VISIONIAS
INSPIRING INNOVATION

UPDATED VALUE ADDITION MATERIAL 2024

LOCATION OF INDUSTRIES IN INDIA AND THE WORLD

AHMEDABAD BENGALURU BHOPAL CHANDIGARH DELHI GUWAHATI HYDERABAD JAIPUR JODHPUR LUCKNOW PRAYAGRAJ PUNE RANCHI

LOCATION OF INDUSTRIES

Student Notes:

Contents

Student Notes:

UPSC Syllabus: Factors responsible for the location of primary, secondary, and tertiary sector industries in various parts of the world (including India)

Q. N.	YEAR	QUESTION	MARKS
1.	2013	Analyse the factors for highly decentralized cotton textile industry in India	5
2.	2013	Do you agree that there is a growing trend of opening new sugar mills in the Southern states of India? Discuss with justification	5
3.	2014	Account for the change in the spatial pattern of the Iron and Steel industry in the world.	10
4.	2014	Whereas the British planters had developed tea gardens all along the Shivaliks and Lesser Himalayas from Assam to Himachal Pradesh, in effect they did not succeed beyond the Darjeeling area. Explain.	10
5.	2017	Petroleum refineries are not necessarily located nearer to crude oil producing areas, particularly in many of the developing countries. Explain its implications.	15
6.	2018	What is the significance of Industrial Corridors in India? Identify industrial corridors, explain their main characteristics.	15
7.	2019	Discuss the factors for localization of agro-based food processing industries of North-West India.	10
8.	2020	Account for the present location of iron and steel industries away from the source of raw material, by giving examples.	10
9.	2022	Describing the distribution of rubber producing countries, indicate the major environmental issues faced by them.	15

Quotations For Content Enrichment

"The availability of raw materials is the most critical factor in the location of primary industries." - Alfred Weber

"Industry does not flourish where nature is barren and the means of communication are defective." - Walter Isard

"The emergence of new economic corridors and industrial clusters is reshaping the rural-urban continuum, creating new opportunities for industrial location." - Economic Survey 2021-22

Student Notes:

1. Manufacturing Industry

It involves **transforming raw materials or components into finished goods through physical or chemical processes.** It includes activities like refining natural resources, making electronic parts, and assembling final products for consumer use or further production.

Classification of Industries

Classification	Types	Explanation	Examples
Source of Raw Materials Used	**Agro-based**	Industries using agricultural products as raw materials.	Cotton, woollen, jute, silk textile, rubber, sugar, tea, coffee, edible oil
	Mineral-based	Industries using minerals as raw materials.	Iron and steel, cement, aluminium, machine tools, petrochemicals
Main Role	**Basic or Key Industries**	Industries supplying raw materials to manufacture other goods.	Iron and steel, copper smelting, aluminium smelting
	Consumer Industries	Industries producing goods for direct use by consumers.	Sugar, toothpaste, paper, sewing machines, fans
Capital Investment	**Small Scale Industry**	Industries defined by the maximum investment allowed on the assets.	Max investment: ₹1 crore
Ownership	**Public Sector**	Industries owned and operated by government agencies.	BHEL, SAIL
	Private Sector	Industries owned and operated by individuals or groups of individuals.	TISCO, Bajaj Auto Ltd., Dabur Industries
	Joint Sector	Industries jointly run by the state and individuals or groups of individuals.	Oil India Ltd. (OIL)
	Cooperative Sector	Industries owned and operated by producers or suppliers of raw materials, workers, or both, sharing profits or losses proportionately.	Sugar industry in Maharashtra, coir industry in Kerala
Bulk and Weight of Raw Materials & Products	**Heavy Industries**	Industries using heavy raw materials and producing heavy goods.	Iron and steel
	Light Industries	Industries using light raw materials and producing light goods.	Electrical goods industries

Footloose Industry

A footloose industry can be located anywhere without being affected by resources, land, labour, and capital. Key characteristics include:

- **Location Flexibility**: Can be set up anywhere.
- **Fixed Costs**: Costs remain constant regardless of location.
- **Raw Materials**: Use small, light, easily transportable raw materials.
- **Skilled Labour**: Require skilled workers due to advanced industrial processes.
- **Output**: Produce lightweight, high-value products.
- **Environmental Impact**: Generally non-polluting with less carbon footprint.

- **Preferred Locations**: Peaceful, cost-effective areas with good connectivity for transportation.
- **Examples**: Diamonds, computer chips, mobile manufacturing, honey processing.

Student Notes:

Non-Footloose Industries

- Non-footloose industries need to be near raw materials due to time-sensitive production. Examples include: **Sugar, Jute and Tea Industry etc.**
- Non-footloose industries are dependent on the proximity to raw materials to minimize transportation costs and time.

Importance of Footloose Industries in India's Development:

- **Job Creation & Skill Enhancement**
  - Employment generation, reduced migration, workforce upskilling
  - Examples: IT parks in Bengaluru, Hyderabad; Technical training centers in Pune.
- **Economic Diversification & Regional Balance**
  - Reduced agriculture dependence, economic resilience, inclusive growth
  - Examples: BPO in Jaipur, Bhopal; Pharmaceuticals in Visakhapatnam; Tourism in Udaipur
- **Infrastructure Development & Connectivity**
  - Transport, telecommunications, utilities improvement, regional linkages
  - Examples: IT corridors in Hyderabad (roads, telecom); SEZs in Gujarat (ports); Agro-processing units in Madhya Pradesh (rural roads).
- **Technology Transfer & Innovation Boost**
  - Knowledge sharing, expertise diffusion, R&D promotion
  - Examples: Biotech in Kerala; Aerospace in Bengaluru; Renewable energy in Rajasthan.
- **Investment Attraction & Export Growth**
  - Foreign/domestic capital inflow, global market integration, forex generation
  - Examples: Auto components in Tier-II/III cities; Electronics in Noida; Textiles in Tirupur; Gems and jewellery in Jaipur.

VisionIAS Test Series Questions

Q. What are footloose industries? Identify the factors that influence the location of these industries, with the help of examples.

2. Location of Industries

Location of industries is **influenced by factors** like **access to raw materials power, market, capital, transport and labour**, etc. The factors affecting can be divided into two broad categories:

Alfred Weber's Theory of Industrial Location

He developed a theory to explain where industries **should be located to minimize costs.**

His theory focuses on three main factors: **transportation cost, labour cost, and agglomeration cost** (the benefits of having industries close together).

Geographical Factors

- **Raw Materials → Industry Location**: Proximity to sources, crucial for heavy/perishable materials → **e.g.,** sugar mills near sugarcane fields, copper smelting near ore deposits.
- **Power Sources → Energy-Intensive Industries:** Steady supply (coal, oil, hydro) essential → **e.g.,** aluminium and synthetic nitrogen plants cluster near power sources.
- **Labour Availability → Manufacturing Centers:** Access to skilled, cost-effective workforce → **e.g.,** light consumer goods and agro-based industries grow in populous regions.
- **Transport → Industrial Efficiency:** Well-developed land/water connectivity → Brings raw material inflow and product distribution, supporting industrial growth.
- **Market Proximity → Reduced transport costs** → competitive pricing → **e.g.,** textile industries in Mumbai, Ahmedabad; refineries near consumption centers.

Student Notes:

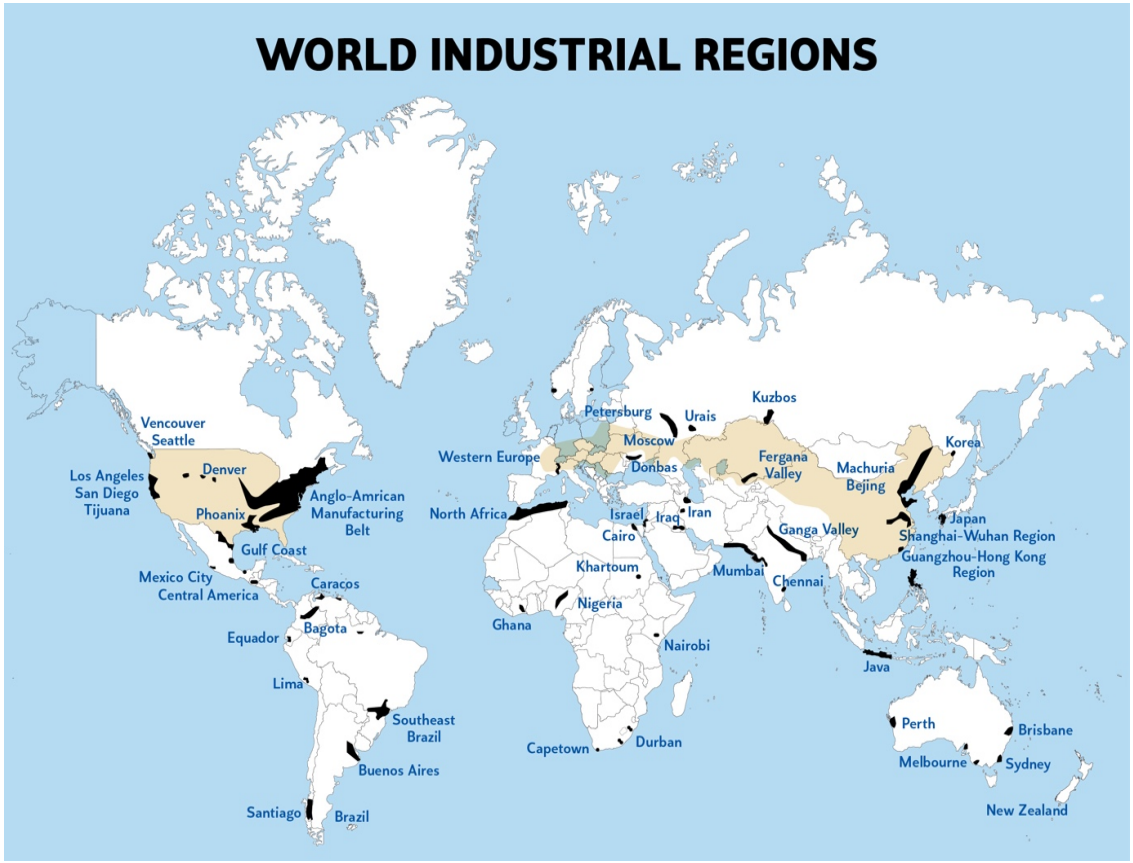
- **Site → Industrial Setup:** Flat terrain, good connectivity, enough space → ideal for factory establishment; trend of rural relocation due to urban land costs.
- **Climate Influence → Sector-Specific Locations:** Moderate conditions preferred → **e.g.,** humid climate in Maharashtra, Gujarat fosters cotton textile industry, preventing thread breakage.

Non – Geographical Factors

- **Capital Availability →** High investment needs → industries concentrate in finance-rich urban centers → **e.g.,** Mumbai's finance and textile industries.
- **Government Policies →** Strategic policies shape industrial locations → aimed at balanced growth, pollution control → **e.g.,** Bengaluru's IT hub emergence.
- **Industrial Inertia →** Historical Centers: Industries grow in original locations → **e.g.,** Ahmedabad's continued prominence in textiles.
- **Banking Infrastructure →** Robust financial services → Support daily operations → e.g., Delhi NCR's strong banking infrastructure supports various industries.

2.1. World Industrial Regions

Major industrial regions of the world are eastern North America, western and central Europe, eastern Europe and eastern Asia. Major industrial regions tend to be located in the temperate areas, near sea ports and especially near coal fields.



3. Industrial Regions of India

Industrial regions can be classified into two types:

- Major Industrial Regions,
- Minor Industrial Regions.

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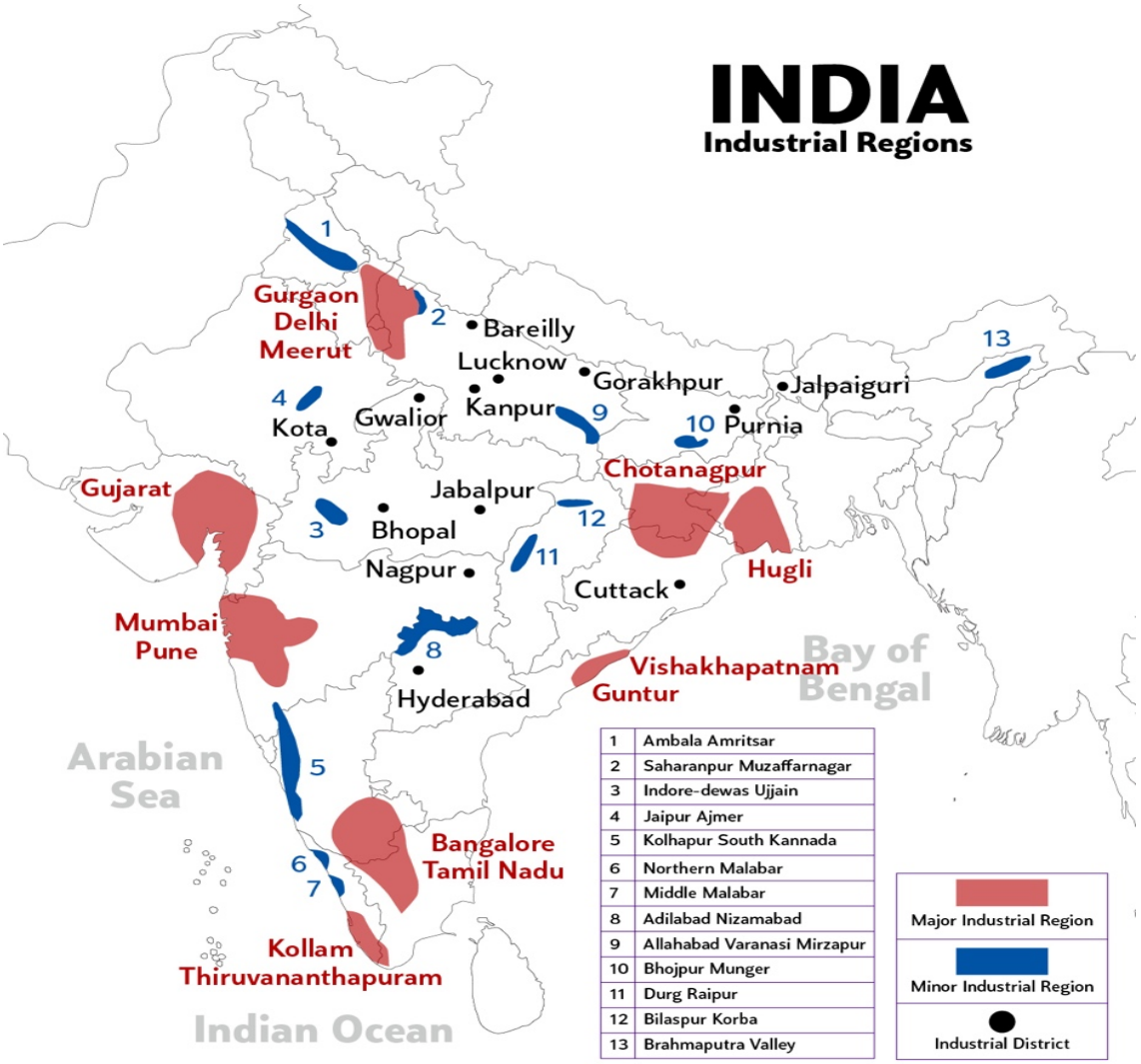

VisionIAS Test Series Questions

Q. The availability of natural resources has been one of the most important reasons for localisation of industrial regions across the world. Discuss with suitable examples.

Q. What are the factors that affect the location of manufacturing industries in India? Highlight the major industrial regions of India.

3.1. Major Industrial Regions

Mumbai-Pune Industrial Region:

Stretching along the Arabian Sea coast in Maharashtra from Mumbai to Pune.

Key Industries:

- Largest **cotton textile hub** in Asia.
- **Other major sectors:** woollen and synthetic textiles, oils, rubber, soaps, detergents, electrical goods, engineering, automobiles, cycles, and oil refining.

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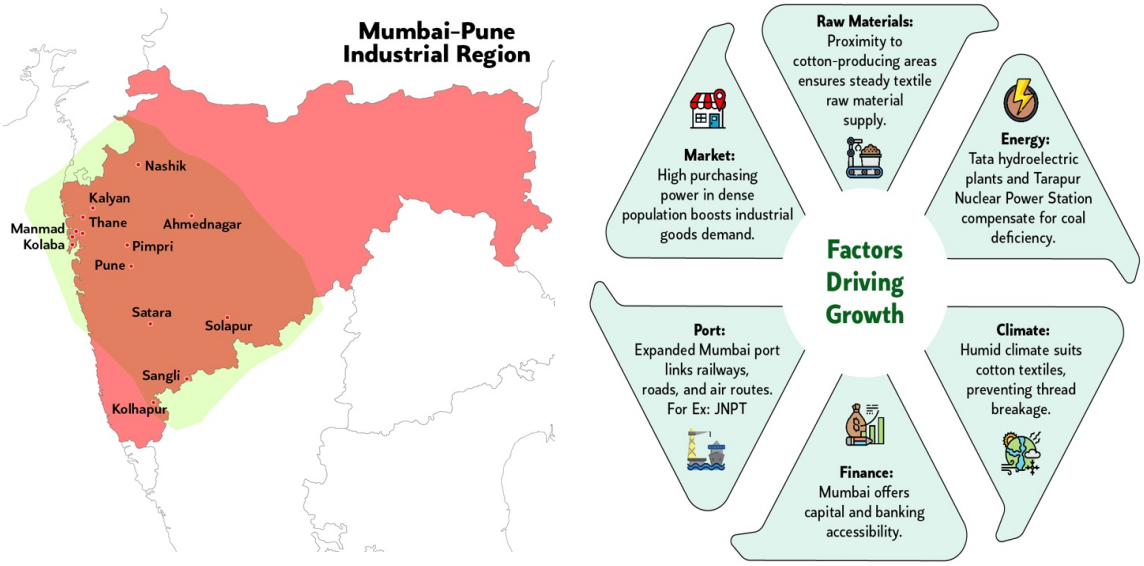


Challenges:

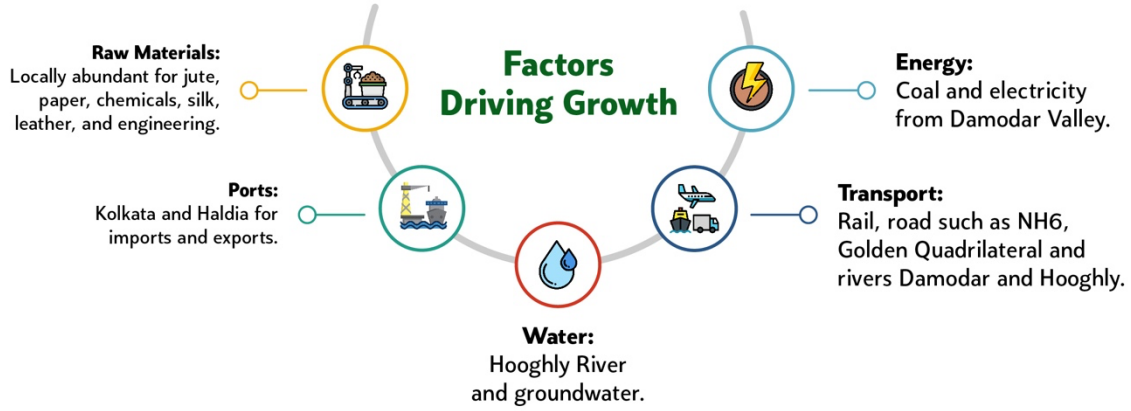
- **Power shortages:** Mumbai experienced a major blackout in October 2020, affecting millions.
- **Outdated machinery** in some sectors, particularly textiles.
- **High land and rental costs:** Mumbai's real estate is among the most expensive globally.
- **Labour unrest:** e.g., 2012 Maruti Suzuki workers' strike in Pune.
- **Pollution:** Mumbai's air quality index frequently exceeds 200 (poor category).

Way Forward:

- To manage growth and ease congestion, **industries should spread to nearby areas**.
  - **For ex;** Government supports **industrial parks in Nashik, Solapur, and Raigad** to balance development outside Mumbai-Pune.
- **Effective policies and investments** will secure the Mumbai-Pune Industrial Region's vital role in India's economy.

The Kolkata-Hooghly Industrial Region

Stretches along the **Hooghly River** from Bansberia to Birlanagar, covering Kolkata, North & South 24 Parganas, Nadia, Hooghly, and Howrah districts.



Key Industries:

- **Largest jute producing region** in the world,
- Textiles, engineering, automobiles, chemicals, pharmaceuticals, leather, iron and steel, food processing.

Student Notes:

Challenges:

- **Lack of sanitation and infrastructure,**
- **River silting:** Hooghly River's depth has reduced in some stretches,
- **Old machinery:** Many jute mills still use 19th-century technology,
- **Labour unrest:** Witnessed major strikes between 2010-2020,
- **Power shortage**: West Bengal faces a peak power deficit of about 3-4%.

Way Forward:

- **Farakka Barrage** → Built to divert water from the Ganges to the Hooghly → Haldia port development → to reduce pressure on Kolkata port.
- **Policy initiatives** → West Bengal Industrial Development Strategy 2013 → Aims to increase the share of manufacturing.

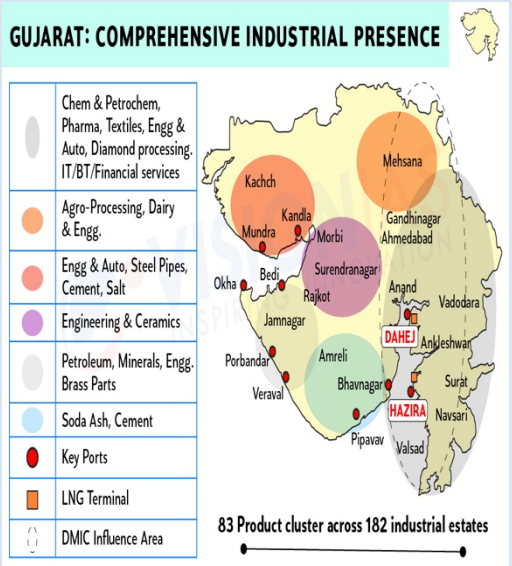
Bangalore-Chennai Industrial Region

The Bangalore-Chennai Industrial Region spans Karnataka and Tamil Nadu, from Madurai in the south to Bangalore in the north.

Industries: Cotton textiles, silk, sugar, leather, chemicals, and machine tools dominate, with major public sector units like Hindustan Machine Tools , Hindustan Aeronautics and SAIL.

Way Forward: Growth prospects include **new refineries near Chennai**, steel mills in Salem, and expanding fertilizer production and **Chennai-Bangalore Industrial Corridor** (CBIC) project for leveraging skilled workforce and robust infrastructure.

Student Notes:

Industrial Regions	Aspects
Gujarat Industrial Region Around the Gulf of Khambhat, Gujarat  	**Key Factors for Development** • **Raw Materials:** Abundant cotton and petrochemical resources like mineral oil and natural gas. • **Cheap Land:** Compared to Mumbai. • **Transport:** Well-connected by rail, road (NH8), and pipelines for oil and gas. • **Ports:** Okha, Porbandar, Veraval, and Kandla facilitate international trade. **Industries:** Cotton textile, chemicals, drugs and pharmaceuticals, woollen and silk textiles, paper, milk products, machinery for textile industries. Petrochemical industry (**e.g., Jamnagar refinery**). **Challenges**: Water scarcity, lack of high-quality cotton, communal tensions. **Government Initiatives:** Policies to attract investments, infrastructure development, industrial parks like **Dholera, GIFT City,** Petrochemicals Investment Region **(PCPIR).**
Chhotanagpur Region West Bengal, Bihar, Jharkhand, Odisha **Key Factors for Development** • **Raw Materials: Rich in minerals** like iron ore, coal, and manganese. • **Labour**: Abundant and skilled workforce.	

- **Energy:** Electricity from **Damodar Valley.**
- **Transport:** Rail, road (NH2, Golden Quadrilateral), waterways of Damodar Project.

Industries:

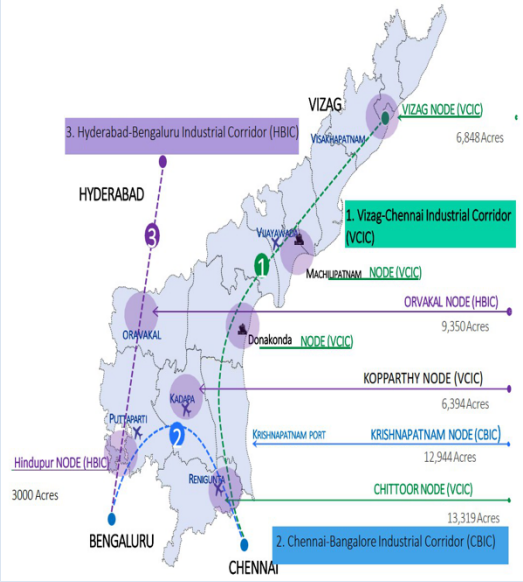
Iron and steel, paper, chemicals, heavy engineering (**BHEL** Ranchi), fertilizers, cement, locomotive and railway wagons (e.g., Steel plants of Bokaro, Durgapur, Kulti, Burnpur).

Challenges: Power shortages, political unrest (**Naxalites**), labour disputes.

Government Initiatives: Jharkhand Industrial and Investment Promotion Policy 2021, reforms to address challenges and promote industrial growth.

Visakhapatnam-Guntur Region

Stretches from Visakhapatnam to Prakasam and Kurnool



Key Factors for Development

- **Raw Materials:** Agricultural resources like sugarcane, cotton, and minerals (e.g., iron ore from **Bailadila mines**).
- **Power Resources:** Coal from Godavari Valley, oil and natural gas from **Krishna-Godavari basin.**
- **Ports:** Visakhapatnam and Machilipatnam ports. **Water Resources:** Krishna and Godavari rivers.

Industries:

Petrochemicals (HPCL), sugar, cotton clothes, jute, paper, fertilizers, cement, aluminium, iron and steel (Vizag Steel Plant), lead, zinc smelting.

Challenges:

- **Environmental concerns:** Coastal erosion, Vulnerability to cyclones etc.
- **Infrastructure gaps:** Inadequate road connectivity & Power supply fluctuations.
- **Water scarcity:** Depleting groundwater levels.

Government Initiatives:

Investments in technical education, infrastructure, industrial zones (**e.g., VCIC-Visakhapatnam-Chennai Industrial Corridor**).

- Initiative to establish a world-class pharmaceutical manufacturing hub (**Pharma City in Visakhapatnam**).

Gurgaon-Delhi-Meerut Region

Delhi, Haryana, Uttar Pradesh

Key Factors for Development

- **Raw Materials:** Agrarian base (sugarcane, milk). **Power Resources:** Hydel and thermal power from **Bhakra-Nangal project.**
- **Transport:** Extensive rail and road networks (NH8, NH2, Golden Quadrilateral).
- **Labour:** Skilled workforce from educational institutions.

Industries: Light engineering, consumer durables, textiles (cotton, wool, silk), automotive, electronics, vegetable oils, oil refineries (Panipat and Mathura).

Student Notes:

Student Notes:

Challenges

- **Environmental degradation:** 14 out of world's 20 most polluted cities are in NCR (WHO, 2018)
- **Infrastructure strain** (Rapid urbanization), **Groundwater depletion**, **Uneven development** (Stark rural-urban divide).

Way Forward: Sustainable urbanization, skill development, environmental protection, **balanced growth in tier-2 and tier-3 cities.**

Kollam-Thiruvananthapuram Region

From Trichur (Thrissur) to Thiruvananthapuram

Key Factors for Development

- **Raw Materials:** Almonite, rutoite, zercon, mononite sands, agricultural resources (cotton, sugar, tea, coffee, spices).
- **Power Resources:** Hydroelectric power (**Kallada project**).
- **Ports:** Kochi port facility.

Industries: Agricultural processing (cotton textiles, sugar, rubber, spices), mineral-based industries (glass, chemical fertilizers, petroleum products), miscellaneous (paperboard, coir products, machinery, tools).

Challenges:

- **Climate vulnerability:** Prone to floods and landslides, impacting industrial operations
- **Infrastructure bottlenecks:** Inadequate road and rail connectivity in some areas
- **Power shortages:** Despite hydroelectric resources, faces occasional power deficits

Way Forward:

- **GIFT City in Kochi:** Make Global financial services hub.
- **Kochi-Palakkad Hi-Tech Valley:** Manufacturing and R&D centre.
- **Smart City Kochi:** IT/ITES special economic zone.

3.2. Minor Industrial Regions

There are **thirteen Minor Industrial Regions** in the country.

- They are Ambala-Amritsar, Saharanpur-Muzaffarnagar-Bijnor, Indore-Dewas-Uijjain, Jaipur-Ajmer, Kolhapur-South Kannada, Northern Malabar, Middle Malabar, Adilabad-Nizamabad, Allahabad-Varanasi-Mirzapur, Bhojpur-Munger, Durg-Raipur, Bilaspur-Korba, and Brahmaputra valley.
- Also, there are **fifteen industrial districts** which are Kanpur, Hyderabad, Agra, Nagpur, Gwalior, Bhopal, Lucknow, Jalpaiguri, Cuttack, Gorakhpur, Aligarh, Kota, Purnia, Jabalpur and Bareilly.

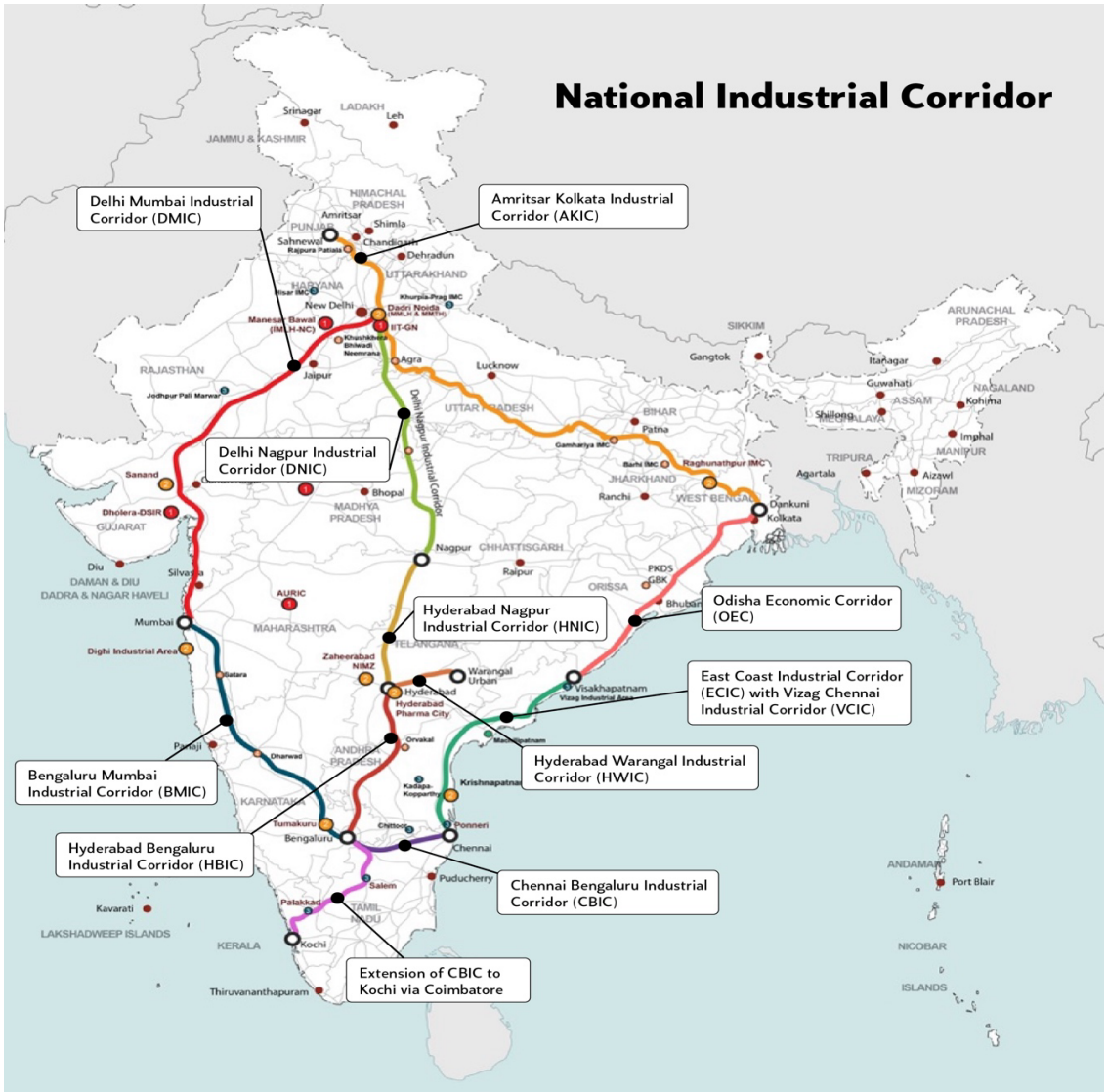
3.3. Industrial Corridors

Industrial corridors are planned development initiatives aimed at boosting economic growth by enhancing industrial infrastructure and connectivity.

These corridors integrate transportation networks, such as highways, railways, and ports, with industrial zones to facilitate efficient movement of goods and services.

Benefits

- **Regional Economic Integration**: Better connects different regions economically.
- **Improved Connectivity**: Faster and more efficient transport.
- **Enhanced Export Competitiveness**: For example, the Krishnapatnam Port in CBIC.
- **Balanced Regional Development**: Reduces disparities between regions.
- **Job Creation**: DMIC alone is expected to create 100 million jobs by 2040.



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Student Notes:

Challenges

- **Land Acquisition**: Difficulties in acquiring land for projects.
- **Environmental Concerns**: Impact on local ecosystems.
- **Funding Constraints**: High costs and need for innovative funding.
- **Inter-State Coordination**: Effective collaboration between states.

Impact

- **Contribution to 'Make in India'**: Promotes manufacturing in India.
- **Sustainable Urbanization**: Develops smart, sustainable cities.
- **Economic Growth**: Accelerates overall economic development.
- **Foreign Investment Attraction**: For example, Japan's $4.5 billion investment in DMIC.

Way Forward

These corridors will help India become a **global manufacturing hub** and **achieve a $5 trillion** economy **through 'Make in India'**.

Effective execution can make India a leader in the **fourth industrial revolution** and boost development. (**The Fourth Industrial Revolution (IR 4.0) involves combining technologies like artificial intelligence, gene editing, and advanced robotics, merging the physical, digital, and biological worlds.)**

How Do Industrial Corridors Differ from Special Economic Zones (SEZs) in India?

Aspect	Industrial Corridors	Special Economic Zones (SEZs)
Purpose	Broad industrial development and job creation across large areas {e.g., Delhi-Mumbai Industrial Corridor (DMIC)}	Promote exports and attract FDI with tax incentives (e.g., Jawaharlal Nehru Port SEZ).
Scale and Scope	Large-scale projects spanning multiple states (e.g., DMIC covers 1,483 km across six states.).	Smaller, duty-free zones for specific industries (e.g., Mundra SEZ).
Infrastructure	High-speed transport, logistics hubs, and smart cities {e.g., Chennai-Bengaluru Industrial Corridor (CBIC) with 500 km expressway}.	Basic infrastructure for export-oriented industries (e.g., Noida SEZ).
Governance	Managed by National Industrial Corridor Development and Implementation Trust (NICDIT) with state partnerships.	Governed by SEZ Act, 2005, and Development Commissioners.

VisionIAS Test Series Questions

Q. What are the major industrial regions of India? In this context, identify the factors that made Mumbai - Pune region as a major industrial hub of the country.

Q. How can the dedicated freight corridors solve the freight problem for the railways? What are the challenges associated with these projects?

4. Emerging Industrial Clusters

4.1. Emerging Industrial Clusters in Tier-2 and Tier-3 Cities in India

India's **industrial landscape is undergoing a transformation** with the **rise of new clusters** in tier-2 and tier-3 cities, fostering regional growth and reducing reliance on metropolitan areas.

Key Drivers:

- **Cost Advantage**: Lower land and labour costs.

- **Government Initiatives**: Programs like Smart Cities Mission and state-specific policies.
- **Improved Connectivity**: Enhanced road and air connectivity through projects like Bharatmala and UDAN.
- **Digital Infrastructure**: Increasing internet penetration supporting tech-based industries.
- **Skilled Workforce**: Educational institutions and reverse migration trends.

Emerging Clusters:

- **Coimbatore (Tamil Nadu)**: Textile machinery, auto components, IT.
- **Indore (Madhya Pradesh)**: Pharmaceuticals, automobiles, IT.
- **Visakhapatnam (Andhra Pradesh)**: Pharmaceuticals, defence manufacturing, IT.
- **Chandigarh-Mohali-Panchkula**: IT, biotechnology, education.

Impact on Regional Development:

- **Employment Generation**: Diverse job opportunities across multiple sectors.
- **Skill Enhancement**: Collaboration between industry and academia fostering relevant skill development.
- **Urban Development**: Improved civic infrastructure and living standards.
- **Reduced Migration**: Retention of local talent and attraction of skilled professionals.

Challenges:

- **Infrastructure Gaps**: Inadequate physical and digital infrastructure in some regions.
- **Skill Mismatch**: Aligning local skill development with industry needs.
- **Environmental Sustainability**: Balancing industrial growth with ecological concerns.
- **Uneven Development**: Risk of creating new intra-state disparities.

Government Initiatives:

- **Atmanirbhar Bharat Abhiyan**: Encouraging local manufacturing and self-reliance.
- **Production Linked Incentive (PLI) Scheme**: Boosting manufacturing across various sectors and regions.
- **National Logistics Policy 2022**: Aiming to reduce logistics costs and improve the competitiveness of smaller cities.

Conclusion:

As India aims to become a **$5 trillion economy**, these emerging clusters will be important in driving inclusive and sustainable growth. This **promotes balanced regional growth**, **support local economy,** and **reduced strain on overburdened metropolitan areas**. However, achieving this potential requires a holistic approach integrating infrastructure development, skill enhancement, and sustainable practices.

4.2. Evolving Global Supply Chains: A Geographical Perspective

Globalization led to the creation of complex, interconnected supply chains spanning continents. For instance:

- **Electronics industry:** Components manufactured in Asia, assembled in Mexico, and sold in North America and Europe.
- **Textile industry:** Cotton grown in India, processed in Bangladesh, and finished products sold globally.

These patterns resulted in:

- **Specialized industrial clusters** (e.g., Silicon Valley for tech, Guangdong for electronics manufacturing)
- **Development of major shipping routes** and ports (e.g., Port of Shanghai, Rotterdam)
- **Emergence of global cities** as coordination centers (e.g., London, Singapore)

Student Notes:

But now, **Deglobalization** is **reshaping supply chain** patterns by driving a shift **from global networks to more localized structures** that prioritize risk mitigation and local sourcing. Key Reasons are given below:

Geographical Impacts of Supply Chain Disruptions

Recent events have exposed vulnerabilities in this global system:

US-China Trade War:

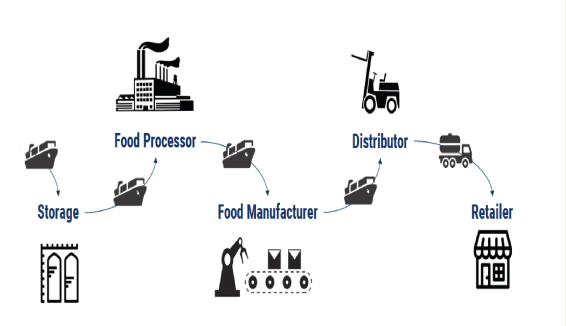
- **Shifted soybean trade patterns:** US exports to China decreased, while Brazil's increased,
- **Relocation of manufacturing** from China to countries like Vietnam and Mexico.

Supply Chain

It is the network that connects the production and distribution of goods from raw materials to final consumers. For example:

Smartphone Production

Rare earth minerals (e.g., from China) → Chip manufacturing (e.g., in Taiwan) → Assembly (e.g., in Vietnam) → Global retail distribution



COVID-19 Pandemic:

- **Disrupted pharmaceutical supply chains**, heavily dependent on China and India,
- Exposed vulnerabilities in just-in-time manufacturing, particularly in automotive and electronics industries.

Russia-Ukraine War:

- Europe's reliance on Russian natural gas has led to energy shortages and price hikes due to sanctions and supply interruptions.
- *Example: Germany faced significant increases in energy costs due to reduced gas supplies from Russia.*

Emerging Geographical Patterns in Supply Chain Strategies

- **Friend Shoring:** Relocating production to allied or friendly countries to reduce reliance on geopolitical rivals.
  - Japan offering incentives for companies to relocate production from China to Southeast Asia or India.
  - **Geographical Impact:** Strengthening of regional economic blocs and potential emergence of new industrial clusters.
- **Nearshoring:** Moving production closer to home to reduce transportation costs and improve supply chain resilience.
  - US companies moving production from China to Mexico.
  - **Geographical Impact:** Revitalization of manufacturing in proximity to major markets, potentially altering urbanization patterns in border regions.
- **Onshoring:** Bringing production back to the company's home country to enhance control over the supply chain.
  - India's push for domestic semiconductor manufacturing under the "Make in India" initiative.
  - **Geographical Impact:** Reindustrialization of developed economies and potential for new domestic industrial zones.

Student Notes:

Student Notes:

From Just-in-Time to Just-in-Case: Spatial Implications

The shift **from JIT to JIC** inventory systems has significant geographical implications:

- Increased demand for warehousing and **storage** facilities **near major urban centers**,
- **Development of secondary and tertiary ports** to diversify supply routes,
- Renewed focus on **strategic stockpiling locations for critical goods** (e.g., medical supplies, rare earth elements).

Example: The **EU's strategy to stockpile rare earth elements,** crucial for green technology, to **reduce dependence on China.**

Key Highlight:
The **shift from just-in-time (JIT) to just-in-case (JIC), highlighted by S. Jaishankar,** reflects a broader trend in global supply chain management due to COVID-19 and trade tensions. Geographical implications:

- **Reshoring and Nearshoring**: Moving production closer to home or friendly nations, changing global production patterns.
- **Stockpiling Locations**: Strategically placing inventory stockpiles closer to end markets.
- **Supply Diversification**: Sourcing from multiple locations to mitigate risks.

Decoupling and De-risking: Reshaping Economic Geography

- **Decoupling:** Efforts to create **parallel supply chains for critical technologies** (e.g., 5G networks) independent of China.
  - **Geographical Impact:** Potential emergence of parallel economic spheres with distinct production and trade networks.
- **De-risking: Diversification of automobile chip suppliers** beyond Taiwan and South Korea.
  - **Geographical Impact:** More distributed network of specialized suppliers, potentially benefiting secondary economic centres.

What is China Plus One Strategy?

- Global shift away from sole reliance on China for manufacturing
- Driven by COVID-19 disruptions, US-China tensions, and rising costs in China
- Companies diversifying production to countries like Mexico, Thailand, and Vietnam.

Conclusion

The evolution of global supply chains, **from just-in-time (JIT) to just-in-case (JIC)** and the rise of strategies like friend shoring, nearshoring, and onshoring, is reshaping economic geography. This shift prioritizes resilience and strategic autonomy, leading to:

- More regionalized production and trade,
- Increased **importance of geographical proximity,**
- **Emergence of new industrial clusters** and potential decline of others.

5. Mineral-based Industry

5.1. Iron and Steel Industry

The Indian iron and steel industry stands as a global powerhouse, ranking as **the world's second-largest producer of crude steel**.

Significance of Iron and Steel Industry

Steel consumption per capita → Indicator of industrialization Steel industry growth → National development. **Key roles:**

- Backbone of infrastructure → Economic growth
- Strong industrial linkages → Supports other sectors (e.g., automobile, construction)
- Regional development → Employment + Local infrastructure improvement.

Student Notes:

Locational Factors of Iron and Steel Industry

Primary Factor: Raw material proximity → Lower transportation costs → Economic viability**.** Example: Bhilai plant near Dalli Rajhara iron ore mines

Secondary Factors:

- **Market access** → Reduced finished product transport costs → Competitiveness. Example: Tata Steel's scrap-based plant in Rohtak (near auto industry),
- **Transportation infrastructure** → Efficient logistics → Operational efficiency → Stimulates regional infrastructure development,
- **Port access** → Easy import/export → Global competitiveness. Example: Vizag Steel Plant near Vizag port,
- **Government policies** → Strategic plant locations → Balanced regional growth.

Types of Steel Plants

Large Integrated Plants: Iron ore + Coal → Crude steel → Finished steel products Advantages: Large-scale production, full control over process

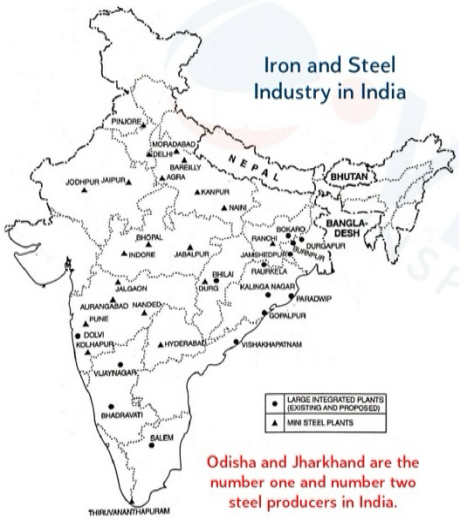
Mini Steel Plants: Utilizing scrap iron/Pig iron → Catering to local demand → Steel products Advantages:

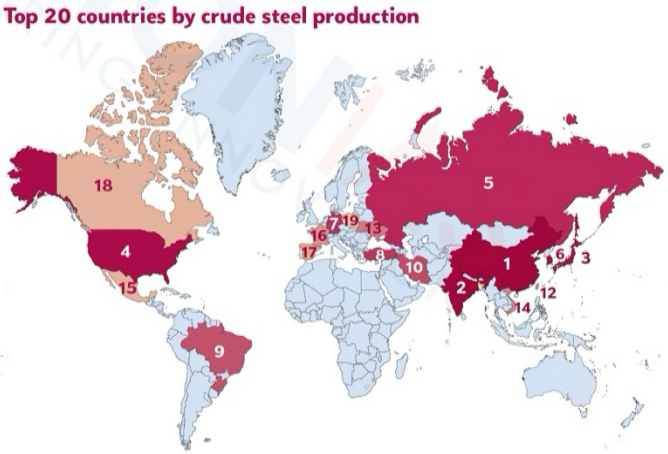
- Lower capital requirement → Easier establishment,
- Shorter production cycle → Quick market response,
- Urban/semi-urban locations → Decentralized industrialization,
- Flexibility → Meet local demands efficiently.

Steel Sector in India

Steel manufacturing produces more CO2 than any other heavy industry, comprising around 8% of total global emissions.
India is currently the world's 2nd largest producer of crude steel

- Important steel-producing centers are Bhilai (Chhattisgarh), Durgapur (West Bengal), Burnpur (West Bengal), Jamshedpur (Jharkhand), Rourkela (Odisha), Bokaro (Jharkhand).
- Consumption: India is the 2nd largest consumer of finished steel in 2021 after China.





What is Green Steel?
Green Steel is the manufacturing of steel using renewable or low-carbon energy sources such as hydrogen, coal gasification, or electricity instead of the traditional carbon-intensive manufacturing route of coal-fired plants.

Challenges Confronting the Industry:

- **Raw material dependence** → Imported coking coal → Higher production costs (India imports 85% of coking coal due to limited domestic reserves; imported coal has lower ash content

~10% vs. domestic ~25-30%, crucial for quality steel).

- **Infrastructure bottlenecks** → Inefficient logistics → Increased operational costs (E.g., congested railways, inadequate port facilities; average logistics cost in India: 14% of GDP vs global average of 8%).
- **Regulatory hurdles** → Project delays → Reduced competitiveness (Multiple clearances needed for mining: environmental, forest, land acquisition; average time for clearances: 2-3 years).
- **Global competition** (e.g., China) → Price pressure → Profit margin squeeze (China produces 50% of world's steel; Indian steel often 15-20% costlier than Chinese imports).
- **Technological lag** → Limited high-grade steel production → Reduced global market share (India's R&D spending in steel: 0.05-0.5% of turnover vs. 1-2% in advanced countries; limits production of automotive and electrical steels).

Government Initiatives: Boosting the Steel Sector

- **National Steel Policy 2017:** Aims for 300MT crude steel capacity by 2030-31 (current capacity: ~154 MT in 2021-22,
- **DMI&SP Policy:** Preference for domestically manufactured iron and steel in government projects (minimum 15-50% domestic content requirement),
- **Steel Scrap Recycling Policy:** Targets to reduce import dependency for scrap (current scrap usage: ~30 MT/year, with ~7 MT imported)
- **Steel Quality Control Orders:** Covers 145 steel products under mandatory BIS certification
- **PLI Scheme for Specialty Steel:** ₹6,322 crore outlay to boost high-value steel production
- **Strategic Trade Measures:** Import duties on steel raised to 15% in 2021-22 to protect domestic industry.

Way Forward: Balancing Growth and Sustainability

Green Steel Production:

- **Emission Reduction:** Transitioning from coal-based processes to cleaner alternatives, like natural gas, aligning with **Pradhan Mantra Urja Ganga project.**
- **Recycling Enhancement:** Increasing **steel recycling** rates **to reduce reliance on raw iron ore** and minimize environmental impacts. {**Recycling**: Aim to increase scrap usage to 50% by 2047 (current: ~15%)}
- Supports **SDG 13** (Climate Action) and **SDG 7** (Affordable and Clean Energy)

Digital Transformation:

- **Embracing Industry 4.0:** Adopting automation, artificial intelligence, and big data to optimize plant operations, reduce waste, and enhance efficiency.
- **Workforce Upskilling:** Upskilling 1.1 million workforce by 2030 to handle advanced technologies.

VisionIAS Test Series Questions

Q. Identify, with examples, the factors responsible for location of iron and steel industry in India.

6. Service/Technology Industries

6.1. IT Industry

The **IT** and **ITeS (IT-enabled Services)** sector covers services like **software development, R&D, engineering design, hardware manufacturing, and BPO.** As of 2023, accounting for approx. 8% of the country's GDP and employs over 5 million people.

Student Notes:

Student Notes:

Factors Influencing Location of IT Industries

- **Climate**: Cities like Bengaluru and Pune offer a **moderate climate** conducive to establishing IT infrastructure.
- **Natural Disaster Risk**: Bengaluru and Hyderabad have lower risks of natural disasters, making them attractive locations.
- **Water Availability and Digital Infrastructure**: These cities also provide better water availability and quality digital infrastructure.
- **Urban Agglomerations**: The **presence of a skilled workforce** in urban agglomerations is a significant factor.
- **Government Policies and Tax Incentives**: Favourable policies and incentives further attract IT industries.

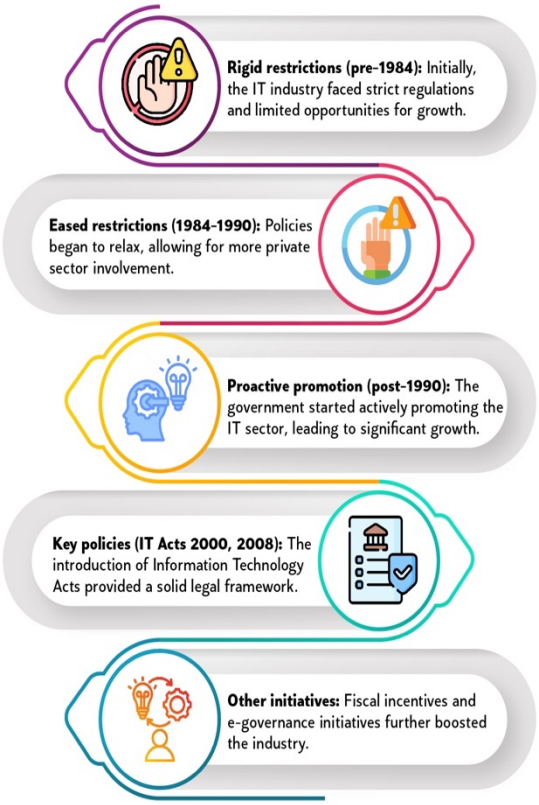
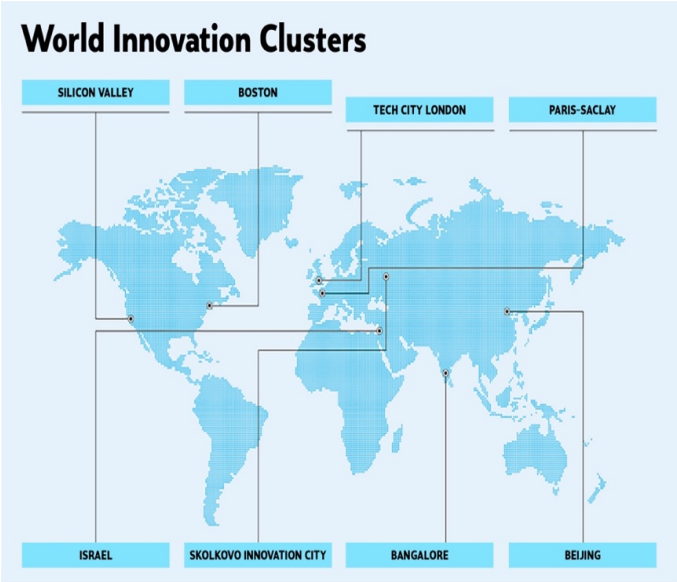


Figure: Evolution of IT Industry in India

Global Distribution of IT Industries

- **Silicon Valley, USA**: Home to giants like Apple, Google, and Facebook.
- **Beijing, China**: Known as Zhongguancun or "China's Silicon Valley," hosting companies like Baidu, Xiaomi, and Lenovo.
- **London, UK**: Focuses on fintech, AI, and cybersecurity.
- **Tokyo, Japan**: Known for hardware and robotics with companies like Sony, Panasonic, and Softbank.



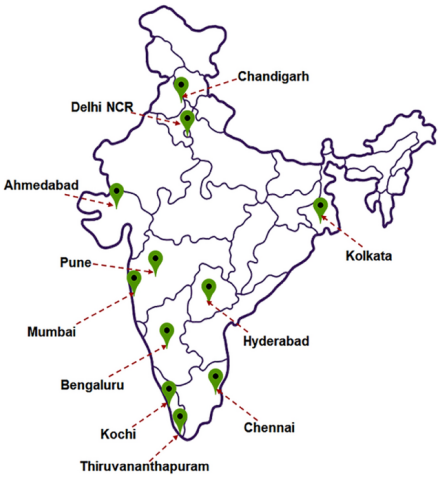


Figure: Distribution of IT Industry in World and India

Bengaluru: Case Study of an IT Hub

Bengaluru, often referred to as the **"Silicon Valley of India,"** stands out as a premier IT hub due to various factors:

- **Policies**: Karnataka's IT Policy (1997) and the establishment of 62 operational Special Economic Zones (SEZs) by 2021.
- **MNC Presence**: Early presence of multinational companies like Texas Instruments (1985), IBM, Intel, and Microsoft.
- **Education Ecosystem**: Home to premier institutions like IISc, IIIT-B, and over 320 engineering colleges.
- **Infrastructure**: Dedicated IT corridors and the Namma Metro enhance connectivity.
- **Startup Culture**: Houses over 5,000 active tech startups (2020).

Challenges: Faces issues like traffic congestion, water scarcity, and urban sprawl.

Way Forward: By **improving infrastructure, sustainable urban planning, and managing resources effectively**, the city can overcome these obstacles and **enhance the overall quality of life** for its residents.

Major Challenges

- **Urban Concentration**: About 70% of IT exports come from seven cities → **Regional imbalance and Urban strain** → Bangalore: accounting 38% exports.
- **Digital Divide**: Urban-rural connectivity gap → Limited rural IT growth → NE states, central India affected.
- **Climate Vulnerability**: Coastal IT hubs are at risk, as evidenced by the Chennai floods in 2015, with Mumbai and Kolkata also exposed.
- **Resource Scarcity**: Water stress in IT clusters → Bangalore water crisis → Sustainability challenges for IT parks.
- **Talent Distribution**: Skills are concentrated in metropolitan areas → Brain drain from Tier-2/3 cities → Bihar, Jharkhand struggling.
- **Infrastructure Disparity**: Tier-1 cities have better infrastructure compared to Tier-2/3 cities, resulting in → Uneven IT growth → STPI (Software Technology Parks of India) scheme addressing gap.

Future Trends in IT Industry Distribution

- **Rise of Tier-2 and Tier-3 Cities**: Coimbatore, Mangaluru, Mysuru, Kochi, Bhubaneswar, Indore, Jaipur
  - Factors: Lower costs, government incentives, quality of life
- **Focus on Emerging Technologies**: Increased emphasis on **AI, IoT, and Blockchain.**
- **Growth of Remote Work**: Leading to decentralization of IT operations.
- **Sector-Specific IT Clusters**: Development of clusters focused on sectors **like fintech and healthtech.**
- **Academia-Industry Collaboration**: Enhanced partnerships in smaller cities to foster innovation and skill development.

Government Initiatives

- **Development of Tier-2 and Tier-3 Cities**: Efforts to decentralize IT industry growth.
- **Software Technology Parks of India (STPI) Scheme**: Focused on promoting IT/ITES in smaller cities.
- **Special Economic Zones (SEZs)**: Providing benefits to IT/ITES sectors.
- **Digital India Program**: Includes projects like **BharatNet** for rural connectivity enhancement.

VisionIAS Test Series Questions

Q. How has globalization impacted the location of the IT industry?

Q. What is meant by High Technology or Hi-Tech industry? Giving examples of some of these industries, highlight their important features.

Q. Give a brief account of the state of IT & BPM (Business Process Management) industry in India. Also, discuss the factors that are at play in determining the location of IT hubs in different Indian cities.

Student Notes:

Student Notes:

Q. The IT industry in India, once centered in a few major cities, is now witnessing significant decentralization towards Tier-2 and Tier-3 cities. Provide reasons. (Answer in 250 words)

6.2. Semiconductor Industries

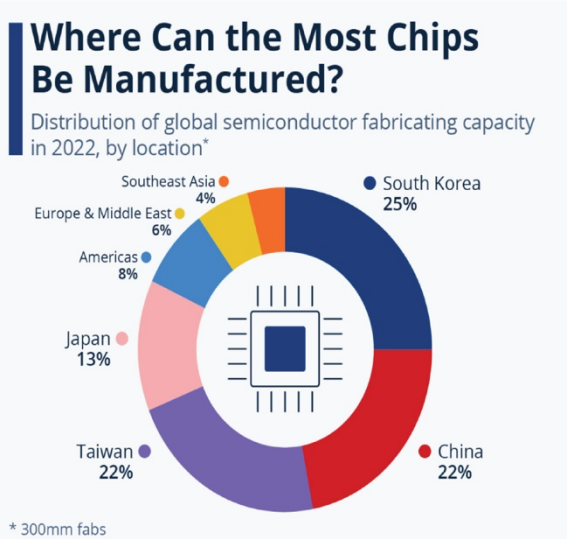
Semiconductors, known as integrated circuits or **"computer chips,"** are crucial for modern electronics and computing. **Silicon** (Si) is the most widely used material due to its abundance and stability.

Location Factors:

- **Availability of Raw Materials:** Proximity to silicon mines, such as those in Silicon Valley, USA, is essential for semiconductor production.
- **Skilled Workforce:** Regions like Hsinchu, Taiwan, benefit from the presence of top tech universities and a highly skilled labour force.
- **Infrastructure:** Advanced facilities and clean rooms, as seen in Dresden, Germany, are crucial for semiconductor manufacturing.
- **Government Policies:** Tax incentives and subsidies in countries like South Korea support semiconductor industry growth.
- **Market Proximity:** Being close to major tech markets, such as Shenzhen, China, helps companies reach consumers and partners more effectively.

Emerging Trends:

- **IoT (Internet of Things):** Development of low-power, high-performance chips to support connected devices.
- **AI (Artificial Intelligence):** Creation of specialized chips designed for parallel processing to enhance AI capabilities.
- **Quantum Computing:** Use of semiconductor-based qubits to advance quantum computing technology.



Global Distribution:

- **Key players:** Japan, Taiwan, the United States, China, Germany, and South Korea.
- India is developing its semiconductor industry with projects in:
  - **Dholera, Gujarat:** Tata Electronics is partnering with Powerchip Semiconductor.
  - **Morigaon, Assam:** Tata Semiconductor Assembly and Test is setting up operations.
  - **Sanand, Gujarat:** CG Power is collaborating with Renesas Electronics and Stars Microelectronics.

Challenges:

- **Supply Chain Dependencies:** Heavy reliance on specific regions like Taiwan (which produces 60% of global semiconductors) and South Korea (which provides 100% of advanced chips).
- **Resource Constraints:** Issues include the need for ultra-pure water, stable power sources, and specialized gases.
- **Infrastructure Development Needs:** Significant investment in facilities and technology is required.
- **Geographical Disparities:** Unequal access to technology across different regions of India.
- **Shortage of Skilled Workforce:** There is a need for more trained professionals in the sector.
- **Regulatory and Policy Hurdles:** Complex regulations and policies can impede progress.

Case Study: Diversifying Semiconductor Supply Chains Recent disruptions have highlighted the need for diversified supply chains:

- **Pandemic:** Shortages arose due to production issues in China.

- **Geopolitical Tensions:**
  - **Russia-Ukraine:** Disruptions due to Ukraine's neon supply.
  - **Trade Restrictions:**
    - **EU & US:** Limitations on semiconductor sales to China.
    - **China:** Export controls on critical materials like gallium and germanium.

Way Forward:

- **Regional Balancing:** → Promote semiconductor hubs in different geographical regions → Reduce concentration in traditional tech centers (e.g., Bangalore, Hyderabad).
- **Resource Management:** → Develop water-efficient technologies for semiconductor manufacturing → Focus on regions with stable water supply (e.g., riverine areas, high rainfall zones).
- **Energy Security:** → Locate facilities near renewable energy sources (solar parks, wind farms) → **Promote green energy corridors** for semiconductor clusters.
- **Urban-Rural Integration:** → Create **semiconductor satellite towns** to reduce urban congestion → Promote rural areas with good connectivity for ancillary industries.
- **Ecosystem Development:** → Create region-specific semiconductor ecosystems based on local strengths → Integrate with existing industrial clusters (e.g., electronics manufacturing hubs).

Steps Toward Self-Reliance (India): → Approval of three semiconductor fabrication units (March 2024) → Total investment: ₹1.26 lakh crore ($15.2 billion) → Key locations: Dholera (Gujarat), Morigaon (Assam), Sanand (Gujarat)

Related SDG Goals

- **SDG 9 (Industry, Innovation, and Infrastructure):** Semiconductor industry drives technological advancement.
- **SDG 12 (Responsible Consumption and Production):** Focus on sustainable manufacturing practices.

VisionIAS Test Series Questions

Q. India needs to move from being an assembler to a manufacturer of microchips. In this context, identify the associated challenges and opportunities.

Q. Identifying the factors affecting the location of semiconductor and electronic chip making industry, discuss the reasons behind their current global shortage. What steps has India taken in recent times to support its electronic manufacturing ecosystem?

Q. Discuss the interdependence and market concentration in the international supply chain of semiconductors. What are the multi-dimensional risks and vulnerabilities associated with the same?

7. Agro-based Industries

7.1. Sugar Industry

Sugar is country's **second largest agro-based** industry, next to cotton. India emerged **world's largest producer and consumer** of sugar as well as the **world's 2nd largest exporter** of sugar after Brazil.

Geographical Distribution:

Largest sugar producing countries: **India > Brazil > Thailand > China > United States of America.**

Student Notes:

In India Uttar Pradesh (35%) is the largest sugarcane producer, with two belts – the **Ganga-Yamuna doab** and the **Tarai region**. Followed by **Maharashtra** (22%), **Karnataka** (10%), and **Tamil Nadu** (8%).

Factors Influencing Location:

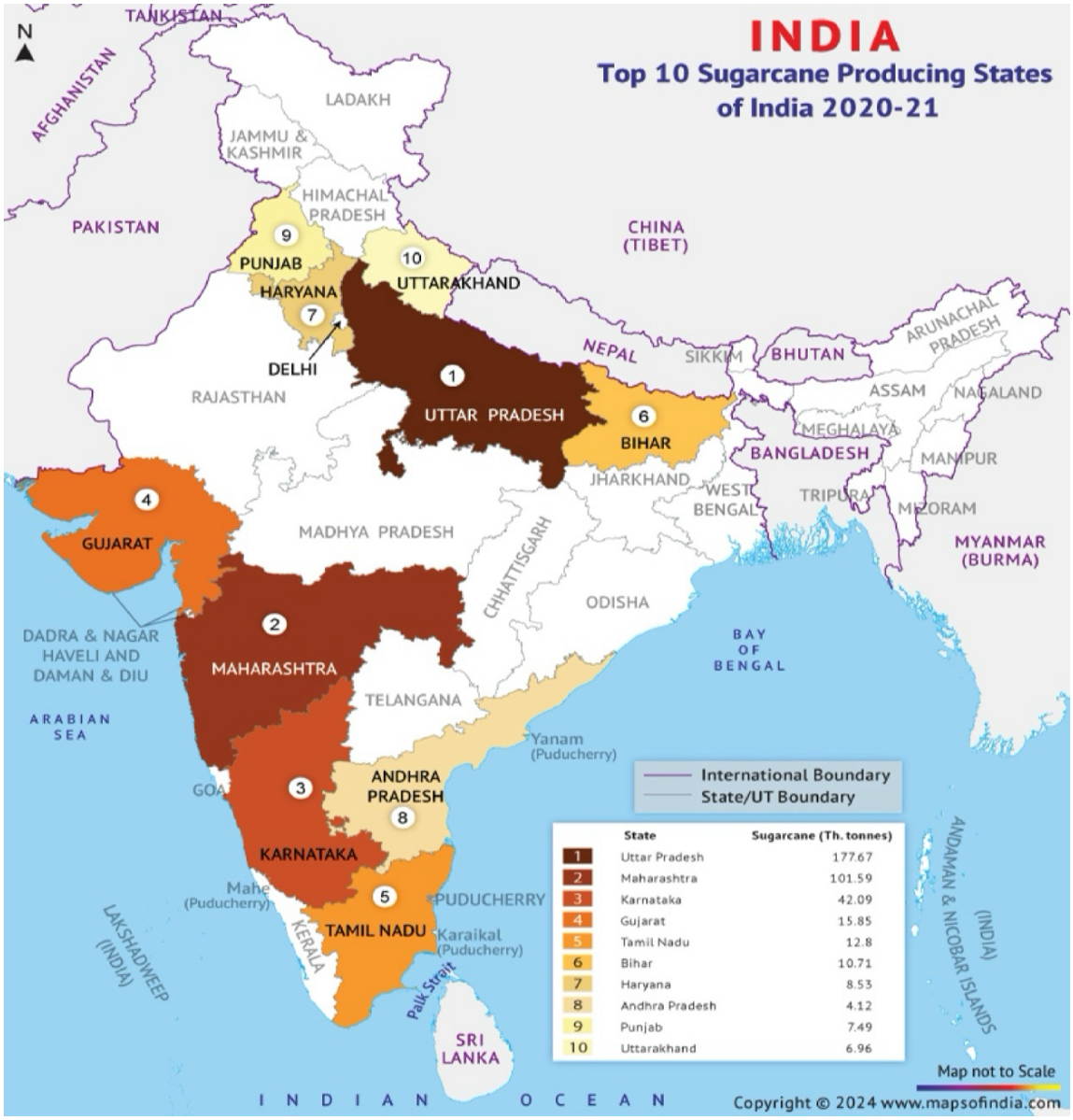
- **Close to Sugarcane Fields:** Sugarcane, the primary raw material for sugar production, is **highly perishable** and **cannot be stored post-maturity.**
- **low sugar yield:** Sugarcane has low sugar yield (9-12% of cane weight) and need Immediate processing.
- **Transportation costs: Mills are located near sugarcane fields** (about 20 km) to minimize costs.
- Mills achieve energy self-sufficiency by using bagasse as fuel.

Sugarcane Cultivation: Key Requirements

- **Temperature**: 28-32°C.
- **Rainfall**: 75-120 cm annually.
- **Humidity**: 70-85% during growth; 55-75% during ripening.
- **Soil**: Well-drained, fertile soils.
- **Irrigation:** Adequate and timely irrigation during the grand growth phase (121-210 days).

Current Status

- **Annual production:** Approximately 30-35 million tonnes.
- Contributes about 1.1% to India's GDP.
- Over 500 operational sugar mills across the country.



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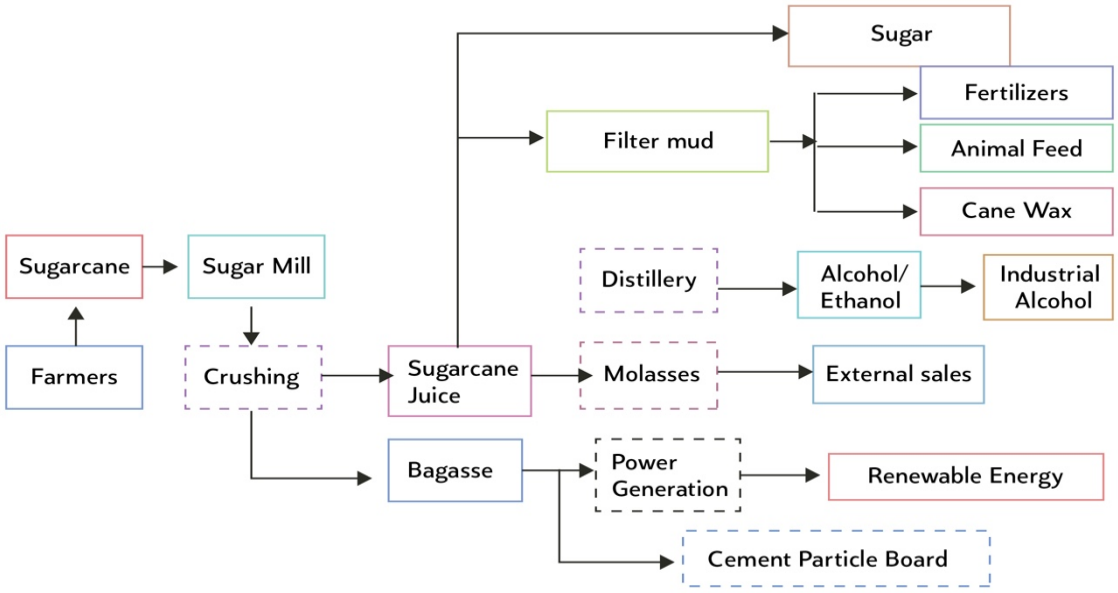


Key Challenges:

- **Low yield:** India's average yield (64.5 tonnes/hectare) is significantly lower than global leaders (e.g., Hawaii: 121 tonnes/hectare).
- **Short crushing season:** 4-7 months, leading to under-utilization of capacity.
- **High production costs:** Due to inefficient technology and high sugarcane prices.
- Regional imbalances in distribution.
- **Low per capita consumption:** 19 kg in India vs. global average of 23 kg (2020).
- **FRP vs. SAP** pricing conflicts.
- **Unpaid dues to farmers:** As of 2021, over Rs. 22,000 crore in arrears.

FRP vs. SAP Pricing Conflicts in Sugarcane Issues

Fair and Remunerative Price (FRP): Set by the Central Government, FRP is the minimum price that sugar mills must pay to sugarcane farmers.

State Advised Price (SAP): Set by individual state governments, SAP is often higher than the FRP to provide additional benefits to local farmers.

Conflict:

- **Financial Strain**: Sugar mills face financial stress due to the obligation to pay higher SAP, affecting their profitability and operations.
- **Farmer's Interests**: Farmers prefer SAP as it guarantees higher income, leading to tensions between their interests and the financial viability of sugar mills.

Minimum Distance Criteria for Sugarcane: Under the Sugarcane Control Order, the central government mandate a specific minimum distance between two sugar mills to ensures that each mill has an adequate catchment area for sourcing sugarcane. This tends to provide a steady supply of raw material for production. Drawbacks of this system is mentioned below:

- **Reduced Competition**: Limits competition among mills, potentially leading to complacency and inefficiency.
- **Farmer Disadvantage**: Farmers may receive lower prices for their sugarcane due to a lack of competition between mills.
- **Discourages New Mills**: Restricts the establishment of new mills, potentially hindering industrial growth and investment in the sector.

Student Notes:

North India and South India sugar industries:

Aspect	South India	North India
Yield (tonnes/hectare)	Higher yield: - Tamil Nadu: 105 (2022-23)	Lower yield: - Uttar Pradesh: 81 (2022-23)
Crushing Season (days)	Longer season: - Tamil Nadu: 200-250 days	Shorter season: - Uttar Pradesh: 150-180 days
Cooperative Mills	Better-managed Machines	Older machinery: - Many mills over 40 years old
Irrigation Methods	Extensive drip irrigation: - Maharashtra: 65% coverage	Limited drip irrigation: - Uttar Pradesh: 10% coverage
Technology Adoption	Modern technology: - Example: 70% mills use diffuser technology	Traditional technology: - Example: 30% mills use diffuser technology

Recent Developments and Government Initiatives:

- **Ethanol Blending Program:** 20% ethanol blending in petrol by 2025. Sugarcane-based derivatives are expected to account for 54% of ethanol requirement.
- **Technology Upgradation:** Scheme for Extending Financial Assistance to Sugar Mills for Enhancement and Augmentation of Ethanol Production Capacity.
- **Sustainable Sugarcane Initiative (SSI):** Promotes water-efficient cultivation techniques.
- **Sugar Development Fund:** Provides loans for modernization and expansion of sugar factories.

Way Forward:

- Implement **Rangarajan Committee** recommendations:
  - Revenue sharing model (70:30 for farmers and mills).
  - Removal of distance criterion between mills.
- **Promote crop diversification** in water-stressed regions.
- Encourage adoption of **precision agriculture techniques.**
- **Invest in R&D for developing high-yielding,** drought-resistant varieties.
- Facilitate technology transfer for improving mill efficiency.
- Develop a **comprehensive export strategy** to manage surplus production.

VisionIAS Test Series Question

Q. Give a brief overview of the distribution of sugar industry in India. Also discuss the various problems faced by the industry.

Q. Give an overview of the location of sugar industry in India. Also, highlight the reasons for the shift of sugar industry from North to South India.

Q. What are the problems associated with the sugar industry in India? Can the rising demand of ethanol help in ensuring its sustenance?

7.2. Cotton Industry

India, with its tropical climate and abundant cotton crop, became a significant centre for fine cotton cloth production.

Current status: India is the largest producer of cotton globally, accounts for 23% of total global cotton production. Cotton grows over 13.06 million hectares in India compared to 33.1 million hectares globally.

Student Notes:

Geographical Distribution

- Initially **concentrated in Mumbai**, the industry expanded to regions like **Rajasthan, Maharashtra, and Gujarat.**
- Factors such as raw material availability, power supply, and proximity to markets influenced mill locations.
- Expansion continued with mills moving closer to urban centres and ports for better market access.

Cotton Cultivation: Key Requirements

- **Temperature:** Cotton thrives in 70-100°F (21-37°C) temperatures.
- **Rainfall:** Needs 500-700 mm of evenly distributed annual rainfall.
- **Soil:** Prefers deep, well-drained sandy loam with pH 5.8-8.0.
- **Other Factors:** Requires a frost-free period of 180-200 days, abundant sunshine, and warm, humid conditions for optimal growth.

Structure of the Industry

The Indian cotton textiles industry **comprises three tiers**: **hand-spun khadi sector, handlooms, and power looms, and large-scale capital-intensive mills.**

Factors Affecting location of Cotton Industry

- **Raw Material**
  - Industry location traditionally aligned with cotton-growing areas like Ahmedabad, Nagpur, and Coimbatore.
  - Not strictly bound to proximity due to the industry's nature as **non-weight losing.**
- **Transportation:** Ideal locations are well-connected to both cotton-producing regions and markets to minimize transport costs.
- **Access to Market**: India's diverse climate supports widespread market potential, even in non-cotton-growing regions.
- **Power**: Early mills relied on water and steam power; later benefited from hydroelectricity and now from electricity-based climate control.
- **Climate**: Coastal regions with tropical/subtropical climates are favoured due to textile production requirements.
- **Labour**: Shift from high-labour-cost regions to low-labour-cost areas like India and Bangladesh has shaped industry dynamics.

Challenges Facing the Industry

- **Cotton Availability:** Dependency on monsoon for cotton crop.
- **Labour Productivity:** Lower compared to global standards due to out-dated machinery and practices which impacts productivity and quality.
- **Global Competition:** Facing competition from cheaper and higher-quality textile goods from countries like Taiwan, South Korea, and Japan.

Student Notes:

Case Study: Global Competition in the Cotton Industry: China and Vietnam vs India

The **textile industry** has seen a significant shift, with Vietnam's export growth rate of 37% over five years outpacing India's 22%, indicating dynamic changes in the global market. Vietnam attracted $19 billion in FDI for textiles (2011-2021),

Factors Contributing to Vietnam's Success:

- **Location** → Trade Efficiency: **Vietnam's Southeast Asian position** → Better access to Asian markets → Enhanced export competitiveness vs. India,
- **Climate** → **Industry Specialization: India's** diverse climate → Cotton cultivation → Cotton-based textiles. **Vietnam's** tropical climate → **Focus on synthetic fibers** → Fast fashion production (e.g., Zara, H&M),
- **Industries**→ **Supply Chain**: Vietnam: Concentrated textile clusters → Efficient supply chains while in India: Dispersed industry → Logistical challenges,
- **Infrastructure** → Export Costs: **Vietnam's modern ports and transportation** → Lower export costs. **India's** infrastructural bottlenecks → Higher logistics expenses,
- **Regional Integration** → Market Access: **Vietnam** in ASEAN and CPTPP → Stronger East Asian economic ties. **India's** RCEP withdrawal → Limited regional market integration

China's Evolving Role: China is transitioning to higher-value products and investing in Vietnam and Bangladesh, intensifying competition for India in the region.

Government Initiatives

- **Market Access Initiative (MAI) Scheme**: Aims to Supports textile exporters through rebates on state and central taxes.
- **SAMARTH Scheme**: Aims to train 10 lakh people to meet industry demand for skilled labour.
- **Cott-Ally Mobile App**: Assists cotton farmers by providing information on MSP, procurement centres, payments, and best farming practices.
- **Mega Investment Textiles Parks (MITRA)**: Establishes seven textile parks to boost industry competitiveness and attract investments.
- **Confederation of Indian Textile Industry (CITI) Initiatives**: Improves cotton yield and production sustainability in collaboration with farmers.

VisionIAS Test Series Question

Q. Discuss the problems and prospects of the cotton textile industry in India.

Q. What are the factors responsible for spatial distribution of cotton textiles industry in India? Also assess the challenges faced by the industry and suggest measures to meet its growing demand going forward.

7.3. Jute Industry

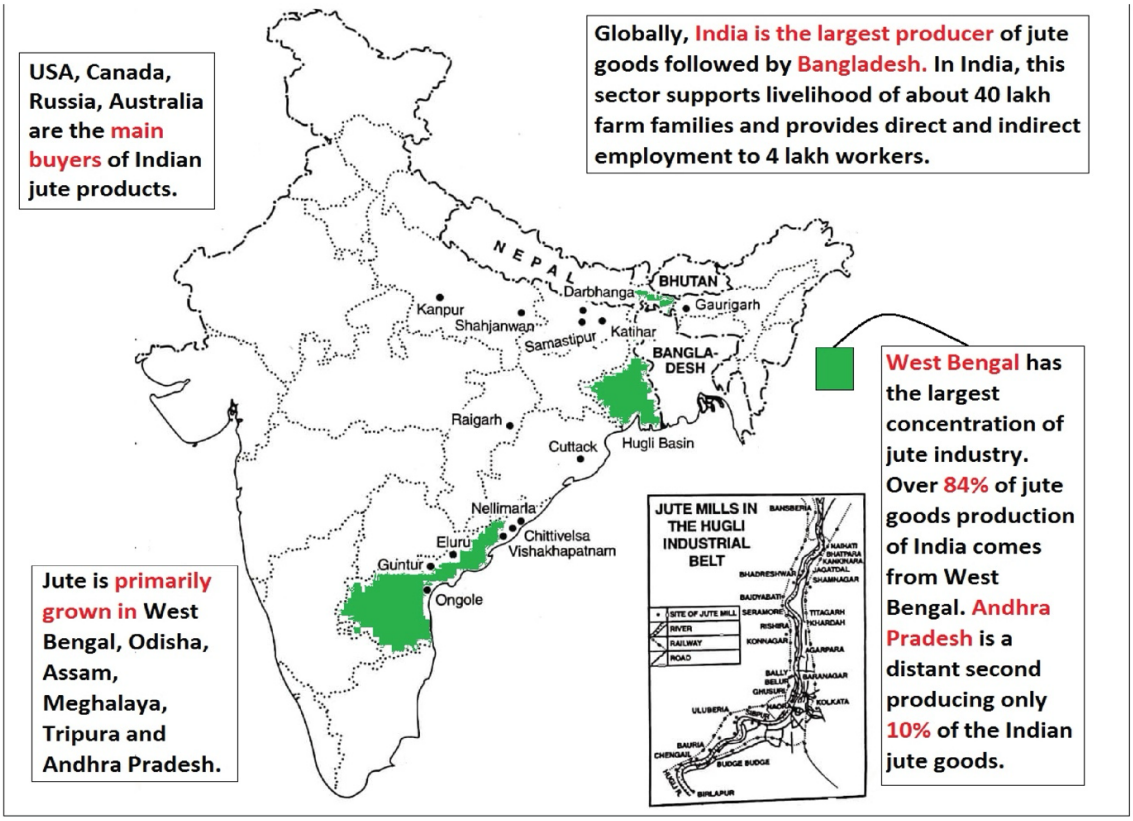
India is the **world's largest producer of jute**. The **jute textile industry** holds **significant** importance in India, ranking **second only to cotton**. As of **2023**, India have 97 jute mills, primarily located in **West Bengal (71) and Andhra Pradesh (12).** The mills in West Bengal are concentrated along a 100 km stretch along the Hooghly River.

Factors affecting location of the Industry

- **Raw Material**: West Bengal's delta soil and climatic conditions are ideal for jute cultivation.
- **Transportation**: The Hooghly River serves as a crucial waterway, facilitating transport from jute-growing areas. Kolkata port aids in machinery imports and finished product exports.
- **Market Access**: There is a robust domestic market across India for jute products, particularly gunny bags.
- **Labour**: The densely populated **Ganga-Brahmaputra Delta region** provides a ready workforce, including from neighbouring Bihar and Uttar Pradesh.

Student Notes:

Jute Textile Industry in India



Challenges

- **Historical Factors**: Post-partition, many jute-producing areas went to Bangladesh, while the mills remained in India. This imbalance necessitates jute fibre imports from Bangladesh to meet demand.
- **Technological Obsolescence**: Outdated machinery, power shortages, and industrial inefficiencies hinder production.
- **Competition and Alternatives**: Newly established **mills in Bangladesh** pose competitive challenges, while synthetic materials like polythene and nylon are replacing traditional jute products.

Government Initiatives for the Jute Industry in India

- **Jute Diversification Scheme**: Encourages diversification of jute products to expand market opportunities.
- **Domestic Market Promotion Activities (DMPA)**: Promotes jute products within India to increase domestic sales.
- **Mandated Jute Packaging**: The Cabinet Committee on Economic Affairs approved reservation norms mandating:
  - **100% packaging of foodgrains** and
  - **20% of sugar** in jute bags for the Jute Year 2023-24.

VisionIAS Test Series Question

Q. Give an account of locational factors that have influenced the distribution of jute industry in India. What are the challenges that this industry faces?

Q. Enlist the factors responsible for the location of jute industry in India. Also, discuss the challenges faced by the industry.

7.4. Tea Industry

Student Notes:

India is the **second-largest produce**r of tea globally. India is also among the world's **top tea-consuming countries,** with **80%** of the tea produced in the country consumed by the **domestic population.**

Growth Conditions for Tea Cultivation

- **Climate**: Hot and humid conditions.
- **Temperature**: 20°-30°C; harmful at above 35°C and below 10°C.
- **Rainfall**: 150-300 cm annually, evenly distributed.
- **Soil**: Slightly acidic, calcium-free, with porous sub-soil for good water percolation.

Distribution of the Industry

- **Regions**: **Assam (83% of national production)** and West Bengal are the primary tea-producing states. The **southern states** of Tamil Nadu, Kerala, and Karnataka contribute **17% of production.** Other regions include Tripura, Himachal Pradesh, and the North-Eastern states.
- **Varieties**: Assam is known for **Camellia Assamica**, with a unique malty and earthy flavour. Darjeeling is famous for its floral aroma and has GI tag recognition.
- **Export**: India is **4th largest tea exporter**, with major markets including Russia, Iran, UAE, USA, UK, Germany, and China. Black tea constitutes 96% of exports.

Challenges

The industry faces several challenges, including:

- **Crisis and Abandonment**: Low productivity, thin margins, and lesser export levels have led to the abandonment of tea estates.
- **Competition**: India faces stiff competition from Sri Lanka, Kenya, China, and Indonesia.
  - Demand for organic tea have further affected India's market position
- **Working Conditions and Small Tea Growers**: Tea workers face deeply embedded human rights and gender issues, such as low wages and poor working conditions, exacerbated by globally low prices.
- **Climate Change impact**: This has led to an increase in pest incidents in plantations, resulting in extensive pesticide use and subsequently raising the input costs of tea production.
- **External Factors**: The Russia-Ukraine war has worsened industry problems by disrupting supply chains and reducing tea imports from Russia, a major buyer of Indian tea.

Regulating Authority: Tea Board of India

- **Establishment**: Set up in 1953 under the Ministry of Commerce
- **Objective**: To make India a leading global tea producer through various programs and schemes.
- **Offices**:
  - **India**: Headquarters in Kolkata with 17 additional offices.
  - **Abroad**: Two offices located in Dubai and Moscow.

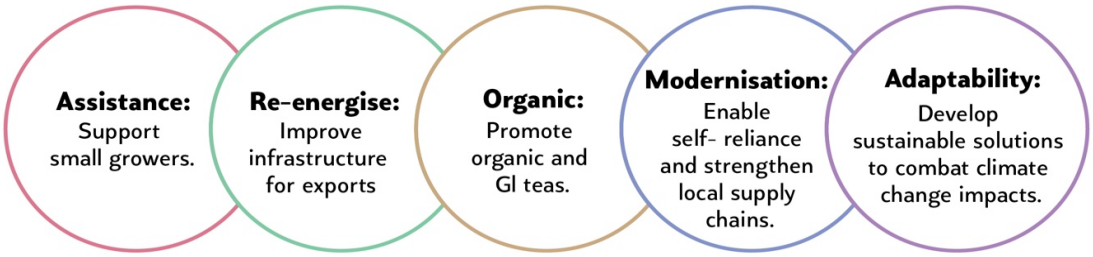
Government Initiatives

- **Tea Board of India**: Offers various schemes like the **Tea Development and Promotion Scheme (2021-26)** and the **Chai Sahyog Mobile App** for small growers.
- **Promotion and Subsidies**: Assistance for promotional campaigns and subsidies for exporters to participate in international fairs.
- **Regulatory Reforms**: Online Licensing System and worker welfare initiatives.
- Setting up of Mini tea factories to encourage entrepreneurs and unemployed youth.

Way Forward:

To enhance the sector's profitability and sustainability, the following steps are crucial:

- **ODOP (One district One Product) Scheme**: Promote tea as a unique product from different districts.
- **AROMA Strategy**:



The tea industry remains vital to India's economy and cultural heritage. Addressing current challenges through strategic initiatives and support systems will ensure its sustainable growth.

VisionIAS Test Series Question

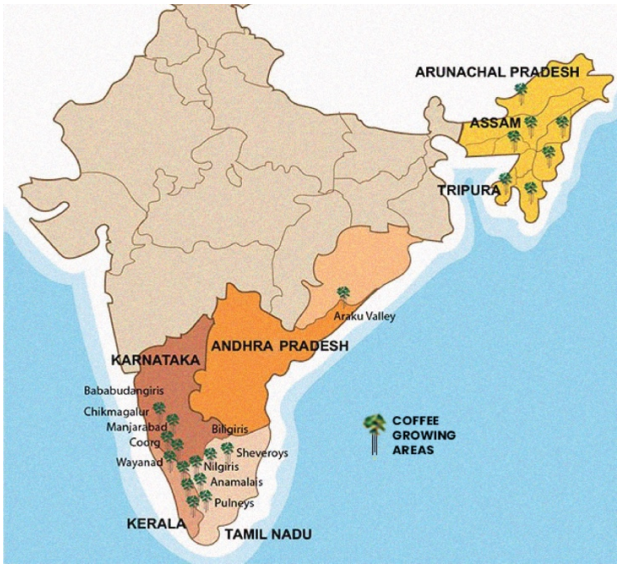
Q. What are the challenges faced by the jute industry in India? Highlight the steps taken by the government to address these challenges.

7.5. Coffee Industry

India became the **world's eighth largest coffee** grower during 2022-2023. India exports 70-80% of its coffee production, with major markets in Italy, Germany, Russia, and Belgium.

India produces two types of coffee:

- **Arabica**: 30% of production, higher quality.
- **Robusta**: 70% of production, more disease-resistant.



Geographical Distribution

- **Major Producing Regions**:
  - **Karnataka**: 71% of total production.
  - **Kerala**: 21% of total production.
  - **Tamil Nadu**: 5% of total production (Nilgiri district).

Factors Determining the Location of Coffee Industry

- **Climate**: Requires a hot and humid climate (15-28°C, 150-250 cm rainfall).
- **Vegetation**: Grown under shady trees.
- **Topography**: Hill slopes at elevations of 600-1,600 meters above sea level.

Why is Coffee Cultivation Restricted to the Bean Belt?

Coffee cultivation is restricted to **the "bean belt" region around the equator, between the Tropics of Cancer and Capricorn**, due to its ideal growing conditions. These include:

- **Soil**: Well-drained, rich in humus and minerals.
- **Capital and Labour**: Capital-intensive, labour-intensive industry requiring abundant, cheap, and skilled labour.

Challenges

- **Climate Change**: Erratic rainfall patterns and increased pest and disease incidence.
- **Small Holdings**: 98% of coffee growers are small farmers with an average farm size of 2-3 hectares.
- **Price Fluctuations**: Vulnerability to international market price volatility.
- **Labour Shortage**: Migration of workers to urban areas.
- **Competition**: From major producers like Brazil and Vietnam.

Geographical Indications (GI)
- **Coorg Arabica Coffee** (Karnataka)
- **Wayanad Robusta Coffee** (Kerala)
- **Chikmagalur Arabica Coffee** (Karnataka)
- **Araku Valley Arabica Coffee** (Andhra Pradesh)

Government Initiatives

- **Coffee Board of India**: Established in 1942 to develop the coffee industry, providing research, financial assistance, and marketing support.
- **Integrated Coffee Development Project**: Launched in 2014-15 to improve replantation, quality, and market development.
- **National policy of tribal development** encouraged coffee cultivation in non-traditional areas.
- **Export Promotion**: Market Development Assistance Scheme and brand promotion in international markets.

Coffee Board of India

Establishment: Statutory organization, constituted under Coffee Act, 1942. **HQ:** Bangalore.

Function: Under the administrative control of the **Ministry of Commerce and Industry.**

Objectives: Mainly focuses its activities in the areas of research, extension, development, market intelligence, external & internal promotion for coffee.

7.6. Rubber Industry

India is **the sixth largest producer** of natural rubber (NR) in the world and **second largest consumer** of NR.

- **Distribution**: Kerala (the largest producer), Tamil Nadu, Karnataka, Tripura, Assam, Andaman and Nicobar, and Goa.
- **World (major producers):** Thailand, Indonesia, Malaysia.

Factors Responsible the Location of Natural Rubber Industry

- **Climatic Conditions**: Favourable warm, humid tropical climate, Lateritic soils rich in iron.
- **Labour**: Need skilled labour to collect Latex,
- **Disease Resistance**: High-yielding varieties resistant to fungal infections.

Favourable Conditions for Rubber
- **Age:** around 32 years in plantations.
- **Soil:** Well-drained and well-weathered soils e.g., Lateritic type, alluvial, sedimentary types
- **Precipitation and Temperature:** An evenly distributed rainfall with at least 100 rainy days a year and a temperature range of about 20 to 34°C.
- **Conditions:** A humidity of around 80%, 2000 hours of sunshine, and absence of strong winds.

Why Did the Southeast Asian Rubber Industry Rise and the South American Industry Fall?
- The **Southeast Asian rubber industry** rose since 1930s due to Favourable climate, successful domestication, abundant labour, political stability, disease resistance, technological advances, and quality control.
- Conversely, the **South American industry** collapsed due to wild tree reliance, labour shortages, political instability, disease susceptibility, technological and competition from Southeast Asia.

- **Yield and Quality Control**: Regular replanting maintained high yield and quality; strong focus on quality control.

Challenges Facing the Rubber Industry:

- **High Labour Costs**: Expensive skilled labour for rubber tapping makes plantations financially unsustainable.
- **Import Competition**: Cheaper imported rubber lowers domestic prices, further discouraging local production.
- **Production-Consumption Gap**: Increasing tire industry demand widens the gap between rubber production and consumption.
- **Climate Change**: Changing weather, especially in traditional areas like Kerala, poses challenges for rubber cultivation.
- **Technological Lag**: Limited adoption of advanced technology reduces productivity and global competitiveness.

The **Rubber Board of India**, established in 1955 and **headquartered** in **Kottayam**, Kerala, operates under the Ministry of Commerce and Industry. Its primary objective is to **foster the growth and advancement of the rubber industry** across India.

Government Initiatives in the Rubber Sector:

- **Rubber Plantation Development Scheme**: Provides financial assistance to farmers to develop rubber plantations.
- **Rubber Group Planting Scheme**: Offers financial incentives for forming rubber farmer groups and societies.
- **National Rubber Policy 2019**: Supports the entire rubber industry value chain, including natural rubber production.
- Sustainable and Inclusive Development of the Natural Rubber Sector
- To encourage investment **100% FDI** permitted.

VisionIAS Test Series Question

Q. Enlisting the key factors responsible for rubber production in India, give an overview of the rubber industry in the country.

8. Other Industries

8.1. Lumbering, Pulp and Paper Industry

Lumbering is the sorting, felling of trees in the forest and transporting them as logs to the various places where they are processed for domestic, industrial and commercial purposes.

Why lumbering in tropical regions is tough ?

- **Dense Vegetation:** Thick forests make it difficult to access and transport logs.
- **High Biodiversity:** Protecting diverse ecosystems and wildlife requires careful, restrictive practices.
- **Climate Conditions**: Heavy rainfall and humidity create muddy, slippery conditions and can cause rapid decay of felled timber.

Distribution of Paper and Pulp Industry

- In **India,** West Bengal, Maharashtra, Madhya Pradesh, Andhra Pradesh, Karnataka, and Tamil Nadu, contribute about 65% of the country's total production capacity.
- Uttar Pradesh (Western region) leads in the number of mills but with smaller capacities.
- **Globally**, North America, Northern Europe, and East Asia dominate production, with China, Japan, and the United States being major contributors.

Student Notes:

Location factors

- **Proximity to Raw Materials:** Depends on availability of bamboo and softwood, e.g., South Gujarat, Odisha, Madhya Pradesh.
- **Abundant Coal Supply:** Influences energy needs and offsets raw material shortages, historically important in Bengal.
- **Nearness to Markets:** Located where cheap labour and water are accessible, e.g., Kolkata sourcing from Northeastern States.
- **Water Supply:** Requires clean, chemical-free water; often situated near forests to avoid polluted rivers.

Canada is major newsprint producer of the world due to:

- Abundant forest resources for pulp and paper mills.
- Cheap hydro-electricity from fast-flowing rivers supports high mechanization.
- Efficient timber transport via rivers ensures easy access to raw materials.
- Strong demand from the US, the world's largest paper consumer, sustains production.

Challenges

- **Raw Material Shortages:** Limited supply of Sabai grass and Bamboo due to shrinking forests, requiring advanced processing technologies.
- **High Production Costs:** Expensive equipment, increasing power and coal costs
- **Environmental Concerns**: Challenges in effluent disposal with insufficient processing solutions, facing environmental opposition.
- **Demand-Supply Dynamics:** India, with 16% of the global population, consumes only 2.5% of global paper and paperboard, indicating significant growth potential driven by rising literacy rates.

Way Forward

- **Raw Material Strategies:** Shift to eucalyptus, wattle, and mulberry wood, promote recycling, and focus on social and farm forestry.
- **Comparative Advantages:** India benefits from faster tropical plantation growth (6-7 years) and lower labour costs.
- **Bagasse Utilization:** Encourage efficient use, possibly shifting from bagasse to coal-fired boilers in sugar mills to enhance availability for paper production.

8.2. Pharmaceutical Industry

India's pharmaceutical industry has emerged as a **"pharmacy of the world".** The Indian pharmaceutical industry is the **world's 3rd largest** by volume and **14th largest in terms of value**.

Location Factors of Pharmaceutical Industries in India

Market:

- Large domestic market,
- West coast location advantageous for exports to Africa and Europe.

Government Policy:

- 100% FDI allowance attracts foreign investments,
- Strong IP protection under Indian Patents Act, 1970,

Infrastructure: Availability of power, transport, and communication,

Labour Skills:

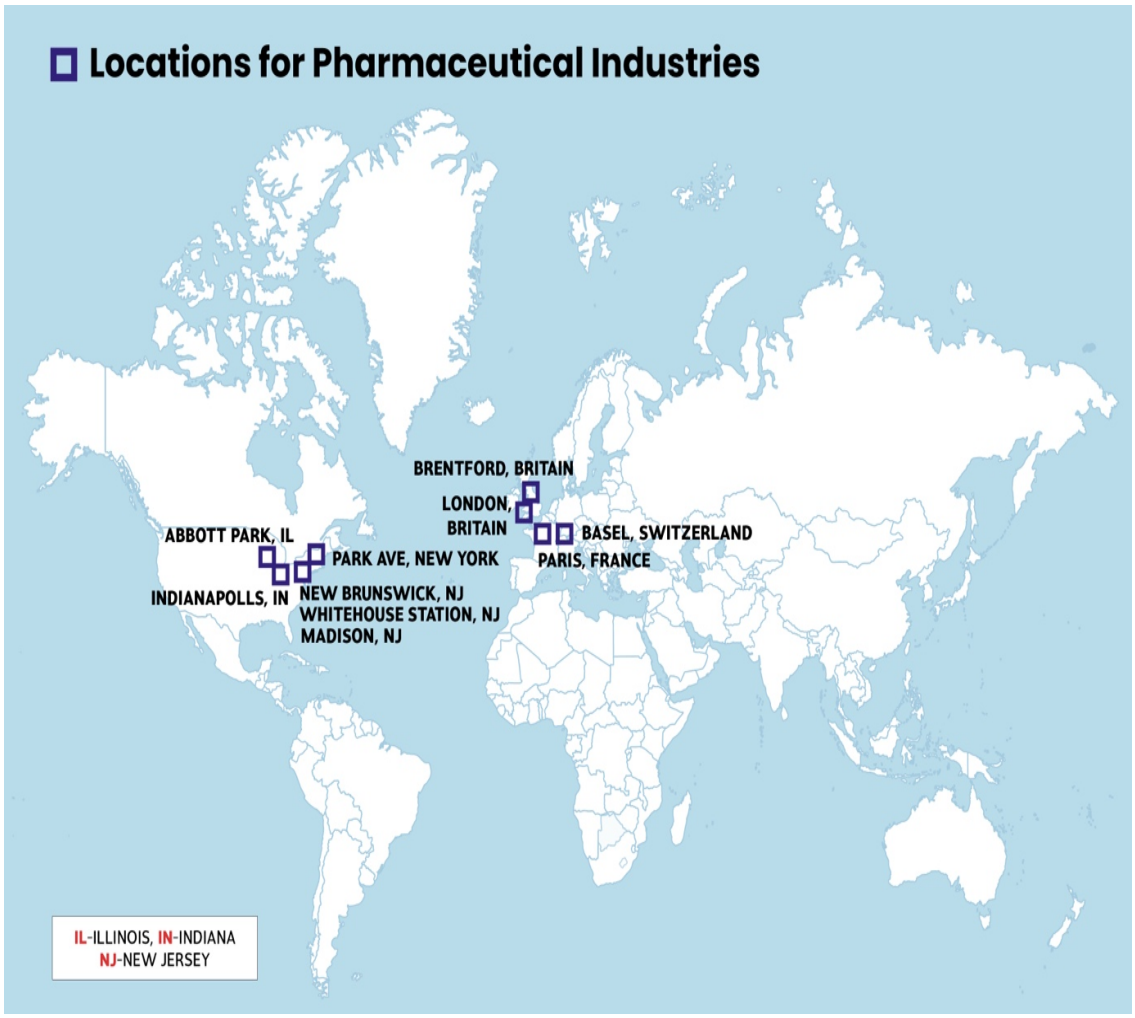
- Availability of skilled labour,
- Contributes to industry decentralization across the country,

Raw Materials: Proximity to petrochemical hubs (e.g., Jamnagar, Gujarat; Bombay High, Maharashtra).

Capital Availability: Western India's traditional role as a trade and capital hub.

Student Notes:

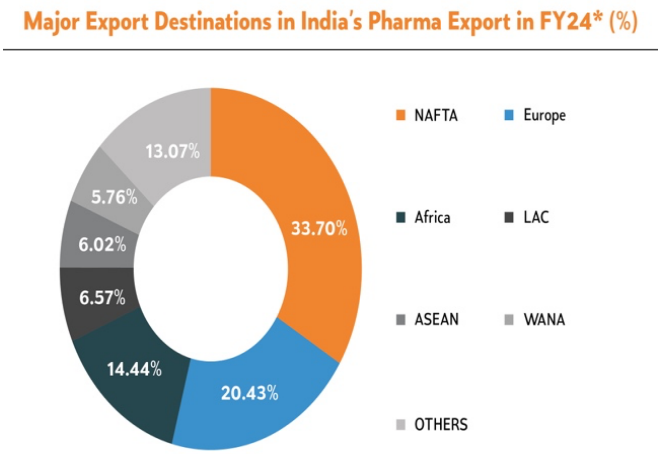
Student Notes:



Problems of Pharmaceutical Industries in India

Technology Gap:

- Lagging in R&D for new medicine development
- Limited focus on research and innovation



Raw Material Dependence:

- High reliance on China for Active Pharmaceutical Ingredients (APIs)
- Import of ~70% of bulk drug requirements from China

Global Competition:

- Stiff competition from China, Israel, and Japan
- Accusations of patent violations by big players
- Weakening intellectual property environment post-TRIPS implementation

Quality Issues:

- Adulteration and piracy concerns,
- Proliferation of duplicate manufacturers.

Student Notes:

International Pressure:

- **U.S. Trade Representative's 2024 Special 301 Report** includes India in the 'Priority Watch List' along with China, Russia, Venezuela, Indonesia, Chile, and Argentina. (**Reason** behind this related to **Intellectual Property (IP) protection** and enforcement),
- Lead to negative impact on industry reputation and exports.

These challenges highlight the need for strategic interventions to enhance India's pharmaceutical industry competitiveness and self-reliance.

Recent Government Initiatives:

- **Scheme for Development of Pharma industry** – Umbrella Scheme such as Assistance to Pharmaceutical Industry (CDP-PS).
- **Production Linked Incentive (PLI) Scheme:** Rs. 15,000 crore allocated to boost domestic manufacturing of APIs and medical devices.
- **Bulk Drug Parks Scheme:** Rs. 1,000 crore for the promotion of bulk drug parks for FY25,
- **R&D and Biotech Focus**: National Biopharma Mission to accelerate biopharmaceutical development.
- **Efforts like Mission COVID** Suraksha and the resumption of vaccine exports to COVAX highlight India's role in global health security.

VisionIAS Test Series Question

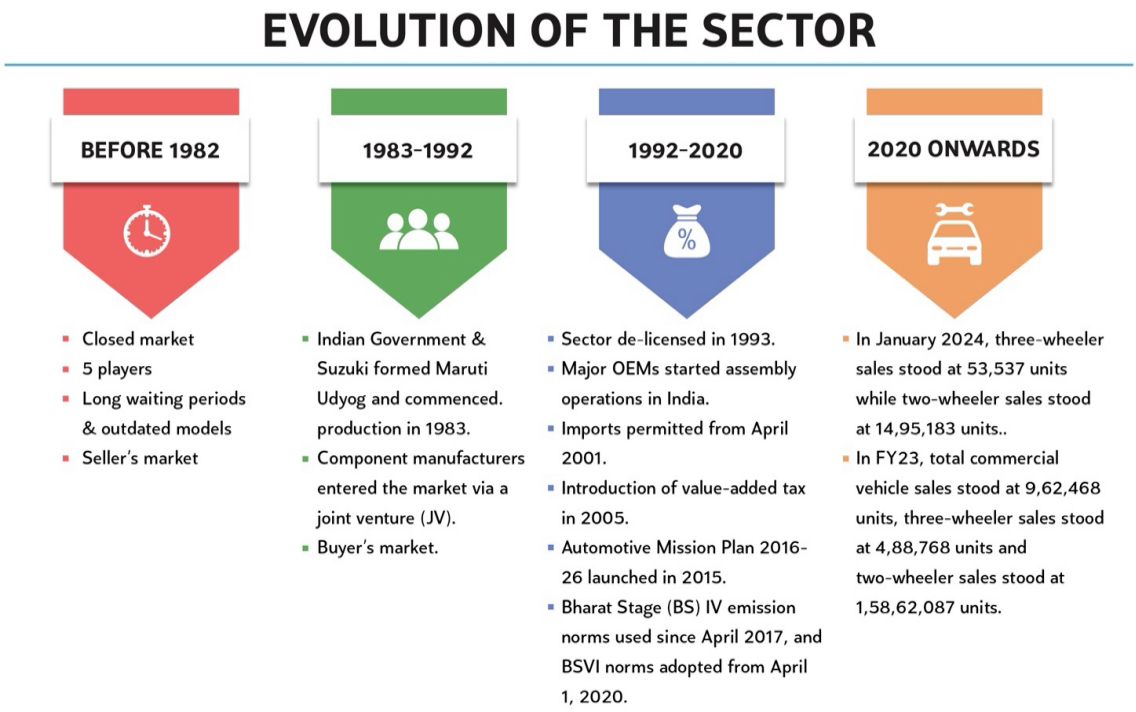
Q. State the key factors behind the growth of the pharmaceutical industry in India. Additionally, discuss its significance with regard to India's economy and public health.

Q. What are the factors driving the growth of nutraceutical industry in India? How can nutraceuticals address the country's public health needs?

Student Notes:

8.3. Automobile Industry

India has emerged as **Asia's fourth largest exporter** of automobiles, following Japan, South Korea, and Thailand. This growth underscores its potential to lead in global car volumes, projected to reach approximately **611 million vehicles on Indian roads by 2050.**



Location Factors of Automobile Industries

- **Proximity to Raw Materials:** Requires a steady supply of raw materials such as steel, nonferrous metals, plastics, rubber, and electronics. **Proximity to steel-producing centres** is **crucial** due to the high demand for steel in vehicle manufacturing.
- **Access to Ports:** Port cities like Mumbai, Chennai, and Kolkata are favoured due to their logistical advantages for importing raw materials and exporting finished vehicles.
- **Market-Oriented Locations:** Urban centres like Delhi-NCR, Mumbai, Chennai, and Pune not only offer large consumer markets but also provide access to skilled labour and supporting industries.
- **Government Policy and Initiatives:** The Auto Policy has positioned India as a hub for small car production, focusing on quality and affordability.

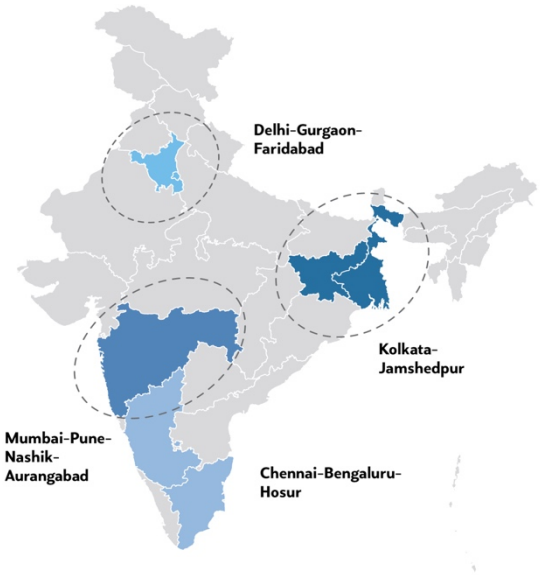
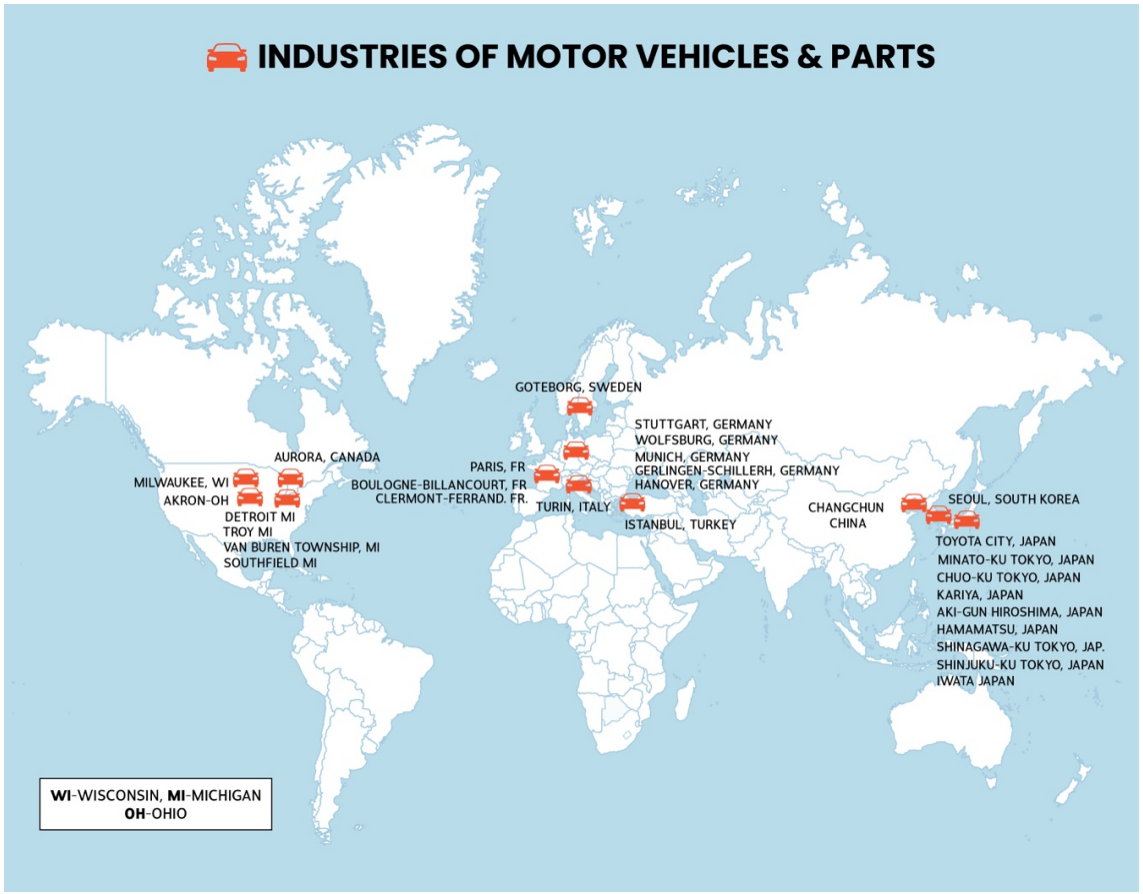


Figure 1 four specific regions in the country have become large auto manufacturing clusters,

Student Notes:



Student Notes:

Challenges Faced by the Industry

- **Environmental Regulations** Stringent environmental safeguards, including emission standards, fuel categorizations, and promotion of biofuels and electric vehicles, pose regulatory challenges.
- **Infrastructure Constraints** Automobile plants require substantial investments in land, capital, and skilled labour. Challenges in land acquisition, as seen in Bengal and Orissa, hinder industry growth.
- **Diverse Market Dynamics** India's diverse consumer base, influenced by varying socio-economic factors, demands a versatile product portfolio that caters to both urban middle-income groups and rural populations.
- **Research and Development** Insufficient focus on research and development in fuel-efficient technologies, emission standards, and cost-effective production methods hampers technological advancement and competitiveness.

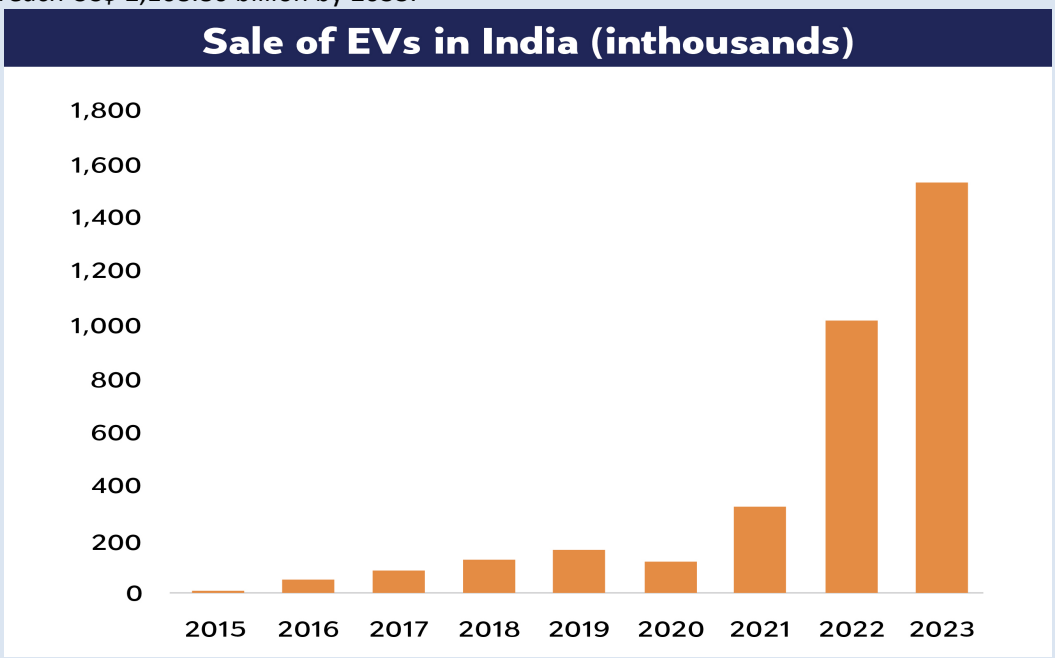
Government Initiatives

- **FDI and NATRIP**: India allows 100% FDI in automobiles and established NATRIP for testing and R&D since 2015.
- **PLI Scheme**: Extended PLI Scheme for Auto and Auto Components till March 2028 to boost manufacturing incentives.
- **Automotive Mission Plan 2016-26 (AMP 2026)**: Aims for four-fold growth in auto sector over next decade.
- **FAME Scheme**: New scheme to promote electric vehicles and enhance charging infrastructure with US$ 321.5 million budget allocation for 2024-25.

Emerging Industry

Electric Vehicle

- **Global Growth**: The global EV market, valued at US$ 255.54 billion in 2023, is expected to reach US$ 2,108.80 billion by 2033.



- **Sales Surge**: Electric vehicle sales in India jumped 49.25% in 2023, reaching 1.52 million units.
- **Government Goals**: **India aims for significant EV adoption by 2030**
- **Infrastructure Focus**: Focus on developing reliable and affordable charging infrastructure is crucial for sustained growth.

- **Industry Landscape**: Over **700 EV startups in India** highlight the sector's dynamic nature, presenting opportunities for automotive suppliers.
- **Battery Market**: The Indian EV battery market is projected to grow from US$ 16.77 billion in 2023 to US$ 27.70 billion by 2028.

Policies to boost Electric Vehicle manufacturing

- **Electric Mobility Promotion Scheme:** Aims to boost green mobility and electric vehicle manufacturing in India.
- **Bihar Electric Vehicle Policy-2023:** Targets 15% EV adoption in vehicle registrations by 2028.
- **Tamil Nadu Battery Manufacturing Policy:** Planned to strengthen its role in global EV manufacturing; currently produces 40% of EV four-wheelers and 70% of two-wheelers in India.

VisionIAS Test Series Question

Q. The automobile industry across the world is witnessing far reaching changes especially in terms of restructuring and reorganization of its production structure. Discuss.

8.4. Fertilizer Industry

India's fertilizer industry is essential for agricultural productivity, food security, employment, and regional development. Historically, fertilizer plants have been concentrated in states like Gujarat, Uttar Pradesh, Punjab, Tamil Nadu, and Maharashtra.

Relationship with Oil Refineries and Coal Producing Areas:

- **Raw Material Dependency:**
  - **Naphtha**, a **byproduct of oil refining**, is crucial for nitrogenous fertilizer production.
  - **Methane** from coal is **used to manufacture ammonia,** a key component in nitrogen-based fertilizers like Urea.
- **Proximity to coal mines** ensures access to minerals essential for fertilizer production.
- **Energy Requirements:** Fertilizer production demands consistent energy supply, often sourced from **nearby oil and coal resources.**

Setting Up Fertilizer Plants Near Consumer Centres:

In recent trends, fertilizer plants are increasingly established **near consumer centres such as in**

Student Notes:

Student Notes:

Uttar Pradesh due to several factors:

- **Increased Consumption in Agricultural Belts:** Intensive cultivation in regions like Punjab and Northern Uttar Pradesh has raised fertilizer demand, necessitating local production.
- **Infrastructure Support:** The Hazira-Vijaipur-Jagdishpur (HVJ) gas pipeline and efficient rail networks facilitate transportation, enabling decentralized plant setups at places like Vijaypur, Jagdalpur, Aonla, Gadepan, Babrala, and Shahjahanpur.
- **Environmental Concerns and Soil Degradation:** Growing soil degradation issues have escalated fertilizer demand in core agricultural areas, influencing plant localization.
- **Government Incentives:** Government subsidies on fertilizers encourage decentralized production closer to major consumption hubs.

The fertilizer industry's evolution from **resource-centric** to demand-driven locations underscores changing economic and policy dynamics in India. Strategic shifts towards consumer centres reflect a proactive response to agricultural needs and logistical advantages.

VisionIAS Test Series Question

Q. What are the major factors that influence the location of the fertilizer industry in India? Explain with the help of suitable examples.

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