in health related spending, potential increase in income and savings
Telecommunications	Improved access and transfer of data, leading to reduced travel times and increase in productivity	Increased access to information leading to improved ability to make decisions on issues like selling price of produce, etc.
Energy	24-hour electricity supply increases the duration of the productive working day	Augments income, increases agricultural yield, etc.

Transport Infrastructure in India

A well-knit and coordinated system of transport plays an important role in the sustained economic growth of a country. The transport system of the country comprises several modes including rail, road, shipping, and air transport, etc.

- ❑ For sustained economic growth, India requires improved transport infrastructure, including investments in roads, railways, aviation, shipping and inland waterways.
- ❑ Development of infrastructure has a multiplier effect on demand and efficiency of transport and increases commercial and entrepreneurship opportunities.
- ❑ India has the second-largest road network in the world, spanning a total of 6.6 million kilometres (kms). This road network transports 64.5% of all goods in the country and 90% of India's total passenger traffic uses road network to commute. Road transportation has gradually increased over the years with improvement in connectivity between cities, towns and villages in the country.
- ❑ India's railway network is recognised as one of the largest railway systems in the world under single management. The railway network is also ideal for long-distance travel and movement of bulk commodities, apart from being an energy-efficient and economic mode of conveyance and transport.

Land Transport in India

Road Transport

- ❑ Roads play an **important role in the transportation of goods and passengers** over short and medium distances. The road transportation infrastructure allows for simple communication between farms, fields, factories, and markets, as well as door-to-door service.
- ❑ **India has the second largest road network in the world**, spanning about 66.71 Lakh km, which includes national highways, state highways, district roads, and rural roads. This extensive network ensures connectivity across various regions of the country.
- ❑ **National Highways (NH)** play a very important role in the economic and social development of the country by enabling efficient movement of freight and passengers and improving access to market. **They account for 2% of the total road network and carry over 40% of total traffic.**
- ❑ The Indian Government has been actively investing in the development of road infrastructure. Major initiatives

like the **Bharatmala Pariyojana** aim to upgrade and expand the road network, including the construction of expressways, economic corridors, and feeder routes. The first phase of the programme will develop **34,800 km of highways**, including **27 Greenfield corridors and India's largest expressway (1,386-km long Delhi-Mumbai Expressway)**. Under the Pariyojana, 60% projects have been envisaged on Hybrid Annuity Mode (HAM), 10% projects on BOT (Toll) Mode, and 30% projects on EPC mode.

- ❑ The roads and highways sector has pioneered several innovative public-private partnership (PPP) models besides having a strong contractual framework compared with other sectors.
- ❑ These factors have led to significant investments from private players in the sector.
- ❑ Several incentives have also been announced by the Government to attract private sector participation and foreign direct investment, which include Government bearing the cost of project feasibility study, land for the right of way and wayside amenities, shifting of utilities, environment clearances, etc.
- ❑ **100% FDI in roads and highways is allowed under automatic route.**

Current Status

- ❑ As per **Economic Survey 2023-24**, the capital investment by the Government and private sector rose from 0.4 per cent in FY15 to about 1.0 per cent of GDP (around Rs.3.01 lakh crore) in FY24.
- ❑ The sector has attracted its **highest-ever private investment in FY24** as the private sector capitalises on a conducive policy environment.
- ❑ Further, tapping on the private investment, funds garnered through asset monetisation in the roads sector have **exceeded Rs.1 lakh crore since FY19**.
- ❑ Notably, the Government **achieved its highest-ever asset monetisation revenues of Rs.40,314 crore in FY24**.
- ❑ Over the last ten years, there has been significant progress in the development of national highways, **increasing by 1.6 times from 2014 to 2024**.
- ❑ The Bharatmala Pariyojana has significantly expanded the national highway network, increasing the length of high-speed corridors by **12 times and 4-lane roads by 2.6 times between 2014 and 2024**.

Communication Infrastructure in India

India's communication infrastructure is a vital component of its rapid modernisation and economic growth. The country's network encompasses a vast array of technologies, including telecommunications, broadband, and satellite systems.

With one of the largest mobile user bases globally, India has seen a significant expansion in both mobile and internet connectivity over recent years. The government's push towards digitalization, exemplified by initiatives like Digital India, aims to enhance connectivity across urban and rural areas alike. This infrastructure supports a range of services, from mobile communication to high-speed internet and digital broadcasting. Overall, India's communication infrastructure is both a cornerstone of its economic development and a key area for continued investment and innovation.

Telecommunication Infrastructure

Current Status

Second Largest in the World

- The Telecom industry in India is the second largest in the world with a subscriber base of 1.094 Bn as of May 2024 (wireless + wireline subscribers).

Tele-density

- As per Economic Survey 2023-24, the overall tele-density (number of telephones per 100 population) in India increased from 75.2 per cent in March 2014 to 85.7 per cent in March 2024.
- The number of wireless telephone connections stood at 116.5 crore at the end of March 2024.

Internet Subscribers

- The Government has placed considerable emphasis on the growth of internet and broadband as part of the Digital India campaign.
- As a result, internet subscribers jumped from 25.1 crore in March 2014 to 95.4 crore in March 2024, of whom 91.4 crore are accessing the internet via wireless phones.

Total Telephone Connections

- Total telephone connections rose to 1203.69 Mn in May 2024 from 933 Mn in Mar 2014, with a growth of 29.01 % in the said period.
- Urban telephone connections rose to 665.89 Mn in Apr 2024 from 555.2 Mn in March 2014, a growth of 19.9%

while the growth in rural telephone connections was 42.3%, which is double of urban increase, rising from 377.8 Mn in March 2014 to 537.8 Mn in Apr 2024.

4th Largest Sector in Terms of FDI Inflows

- The Telecom sector is the 4th largest sector in terms of FDI inflows, contributing 6% of total FDI inflow, and contributes directly to 2.2 Mn employment and indirectly to 1.8 Mn jobs.
- Between 2014 and 2021, the FDI inflows in the Telecom sector rose by 150% to \$20.72 Bn from \$8.32 Bn during 2002-2014.
- 100% Foreign Direct Investment (FDI) has now been allowed in the Telecom.

Government Initiatives

The Government has fast-tracked reforms in the telecom sector and continues to be proactive in providing room for growth for telecom companies. Some of the key initiatives taken by the Government are as follows:

Introduction of 5G Technology

- The Government of India intends to establish one hundred labs for creating applications using 5G services in engineering universities as part of the Union Budget 2023, in order to realize a new range of possibilities, business models, and job potential.
- Government launched 5G services on October 1, 2022.
- 5G technologies is the next generation of mobile networking standards and promises to deliver an improved end-user experience by offering new applications and services through seamless coverage, a high data rate, low latency, significantly improved performance, and reliable communications.

Production Linked Incentive (PLI) Scheme

- The Union Cabinet had given its approval to introduce the Production-Linked Incentive (PLI) Scheme in Telecom & Networking Products sector for Enhancing India's Manufacturing Capabilities and Enhancing Exports – Atmanirbhar Bharat.
- In June 2022, the Department of Telecommunications (DoT) amended the guidelines for PLI Scheme to introduce Design-led Manufacturing Scheme as part of the PLI Scheme with additional incentives worth more than INR \$533.33 Mn.

Social Infrastructure

Social infrastructure comprises of the facilities, spaces, services and networks that support the quality of life and wellbeing of our communities. It helps us to be happy, safe and healthy, to learn, and to enjoy life. Social infrastructure plays a vital role in ensuring the social welfare of the citizens. Access to education, healthcare, and public transportation is essential for individuals to lead a healthy and fulfilling life.

- ❑ Social infrastructure also promotes social inclusion and cohesion, creating a sense of community and fostering social interactions.
- ❑ Unlike economic infrastructure, which focuses on physical infrastructure such as roads, ports, and power grids, social infrastructure is concerned with intangible assets that support human development and quality of life.
- ❑ The education infrastructure, health care facilities and other civic amenities are some of the basic components of social infrastructure.
- ❑ Social services are another essential component of social infrastructure. Social services include a wide range of programs and services designed to support individuals and families in need, including programs for housing assistance, food security, and financial assistance.
- ❑ Social services are critical for promoting social equality, addressing poverty, and providing a safety net for the most vulnerable sections of the society.

Constitutional Provisions for Social Infrastructure in India

- Under **Directive Principles of State Policy (DPSP)**, the Constitution of India makes it the duty of the state to work for citizen's welfare.
- **Article 42:** Provision for securing just and humane conditions of work and for maternity relief.
- **Article 47:** Duty of the State to raise the level of nutrition and the standard of living and to improve public health.
- **Article 21A:** Provision for free and compulsory education for children.
- **Article 39(b):** Encourages distribution of material resources to subserv the common good.
- **Article 39(c):** Emphasises that economic system should not result in the concentration of wealth.
- Under **Seventh Schedule**, public health and sanitation is placed in State List whereas education, welfare of labour including conditions of work is in Concurrent List.

Significance of Social Infrastructure

- ❑ **Human Development:** Social infrastructure reduces poverty and inequality. It also leads to expansion of opportunities and choices of people.
- ❑ **Economic Growth:** It forms the foundational services and structures that contribute to economic development through increased income, better productivity, and technological advancement.
- ❑ **Better Quality of Life:** It includes policies, programmes, projects, schemes, and services of the government, and also the network of facilities, spaces, institutions and groups aimed at increasing the quality of life and living standard of the people.
- ❑ **Productive Efficiency of Human Resources:** An economy with better health and skill level is more productive.
- ❑ **Inclusive Growth:** Social Infrastructure plays a pivotal role in promoting equality and inclusive growth. It reduces sense of alienation among citizens by creation of liveable and inclusive settlements where social and economic benefits also accrue to the marginalised groups such as poor, women, children, persons with disability etc.
- ❑ **Achieving SDGs:** It helps in achievement of Sustainable Development Goals (SDGs) by adoption of eco-friendly practices such as reducing carbon footprints, promoting resilience to climate change.

Social Infrastructure: Key Segments

A. Health, Water and Sanitation Infrastructure

Drinking-water encompasses water used for drinking, cooking and personal hygiene. Water safety and quality are fundamental to human development and well-being. Providing access to safe water is one of the most effective instruments in promoting health and reducing poverty.

- ❑ Health risks may arise from consumption of water that is contaminated with infectious agents, toxic chemicals, and radiological hazards. Contaminated water and poor sanitation are linked to transmission of diseases such as cholera, diarrhoea, dysentery, hepatitis A, typhoid, and polio.
- ❑ Absent, inadequate, or inappropriately managed water and sanitation services expose individuals to preventable health risks.

Digital Infrastructure in India

Digital infrastructure has emerged as an equally or arguably a more significant necessity, as compared to the traditional infrastructural necessities such as power, water, and roads. The COVID-19 pandemic did not only shuffle the global order, but it also provided an impetus to the ever expanding digital infrastructure.

Economies across the globe are charting ways to make their digital infrastructure more resilient, agile, and futuristic. The digital infrastructure has become indispensable to the functioning of the society and the quality of life of its citizens.

What is Digital Infrastructure?

- Digital infrastructure refers to the underlying technological systems and networks that support the delivery of digital services and applications.
- It includes hardware, software, and communication technologies that enable data storage, processing, and transmission over the internet.

Some Key Features of Digital Infrastructure Include:

- **Hardware:** Digital infrastructure includes physical hardware such as servers, data centers, storage devices, and networking equipment that support the delivery of digital services.
- **Software:** It also includes software systems such as operating systems, middleware, and other software components that enable data processing, storage, and communication.
- **Communication Technologies:** Digital infrastructure relies on communication technologies such as broadband internet, fiber optic cables, wireless networks, and satellite systems to connect devices and transfer data.
- **Scalability:** Digital infrastructure should be designed to scale, allowing for adding or removing computing resources as demand for digital services and applications fluctuates.
- **Reliability:** Digital infrastructure should be reliable and resilient, with redundancy built into the system to ensure continuous operation even in the event of hardware or software failures.
- **Security:** Digital infrastructure must be secure, with robust measures in place to protect against cyber threats and unauthorized access to data.

Indian Context

- With nearly 820 million internet users in India, a host

of indigenous digital services, platforms, applications, content, and solutions, are expected to **transform the digital ecosystem**.

- India could potentially see a fivefold increase in economic value from digital transformation by 2025, representing an attractive opportunity for global and local businesses, startups, and innovators to invest in emerging technologies (like AI, Blockchain, or drones) in ways that are customised to India's needs.
- The rapid adoption of frontier technologies such as **Artificial Intelligence (AI), Blockchain, Internet of Things (IoT)** has placed the entire digital infrastructure under immense pressure.
- With the Government of India progressively working towards goals such as Smart Cities and Smart Health, it is crucial for the nation to augment its digital infrastructure to effectively utilise the frontier technologies in economic development.

Importance of Digital Infrastructure

Fostering Economic Development

- Digital infrastructure plays a vital role in **fostering economic growth** by facilitating productivity enhancements, promoting innovation, and enabling new business models.
- High-speed internet connectivity, reliable telecommunications networks, and efficient data infrastructure are essential components that **enable businesses to operate more efficiently, access global markets**, and leverage digital technologies for growth.
- Moreover, digital infrastructure serves as a **catalyst for entrepreneurship and job creation**, enabling the emergence of digital startups and fostering a vibrant ecosystem of innovation and creativity.

Enhancing Social Inclusion and Access to Services

- Digital infrastructure plays a crucial role in **enhancing social inclusion by providing access to essential services such as education, healthcare, and financial services**.
- Through digital platforms and mobile technologies, individuals in remote and underserved areas can access educational resources, receive telemedicine services, and participate in e-commerce activities, thereby **bridging the digital divide and empowering marginalized communities**.

Space Infrastructure in India

Space infrastructure refers to the physical and organizational components which are necessary to support human activities and operations in space. This infrastructure is critical for various space-related endeavours, including scientific research, communication, navigation, national security, and commercial ventures.

India's space infrastructure has undergone remarkable growth in recent years, solidifying its position as a key player in the global space industry. From launch vehicles and satellites to ground stations and research facilities, India has built a robust system capable of supporting a diverse range of space activities.

- ❑ India's space activities began in 1962 with the establishment of the Indian National Committee for Space Research (INCOSPAR).
- ❑ In 1969, the Indian Space Research Organisation (ISRO) was formed, superseding INCOSPAR.
- ❑ Subsequently, in 1972, the Department of Space (DOS) was created to oversee the development and application of space technology to meet various national needs.
- ❑ There are collaborations between government agencies and private parties for manufacturing parts of satellites and their launchers. For instance, PSLV-C53 is the first official public-private collaboration for a space launcher in India.

Current Status of Space Infrastructure

Presently, India has 55 active space assets which include 18 communication satellites, nine navigation satellites, five scientific satellites, three Meteorological Satellites, and 20 Earth Observation satellites.

- ❑ In addition to existing Launch Vehicles with ISRO viz. Polar Satellite Launch Vehicle (PSLV) and Geosynchronous Satellite Launch Vehicle (GSLV), the organization has added two more to its fleet i.e., Launch Vehicle Mark-3 (LVM3) and the Small Satellite Launch Vehicle (SSLV).
- ❑ The current size of the Indian Space Economy is estimated around \$8.4 billion (around 2-3% of global space economy) and it is expected that with the implementation of the Indian Space Policy 2023, \$44 billion Indian space economy can be achieved by the year 2033.
- ❑ **ISRO is the 6th largest space agency** in the world and holds an exceptional success rate.

- ❑ With over 400 private space companies, India ranks fifth globally in terms of number of space companies.
- ❑ ISRO has signed six agreements with four countries for launching foreign satellites between 2021- 2023.
- ❑ India is **the 27th country to sign the Artemis Accords**, which establishes a practical set of principles to guide space exploration cooperation among nations participating in NASA's Artemis program.
- ❑ Indian start-ups are taking active interest in the space market, from just 1 start-up in space sector in 2012; industry has grown to **189 start-ups in 2023**.
- ❑ The funding received by these start-ups reached a total of **\$124.7 Mn in 2023 from \$67.2 Mn in 2021**.

Space Infrastructure: Institutional Framework

Department of Space (DOS)

It is a department of Government of India, responsible for administration of the Indian space programme.

- ❑ DOS has the primary objective of promoting development and application of space science and technology to assist in all-round development of the nation.
- ❑ Towards this, DoS has evolved the following programmes:
 - Launch Vehicle programme having indigenous capability for launching spacecrafts.
 - INSAT Programme for telecommunications, broadcasting, meteorology, development of education, etc.
 - Remote Sensing Programme for application of satellite imagery for various developmental purposes.
 - Research and Development in Space Sciences and Technology for serving the end of applying them for national development.

Indian Space Research Organisation (ISRO)

ISRO, India's space agency, is involved in science, engineering and technology to harvest the benefits of outer space for India and the mankind.

- ❑ ISRO is a major constituent of the Department of Space (DOS). The department executes the Indian Space Programme primarily through various Centres or units within ISRO.

RESOURCES

- **Natural Resources of India**
- **Minerals & Mining**
- **Energy Resources of India**

Natural Resources of India

Resources that are drawn from nature and used without much modification are called natural resources. The survival of humans and other living organisms depends on natural resources. India is rich in natural resources, with diverse landscapes ranging from mountains to rivers and oceans. India has abundant reserves of minerals, fossil fuels, timber, and other resources that contribute to the country's economic growth and development.

- ❑ Some of the major natural resources in India include coal, iron ore, manganese, bauxite, copper, lead, zinc, natural gas, and petroleum. India is also rich in forests and agricultural resources, with a vast array of crops grown across the country.
- ❑ India has a long coastline, which provides a valuable source of fish and other seafood. The country's forests are home to a wide range of plant and animal species, including many that are endemic to India. India's rivers also play a crucial role in the country's economic development, providing water for irrigation, hydroelectric power and transportation.
- ❑ However, India's natural resources are under increasing pressure due to a growing population and expanding economy. The country faces a number of environmental challenges, including deforestation, air and water pollution, and climate change.
- ❑ To sustainably manage its natural resources and protect its environment, India has implemented a range of policies and programs aimed at conservation, sustainable development, and environmental protection.

Concept of Natural Resources

Anything on the earth which is of any **value to human kind is called a resource**. A resource **produced in nature and utilized by humans** is known as natural resource. It includes **air, water, soil, mineral, flora and fauna and energy goods (for example, coal, gas, etc.)** that serve human needs.

- ❑ The resources present in nature are thus nothing more than '**neutral material**' till humans identify their presence and importance and develop ways to capitalize them.
- ❑ Natural resources also include industrial raw materials and renewable resources such as timber and fisheries.
- ❑ Natural resources are derived from the environment and are essential for survival of mankind.
- ❑ These resources **constitute the most important components for human survival** and development. One cannot even think of development in the absence

of natural resources. Since time immemorial, humans have been dependent on natural resources.

- ❑ The natural resources are exploited to provide materials for forest-based industries, development activities including hydropower generation and to meet demands of fuel, fodder and timber.

Classification of Natural Resources

Natural resources vary greatly with respect to location, climate, soil, quantity and quality. For instance, a specific forest type may occur only in some nations. Likewise, the geographical area covered by the forests and wood quality may differ extensively across different countries.

On the Basis of Origin

On the basis of origin, resources may be classified as biotic and abiotic.

1. **Biotic Resources:** Biotic resources are obtained from the biosphere and include forests and their products; fauna; and minerals formed from decayed organic matter.
2. **Abiotic Resources:** Abiotic resources comprise of non-living things such as land, water, air and minerals such as gold, iron, copper, silver, etc.

On the Basis of Availability

Based on their availability, natural resources can be categorized as inexhaustible or exhaustible.

Exhaustible Resources

There are some resources, which are **available in limited quantities** and are going to be exhausted as a result of continuous use. These are called exhaustible resources. For example, the stock of coal in the earth is limited and one day there will be no more coal available for our use.

These are further divided into **renewable and non-renewable resources**.

1. Non-Renewable Resources

- The resources, which cannot be replaced after the use, are known as non-renewable resources. These include minerals (copper, iron, etc.) and fossil fuels (coal, oil, etc.).
- Even wildlife species (rare plants and animals) belong to this category.
- These are finite resources, that is, they are non-renewable and once consumed, they are lost forever.

Minerals & Mining

Minerals are non-renewable raw materials extracted from the earth's crust – the upper layer of the lithosphere. A mineral is defined as a naturally occurring inorganic element or compound having an orderly internal structure and characteristic chemical composition, crystal form, and physical properties. An ore is a mineral deposit containing enough of a metallic element to permit it to be extracted and sold. The higher the concentration of metal in the ore, the higher is its grade. India is endowed with a rich variety of mineral resources due to its varied geological structure. The mineral resources provide the country with the necessary base for industrial development.

Unlike biological resources, the mineral resources cannot be managed to produce a sustained yield. Their supply is limited. We can recycle, reuse and conserve some minerals to make them last longer. But after the high-grade ores and easy-to-get deposits have been tapped, the supply of these minerals will be eventually depleted. Then, it would cost too much to find, process and use what is left.

Origin of Mineral Resources

The Rock Cycle

- A rock is a naturally occurring solid that contains one or more minerals. The largest and slowest of the earth's cyclical processes is the rock cycle.
- It involves the formation and the modification of rocks in the earth's crust and mantle.
- The **rock cycle is powered by energy from the sun**, heat from the earth's interior, wind, flowing water, and movements of the earth's crust.
- Mountains, plains, ocean floors, and other geologic features the earth are the results of this geological cycle of destruction and creation of the earth's three basic types of rocks.
- Three major types of rocks are formed in this cycle: **igneous, sedimentary and metamorphic**.

i. Igneous Rocks

- They are formed by the **cooling, hardening and crystallizing of various kinds of lavas** and differ widely in their chemical composition.
- They chiefly contain **feldspars, mafic minerals and quartz**.
- Rocks containing a **high proportion of quartz (60-75%) are classified as acidic**, whereas those containing less than 50% quartz are classified as **basic**.

- The common igneous rocks found in India are the **granites (acidic) and basalts or the Deccan Trap (basic)**.

ii. Sedimentary Rocks

- They are **derived from igneous rocks** and are formed by the **consolidation of fragmentary rock materials** and the products of their decomposition deposited by water.
- The common sedimentary rocks are **conglomerate, sandstone, shale and limestone**.
- **Alluvial, glacial and Aeolian deposits** form the unconsolidated sedimentary rocks.

iii. Metamorphic Rocks

- They are formed from the **igneous or sedimentary rocks** by the action of **intense heat** and high pressure or both resulting in considerable change in the texture and mineral composition.
- The common metamorphic rocks are **gneiss from granite, quartzite from quartz or sandstone, marble from limestone and slate from shale**.

Minerals in India

India is rich in natural resources, including minerals and energy resources. The country is home to a vast array of mineral and energy resources, ranging from coal and oil to iron ore and natural gas. These resources are essential for the economic development of the country, providing the necessary raw materials for various industries, such as manufacturing, construction, and transportation.

- India is one of the largest producers of minerals in the world, including coal, iron ore, bauxite, manganese, copper, lead, and zinc.
- India is also **the world's largest producer of mica, accounting for over 60% of global production**.
- In addition to metallic minerals, India also has a vast reserve of non-metallic minerals, such as limestone, dolomite, gypsum, and kaolin.
- Minerals in India are mainly associated with **metamorphic and igneous rocks of the peninsular India**.
- **The vast alluvial plain tract of north India is devoid of minerals of economic use**.
- The development of mineral and energy resources in India has played a crucial role in the economic growth and development of the country.

Energy Resources of India

India, the world's third-largest energy consumer, faces a complex interplay of challenges and opportunities in its quest for sustainable energy development. As the nation continues to experience rapid economic growth and urbanization, the demand for energy has surged, necessitating a comprehensive understanding of its diverse energy resources. This chapter delves into the various forms of energy that power India—from traditional sources like coal and biomass to renewable energy technologies such as solar, wind, and hydroelectric power.

With a rich array of geographical features and climatic conditions, India is uniquely positioned to harness a multitude of energy resources. However, the reliance on fossil fuels presents significant environmental concerns and geopolitical vulnerabilities. The government's commitment to achieving energy security, alongside its ambitious targets for renewable energy expansion, reflects a strategic shift towards a more sustainable energy landscape.

Classification of Energy Resources

Energy resources can be classified either on the basis of long term availability or on the basis of traditional use.

- ❑ **On the Basis of Traditional Use:** Energy resources are classified into Conventional sources and Non-Conventional sources.
 - **Conventional sources of energy** refer to the traditional form of power/energy production sources and include fossil fuels such as coal, natural gas, oil, etc.
 - **Non-Conventional sources of energy** refer to the newer and less commonly used sources of energy that have the potential to play a crucial role in fulfilling future needs. These include renewable energy sources like wind, solar, biomass, hydroelectric, etc.
- ❑ **On the Basis of Long Term Availability:** Energy resources are classified as Renewable and Non-Renewable sources.
 - **Renewable energy sources** are plentiful and all around us such as solar energy, wind energy, etc.
 - **Non-renewable sources** include fossil fuels like coal, oil and gas that take millions of years to form.

Non-Renewable Energy Sources

Non-renewable energy comes from sources that will run out or will not be replenished in our lifetimes—or even in many, many lifetimes.

- ❑ Most nonrenewable energy sources are fossil fuels: **coal, petroleum, and natural gas**. Carbon is the main element in fossil fuels. For this reason, the time period that fossil fuels formed (about 360-300 million years ago) is called the **Carboniferous Period**. All fossil fuels formed in a similar way.
- ❑ Millions of years ago, even before the dinosaurs, Earth had a different landscape. It was covered with wide, shallow seas and swampy forests.
- ❑ **Plants, algae, and plankton** grew in these ancient wetlands. They absorbed sunlight and created energy through photosynthesis. When they died, the organisms drifted to the bottom of the sea or lake. There was energy stored in the plants and animals when they died.
- ❑ Over time, the dead plants were crushed under the seabed. Rocks and other sediment piled on top of them, creating high heat and pressure underground. In this environment, the plant and animal remains eventually turned into fossil fuels (coal, natural gas, and petroleum). Today, there are huge underground pockets (called reservoirs) of these non-renewable sources of energy all over the world.

Coal

India depends on coal for more than half of its total energy needs. **As per Economic Survey 2023-24, coal accounts for nearly 70 per cent of the total electricity generation.** Coal accounts for more than 55 per cent of India's primary commercial energy. It is also a critical input in various industries, such as steel, sponge iron, cement, and paper.

- ❑ India has huge coal reserves accounting for **around 8% of the world's total**.
- ❑ It is the **second leading coal producer in the world after China**. Most of its coal demand is satisfied through domestic production with the only exception being coking coal that is in short supply.
- ❑ Despite India's wealth in coal reserves, **only about 3% is coking coal**, so India's steel industry has to **import coking coal** to meet about 25% of its annual needs.
- ❑ In India, coal occurs in rock sequences mainly of two geological ages, namely **Gondwana and Tertiary deposits**.