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Economic Geography Part II (Industrial Locational Factors Part I)

Factors responsible for the location of primary, secondary, and tertiary sector

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1. Primary, Secondary and Tertiary Sectors

- Economic activities are broadly grouped into **primary, secondary, tertiary** and **quaternary activities**.

1.1. Primary Activities

- Primary activities are **directly dependent on the environment** as these refer to utilisation of earth's resources such as land, water, vegetation, building materials, minerals, etc.
- It thus includes hunting, gathering, pastoral activities, fishing, forestry, agriculture, **mining, quarrying, etc.**
- Industries that are involved in primary economic activities are called as primary industries.

1.1.1 Hunting and Gathering

- Gathering is practised in regions with harsh climatic conditions.
- It involves primitive societies that extract from both plants and animals to satisfy their basic needs.
- The yield per person is meagre and little, or no surplus is produced.
- Gathering is practised in:
 - ✓ high latitude zones which include northern Canada, northern Eurasia and southern Chile.
 - ✓ Low latitude zones such as the Amazon Basin, tropical Africa, Northern fringe of Aus-

tralia and the interior parts of Southeast Asia.

- They use various parts of the plants, e.g., the bark is used for **quinine, tanin** extract and tree trunk yield rubber, gums and resins.
- The chewing gum after the flavour is gone is called Chicle — it is made from the juice of **zapota tree**.
- In modern times some gathering is market-oriented and has become commercial.
- However, synthetic products often of better quality and at lower prices have replaced many items supplied by the gatherers in tropical forests.
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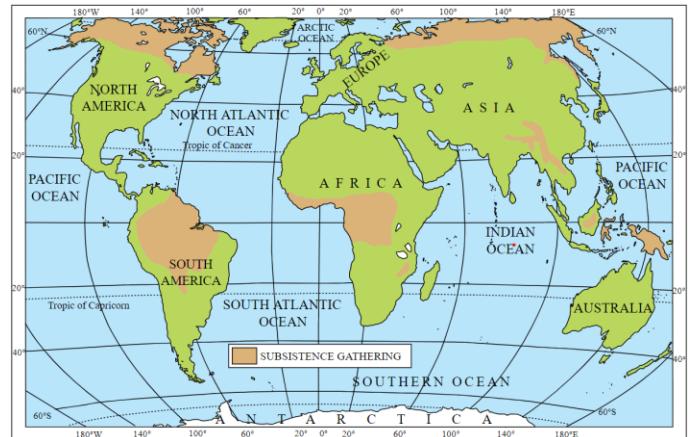


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1.1.2 Pastoralism

- At some stage in history, as hunting was unsustainable, humans began the domestication of animals.
- People living in different climatic conditions selected and domesticated animals found in those regions.

Nomadic Herding (pastoral nomadism)

- Nomadic herding is a primitive subsistence activity.

- They move from place to place along with their livestock, depending on the availability of pastures & water.
- A wide variety of animals is kept in different regions.
- In tropical Africa, cattle are the most important livestock, while in Sahara and Asiatic deserts, sheep, goats and camel are reared.
- In the mountainous areas of Tibet and Andes, yak and llamas and in the Arctic and sub-Arctic regions, reindeer are the most important animals.
- Pastoral nomadism is associated with three important regions.
- The core region extends from the Atlantic shores of North Africa eastwards across the Arabian Peninsula into Mongolia and Central China.
- The second region extends over the tundra region of Eurasia.
- In the southern hemisphere there are small areas in South-west Africa and on the island of Madagascar.

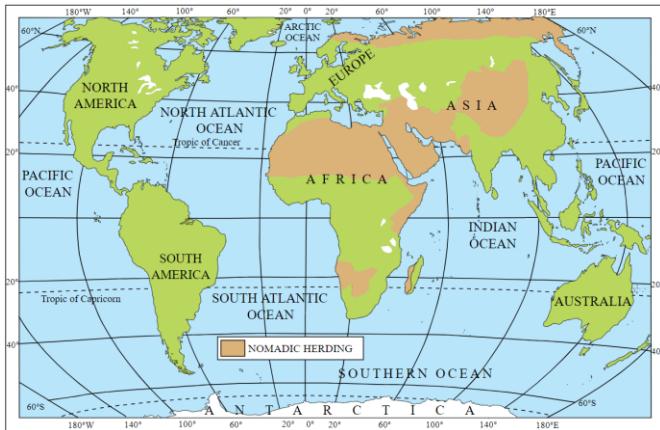


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- The process of migration from plain areas to pastures on mountains during summers and again from mountain pastures to plain areas during winters is known as **transhumance**.
- In mountain regions, such as Himalayas, **Gujjars, Bakarwals, Gaddis** and **Bhotiyas** migrate from plains to the mountains in summers and

to the plains from the high altitude pastures in winters.

- The number of pastoral nomads has been decreasing due to the imposition of political boundaries.

1.1.3 Commercial Livestock Rearing

- Commercial livestock rearing is more organised and capital intensive.
- Commercial livestock ranching is associated with western cultures and is practised on permanent ranches.
- These ranches (a large farm where cattle are bred) cover large areas and are divided into a number of parcels, which are fenced to regulate the grazing.
- When the grass of one parcel is grazed, animals are moved to another parcel.
- This is a specialised activity in which **only one type of animal is reared**.
- Essential animals include sheep, cattle, goats and horses.
- Meat, wool, hides and skin are processed and packed scientifically and exported world markets.
- Rearing of animals in ranching is organised on a scientific basis.
- The main emphasis is on breeding, genetic improvement, disease control and health care of the animals.

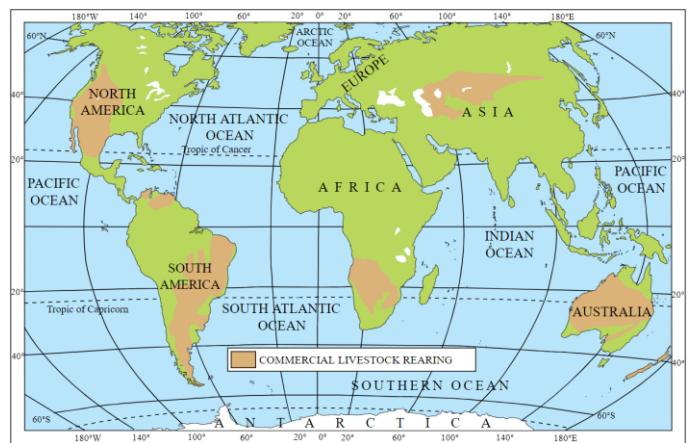


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- **New Zealand, Australia, Argentina, Uruguay** and **the United States of America** are important countries where commercial livestock rearing is practised.

1.1.4 Subsistence Agriculture

- In subsistence agriculture, almost all the production is consumed locally with little or nothing left for trade.
- Primitive Subsistence Agriculture and Intensive Subsistence Agriculture are the two types.

Primitive Subsistence Agriculture

- Primitive subsistence agriculture or **shifting cultivation** is widely practised by many tribes in the tropics.
- The vegetation is usually cleared by fire, and the ashes add to the fertility of the soil.
- Shifting cultivation is thus, also called **slash and burn** agriculture.
- It is prevalent in the tropical region in different names, e.g. **Jhuming** in Northeastern states of India, **Milpa** in Central America and Mexico and **Ladang** in Indonesia and Malaysia.

Intensive Subsistence Agriculture

- This type of agriculture is largely found in **densely populated regions of monsoon Asia**.
- There are two types of intensive subsistence agriculture.

Intensive subsistence agriculture dominated by wet paddy cultivation

- Landholdings are very small due to the high density of population.
- Farmers work with the help of family labour leading to intensive use of land.
- Use of machinery is limited, and most of the agricultural operations are done by manual labour.

- Farmyard manure is used to maintain the fertility of the soil.
- In this type of agriculture, the **yield per unit area is high but per labour productivity is low**.

Intensive subsistence agriculture dominated by crops other than paddy

- Due to the difference in relief, climate, soil, etc. it is not practical to grow paddy in parts of monsoon Asia.
- Wheat, soyabean, barley & sorghum are grown in northern China, North Korea and North Japan.
- In India wheat is grown in plains and millets are grown in dry parts of western and southern India.
- Most of the characteristics are similar to that of wet paddy cultivation except that **irrigation is often used**.

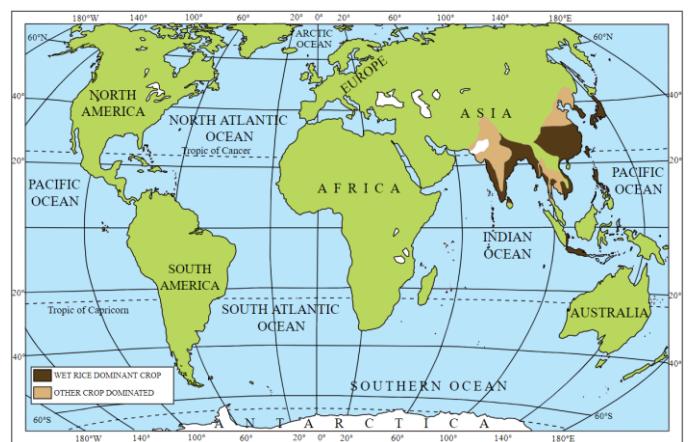


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1.1.5 Plantation Agriculture

- Plantation agriculture was introduced by the Europeans in colonies situated in the tropics.
- Plantations are mainly profit-oriented large scale production systems.
- E.g. **tea, coffee, cocoa, rubber, cotton, palm, sugarcane, banana & pineapple**.
- The characteristic features of this type of farming are

- ✓ **large estates or plantations,**
- ✓ **large capital investment,**
- ✓ managerial and technical support,
- ✓ scientific methods of cultivation,
- ✓ single crop specialisation,
- ✓ cheap labour, and
- ✓ **a good system of transportation** which links the estates to the factories and markets.
- The **French** established **cocoa** and **coffee** plantations in **west Africa**.
- The **British** set up large
 - ✓ **tea gardens in India and Sri Lanka,**
 - ✓ **rubber plantations in Malaysia** and
 - ✓ **sugarcane** and **banana** plantations in **West Indies**.
- Spanish and Americans invested heavily in **coconut** and **sugarcane** plantations in the **Philippines**.
- The Dutch once had a monopoly over **sugarcane** plantation in **Indonesia**.
- Some **coffee** fazendas (large plantations) in **Brazil** are still managed by Europeans.

1.1.6 Extensive Commercial Grain Cultivation

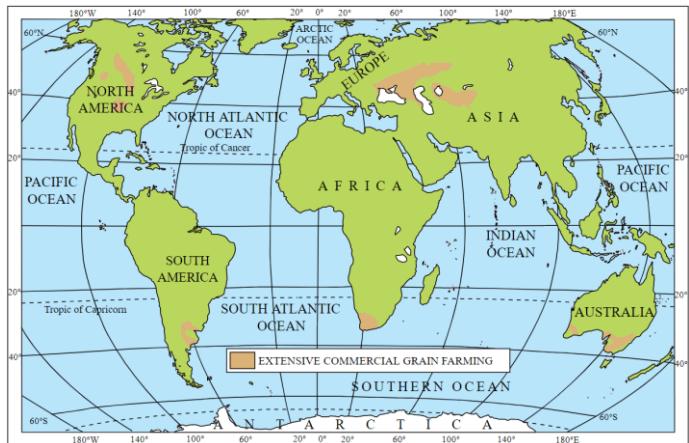


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- Commercial grain cultivation is practised in the interior parts of semi-arid lands of the midlatitudes.

- **Wheat** is the principal crop, though other crops like **corn, barley, oats** and **rye** are also grown.
- The size of the farm is very large. Therefore entire operations of cultivation are **mechanised**.
- There is a **low yield per acre but high yield per person**.
- This type of agriculture is best developed in the **Eurasian steppes**, the **North American Prairies**, **Pampas of Argentina**, **Velds of South Africa**, the **Australian Downs** and the **Canterbury Plains of New Zealand**.

1.1.7 Mixed Farming

- This form of agriculture is found in the highly developed parts of the world, e.g. **North-western Europe**, **Eastern North America**, and the temperate latitudes of Southern continents.
- Mixed farms are moderate in size & the crops grown are **wheat, barley, oats, maize, fodder & root crops**.

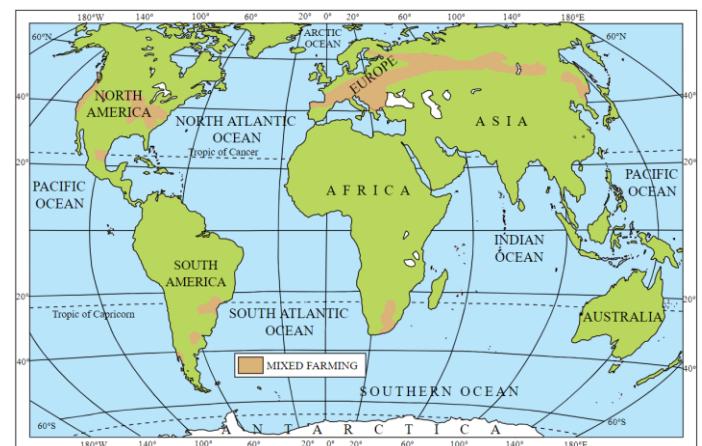


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- **Animal husbandry** is an essential component of mixed farming.
- Animals like cattle, sheep, pigs and poultry provide the primary income along with crops.
- **Crop rotation** and **intercropping** play an essential role in maintaining soil fertility.
- Mixed farming is characterised by **high capital expenditure** on farm machinery and building, **extensive use of chemical fertilisers** and

green manures and also by the **skill and expertise of the farmers**.

1.1.8 Dairy Farming

- Dairy is the most advanced and efficient type of rearing of milch animals.
- It is highly capital intensive.**
- Animal sheds, storage facilities for fodder, feeding and milking machines add to the cost of dairy farming.
- Special emphasis is laid on cattle breeding, health care and veterinary services.
- It is highly labour intensive** as it involves rigorous care in feeding and milking.
- There is no offseason during the year as in the case of crop raising.
- It is practised **near urban centres** which provide a neighbourhood market for fresh milk & dairy products.
- The development of transportation, refrigeration, pasteurisation and other preservation processes have increased the duration of storage of various dairy products.
- There are three main regions of commercial dairy farming.
- The largest is **North Western Europe** the second is **Canada**, and the third belt includes **South Eastern Australia, New Zealand and Tasmania**.

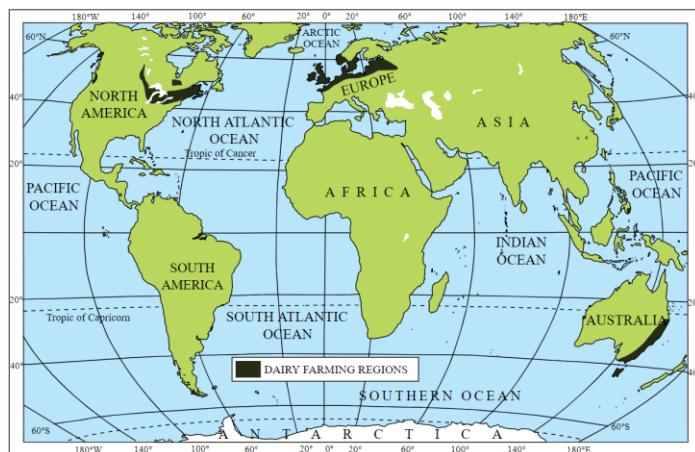


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1.1.9 Mediterranean Agriculture

- Mediterranean agriculture is highly specialised commercial agriculture.
- It is practised in the countries on either side of the Mediterranean Sea, southern California, central Chile, southwestern parts of South Africa and south and southwestern parts of Australia.
- This region is an important supplier of **citrus fruits**.
- Viticulture or grape cultivation** is a speciality of the Mediterranean region.
- Best quality wines in the world are produced from high-quality grapes in various countries of this region.
- The inferior grapes are dried into raisins and currants. This region also produces olives and figs.
- The advantage of Mediterranean agriculture is that more valuable crops such as fruits and vegetables are grown in **winters** when there is a great demand in European and North American markets.

1.1.10 Market Gardening and Horticulture

- Market gardening and horticulture specialise in the cultivation of high-value crops such as vegetables, fruits and flowers, solely for the **urban markets**.
- Farms are small and are located where there are **good transportation** links with the urban centre.
- It is **both labour and capital intensive** and lays emphasis on the use of irrigation, HYV seeds, fertilisers, insecticides, greenhouses and artificial heating in colder regions.
- This type of agriculture is well developed in densely populated industrial districts of **north-west Europe, northeastern United States of America and the Mediterranean regions**.

- The farming where farmers specialise in vegetables only is known as **truck farming**.
- The distance of truck farms from the market is governed by the distance that a truck can cover overnight.
- The modern development in the industrial regions of Western Europe & North America is **factory farming**.
- Livestock, particularly poultry and cattle rearing, is done in stalls and pens.
- They fed on manufactured feedstuff and carefully supervised against diseases.
- This requires **heavy capital investment**, veterinary services and heating and lighting.

1.1.11 Co-operative Farming

- A group of farmers form a co-operative society voluntarily for more efficient and profitable farming.
- Individual farms remain intact, and farming is a matter of cooperative initiative.
- Co-operative societies help farmers, to procure all valuable inputs of farming, sell the products at the most favourable terms and assist in the processing of quality products at cheaper rates.
- The co-operative movement has been successful in many western European countries like **Denmark, Netherlands, Belgium, Sweden, Italy** etc.

1.1.12 Collective Farming

- It is based on social ownership of the means of production and collective labour.
- Collective farming or the model of **Kolkhoz** was introduced in erstwhile USSR to improve upon the inefficiency of the previous methods of agriculture and to boost agricultural production for self-sufficiency.
- The farmers used to pool in all their resources like land, livestock and labour.

- They were allowed to retain very small plots to grow crops in order to meet their daily requirements.

1.1.13 Mining

- The actual development of mining began with the industrial revolution.
- Mining is of two types: surface mining (**open-cast mining**) and underground mining.
- Surface mining is the easiest and the cheapest way of mining minerals that occur close to the surface.
- The output is both large and rapid.
- When the ore lies deep below the surface, the underground mining (**shaft method**) has to be used.
- In this method, underground galleries from vertical shafts radiate to reach the minerals.
- Minerals are extracted and transported to the surface through these passages.
- It requires specially designed lifts, drills, haulage vehicles, ventilation system for safety and efficiency.
- This method is risky — poisonous gases, fires, floods, and caving lead to fatal accidents.
- The developed economies are retreating from mining, processing and refining stages of production due to high labour costs, while the developing countries with large labour force are becoming more important.
- Several countries of Africa and Asia have over fifty per cent of the earnings from minerals alone.

1.2. Secondary Activities

- Secondary activities transform raw materials into valuable products by the processes of processing, manufacturing, and construction.
- In each of these processes, the common characteristics are the **application of power, mass**

production of identical products and **specialised labour** in factory settings for the production of commodities.

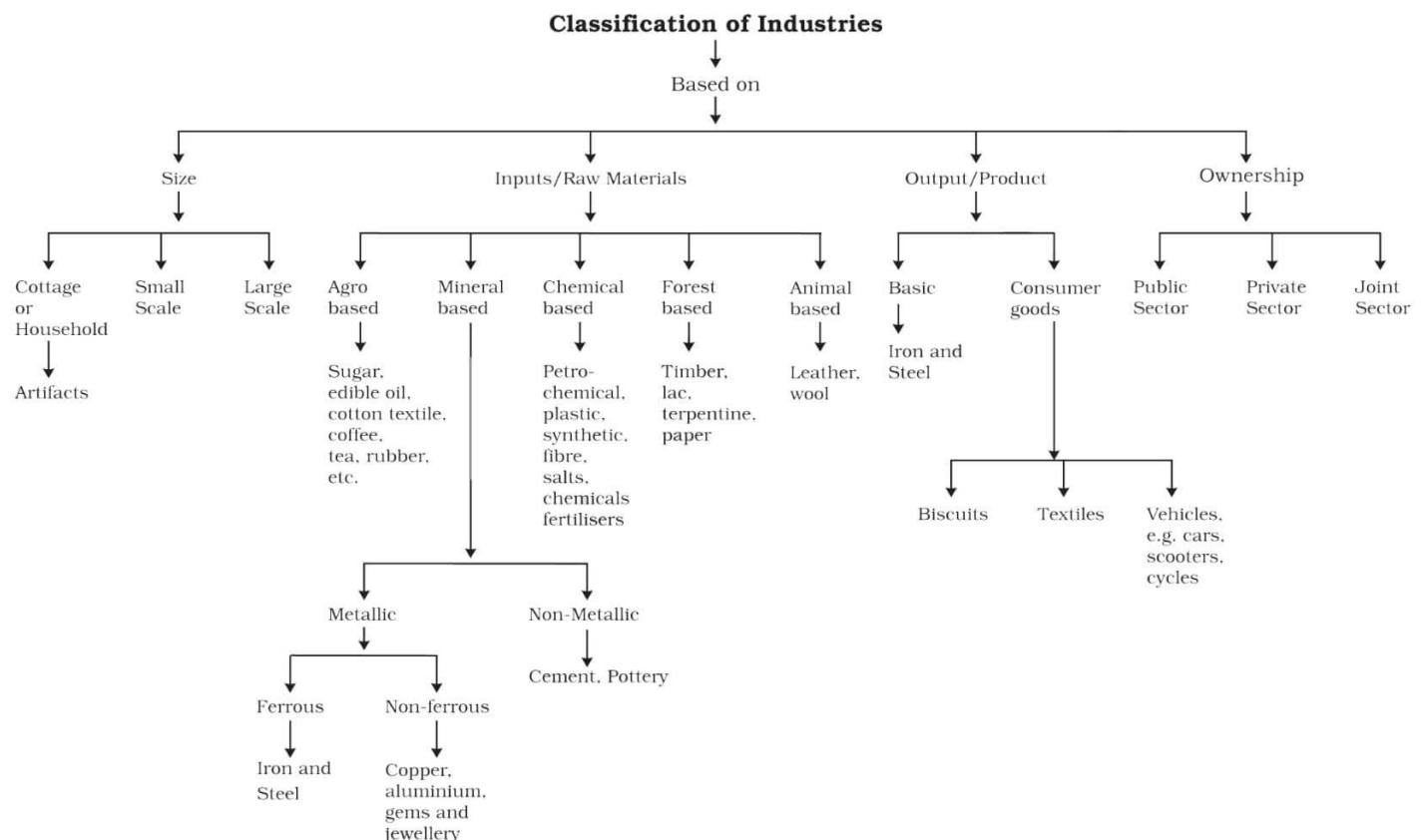
1.2.1 Modern Manufacturing Industry

- Modern large scale manufacturing undertakes mass production of standardised parts by each worker or robot performing only one task repeatedly.

Mechanisation

- Mechanisation refers to using gadgets which accomplish tasks.
- Automation** (manufacturing without the aid of human thinking) is the advanced stage of mechanisation.

1.2.2 Classification of Manufacturing Industries



Industries based on Size

- The amount of capital invested, number of employees, and volume of production determine the size of industry.

Technological Innovation

- Technological innovations through research and development strategy are an important aspect of modern manufacturing for quality control, eliminating waste and inefficiency, and combatting pollution.

Organisational Structure and Stratification

- Modern manufacturing is characterised by:
 - a complex machine technology
 - extreme specialisation and division of labour for producing more goods with less effort, and low costs
 - vast capital
 - large organisations
 - executive bureaucracy.

- Accordingly, industries may be classified into household or cottage, small-scale and large-scale.

Household industries or cottage manufacturing

- It is the smallest manufacturing unit.
- The artisans use local raw materials and simple tools to produce everyday goods in their homes with the help of their family members or part-time labour.
- Finished products may be for consumption in the same household or, for sale in local markets.
- Some common everyday products produced in this sector of manufacturing include foodstuffs, fabrics, mats, tools, furniture, leather, pottery, bricks from clays, etc.
- Goldsmiths make jewellery of gold, silver and bronze.

Small Scale Manufacturing

- Small scale manufacturing is distinguished from household industries by its production techniques and place of manufacture (a workshop outside the home/cottage of the producer).
- This type of manufacturing uses local raw material, simple power-driven machines and semi-skilled labour.
- It provides employment and raises local purchasing power.
- Therefore, countries like India, China, Indonesia and Brazil, etc. have developed labour-intensive small scale manufacturing in order to provide employment to their population.

Large Scale Manufacturing

- Large scale manufacturing involves a large market, various raw materials, enormous energy, specialised workers, advanced technology, assembly-line mass production and large capital.
- This kind of manufacturing developed in the last 200 years, in the United Kingdom, north-eastern U.S.A. and Europe. Now it has diffused to almost all over the world.
- On the basis of the system of large scale manufacturing, the world's major industrial regions

may be grouped under two broad types, namely

1. traditional large-scale industrial regions which are thickly clustered in a few more developed countries.
2. high-technology large scale industrial regions which have diffused to less developed countries.

Industries based on Inputs/Raw Materials

- On the basis of the raw materials used, the industries are classified as: (a) agro-based; (b) mineral based; (c) chemical-based; (d) forest-based; and (e) animal-based.
- Major agro-processing industries are food processing, sugar, pickles, fruits juices, beverages (tea, coffee and cocoa), spices and oils fats and textiles (cotton, jute, silk), rubber, etc.
- Agro-processing includes canning, producing cream, fruit processing and confectionery.
- Timber for the furniture industry, wood, bamboo and grass for the paper industry, lac for lac industries come from forests.
- Leather for the leather industry and wool for woollen textiles are obtained from animals.

Industries Based on Output/Product

- The industries whose products are used as raw material to make other goods are called **basic industries**.
- E.g. **Iron and steel**, copper smelting and aluminium smelting industries.
- The consumer goods industries produced goods which are consumed by consumers directly.
- E.g. industries producing bread, tea, soaps, paper, etc. are consumer goods or **non-basic industries**.

1.2.3 Foot Loose Industries

- Foot loose industries **can be located in a wide variety of places**.
- They are **not dependent on any specific raw material**, weight losing or otherwise.
- They largely depend on component parts which can be obtained anywhere.
- They produce in small quantity and also employ a small labour force.
- These are **generally not polluting industries**.
- The essential factor in their location is accessibility by road network.

1.2.4 Traditional Large-Scale Industrial Regions

- These are based on heavy industry, often located near coal-fields and engaged in metal smelting, heavy engineering, chemical manufacture or textile production.
- These industries are now known as **smokestack industries**.
- Traditional industrial regions can be recognised by:
 - ✓ High proportion of employment in manufacturing industry.
 - ✓ High-density housing, often of inferior type, and poor services.
 - ✓ Unattractive environment, for example, pollution, waste heaps, and so on.
 - ✓ Problems of unemployment, emigration and derelict land areas caused by closure of factories because of a worldwide fall in demand.

1.2.5 Concept of High Technology Industry

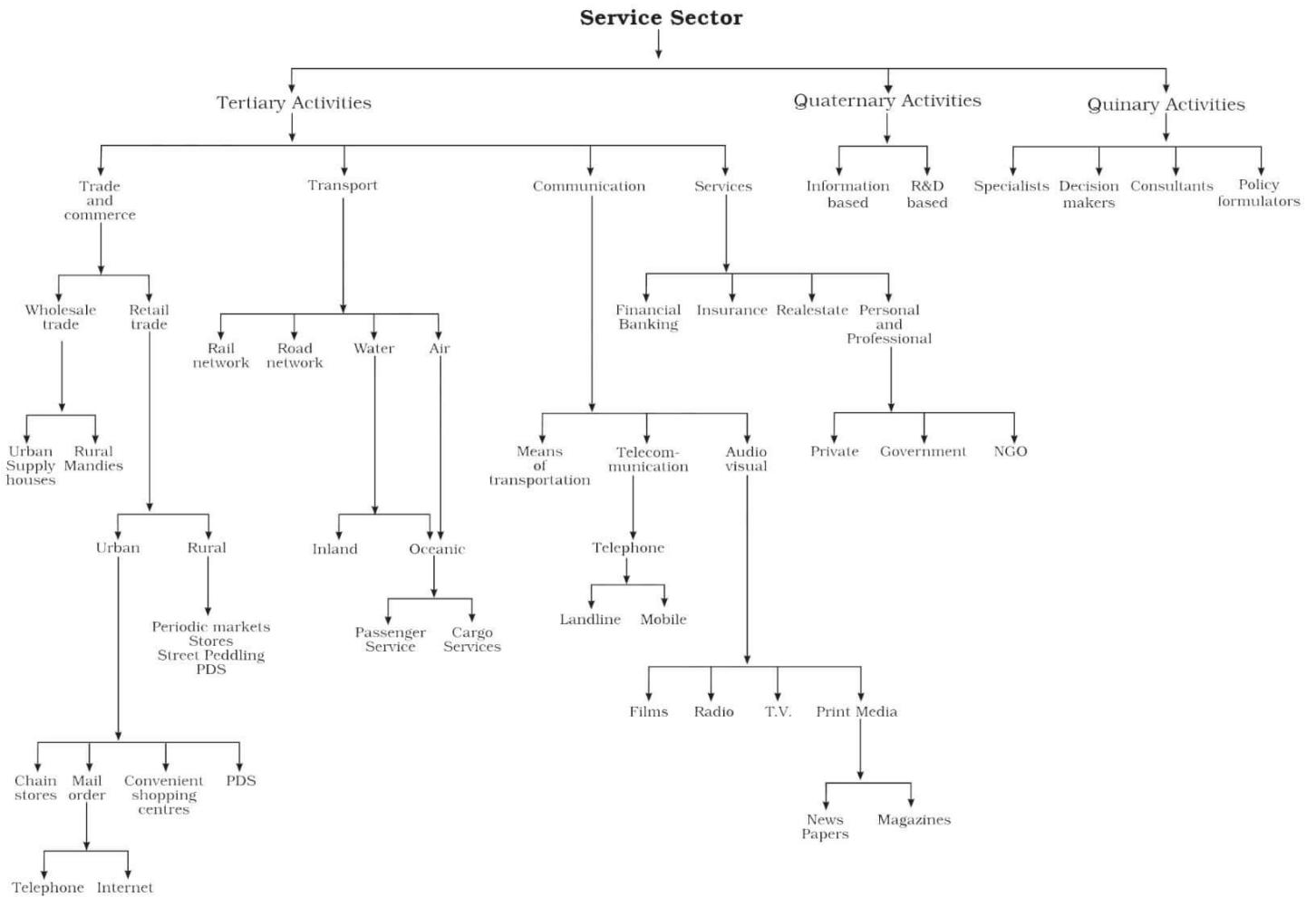
- High technology, or simply high-tech, is the latest generation of manufacturing activities.
- It is best understood as the application of intensive research and development (R and D) efforts leading to the manufacture of products of an advanced scientific and engineering character.

- Professional (white-collar) specialists greatly outnumber the actual production (blue-collar) workers.
- Robotics on the assembly line, computer-aided design (CAD) and manufacturing, electronic controls of smelting and refining processes, etc. are notable examples of high-tech industry.
- Neatly spaced, low, modern, dispersed, office-plant-lab buildings rather than massive assembly structures, factories and storage areas mark the high-tech industrial landscape.
- Planned business parks for high-tech start-ups have become part of regional development schemes.
- High-tech industries which are regionally concentrated, self-sustained and highly specialised are called **technopolies**.
- The **Silicon Valley near San Francisco** and **Silicon Forest near Seattle** are examples of technopolies.

1.3. Tertiary Activities

- Tertiary activities involve the commercial output of **services** rather than the production of tangible goods.
- They are not directly involved in the processing of physical raw materials.
- Common examples are the work of a plumber, electrician, technician, launderer, barber, shopkeeper, driver, cashier, teacher, doctor, lawyer and publisher etc.
- Tertiary activities include both production and exchange.
- The production involves the 'provision' of services that are 'consumed'.
- The output is indirectly measured in terms of wages and salaries.
- The exchange involves trade, transport and communication facilities that are used to overcome distance.

1.3.1 Types of tertiary activities



1.3.2 Transportation

- World's resources are not equitably distributed across regions, and no region is self-sufficient.
- This makes the exchange (transport) of resources, goods and services a necessity throughout the world.
- The areas of shortage are supplied by areas of surplus (bringing sources of supply and demand together) by a wide network of transport systems.
- The most determining factor for the exchange of resources and goods other than supply and demand is the economic distance.

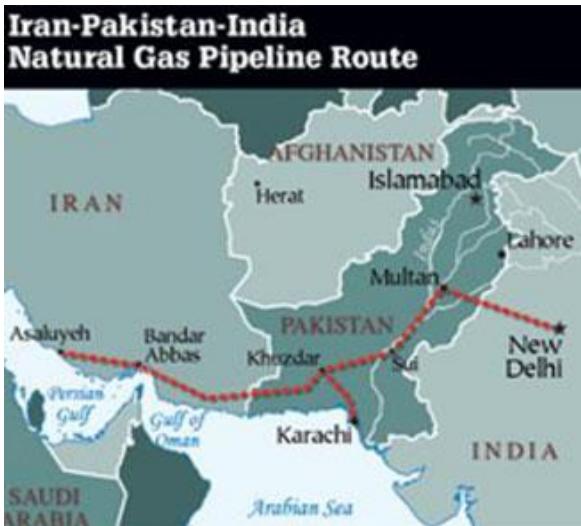
Economic distance

- **Economic distance** is the maximum distance a resource or a good can be transported such

that **the increase in the value of the transported good is higher than the cost of transportation.**

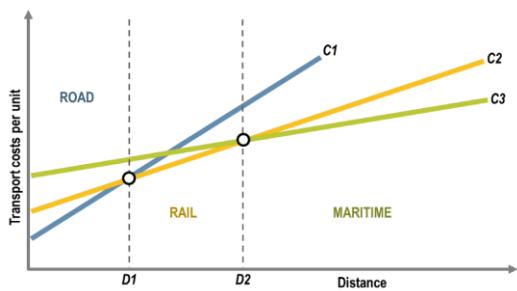
- The maximum economic distance is determined by the origin and destination (distance), demand and supply, nature of the good — weight, size, fragility, perishability, etc. and other factors like terrain, infrastructure, mode of transport, competition, costs (fuel, wages, transport, insurance), feasibility, etc.
- For example, the maximum economic distance of a perishable product like milk is much lesser compared to that of iron.
- Milk can be transported for a longer distance using refrigeration; however, the cost of refrigeration (operating cost involved in the movement of good) seriously limits the economic distance.

- The economic distance of large quantities of petroleum can be increased by transporting it through pipelines rather than tankers.
- However, India imports petroleum from Iraq and Iran by oil tankers as laying a pipeline through Pakistan is currently not feasible.



- Likewise, India is not able to import gas from Russia as the gas pipeline needs to pass through China.

The cost structure of different methods of transport



- In selecting the mode of transport, distance, in terms of time or cost, is the determining factor.
- Isochrone lines** are drawn on a map to join places equal in terms of the time taken to reach them.
- Transport of goods involve various kinds of costs such as **line-haul costs (cost of movement: fuel, wages)** **overhead costs** (costs of terminal facilities – loading and unloading, vehicles, equipment, roads, railway tracks, mainte-

nance, etc.) and **transfer costs** (indirect costs such as insurance cover, taxes, etc.)

- Line-haul and overhead costs differ between various methods of transport.
- The overhead costs of ocean transport (ports, terminals) are high when compared to that of road transport.
- However, the line-haul costs of road transport rise rapidly with distance compared to that of ocean transport as the costs of ocean transport are spread over much larger cargo.
- Rail transport occupies an intermediate position in terms of both line-haul and overhead costs.
- Road transport is, therefore, cheapest over short distances, rail over medium distances (D1-D2) and ocean transport over long distances (beyond D2).

1.3.3 Tourism

- Improvements in the standard of living and increased leisure time has promoted tourism.
- It has become the world's single largest tertiary activity in total registered jobs (250 million) and total revenue (40 per cent of the total GDP).
- Tourism fosters the growth of infrastructure industries, retail trading, and craft industries (souvenirs).
- The warmer places around the **Mediterranean Coast** and the **West Coast of India** are some of the popular tourist destinations in the world.
- Most people from colder regions expect to have warm, sunny weather for beach holidays. This is one of the main reasons for the importance of tourism in Southern Europe and the Mediterranean lands.
- The Mediterranean climate offers almost consistently higher temperatures than in other parts of Europe, long hours of sunshine and low rainfall throughout the peak holiday season.

- Home-stay has emerged as a profitable business such as heritage homes in Goa, Madikere and Coorg in Karnataka.

Medical Tourism

- When medical treatment is combined with international tourism activity, it lends itself to what is commonly known as medical tourism.
- India has emerged as the leading country of medical tourism in the world.
- World class hospitals located in metropolitan cities cater to patients all over the world.

1.4. Quaternary Activities

- Quaternary activities are a segment of the service sector that is **knowledge oriented**.
- This sector can be divided into **quaternary** and **quinary** activities.
- Quaternary activities involve some of the following: the collection, production and dissemination of information or even the production of information.
- Quaternary activities centre around research, development and may be seen as an advanced form of services involving specialised knowledge and technical skills.

1.4.1 The Quaternary Sector

- Over half of all workers in developed economies are in the 'Knowledge Sector'.
- Personnel working in elementary schools and university classrooms, hospitals and doctors' offices, theatres, accounting and brokerage firms all belong to this category of services.
- Like some of the tertiary functions, quaternary activities can also be outsourced.

1.4.2 Quinary Activities

- The highest level of decision-makers or policy-makers perform quinary activities.

- Quinary activities are services that focus on the creation, re-arrangement and interpretation of new and existing ideas, data interpretation and the use and evaluation of new technologies.
- Often referred to as '**gold collar**' professions, they represent exclusive and highly paid senior business executives, government officials, research scientists, financial and legal consultants, etc.

1.4.3 Outsourcing

- Outsourcing is giving work to an outside agency to improve efficiency and to reduce costs.
- When outsourcing involves transferring work to overseas locations, it is described by the term offshoring.
- Business activities that are outsourced include information technology (IT), human resources, customer support and call centre services and at times, also manufacturing and engineering.
- Data processing is an IT related service easily be carried out in Asian, East European and African countries.
- In these countries, **IT skilled staff with excellent English language skills are available at lower wages than those in developed countries**.
- Thus, a company in Hyderabad does work on a project based on GIS techniques for a country like the U.S.A.
- Overhead costs are also much lower, making it profitable to get job-work carried out overseas, whether it is in India, China or even a less populous country like Botswana in Africa.
- Outsourcing countries are facing resistance from job-seeking youths in their respective countries.
- The **comparative advantage** is the main reason for continuing outsourcing.
- New trends in quinary services include knowledge processing outsourcing (KPO) and

'home shoring', the latter as an alternative to outsourcing.

- The KPO industry is distinct from Business Process Outsourcing (BPO) as it involves highly skilled workers.
- KPO enables companies to create additional business opportunities.
- Examples of KPOs include research and development (R and D) activities, e-learning, business research, intellectual property (IP) research, the legal profession and the banking sector.

1.5. Some of the factors influencing locations of various sectors (industries)

- Location of industries is influenced by several factors like access to raw materials, power, market, capital, transport and labour, etc.
- Relative significance of these factors varies with time and place.
- There is a strong relationship between raw material and type of industry.
- It is economical to locate the manufacturing industries at a place where the cost of production and delivery cost of manufactured goods to consumers are the least.
- Transport costs, to a great extent, depend on the nature of raw materials and manufactured products.
- Major concentrations of modern manufacturing have flourished in a few number of places.
- These cover less than 10 per cent of the world's land area.

1.5.1 Historical Factors

- The colonial past greatly influenced industrial nodes such as Mumbai, Kolkata and Chennai.
- During the initial phase of colonisation, manufacturing received impetus provided by the European traders.

- Surat, Vadodara, Kozhikode, Coimbatore, Mysuru, etc., emerged as important manufacturing centres.
- In the subsequent industrial phase of colonialism, these manufacturing centres experienced rapid growth due to competition from imported British goods and the discriminatory policies of the colonial power.
- In the last phase of colonialism, the British promoted few industries in selected areas.
- This led to broader spatial coverage by different types of industries in the country.

1.5.2 Access to Raw Materials

- The raw material used by industries should be cheap and easy to transport.
- Industries based on cheap, bulky and weight-losing material (ores) are located close to the sources of raw material. E.g. **steel, sugar, pulp, copper smelting** and **cement industries**.
- This is why most of the iron and steel industries are located either near coalfields (**Bokaro, Durgapur**, etc.) or near sources of iron ore (**Bhadrawathi, Bhilai, and Rourkela**).
- Agro-processing and dairy products are processed close to the sources of farm produce or milk supply (perishables), respectively.

1.5.3 Access to energy sources

- Industries which use more power are located close to the source of the energy supply. E.g. **aluminium industry**, synthetic nitrogen manufacturing industry, etc.
- Earlier coal was the main source of energy; today, hydroelectricity and petroleum are also important sources of energy for many industries.

1.5.4 Access to Market

- The existence of a market for manufactured goods is the most critical factor in the location of industries.
- The developed regions of Europe, North America, Japan and Australia provide large global markets as the purchasing power of the people is very high.
- The densely populated regions of South and South-east Asia also provide large markets.
- Some industries, such as aircraft manufacturing, defence industry, have a global market.
- The cotton textile industry uses a non-weight-losing raw material and is generally located in a large urban centre, e.g. Mumbai, Ahmedabad, Surat, etc.
- Petroleum refineries are also located near the markets as the transport of crude oil is easier, and several products derived from them are used as raw materials in other industries.
- Koyali, Mathura and Barauni refineries are typical examples.

1.5.5 Access to Transportation and Communication Facilities

- The cost of transport plays an important role in the location of industrial units.
- The industries shifted to interior locations, only when railway lines were laid.
- Western Europe and eastern North America have a highly developed transport system which has always induced the concentration of industries in these areas.
- The concentration of industries in Mumbai, Chennai, Delhi and in and around Kolkata was due to the fact that they initially became the nodal point having transport links.

1.5.6 Supply of cheap labour and skilled workforce

- Some types of manufacturing still require skilled labour.

- In India, labour is quite mobile and is available in large numbers due to our large population.
- Increasing mechanisation, automation and flexibility of industrial processes have **reduced the dependence of industry upon the labours**.
- However, the importance of a skilled workforce in the quaternary sector is only increasing day by day.
- **Technopolies** such as **Silicon Valley (San Francisco)** are highly dependent on skilled IT professionals.

1.5.7 Access to Agglomeration Economies/Links between Industries

- Many industries benefit from nearness to leader-industry and other industries.
- These benefits are termed as agglomeration economies.
- Savings are derived from the linkages which exist between different industries.
- These factors operate together to determine industrial location.

1.5.8 Industrial inertia

- **Industrial inertia** is when a firm remains in its original location even after the initial advantage or alluring factors that led to them locating there has disappeared.
- Reasons behind industrial inertia:
 - ✓ there may be strong transportation and economic linkage with other activities of the area.
 - ✓ irreplaceable skilled labour force.
 - ✓ cost and disruption that can arise from relocation.
 - ✓ encouraging government policy like subsidies, ease of doing business, etc.
 - ✓ Sometimes it is easier to modernize an existing location rather than relocation. E.g. when the cotton industry declined in the

U.K., the textile mills were converted into light engineering goods factories.

1.5.9 Government Policy

- Governments adopt 'regional policies' to promote 'balanced' economic development and hence set up industries in particular areas.
- Establishment of iron and steel industry in **Bhilai** and **Rourkela** were based on decision to develop backward tribal areas of the country.
- At present, the government of India provides lots of incentives to industries locating in backward areas.

1.6. Questions

- In which one of the following countries, co-operative farming was the most successful experiment? (a) Russia (b) Denmark (c) India (d) The Netherlands
- Growing of flowers is called: (a) Truck farming (c) Mixed farming (b) Factory farming (d) Floriculture
- Which one of the following types of cultivation was developed by European colonists? (a) Kolkhoz (b) Viticulture (c) Mixed farming (d) Plantation
- In which one of the following regions is extensive commercial grain cultivation not practised? (a) American Canadian prairies (b) European Steppes (c) Pampas of Argentina (d) Amazon Basin
- In which of the following types of agriculture is the farming of citrus fruit very important? (a) Market gardening (b) Plantation agriculture (c) Mediterranean agriculture (d) Co-operative farming
- Which one type of agriculture amongst the following is also called 'slash and burn agriculture'? (a) Extensive subsistence agriculture (b)

Primitive subsistence agriculture (c) Extensive commercial grain cultivation

- Which one of the following does not follow monoculture? (a) Dairy farming (c) Plantation agriculture (b) Mixed farming (d) Commercial grain farming
- Which one of the following statements is wrong?
 - Cheap water transport has facilitated the jute mill industry along the Hugli.
 - Sugar, cotton textiles and vegetable oils are footloose industries.
 - The development of hydro-electricity and petroleum reduced, to a great extent, the importance of coal energy as a locational factor for industry.
 - Port towns in India have attracted industries.
- In which one of the following types of economy are the factors of production owned individually? (a) Capitalist (b) Mixed (c) Socialist (d) None
- Which one of the following types of industries produces raw materials for other industries? (a) Cottage Industries (b) Small-scale Industries (c) Basic Industries (d) Footloose Industries
- Which one of the following pairs is correctly matched? (a) Automobile industry ... Los Angeles (b) Shipbuilding industry ... Lusaka (c) Aircraft industry ... Florence (d) Iron and Steel industry ... Pittsburgh
- Discuss the major trends of modern industrial activities especially in the developed countries of the world.
- Explain why high-tech industries in many countries are being attracted to the peripheral areas of major metropolitan centres.
- Africa has immense natural resources and yet it is industrially the most backward continent. Comment.
- Which one of the following is a tertiary activity?
 - Farming (b) Trading (c) Weaving (d) Hunting

- Which one of the following activities is NOT a secondary sector activity? (a) Iron Smelting (b) Catching fish (c) Making garments (d) Basket Weaving
- Which one of the following sectors provides most of the employment in Delhi, Mumbai, Chennai and Kolkata? (a) Primary (b) Quaternary (c) Secondary (d) Service
- Jobs that involve high degrees and level of innovations are known as: (a) Secondary activities (b) Quaternary activities (c) Quinary activities (d) Primary activities
- Which one of the following activities is related to the quaternary sector? (a) Manufacturing computers (b) Paper and Raw pulp production (c) University teaching (d) Printing books
- Which one out of the following statements is not true?
 - a) Outsourcing reduces costs and increases efficiency.
 - b) At times engineering and manufacturing jobs can also be outsourced.
 - c) BPOs have better business opportunities as compared to KPOs.
 - d) There may be dissatisfaction among job seekers in the countries that outsource the job.

2. Iron and Steel Industry

- The iron and steel industry forms the base of all other industries and, therefore, it is called a **basic industry**.
- It may also be called a heavy industry because it uses large quantities of bulky inputs and outputs.
- Iron is extracted from iron ore by smelting (heating, melting & separation of impurities) in a blast furnace with carbon (coke) and limestone.
- The molten iron is cooled and moulded to form **pig iron**.
- The pig iron is used for converting into steel by adding strengthening materials like **manganese**.

2.1. Smelting of Iron Ore

- Of the impurities in iron ore, some are beneficial when present in small quantities while the others are harmful no matter what their proportion is.
- So, the unwanted impurities must be removed, and this is done by **smelting iron ore in a blast furnace**.

Harmful impurities in Iron Ore

Sulphur

- A **very harmful** element.
- It reacts with iron to form **iron sulphide**, which is a very **brittle** substance.
- Iron sulphide greatly reduces the strength of steel.

Tin

- It forms a low melting point brittle film round the grain boundaries making the steel **practically useless**.

Oxygen

- Has a bad influence on the properties of steel (**Oxides make Iron and steel weak**).

Other impurities

Silicon

- Silicon is found in small quantities, and it slightly raises the strength and hardness of steel.

- It acts as a **de-oxidizing agent** (Oxides decrease the strength of Iron. Hence, they must be removed).

Lead

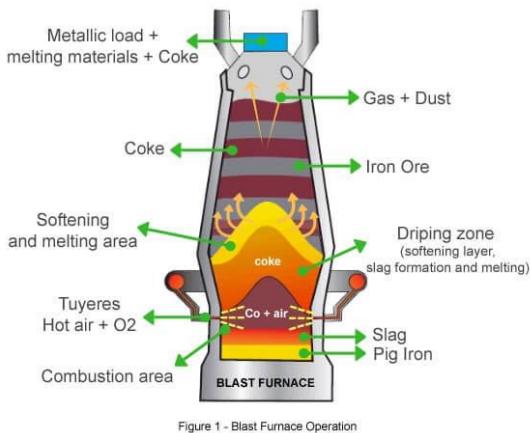
- Added to all classes of steel to improve the **machinability of the Steel**.
- When added in small quantities, it **improves tool life**.

Manganese

- A powerful and most effective de-oxidant.
- Small quantities is good as it can deoxidize sulphur.

2.1.2 What exactly happens in a blast furnace?

- Coke (fuel & reducing agent), iron ore, & limestone (flux)** are continuously added to the blast furnace.
- A hot blast of air is blown into the lower section.



- Final product → **liquid slag, liquid iron (pig iron)** and gases (CO & CO₂).

Why coke and not coal in smelting?

- To separate impurities, iron needs to be melted.
- The **coke is the fuel** that melts iron. (Coal is cooked through **destructive distillation** to produce coke.)
- Coal has many impurities, and the most dan-

gerous one is **sulphur**.

- Coke is a fuel with **few impurities** and **high carbon content** (90%).

Reduction → Remove Oxygen

- Oxygen in the iron oxides is reduced (removed) by a series of chemical reactions.
 - $3\text{Fe}_2\text{O}_3 + \text{CO} \rightarrow \text{CO}_2 + 2\text{Fe}_3\text{O}_4$
 - $\text{Fe}_3\text{O}_4 + \text{CO} \rightarrow \text{CO}_2 + 3\text{FeO}$
 - $\text{FeO} + \text{CO} \rightarrow \text{CO}_2 + \text{Fe}$ (pure metal)
- So, **carbon monoxide (CO) & CO₂** are the gaseous pollutants coming out of blast furnace.

Is there no alternative to highly polluting coke fuel?

- Melting iron ore can also be done with the help of electricity (electric smelting).
- But most of the traditional iron and steel industry is built to use coke as fuel.
- Switching to electric smelting involves enormous overhead costs, and hence the traditional iron and steel industry has stuck to coke as fuel.
- Moreover, in most of the traditional iron and steel industry, coal remains more accessible than electricity.
- Also, in countries like India, more than 50% of the electricity is generated by coal-fired power plants.
- But wherever cheap hydroelectricity is available, electric smelting can be used.
- E.g. Vishweshvaraiah Iron and Steel Plant in Bhadravathi, Karnataka now uses hydroelectricity (Sharavathi hydroelectric power plant, **Jog Falls**) instead of **charcoal**.

Role of limestone → Remove Sulphur

- It acts as a **flux** (a substance mixed with a solid to lower the melting point, especially in smelting).

- Limestone melts and reacts with sulphur to form **slag** (all solid and liquid impurities).

$$\text{CaCO}_3 \rightarrow \text{CaO} + \text{CO}_2$$
- The CaO formed from this reaction is used to remove sulphur from the iron.

$$\text{FeS} + \text{CaO} + \text{C} = \text{CaS} + \text{FeO} + \text{CO}$$
 (**Roasting** → drives out the unwanted sulphur, leaving an oxide)
- The **CaS** becomes part of the slag.
- The slag is also formed from any remaining silica, alumina, etc. that entered with the iron ore or coke.
- The liquid slag then trickles to the bottom of the furnace where it floats on top of the molten iron since it is less dense.

Pig Iron

- Pig iron is the intermediate product of smelting iron ore.
- The constituents of pig iron are:
 - ✓ Iron (Fe) – 93-95%
 - ✓ Silicon (Si) – 0.3-0.9%
 - ✓ Sulphur (S) – 0.02-0.05%
 - ✓ Manganese (Mn) – 0.55-0.75%
 - ✓ Phosphorus (P) – 0.03-0.09%
 - ✓ Carbon (c) – 4.1-4.4% (The strength of steel can be varied by varying the carbon content)

Cast iron

- Carbon content greater than 2%.
- Carbon (C) and silicon (Si) are the main alloying elements.
- Cast iron tends to be **brittle**.
- Applications: automotive industry parts, cast iron pan.

Steel

- Carbon content is up to 2.1% (by weight).

Stainless steel

- It is a steel alloy with a minimum of **10.5%**

chromium content by mass.

- Nickel** is another important element of steel alloy.
- It also contains **manganese, molybdenum**, and other metals.
- Stainless steel **does not readily corrode**, rust or stain with water as ordinary steel does.

Wrought iron

- Wrought iron is a very different material made by **mixing liquid iron with some slag**.
- The result is an iron alloy with **much lower carbon content**.
- Wrought iron is softer than cast iron and much less tough, so you can heat it up to shape it relatively easily, and it's also much less prone to rusting.

2.2. Factors that influence the location of Iron and Steel Industry

2.2.1 Raw Material

- The essential bulk inputs of iron & steel industry are **iron ore (gross/weight-losing raw material)**, **fuel (coal; weight-losing)**, **limestone (flux)** & **water (required for cooling & worker safety)**.
- These bulk inputs, especially iron ore and coal, have a significant influence on the location of the industry.
- Other raw material like **dolomite** (refractory material), **manganese, chromite** (stainless steel making) are required only in small quantities.

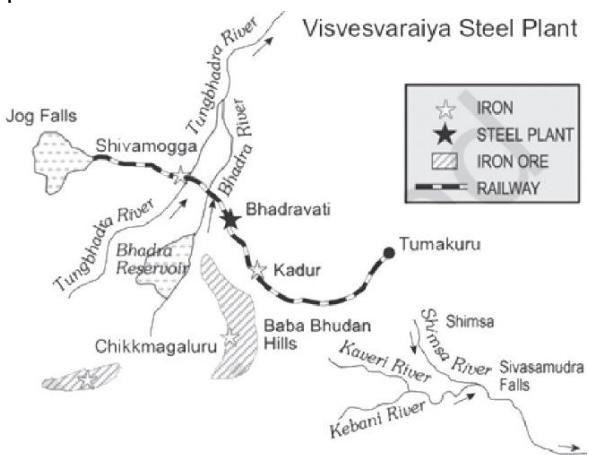
Charcoal: Primitive iron ore smelters near forests

- All iron-making blast furnaces were fuelled by **charcoal** until the end of the seventeenth century.

- The industry remained primitive as 10-15 tonnes of charcoal was needed to smelt one tonne of iron.
- The steam engine was not yet invented (to bulk transport coal, iron ore) and hence fuel and power were immobile.
- Hence the iron smelting had to be carried out **close to the forests** (charcoal).
- Till recently, **Vishweshvaraiah Iron and Steel Plant in Karnataka** relied on charcoal as fuel.

Visvesvaraiya Iron and Steel Works Ltd. (VISL)

- It is the third integrated steel plant in India.
- It was initially called the Mysore Iron and Steel Works.
- It is located close to an iron ore producing area of **Kemangundi in the Bababudan hills**.
- Limestone and manganese are also locally available.
- But this region has **no coal**.
- In the beginning, charcoal obtained by burning wood from nearby forests was used as fuel till 1951.
- Afterwards, electric furnaces which use hydroelectricity from the Jog Falls (Sharavati) hydel power project were installed.
- The **Bhadra river** supplies water to the plant.



Coal and iron ore: Near Coalfields during the Industrial Revolution

- With the advent of the steam engine and railways and the successive industrial revolution (the 1760s) in the eighteenth century, the iron and steel industry developed on a massive scale in the regions where coal and iron ore were available in close proximity.
- Processing one tonne of iron ore required 8-12 tonnes of coal (for smelting and transportation), which meant that it was cost-effective to have an iron and steel plant near a coalfield rather than at an iron mine.
- E.g. Iron industry in Western Europe and North-Eastern USA
 - ✓ Ruhr Valley in Germany.
 - ✓ Lancashire, York shire and South Wales in Britain.
 - ✓ Appalachian-Pennsylvania-Great Lakes region in United States.
 - ✓ New South Wales region in Australia.
 - ✓ Wuhan, Anshan, Chongqing in China.
- A large network of canals was established to supply water to the industry.
- Canals not only supplied water but also offered a cheap mode of transportation for transporting raw materials and finished goods.

Coal and Iron ore: Regions with close proximity to Coalfields and Iron Ore mines

- Birmingham District in Alabama became the largest iron and steel producer in the southern United States due to the close proximity of abundant deposits of iron ore, coal, limestone, and dolomite.
- In India, there is a crescent-shaped region comprising parts of Chhattisgarh, Northern Odisha, Jharkhand and western West Bengal, which is extremely rich in high-grade iron ore, good quality coking coal and other supplementing raw materials.
- Here the iron and steel industry consists of large integrated steel plants.

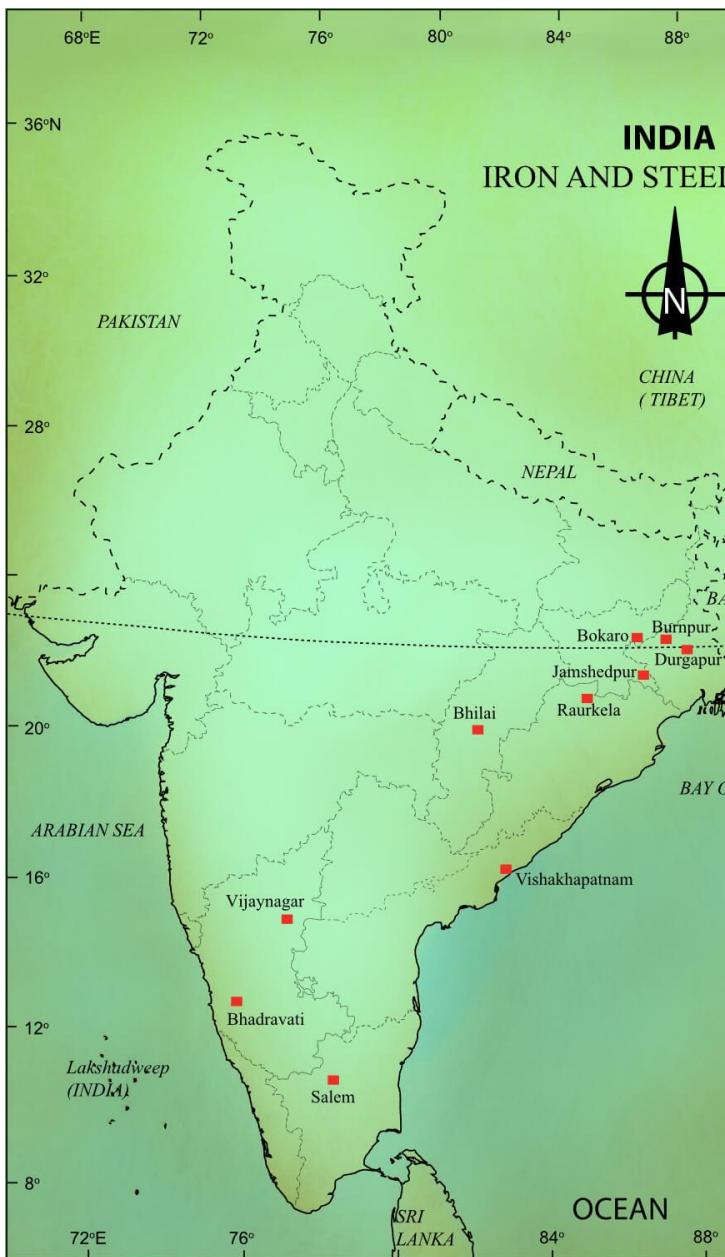


Image Source: [NROER](#)

- Coking coal comes from **Jharia** and **west Bokaro** coalfields.

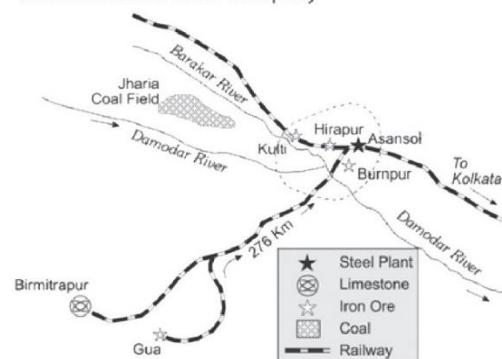
Tata Iron and Steel Plant (TISCO)



IISCO

- The Indian Iron and Steel Company (IISCO) set up its first factory at Hirapur (Madhya Pradesh) and later at Kulti and Burnpur (West Bengal).
- All the three plants are located very close to **Damodar valley coal fields (Raniganj, Jharia, and Ramgarh)**.
- Iron ore comes from **Singhbhum** in Jharkhand.
- Water is obtained from the **Barakar River**, a tributary of the **Damodar**.
- All the plants are located along the Kolkata-Asansol railway line.

Indian Iron and Steel Company

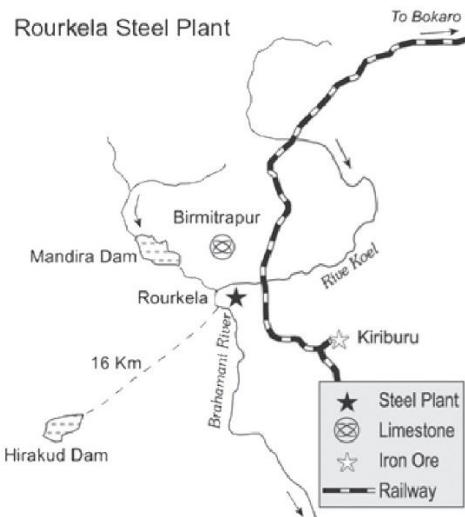


Rourkela Steel Plant

- After independence, during the Second Five Year Plan (1956-61), three new integrated steel

plants were set up with foreign collaboration: **Rourkela in Odisha**, **Bhilai in Chhattisgarh** and **Durgapur in West Bengal**.

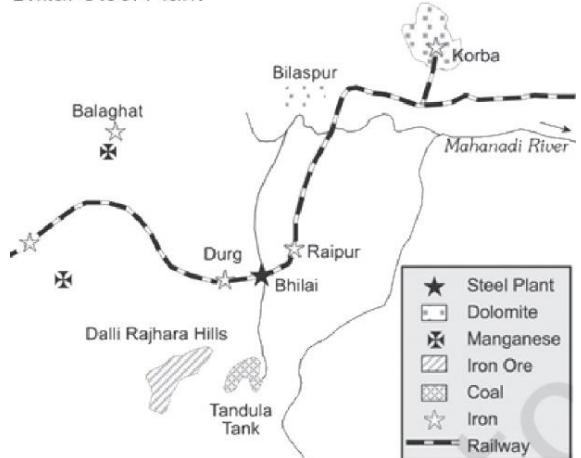
- In 1973, the **Steel Authority of India Limited (SAIL)** was created to manage these plants.
- The Rourkela Steel plant was set up in the Sundargarh district of Odisha in collaboration with Germany.
- This plant has a unique locational advantage, as it receives **coal from Jharia** (Jharkhand) and **iron ore from Sundargarh and Kendujhar**.
- The **Hirakud project** supplies power for the electric furnaces and water is obtained from the Koel and Sankh rivers.



Bhilai Steel Plant

- The Bhilai Steel Plant was established with Russian collaboration in Durg district of Chhattisgarh.
- Iron ore comes from **Dalli-Rajhara** mine and coal from **Korba** and **Kargali** coal fields.
- Water comes from the Tanduladam and the power from the Korba Thermal Power Station.
- This plant also lies on the Kolkata-Mumbai railway route.
- The bulk of the steel produced goes to the Hindustan Shipyard at **Vishakhapatnam**.

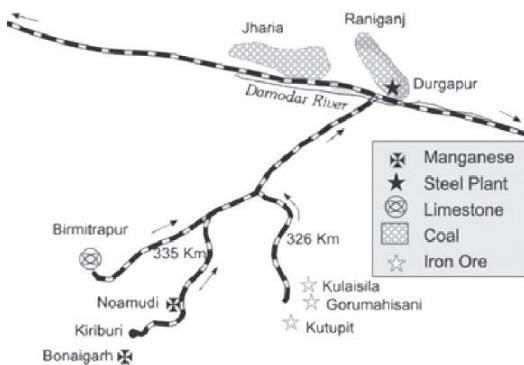
Bhilai Steel Plant



Durgapur Steel Plant

- Durgapur Steel Plant in West Bengal was set up in collaboration with the government of UK.
- This plant lies in **Raniganj and Jharia coal belt** and gets iron ore from **Noamundi**.
- Durgapur lies on the main Kolkata-Delhi railway route.
- Hydel power and water are obtained from the Damodar Valley Corporation (DVC).

Durgapur Steel Plant



Coking coal shortage

- Sweden has high-grade iron ore but doesn't have enough coking coal.
- Hence it specializes in non-ferrous metallurgy and light engineering rather than iron-steel industry.
- Sweden exports its iron ore to Ruhr (Germany) and imports pig iron from Ruhr.
- It converts pig iron into steel, using electrical furnaces. (Sweden has abundant hydropower

- potential — hydropower contributes to more than half of energy production).
- The steel thus manufactured, is used for making high-value items.

2.2.2 Transportation: Near coastal areas for cheaper raw material imports

- With the beginning of the 20th century, colonial powers like Japan, with no significant iron ore or coal resource base, began to set up iron and steel plants near the ports. E.g. steel industry in Osaka-Kobe.
- Also, as the coal reserves started depleting in Western Europe and North-Eastern USA, a part of the industry, which relied on imported coal, began to relocate to port cities.
- In the USA, the industry cropped up in the coastal cities of Buffalo, Cleveland, Detroit, Chicago that used imported coal from Canada (through Saint Lawrence Seaway) and Appalachian coalfields.
- In India too, steel plants were set up at Vishakhapatnam, Ratnagiri and Mangalore.

The Ruhr, Germany

- Ruhr has been one of the major industrial regions of Europe for a long time.
- Coal and iron and steel formed the basis of the economy.
- But after the 1950s, the demand for coal declined (due to competition from cheaper imported coal and oil), and the iron ore was also exhausted.
- However, the iron and steel industry thrived using imported ore brought by **Rhine River waterway** to the Ruhr from deeper water ports such as **Rotterdam (Netherlands)**.
- The Ruhr region is responsible for 80 per cent of Germany's total steel production.

- The future prosperity of the Ruhr is based less on coal and iron ore and more on the automobile industry.

2.2.3 Transport Cost Minimization

Bokaro-Rourkela combine

- Bokaro Steel Plant steel plant was set up in 1964 at Bokaro with Russian collaboration.
- This plant was set up on the principle of cost minimisation by creating Bokaro-Rourkela combine.
- It receives iron ore from the Rourkela region and the wagons on return take coal to Rourkela.**
- Other raw materials come to Bokaro from within a radius of about 350 km.
- The Damodar Valley Corporation supplies water and hydel power.

Ural-Kuznetsk combine

- The Ural-Kuznetsk industrial combine was formed in the early 1930s.
- It became a centre for the production of iron and steel with raw materials and finished products being shipped to and from sites in the Kuzbas and Urals.
- The Ural of Russia is rich in iron ore deposits.
- Kuznetsk Basin in Western Siberia is rich in coal deposits.
- Coal from Kuznetsk Basin is sent to the Ural region by Railways.
- The returning wagons after emptying coal, bring iron ore from the Ural region.

2.2.4 Access to markets: Mini Steel plants

- The large integrated steel industry is traditionally located close to the sources of raw materials – **iron ore, coal, manganese and limestone** – or at places where these could be easily brought, e.g. **near ports**.

- But in mini steel mills with electric furnaces, access to markets is more important than inputs.
- These are less expensive to build and operate and can be located near markets because of the abundance of scrap metal, which is the primary input.

- Traditionally, most of the steel was produced at large integrated plants, but mini mills are limited to just one-step process – steelmaking – and are gaining ground.

2.2.5 Economies of Linkages and Agglomerations: Duluth-Detroit-Cleveland-Pittsburgh

- Lake Superior region of Michigan has significant iron ore deposits but has no coal or markets nearby.
- The only profitable way to exploit the ore was to transport it in bulk to distant blast furnaces on the lower Great Lakes — to places like Cleveland and Chicago.

- On the other hand, Pittsburgh's (Pennsylvania) iron and steel industry was facing a shortage of local iron ore but had abundant coal reserves.
- Hence Pittsburgh started importing iron ore from the Lake Superior region of Michigan and Minnesota and started exporting coal to Duluth in Minnesota (Lake Superior region).



- Ships brought iron ore from Lake Superior region to Cleveland while the railway wagons brought coal from Pittsburgh.
- On their return journey, ships carried coal to Lake Superior region whereas railway wagons brought iron ore to Pittsburgh.
- Cleveland, which is located at the crossroads (on the banks of **Lake Erie**), got coal from Pittsburgh and iron ore from Lake Superior region of Michigan.
- Thus, despite having neither of the resources locally, the region around Cleveland has a thriving iron and steel industry.

- The same is the case with Chicago in Illinois, Detroit in Michigan and Buffalo in New York.

2.2.6 Competition

- In the latter half of the twentieth century, industrial west's iron and steel industry began a decline.
- This is due to the fall in local demand, reduced exports, overcapacity and saturation, outdated technology, rise in mini scrap steel mills, rise in wages, and the emergence of China as the major steel producer.
- Some areas affected by the steel crisis were the Rust belt in North America, the English Midlands in the United Kingdom, the Ruhr area in West Germany and Bergslagen in Sweden.
- Other major steel-producing cities, such as Chicago, Gary, East Chicago, Cleveland, Toledo, and Pittsburgh, never recovered from the losses in the industry.
- The causes of the declines in these countries were similar to the United Kingdom's: foreign competition (primarily against each other), overcapacity resulting from the construction of mills during the post-war boom and integration of markets, and productivity gains.
- China's steel production went from a third of the output of American mills in 1981 to match US production only 12 years later.
- Today China's steel industry produces roughly half the steel in the world.

2.2.7 Technology

- A rise in simpler basic oxygen furnace (BOF) and the recycling of scrap, led to the decline and consolidation of the industry in the 1970s and 1980s across the industrial west.
- This further reduced coal requirement and the new industry could move away from coalfields.

2.2.8 Quality of ore, economies of scale, Cheap labour

- China is the leading producer and consumer of iron and steel in the world.
- But most of the Chinese iron and steel industry depends on imported iron ore from Australia, Brazil and imported coking coal from Australia and Indonesia.
- This is because of the poor quality of both iron ore and coal in China.
- Despite the raw material imports, Chinese steel is highly competitive in the global markets due to the 'economies of scale' production and cheap labour.

2.2.9 Industrial Inertia

- Though alternate sources of energy are available, traditional industries are still located around the coalfields, sometimes even after the coal mines have exhausted.
- Example Ruhr in Germany, Pittsburgh in USA and Lancashire in the UK.
- Possible reasons behind industrial inertia in the iron and steel industry:
 - ✓ The biggest reason for industrial inertia is the high overhead costs and regulatory clearances associated with the relocation of the heavy industry.
 - ✓ Industries will simply stay put as long as the cost of transportation of raw materials is well below the cost of relocation.
 - ✓ Moreover, transportation cost has fallen drastically. Countries like China have been able to import iron ore from as far as Goa and still produce steel globally competitive prices.
 - ✓ Well established economic (allied sectors like automobile, heavy engineering and markets) and transport linkages are already available in the present locations and the

- new areas if remote will offset the locational advantages like availability of raw materials.
- ✓ Industries present for decades would have established a very efficient supply chain and markets. There is always a risk of relocation benefitting the competitor more.
- ✓ Areas near coalfields developed into industrial cities with a large pool of skilled workforce. New area may not have the same labour supply (not a significant reason in India due to the unemployment rate).
- ✓ Economies of agglomeration offer a high bargaining chip (social, political and economic). Relocation may spell trouble in times of adverse government policies.
- ✓ For example, to protect down sliding Pittsburgh steel industry, the US government made steel-pricing policies in the early 1900s such that no other competing region could sell steel at prices lower than the prices at which Pittsburgh industry sold its steel.

2.2.10 Rules and regulations

- POSCO India is an Indian subsidiary of Korean iron and steel conglomerate POSCO.
- POSCO signed a memorandum of understanding in 2005 with Odisha to construct a \$12 billion steel plant
- The land acquisition process was not fructified due to the tussle between the Environment Ministry (Forests Rights Act), the state government, local dwellers and the Supreme Court.
- Apart from Odisha, POSCO India withdrew from project sites in Karnataka and Maharashtra states due to similar issues.

2.2.11 Strategic reasons

- During WWII, the allied powers had to pay a heavy price for concentrating all their industries in a few pockets. It made it easy for the enemy

aerial bombers to target these concentrated industrial pockets.

- After WWII, the US government decided to diversify its industrial base, and some steel plants were set up in the west — far away from the highly concentrated industrial East (Great Lakes-Pittsburgh region).
- Similarly, USSR adopted a policy to disperse Soviet industries on the Eastern side, towards the Pacific coast — far away from the Ukraine-Donbas region.

2.2.12 Government policies

- Establishment of iron and steel industry in **Bhilai** and **Rourkela** were based on the decision to **develop backward tribal areas** of the country.
- Three new steel plants set up in the Fourth Plan period **are away from the primary raw material sources**.
- All three plants are located in South India: The Vizag Steel Plant, Vijayanagar Steel Plant at Hospet in Karnataka (now it uses local iron ore and limestone) and the Salem Steel Plant in Tamil Nadu.
- Salem steel plant was set up due to the insistence of the then TN Chief Minister M. Karunanidhi. It had neither of the raw materials nearby.
- In China, backyard furnaces were constructed to further the Great Leap Forward ideology of Mao for rapid industrialization of China.
- However, the backyard furnaces produced high-carbon pig iron, which needs to be smelted further to make steel. Hence, almost all of the iron produced by backyard furnaces was practically useless.

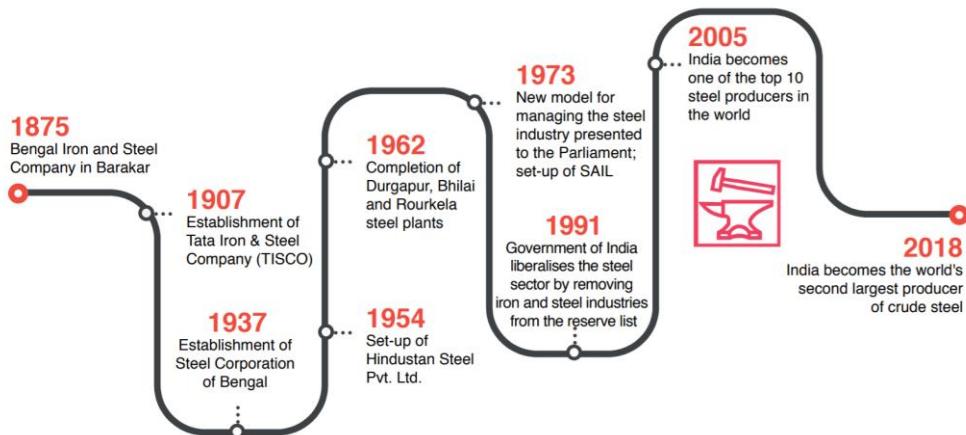
2.2.13 Distribution of Iron and Steel Industry

- The industry is one of the most complex and capital-intensive industries and is concentrated

in the advanced countries of North America, Europe and Asia.

- In the U.S.A, most of the production comes from the Appalachian region (Pittsburgh), Great Lake region (Chicago, Erie, Cleveland, Lorain, Buffalo and Duluth) and the Atlantic Coast (Sparrows Point & Morrisville).
- The industry has also moved towards the southern state of Alabama (Birmingham).
- Pittsburgh area is now losing ground. It has now become the "rust bowl" of U.S.A.
- In Europe, the U.K., Germany, France, Belgium, Netherlands & Russia are the leading producers.
- The vital steel centres are

- ✓ Scun Thorpe, Port Talbot, Birmingham and Sheffield in the U.K.;
- ✓ Duisburg, Dortmund, Dusseldorf and Essen in Germany;
- ✓ Le Creusot and St. Ettienne in France; and
- ✓ Moscow, St. Petersburgh, Lipetsk, Tula, in Russia and
- ✓ Krivoi Rog, and Donetsk in Ukraine.
- In Asia, the important centres include
 - ✓ Nagasaki and Tokyo-Yokohama in Japan;
 - ✓ Shanghai, Tienstin and Wuhan in China; and
 - ✓ Jamshedpur, Kulti-Burnpur, Durgapur, Rourkela, Bhilai, Bokaro, Salem, Visakhapatnam and Bhadravati** in India.



- At 51.3%, China is the world's largest producer of steel.
- India has overtaken Japan to become the second-largest producer of steel.
- India's steel production in 2018-19 stood at 111 million tonnes.
- The construction industry is the largest consumer of steel in India.
- The National Steel Policy, 2017, has envisaged 300 million tonnes of production capacity by 2030-31.

3. Cotton Textile Industry

(This topic is important for 'Modern World History: Industrial Revolution' also)



- A cotton mill houses spinning or weaving machinery for the production of yarn or cloth from cotton.
- Till the industrial revolution, cotton cloth was made using hand-spinning techniques (wheels) and looms.

- In 18th century, power looms facilitated the development of cotton textile industry, first in Britain and later in other parts of the world.
- In India, the cotton textiles industry is the single largest organised industry.
- Being labour intensive at all stages, it employs a large number of people.

3.1. Factors that affect the location of the cotton textile industry

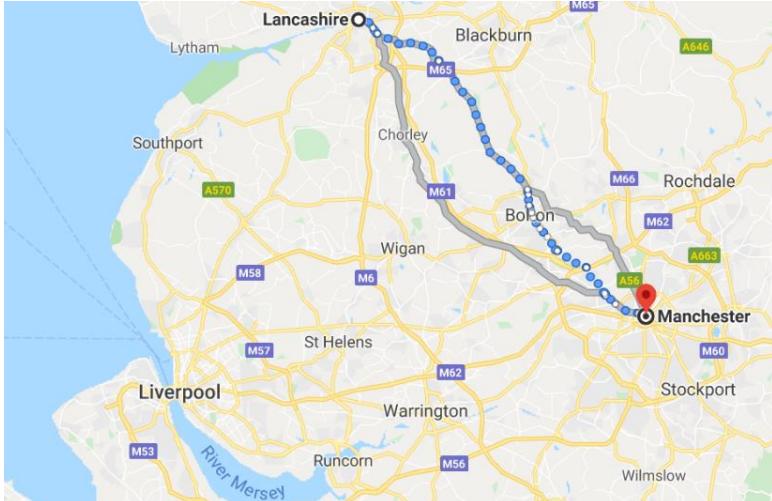
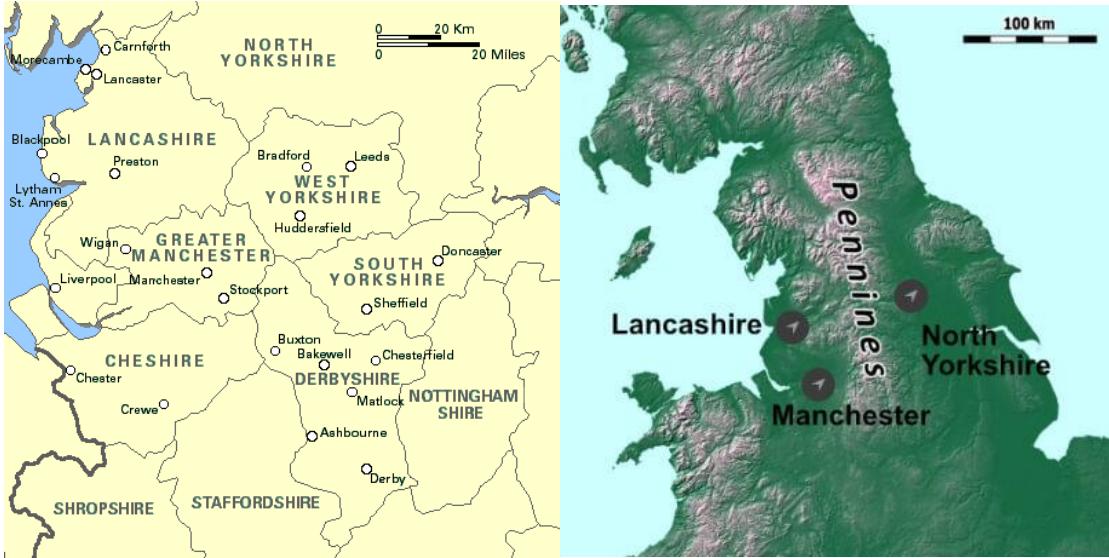
Raw material	<ul style="list-style-type: none"> • In India and the U.S., the industry is coterminous with the cotton-growing tracts. • For example, Ahmedabad (Manchester of India), Solapur, Nagpur & Coimbatore (Manchester of South India) are located in the areas of large-scale cotton cultivation. • In the U.S., the industry is concentrated in the cotton-growing southern states. • Since the cotton industry is not a weight losing industry, it isn't always necessary to set up the industry close to the cotton-producing areas. • E.g. Cotton textiles industry in Kanpur (market, local investment), Kolkata (port), Manchester (market, coal, water) & Bangladesh (cheap labour, government support).
Transportation linkages	<ul style="list-style-type: none"> • The most favourable location for setting up the cotton textile industry is the one that is well connected with cotton-producing areas and markets. • This is because raw cotton and finished cloth can be transported without adding much to the total cost of production. • In India, dispersal of the industry from the old nuclei (Mumbai, Ahmedabad) started after 1921 with railway lines penetrating into the peninsular region (Madurai, Bengaluru). • The industry reached Nagpur due to its nearness to coal. • The industry reached Kolkata — broad market with port facilities — even though it was located far away from the major cotton-producing belt.
Access to market for the cotton textiles	<ul style="list-style-type: none"> • The cotton industry is primarily a market-oriented industry. • For example, in the 1800s, the British (Lancashire and Manchester) imported raw cotton from far away regions like West Indies, U.S., Egypt and India and exported cloth to countries in Europe and other parts of the world (mostly to its colonies like India, Bangladesh, Egypt, etc.). • With a tropical and sub-tropical climate, all parts of India provide vast market potential for the cotton textile industry. • For example, West Bengal, Bihar, Uttar Pradesh, Kerala and Odisha do not grow cotton and still has cotton textile industry.
Access to market for the by-products of cotton textile industry	<ul style="list-style-type: none"> • The good thing about the cotton industry is that nothing goes as a waste. • Cottonseed provides about 12-15 per cent of the total farm value of cotton production. • Cottonseed can be fed directly to dairy cattle or crushed to produce cottonseed meal and oil (nowadays, vegetable oils are preferred over animal fats). • As a protein-rich feed, cottonseed meal is extensively used as a feed in poultry and livestock industry, notably in cotton-producing areas such as India, China and the U.S. • All these auxiliary industries (poultry, cottonseed oil extraction) are located close to the

	market.
Power	<ul style="list-style-type: none"> The first modern cotton mills were powered by constant flow of water. Such mills were built in Lancashire and its neighbouring rural locations. They faced issues of labour supply and access to urban markets. From the 1780s onwards, steam engines drove the cotton mills. This enabled new mills to be built in urban contexts. E.g. Manchester. The development of hydro-electricity favoured the location of the cotton textile mills away from the cotton-producing areas. For example, the growth of this industry (away from Mumbai) in Tamil Nadu (Coimbatore, Madurai and Tirunelveli) is largely due to the availability of hydroelectricity from Pykara dam.
Climate	<ul style="list-style-type: none"> The air in the cotton mill has to be hot and humid (18°C to 26°C and 85% humidity) to prevent the thread from breaking. Hence the coastal regions in the tropics and subtropics are preferred locations. E.g. Mumbai and Southeastern U.S. However, electricity-based temperature and humidity controllers enable the mills to be set up in a wide range of locations.
Labour	<ul style="list-style-type: none"> The industry has shifted from areas of high labour cost (UK, Germany, Japan) to those with low labour cost (India, China and Bangladesh). Bangladesh has very little cotton production but is a significant producer of textiles mainly due to the availability of very cheap labour (poverty & poor working conditions). The labour cost factor played a crucial role in establishing the industry at Madurai, Tirunelveli and Coimbatore.
Water	<ul style="list-style-type: none"> A significant amount of water is required for bleaching and dyeing of cotton fabric. Hence most of the textile industry is close to the soft water source. E.g. Manchester on the banks of River Mersey, Mumbai (Mithi River), Ahmedabad (Sabarmathi River) and Coimbatore (Noyyal River).
Government interventions	<ul style="list-style-type: none"> Manchester became a cottonopolis only because the British were able to secure raw cotton and markets in colonies like India. It was the friendly government policy (coupled with cheap labour) that made Bangladesh a significant producer of cotton textiles.
Technological developments	<ul style="list-style-type: none"> The British got an early start, mainly due to a series of inventions that paved the way for the modern cotton textile industry.

3.2. Cotton Textile Manufacturing Regions of the World

3.2.1 Factors responsible for the Localization of the British Cotton Textile Industry

Raw material	<ul style="list-style-type: none"> Till the American Civil War (1861-65), most of the cotton produced in the American South (cotton-producing southern states of the U.S.) was fed into the British cotton mills.
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	<ul style="list-style-type: none"> Post the American Civil War, Britain controlled and relied on the cotton supply from its colonies like India, Egypt, West Indies, etc.
Capital	<ul style="list-style-type: none"> East India Company's capital amassed from Bengal after its 1757 conquest was used to invest in British industries.
Connectivity and Transportation	<ul style="list-style-type: none"> Raw cotton was imported through the port of Liverpool. An extensive network of canals and railways made it easy to import cotton and coal and export cotton textiles to countries like the U.S. and India. River Ribble connected the interior parts of Lancashire to the Irish Sea. River Mersey and The Manchester Ship Canal connected Manchester (Port of Manchester) to Liverpool port. The Bridgewater Canal was constructed to transport coal from Worsley to Manchester. 
Market	<ul style="list-style-type: none"> Western Europe, U.S. (till the American Civil War) and British Colonies like India (the British had a monopoly over the Indian market — there was no tariffs or import duties on imported British goods whereas high tariffs were imposed on the locally produced fabric).
Power & Water	<ul style="list-style-type: none"> Fast-flowing streams down the Pennines facilitated the establishment of water-powered mills in Lancashire (River Ribble) and Manchester (River Mersey) in the 1750s. Soft water for the washing and bleaching of cotton was reading available. 

	<ul style="list-style-type: none"> With the advent of the steam engine and coalfIELDS nearby (Lancashire, Yorkshire, Nottinghamshire and Derbyshire), Manchester rose as a cottonopolis in the 1780s.
Technology (Inventions and Innovations)	<ul style="list-style-type: none"> 18th-century inventions such as Flying shuttle (in Lancashire; improved labour productivity), Spinning Jenny (in Lancashire; for spinning cotton more quickly), Cotton Gin (in the U.S.; removed seeds quickly) and Steam Engine (James Watt in the UK; facilitated the establishment of large cotton mills and improved productivity) gave an 'early start' advantage to the British cotton textile industry.
Climate	<ul style="list-style-type: none"> Weather is high in humidity due to Cool Temperate Western Margin Climate (Westerlies and North Atlantic Drift Current).
Labour	<ul style="list-style-type: none"> Child labour, a high percentage of women labour and long working hours were a common feature of the Industrial Revolution.

Factors that led to the decline of the British Textile Industry

Loss of Raw material	<ul style="list-style-type: none"> Loss of cheap raw material after the American Civil War (1861) was the first major blow. Decolonization of India and Egypt was the final nail in the coffin. The British government, starved of raw cotton, established mills in south Asia.
Loss of Market	<ul style="list-style-type: none"> India's boycott of British cotton (Swadeshi movement) products devastated Lancashire. The British lost huge markets (like India) post decolonization (coincided with WW II).
Competition from the U.S.	<ul style="list-style-type: none"> The Lancashire Cotton Famine (1861–65) depression happened due to overproduction. It coincided with the interruption of cotton imports caused by the American Civil War. Following the American Civil War, cotton mills were built in the southern states of the U.S. Cheap labour and plentiful water power made operations profitable, which meant that the cotton could be processed into fabric where it grew, saving transportation costs. Lancashire mills found it increasingly difficult to compete and went into gradual decline.
Interwar period and competition from Japan	<ul style="list-style-type: none"> The outbreak of the WW I (1914-18) spelt disaster for the British cotton industry. Demand for British cotton slumped during the interwar period because, <ul style="list-style-type: none"> During WW I, cotton couldn't be exported to foreign markets. By 1933 Japan introduced 24-hour cotton production and became the world's largest cotton manufacturer. After the demise of the textile industry, many mills were lost in the fire, some became residential complexes, and others were used by the light engineering industry.
Cheap electricity	<ul style="list-style-type: none"> With an increase in the availability of cheap thermal and hydroelectric power and a wide network of transportation, the industry moved to diverse locations across the world.
Higher labour wages and Rise of China and India	<ul style="list-style-type: none"> Raising standard of living and higher wages post WW II meant that the British cotton textile industry was no longer competitive on the world stage. Textile mills moved from Western Europe to lower-wage areas like India, China, Pakistan, Bangladesh, etc. Industrial production is currently mostly located in countries like India, China and the U.S..

How the British destroyed the Egyptian Cotton Textile Industry

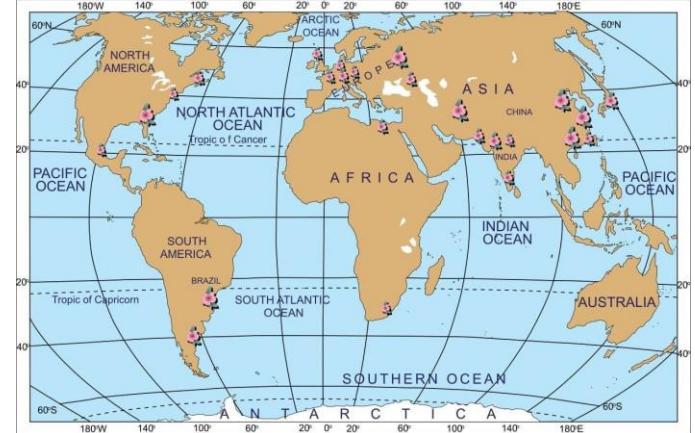
- Muhammed Ali (founder of modern Egypt) embraced cotton as a valuable cash crop.

- The **Nile Delta** provided the most ideal conditions for the cultivation of **extra-long-staple (Pima) cotton**.
- Muhammad Ali established cotton textile industry in an effort to compete with the European industries.
- In the 1850s, Egypt had become the first country outside Europe or the United States to have a railway line.
- With the decline in imports from the U.S., the British were desperately looking for new cotton markets.
- First, the British financed projects in Egypt, and when Egypt defaulted, grabbed its cotton industry (in typical British style). The demise of the Egyptian cotton textile industry was as quick as its rise.
- The British made full use of Nile's fertility to feed their cotton industry.
- Nowadays, very little of the celebrated long-staple cotton is grown in the Nile Delta (whose fertility greatly decreased due to overexploitation and construction of the Aswan Dam — reduced silt replenishment).
- China, with its cheap cotton exports, destroyed whatever was left.

Commercial Species of Cotton

- India is the only country to grow all four species of cultivated cotton
 - Gossypium arboreum and herbaceum (Asian cotton – low quality)**,
 - G.barbadense (Egyptian cotton or Pima – very high quality)** and
 - G.hirsutum (American Upland cotton or Mexican cotton)**.
- In India, 45%, 30% and 24.7% area is covered by hybrids, **upland cotton** and **Asian cotton** respectively.
- G.hirsutum and G.arboreum are grown in all the

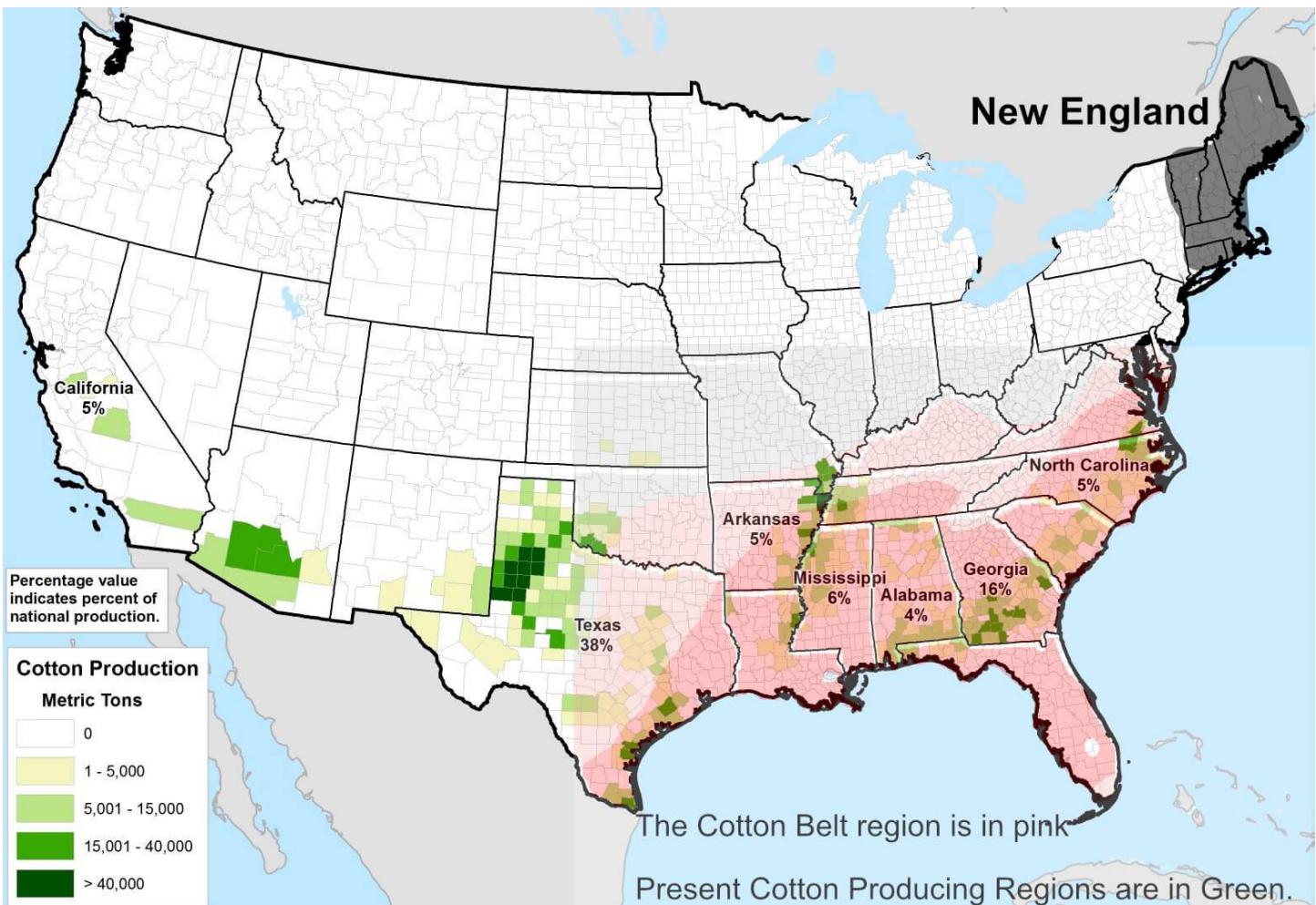
- major cotton-growing states in India
- G.herbaceum is limited to the states of Gujarat and Karnataka.
- G.barbadense is grown on a very little area (0.3%) in the state of Tamil Nadu and Andhra Pradesh.
- Globally, 90% of all cotton production is derived from **Gossypium hirsutum (Mexican cotton)**.
- In the U.S., it constitutes approximately 95% of all cotton production.



Cotton Textile Manufacturing Regions of the World

3.2.2 Factors responsible for the Localization of the American Cotton Textile Industry

- The climate of Southern U.S. (hot, humid & 200 frost-free days) is the best for cotton cultivation.
- In the Cotton Belt (South-eastern U.S.), cotton was the predominant cash crop from the late 18th century into the 20th century.
- In the 1890s to 1950s, the boll weevil, a pest from Mexico, began to spread across the United States, affecting yields drastically as it moved east.
- The boll weevil pest, soil depletion and cultivation of corn, wheat and soybeans led to the **westward migration of the Cotton Belt**.
- The commercial cultivation of cotton is now concentrated only in the most favourable areas which are the **Mississippi flood plains, Atlantic coastlands** and Northern Texas.



- More than 99% of the cotton grown in the U.S. is of the upland variety, with the rest being American Pima.
- The major markets for the upland U.S. cotton (*Gossypium hirsutum* — short-staple) are Vietnam, China, Turkey, Pakistan, India, Indonesia, Bangladesh, Mexico, Thailand etc.
- High-quality cotton (**American Pima**) produced in California, Arizona, and New Mexico is exported to mills in Japan, Korea, and Europe for use in the production of **high-quality textile products**.

The U.S. Cotton Textile Industry

- The invention of Cotton Gin in 1793 enabled the rapid growth of cotton industry in New England (it consists of six states in the north-eastern corner of U.S. **Boston** is the most important city).

- Strong banking industry (**New York** is only 350 km from Boston), British immigrants, domination in the cotton trade and coalfields nearby (Appalachian Region) gave it an edge over the American South.
- By 1860, Boston and New York (both port cities) played a dominant role in the cotton trade.
- When the Civil War began in 1861, the cotton exports from the American South to Britain stopped.
- This gave impetus to the U.S. cotton textile industry.
- Other industries became prominent in New England and the cotton industry was running out of space.
- Migration of the textile industry from New England to the American South** started in the 1920s.

- Lower taxes, plentiful labour supplies, adequate water, and closeness to raw materials were factors contributing to this shift.
- Today, the cotton textile industry is concentrated primarily in **North Carolina, South Carolina, Alabama, and Georgia**.
- Since World War II, cotton's share of U.S. mill use has fallen significantly.
- During the decline in cotton's share, humanmade fibres became the major fibres.
- From 1970s growing textile imports (from China) reduced the demand for the U.S. made products.
- In an effort to remain competitive, U.S. mills are adopting labour-saving innovations like automation.

Market	<ul style="list-style-type: none"> Because of its sturdiness, jeans became a popular textile for miners, railroad workers, cowboys, and farmers in nineteenth-century America. New England: Large urban market for fashion clothing.
Market for byproducts (auxiliary industries)	<ul style="list-style-type: none"> Cottonseed oil accounts for about 5 per cent of the fats and oils used in edible oil products in the United States, with soybean oil, corn oil, being the major competing oils. Recent dietary trends away from animal fats and oils in fast foods have led to increases in vegetable oil consumption, including cottonseed oil.
Water	<ul style="list-style-type: none"> American South: Mississippi River and Tennessee River.  <p>The map shows the major river systems of the American South. The Mississippi River flows from west to east, with its main stem originating in the central US and emptying into the Gulf of Mexico. Major tributaries shown include the Ohio River, Tennessee River, and Alabama River. The Tennessee River is a significant tributary of the Mississippi, flowing through several states. The map also includes labels for the Atlantic Ocean and the state boundaries of the southern US.</p>
Climate	<ul style="list-style-type: none"> The climate in American South (Gulf Type Climate) and New England (Laurentian Climate) is Humid.
Labour	<ul style="list-style-type: none"> New England: British immigrants. American South: The cotton industry was synonymous with slavery till the end of the American Civil War. After the American Civil War, slavery was replaced with the institution of sharecropping (farmers worked it for a portion of the profits).
Technology & Mechanization	<ul style="list-style-type: none"> The invention of Cotton Gin by Eli Whitney in 1793 enabled the rapid growth of the cotton industry in America. By the 1950s, the mechanical cotton picker replaced the labour force throughout the U.S. cotton-growing area. Bt Cotton has significantly increased the yield of cotton.

3.2.3 Factors responsible for the Localization of the Japanese Cotton Textile Industry

Land	<ul style="list-style-type: none"> Japan's terrain is predominantly mountainous, and forests cover more than 65% of the geographical area. The extensive plains around Osaka (also known as the 'Manchester of Japan') and Nagoya ensured that land was readily available for the growth of cotton mills.
Historical aspects	<ul style="list-style-type: none"> Cottage industry based on domestic raw cotton developed around Osaka and Nagoya during 1600-1868. The Meiji Restoration of 1868 modernized the industry.
Raw material	<ul style="list-style-type: none"> Depended entirely upon imported raw cotton from U.S., India, Egypt, and China.
Transportation	<ul style="list-style-type: none"> Both Osaka and Nagoya are port cities. Location of port facilitated the import of raw cotton and for exporting textiles. 
Market	<ul style="list-style-type: none"> Japan was a major exporter of cotton textiles before World War II. The U.S. was its biggest trading partner. There was a good market in the neighbourhood due to the good quality and low price.
Power	<ul style="list-style-type: none"> Cheap hydroelectricity
Water	<ul style="list-style-type: none"> The river Yodo (Osaka) and river Kiso (Nagoya) provide sufficient water for the mills.
Climate	<ul style="list-style-type: none"> The warm, humid climate (China Type climate) is well suited to spinning and weaving.
Labour	<ul style="list-style-type: none"> Labour was readily available in the 1930s.
Foreign Assistance	<ul style="list-style-type: none"> World War II devastated the industry. Japanese cotton textile industry made a miraculous recovery with U.S. assistance and was the largest exporter of cotton textiles in the world until the 1980s.

Factors responsible for the decline of the Japanese Textile Industry

- Japan's cotton textile industry began to wane in the 1980s because of increasing labour costs, competition from new synthetic textiles and **competition from China and India**.
- Many Japanese cotton textile companies **relocated to low wage countries** such as China and Indonesia.
- Automobile and heavy machinery industry** overpowered Nagoya's cotton textile industry.
- Of late, the cotton textile industry of Osaka has also been replaced by other industries, such as iron and steel, machinery, shipbuilding, automobiles, electrical equipment and cement.

3.2.4 Factors responsible for the Localization of the German Cotton Textile Industry.

Raw material	<ul style="list-style-type: none"> Just like the British, Germany depended heavily on American cotton till 1861. Later, German colonization in East Africa ensured a steady supply of raw cotton. Now, Germany imports normal fabric from Bangladesh and China.
Connectivity and Transportation	<ul style="list-style-type: none"> The Rhine River connected The Ruhr region (Lower Rhine Valley) and the Alsace-Lorraine region (Upper Rhine Valley; Alsace-Lorraine was annexed from France in the Franco-Prussian War of 1870) with the port of Rotterdam (30km to the North Sea).
Market	<ul style="list-style-type: none"> Germany entered late and hence it couldn't compete with the British for the global market. Germany imposed entry barriers on the cheaper British textiles to protect its internal market. At present, Germany caters to Europe's expensive designer clothes market and technical textiles (for the automobile industry). Technical textiles (textiles used for purposes other than clothing) includes products like filters, composite products, and outerwear capable of repelling germs to water.
Technology	<ul style="list-style-type: none"> Germany entered late, and it took some time to catch up with the British (it got better technology only after annexing Alsace-Lorraine)
Power	<ul style="list-style-type: none"> Coal was abundantly available in the nearby regions (The Ruhr).
Water	<ul style="list-style-type: none"> Rhine River
Climate	<ul style="list-style-type: none"> Cool Temperate Western Margin Climate (Westerlies and North Atlantic Drift Current).
Labour	<ul style="list-style-type: none"> Earlier, cheap labour (child labour and a high share of women workforce) was available. Quick technological advancement Post-German Unification saw the country move towards machines and automation.

Factors responsible for the decline of the German Cotton Textile Industry

- The German textile industry of the 19th and early 20th Century was largely made up of **Jews**.
- When the Nazi party came to power in 1933, they destroyed the lineage of the Jewish textile trade.
- After the **genocide of Jews**, the German textile industry was unable to compete with other countries manufacturing in the 20th Century.
- In replacement for textiles, the steel and automobile industry saw great growth.

3.2.5 Factors responsible for the Localization of Russian Cotton Textile Industry

Raw material	<ul style="list-style-type: none"> Imported cotton from Uzbekistan (a major producer of cotton).
Land	<ul style="list-style-type: none"> Rolling plains of Central Economic Region with Moscow as its centre.
Water & power.	<ul style="list-style-type: none"> The Volga and Oka Rivers.



Machinery	<ul style="list-style-type: none"> Machinery, managers and engineers were imported from Britain
Market	<ul style="list-style-type: none"> Urban markets of Western Russia and Central Asia.
Climate	<ul style="list-style-type: none"> The climate of Western Russia is humid

3.2.6 Factors responsible for the Localization of the Chinese Cotton Textile Industry

- Most of the Chinese cotton textile industry is scattered along the **Yangtze River valley region** with the highest concentration around **Shanghai**.

Raw material	<ul style="list-style-type: none"> China is the world's second-largest cotton producer in 2018-19 after India. Its yields are among the highest in the world. Northwest inland cotton region (Xinjiang and Gansu). Yellow River valley region (Shandong, Hebei, Henan, Shanxi). Yangtze River valley region (Hubei, Hunan, Anhui, Jiangsu).  <ul style="list-style-type: none"> At times of cotton price volatility, the domestic mills import cotton from India, Bangladesh, Vietnam and the U.S.
Connectivity and Transportation	<ul style="list-style-type: none"> Yangtze River and Yellow River inland waterways. Shanghai port.
Capital	<ul style="list-style-type: none"> Tremendous capital inflow occurred in the 1980s after the Opening of China by Deng Xiaoping in 1978.

	<ul style="list-style-type: none"> Cotton mill owners in Japan, Hong Kong, and Korea transferred their base to China.
Market	<ul style="list-style-type: none"> U.S., Europe, Japan, South Korea, etc.
Power	<ul style="list-style-type: none"> Coal powered captive power plants and numerous hydel power stations along the Yangtze River.
Water	<ul style="list-style-type: none"> Yangtze River.
Climate	<ul style="list-style-type: none"> Humid (Temperate Monsoon or China Type climate)
Labour	<ul style="list-style-type: none"> Plenty just like in India.
Economic clout (competitive edge)	<ul style="list-style-type: none"> Being a global economic powerhouse, China is able to influence the global cotton price with its firm grip on production, stock hoarding, import and export.

3.3. Cotton Textile Industry in India

- In the ancient and medieval times, the cotton textile industry used to be only a cottage industry.
- India was famous worldwide for the production of muslin, a very fine variety of cotton cloth, calicos, chintz and other different types of fine cotton cloth.
- With the beginning of the industrial revolution, Indian cotton textiles industry was decimated due to competition from the mill industry of Britain.
- The first successful modern cotton textile mill was established at **Mumbai in 1854** with local capital.
- This industry around Mumbai grew tremendously in the 1870s due to a spurt in demand in the wake of the **American Civil War**.
- Indian industries made rapid strides during WW I due to a rise in demand for industrial goods.
- The cotton textile industry was concentrated in the cotton belt of Rajasthan, Maharashtra & Gujarat.
- The real spurt was provided by the **Indian Fiscal Commission set up in 1921-22**.
- This gave protection to industries like iron and steel, textiles, cement, sugar, paper and metals.
- This led to the dispersal of the cotton textile industry away from the main cotton belt.
- The world wars and the **Swadeshi Movement** favoured the growth of this industry at a rapid pace.
- The industry suffered a severe setback after partition as most of the **long-staple cotton-growing areas went to Pakistan while most of the cotton mills remained in India**.
- With limited foreign exchange, India struggled to import expensive long-staple cotton from the U.S. and UK.
- With the introduction of Bt Cotton, India is now one of the leading producers of cotton textiles.

The Indian cotton textiles industry has a three-tier structure:

- ✓ Low capital but labour intensive handspun khadi sector,
- ✓ An intermediate, labour-intensive sector of handlooms and power looms,
- ✓ The large scale mill sector which is capital intensive.
- Post partition, the share of the mill sector declined with the growth of power looms and handlooms.
- At present, the bulk of India's cotton cloth comes from the **power loom sector**.
- India is now the world's largest cotton producer, accounting for ~38% of global cotton acreage but only ~23% of global cotton production.
- It is also the second-largest exporter (after the U.S.) and the second-largest consumer (after China).

3.3.2 Factors responsible for the Localization of the Cotton Textile Industry in India



Raw Material	<ul style="list-style-type: none"> Cotton was an important crop since the Indus valley civilization.
Market	<ul style="list-style-type: none"> In the ancient & medieval times, cotton fabric was exported worldwide. At present, India has a robust domestic textile market. It also caters to the markets in the U.S., European Union & Middle East (West Asia).
Labour	<ul style="list-style-type: none"> Some communities and regions were producing cotton textiles for generations and transferred the skill from one generation to the other. Lower labour costs at centres like Ujjain, Bharuch, Agra, Coimbatore and Tirunelveli caused industries to be located away from cotton-producing areas.
The British Factor	<ul style="list-style-type: none"> Initially, the British discouraged the development of the indigenous cotton textile industry to safeguard their own industry. But after WW I, the British encouraged cotton textiles industry across South Asia.

Factors responsible for the Localization of Cotton Textile Industry in Mumbai

- Mumbai** is called the **Cottonopolis of India**.
- The following factors favoured the development of cotton textiles industry at and around Mumbai.

Raw material	<ul style="list-style-type: none"> Cotton from nearby cotton-growing areas of Maharashtra and Gujarat.
Connectivity	<ul style="list-style-type: none"> Raw cotton used to be brought to Mumbai port to be transported to England. Mumbai is well connected through rail and road links with cotton-growing areas of Gujarat and Maharashtra and the surrounding markets.
Location	<ul style="list-style-type: none"> Location of port facilitates import of long-staple cotton (Egypt, U.S.), capital goods, chemicals and the export of finished goods.
Early start	<ul style="list-style-type: none"> In 1854, the first successful modern cotton mill in India was established in Mumbai with Indian capital. (Mills started in Kolkata in the 1830s by the British were a commercial failure). The machinery required could be directly imported from England. It always had the advantage of an early start in all aspects.
Market	<ul style="list-style-type: none"> There is a ready market for Mumbai products both in India and abroad.
Climate	<ul style="list-style-type: none"> The humid coastal climate favoured textile-making without breaking the thread.
Power	<ul style="list-style-type: none"> Cheap hydroelectricity is available from the nearby Western Ghats.
Water	<ul style="list-style-type: none"> Water for boilers, bleaching and dyeing cotton fabric is obtained from Mithi River.
Ancillary industry	<ul style="list-style-type: none"> Chemical industry around Mumbai provides the necessary chemical inputs.
Capital	<ul style="list-style-type: none"> Mumbai has been a financial centre since the time of the British. Easy availability of capital has given rise to large cotton mills.
Labor	<ul style="list-style-type: none"> Cheap labour is abundantly available.

Factors responsible for the Localization of Cotton Textile Industry in Ahmedabad

- Ahmedabad (Manchester of India) is now the second-largest centre of cotton textile industry after Mumbai.

Raw material	<ul style="list-style-type: none"> Cotton from nearby cotton-growing areas of Gujarat.
Connectivity	<ul style="list-style-type: none"> Mumbai port nearby facilitates import of machinery and export of cotton textiles. Well-developed road and railway network permit easy transportation of textiles to dif-

	ferent parts of the country, thus providing easy access to the market.
Early start	<ul style="list-style-type: none"> The opening of Shahpur mill in 1861 and Calico mill in 1863.
Market	<ul style="list-style-type: none"> Ahmedabad has the advantage of cheap land and high-quality goods. Most of Ahmedabad mills produce cheap cloth which finds a ready market among the poor masses.
Power	<ul style="list-style-type: none"> Sabarmati and Gandhinagar Thermal Power Stations
Water	<ul style="list-style-type: none"> Sabarmati River.
Climate, Capital & Labor	<ul style="list-style-type: none"> Similar to that in Mumbai

- In recent years, many textile mills in Ahmedabad have closed down.
- This is primarily due to the emergence of new textile centres in the country as well as non-upgradation of machines and technology.

Others

- Tamil Nadu has the largest number of mills, and most of them produce yarn rather than cloth.
- Coimbatore** is the most crucial centre and is known as **Manchester of South India**.
- Tirupur has some of Asia's largest garment manufacturing units.
- Cotton textile mills were set up at **Kanpur (Uttar Pradesh)** based on local investment.
- Mills were set up at **Kolkata (Hooghly Region)** due to its port facilities.
- It enjoys facilities of a port, humid climate, **coal from Raniganj**, local labour due to the high density of population and those of dyeing and washing.
- But Kolkata suffers from the disadvantage of being away from the main cotton-producing areas of India.

- Approximately 62% of India's cotton is produced in rainfed areas and only 38% on irrigated lands.
- Hence, India suffers from both overproduction and shortages.
- This makes the supply of cotton to industries highly variable.
- Although India has made a significant increase in the production of good quality long-staple cotton, much of the long-staple cotton requirements are still met by imports.

Cotton yields in India are among the lowest in the world

- Low yields are due to many varieties planted, inadequate inputs, and lack of mechanization, fragmented landholdings and other inefficient practices.

Lack of modernization

- The industry suffers from antiquated machinery and technology, leading to low productivity of machine and labour.

Good spinning sector but weak weaving, knitting and processing sector

- Since the mid-eighties, the spinning sector has received a lot of attention.
- India's spinning mills are competitive at the global level and capable of using all the fibres produced.

3.3.3 Issues Faced by the Cotton Textile Industry in India

Cotton crop is highly vulnerable to vagaries of monsoon

- Crop (Kharif crop) is heavily dependent on the erratic monsoon season.

- However, the weaving, knitting and processing units cannot use much of the high-quality yarn that is produced in the country.
- There are some large and modern factories in these segments, but most of the production is in small fragmented units, which cater to the local market.
- As a result, many of our spinners **export cotton yarn** while apparel/garment manufactures have to **import fabric (loss of employment)**.

UPSC Mains 2019: Can the strategy of regional-resource based manufacturing help in promoting employment in India? (Answer in 150 words)

- You can site the above example.

3.4. Top cotton producers, importers and exporters

Top Cotton Producers (2019-20)	Top Cotton Importers in 2019	Top Importers of India's Cotton (2018-19)	Top Cotton Exporters (2018-19)
1. India	1. China	1. Bangladesh	1. U.S.
2. China	2. Vietnam	2. China	Brazil, Australia & India are other major exporters
3. U.S.	Turkey & Bangladesh	Vietnam & Pakistan	
Top Exporters of Textile in 2018	Top Exporters of Apparel (clothing) in 2018	Top Importers of Textile in 2018	Top Importers of Apparel (clothing) in 2018
1. China	1. China	1. EU	1. EU
2. EU	2. EU	2. U.S.	2. U.S.
3. India	3. Bangladesh	3. China	3. Japan

4. Woollen Textile Industry

- Wool is the fibre obtained from sheep and other animals, including goats, Angora rabbits, etc.
- Wool obtained from **Merino sheep, Angora goat, Changthangi or Ladakh Pashmina goat**, etc. are of commercial importance.

4.1. Factors that affect commercial wool production

Climate	<ul style="list-style-type: none"> Sheep grow well in dry and moderate climate (neither too hot nor too cold). Humid climate is not suitable as it encourages the spread of infectious diseases.
Vegetation	<ul style="list-style-type: none"> Vast pastures with dry conditions are ideal for sheep grazing.
Breed	<ul style="list-style-type: none"> The quality of wool is determined by its fibre diameter, length, softness, strength, etc. The finest and most valuable wool comes from Merino sheep breed reared in Australia,

	<p>New Zealand, Argentina, South Africa, U.K., etc.</p> <ul style="list-style-type: none"> • Merino wool is typically 9-12 cm in length and is very fine. • Wool taken from sheep breed reared for meat is typically coarse and has short fibres. E.g. Indian tropical sheep.
Economies of scale	<ul style="list-style-type: none"> • Availability of land, population pressure, competition from other occupations, etc. affect the commercial success of wool production industry.

4.1.1 Major wool producing regions

Australia

- Sheep stations (the equivalent of a ranch) provides the best economic use of the land in the predominantly semiarid landscape of Australia.
- The sparse grassland vegetation and vast farms of Australia are well suited to sheep.

New Zealand

- The main area of sheep rearing is located in southern Island, especially the **Canterbury Plains** where sheep rearing is a part of **mixed farming**.

South America

- In South America, sheep rearing is most important in the direr parts of Argentina including the whole of **Patagonia** and the eastern foothills of the Andes.

- The low and variable rainfall, the poor pasture, the severe winter, and the sparse population, all make the region more suitable for sheep grazing than for cattle rearing.
- The sheep ranchers are extremely large in **Patagonia**.
- Patagonia is an exporter of both wool and mutton.

South Africa

- The dry climate of **Veld**, its grassland vegetation and plateau relief is ideal for sheep.
- The sheep reared are almost exclusively merino breeds kept for wool.

China

- In China, sheep rearing is mostly done in the vast empty areas of the west.
- Most of the raw material needs are met by imports.

4.2. Factors that affect the location of the woollen textile industry

Raw material	<ul style="list-style-type: none"> • The woollen industry is not weight losing. • Hence mills can be established at faraway places from wool-producing areas. • For example, mills in the northern hemisphere import fine quality wool from faraway places like Australia and New Zealand.
Wool quality	<ul style="list-style-type: none"> • Finer wool can be used for garments, while coarser grades are used for durable outerwear or rugs. • For example, In India, the wool produced is coarser, and hence the industry tends to focus more on durable goods. • Only imported wool from Australia is used for quality apparel making.
Transportation	<ul style="list-style-type: none"> • As wool is nonperishable and lightweight, it can be transported over longer distances

linkages	<p>economically through waterways.</p> <ul style="list-style-type: none"> Mills that work on imported wool are usually located close to the ports to reduce transportation costs. E.g. mills in Mumbai and Chennai.
Market	<ul style="list-style-type: none"> The woollen industry is primarily market-oriented. Wool fabrics hold more air which makes them excellent insulators against cold. Hence most of the woollen apparel industry is located in the temperate coastal regions of the northern hemisphere. Industry located in the tropics is mostly export-oriented.
Power & Water	<ul style="list-style-type: none"> Similar to cotton.
Labour	<ul style="list-style-type: none"> Though Australia is the top producer of wool, it does not have a significant woollen textile industry. This can be attributed to an insignificant market in the region and high labour costs. On the other hand, cheap labour plays an essential factor in the establishment of mills in the tropics.

4.2.1 Despite the added cost of transportation, the wool exports from southern to northern hemisphere remain competitive. Explain.

✓ dry rain shadow region in the Patagonia grasslands of Argentina.

Sheep rearing is relatively less profitable in the northern hemisphere

- Cattle and pigs can be raised in **factory farms**, and hence beef and pork are a lot cheaper than mutton.
- Sheep are sensitive to stress and cannot be raised in extreme confinements (factory farm setting).
- They need to be kept longer on open pastures to get them to market weight.
- Hence sheep rearing is less profitable compared to cattle rearing, piggery, poultry, etc.
- Also, relatively high population pressure means large sheep ranches cannot be established like in the south ('economies of scale' factor is missing).

Merino sheep

- The high yielding Merino sheep are strong and hardy animals.
- They are well suited for the
 - ✓ dry and moderate climate of south-eastern Australia and south-western Australia,
 - ✓ grasslands (Veld) of South Africa,
 - ✓ dry rain shadow region in the Canterbury plains of New Zealand, and

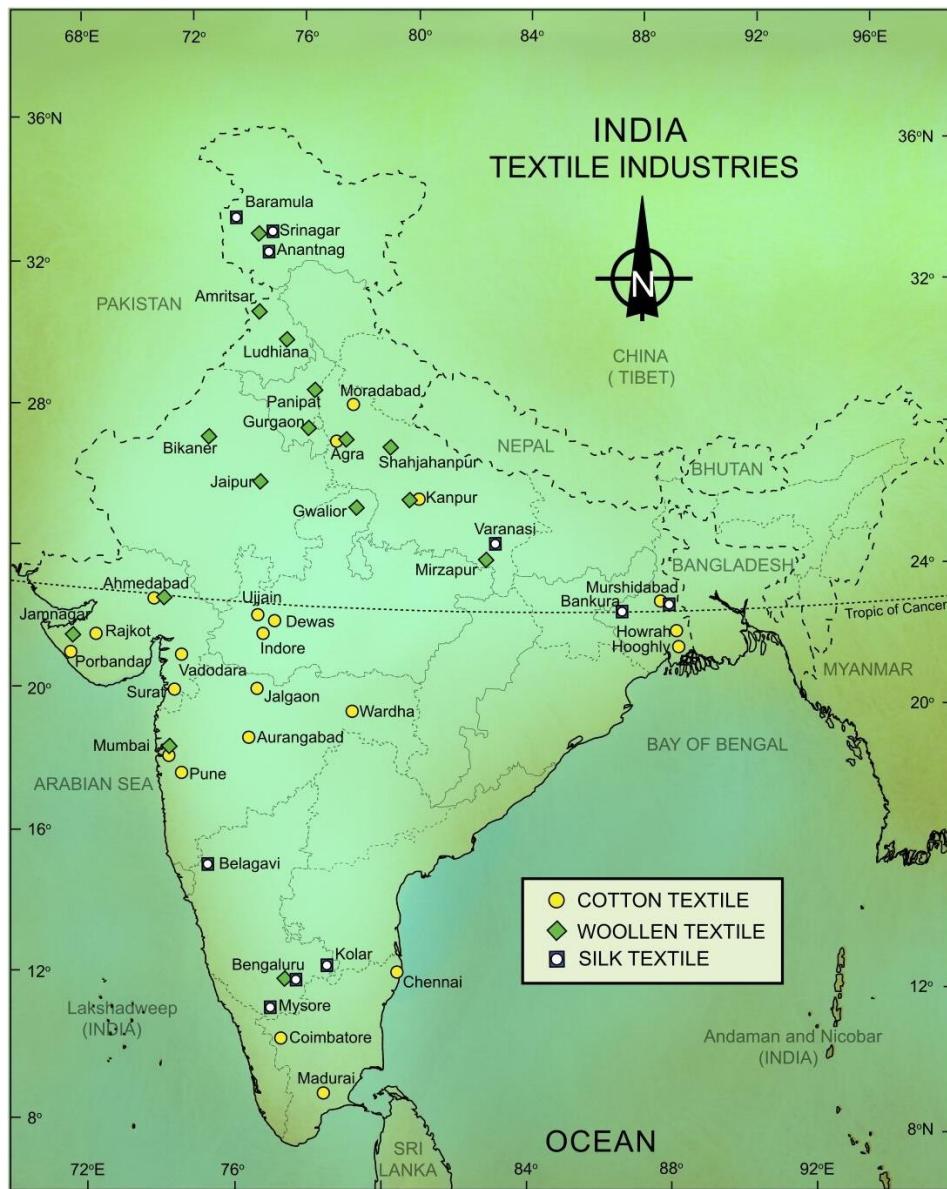
4.2.2 U.K. – The Rise and Fall

- Britain has for centuries been a sheep raiser and an exporter of pedigree sheep.
- During the colonial times, the woollen industry thrived around **Yorkshire**.
- Both locally produced and imported wool was used to feed the mills.

- Sheep rearing declined in the later stages due to stiff competition from cheaper Australian wool imports.
- Just like the cotton industry around Manchester, the Yorkshire woollen textile industry is now heavily dependent on the imported wool from the southern hemisphere.
- Sheep rearing, which used to be a major occupation, is now a part of the mixed farming system.
- The principal British sheep areas are now those where agriculture or cattle-rearing is not viable.
- They include the pasture lands of the Scottish Highlands, the Pennines, the Welsh mountains, etc.

4.3. Indian Woollen Textile Industry

- In India, woollen textiles industry is relatively small compared to the cotton & synthetic fibre based industry.
- India does not produce quality raw wool in sufficient quantity.
- It imports large quantities of fine wool, mainly from **Australia**.
- However, India is a significant exporter of woollen goods.
- Cheap and abundant skilled labour is the favourable factor.



4.3.1 Punjab

- The woollen industry is located around Amritsar-Gurdaspur-Ludhiana belt, Patiala and **Dhariwal**.
- Market: The industry in Punjab serves the high demand region in northern India.
- Raw material: Punjab is close to the sheep-rearing regions of Jammu and Kashmir (**Ba-karwal** sheep rearing nomads) and Himachal Pradesh (**Gaddis** nomads).
- Power: hydroelectricity from **Bhakra Nangal Dam**.

4.3.2 Others

- Uttar Pradesh: The first woollen textiles mill was set up in 1876 at Kanpur.
- Gujarat: Jamnagar, Ahmedabad, and Vadodara. Inferior wool is obtained from Rajasthan and while superior wool is imported from Australia.
- Maharashtra: quality woollens are manufactured from the imported wool in Mumbai.
- Jammu and Kashmir: significant producer of handloom and power loom woollen goods. The

famous **Kashmiri shawls** are produced from **pashmina wool**.

- Ladakh: India produces the finest quality of pashmina wool which comes mainly from the pashmina goats.

4.3.3 Problems of Indian woollen textile industry

Weak demand

- Most parts of India have tropical and sub-tropical climate.
- Short winter and long summer in India lead to inadequate demand for woollen textiles.
- Due to decreasing demand with the increased use of synthetic fibres, wool production is much less than what it was in the past.

Low Quality

- Indian wool is coarse (tropical sheep produce inferior quality wool) and is not suitable for apparel making.

Low productivity

- India has one of the highest sheep stocks in the world but is far behind in wool production.

5. Jute Textile Industry

- Jute industry is the second most important textile industry in India after cotton.
- The British setup the first jute industry in India in 1855 in the **Hooghly valley** near Kolkata.
- As of 2018, there are 97 jute mills in India.
- **West Bengal (71)** has the highest number of jute mills, followed by **Andhra Pradesh (12)**.
- All the mills in West Bengal are located in a narrow belt about 100 km long along **river Hooghly**.

- The remaining mills are located in Uttar Pradesh (3), Bihar (3), Orissa (3) and Assam (2).
- The mills in **Uttar Pradesh (sugar and cement industry)** and **Andhra Pradesh (Paddy)** were set up to meet the increasing local demand for gunny bags.
- Also, there is the availability of local fibres like **mesta** (important commercial fibre crop after cotton and Jute. Jute and mesta fibre together is known as raw jute).

5.1. Factors responsible for the concentration of Jute Industry in the Hooghly Basin

Geography (agricultural conditions)	<ul style="list-style-type: none"> Soil and climatic conditions in the delta region are ideal for jute cultivation. There is no better alternative to jute in severely flood-prone regions of the delta.
Raw material	<ul style="list-style-type: none"> India is the world's largest producer of jute and WB alone accounts for 72% of India's jute production.
The British Factor	<ul style="list-style-type: none"> The region has got 'early start' advantage. The industry was promoted heavily by the British with both capital as well as expertise.
Capital	<ul style="list-style-type: none"> Kolkata had excellent banking facilities since the time of British (Calcutta was the capital of British India from 1772 to 1911).
Transportation	<ul style="list-style-type: none"> Hooghly is well connected through waterways (Ganga-Bhagirathi-Hooghly Waterway — National Waterway 1) and rail with the jute growing areas. Kolkata port helps in the import of machinery and export of finished jute products
Market	<ul style="list-style-type: none"> There is a vast domestic market throughout India for jute products (gunny bags). The mills in Hooghly export jute hessian to Bangladesh.
	
Power	<ul style="list-style-type: none"> Thermal stations in the Hooghly basin (come under Damodar Valley Corporation) use coal from Raniganj coalfields (~170 km).
Climate	<ul style="list-style-type: none"> The humid climate is very convenient for spinning and weaving.
Labour	<ul style="list-style-type: none"> The Ganga-Brahmaputra Delta region has a very high population density, and most of the population here is poor. Cheap labour is also available from the surrounding regions of Bihar and Uttar Pradesh.
Livelihood factor	<ul style="list-style-type: none"> Jute industry provides direct and indirect employment for more than 40 lakh people.
Water	<ul style="list-style-type: none"> Hooghly River (Plenty of standing water is required for processing of jute crop)
Government support keeps the industry alive	<ul style="list-style-type: none"> The Jute Corporation of India (JCI) procures raw jute at Minimum Support Price (MSP). Jute Packaging Materials Act (JPMA), 1987 makes it compulsory to pack 100 per cent of the food grains and 20 per cent of the sugar in diversified jute (gunny) bags. The Incentive Scheme for Acquisition of Plant & Machinery (ISAPM) scheme has been launched in 2013 with an incentive @20% of the cost of machinery to Jute mills.

5.2. Issues faced by the jute industry

- After partition, most of the jute producing areas went to **Bangladesh** while most of the **jute mills remained in India**.
- This problem was overcome to a large extent by extending the area in India under jute and mesta.

- However, domestic production is simply not enough to satisfy the demand of Indian jute mills.
- **The constant increase in rice** cropped area in the delta region further complicates the situation.
- **India imports significant quantities of jute fibre from Bangladesh to meet the shortfall.**
- Antiquated technology and machinery, shortage of power and industrial sickness affect production.
- Newly established factories in **Bangladesh** are posing a tough competition.
- Adoption of **synthetic alternatives** (polythene, nylon) has resulted in the decline of demand for jute.

5.3. Future positives for the jute industry

- Emerging environment consciousness can turn the fortunes of jute as it meets all the standards of safe packaging (natural, renewable, biodegradable).
- Some advanced countries are already switching to jute.
- The main buyers of Indian jute products are the USA, EU, Canada, Russia, etc.

5.4. Top jute producing, exporting and importing countries

- Top producers of jute: India and Bangladesh.
- Top consumers of jute: India, Bangladesh and Pakistan.
- Top exporters of jute: Bangladesh and India.
- Top importers of jute: Pakistan and India.

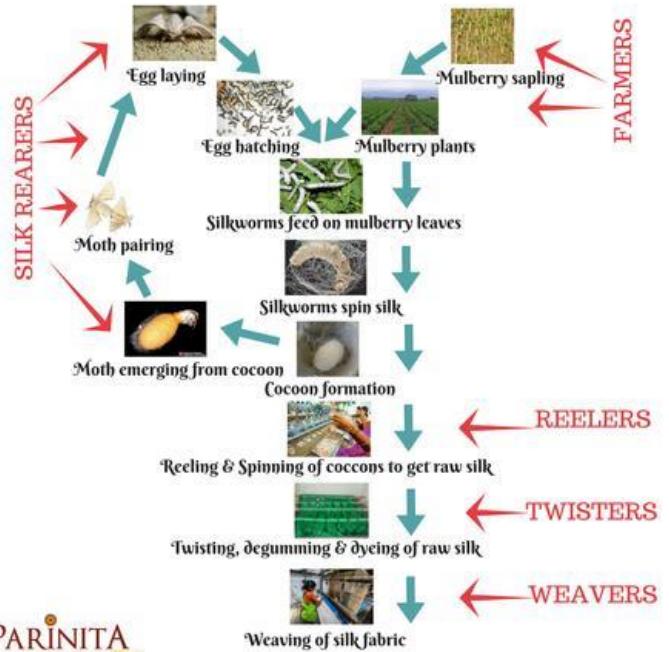
6. Silk Textile Industry

- Silk is a fibre made up two different proteins – **sericin** and **fibroin**.
- A layer of sericin surrounds the fibroin core (80% of silk fibre).
- The pigments in the sericin layer impart colour to the silk.
- Silk is used to make silk fabric, **parachutes**, **teeth braces (Italy)** and **fishing nets** around the world.
- Sericulture is the process of breeding silkworms and extracting silk from them.
- The production of mulberry silk involves the following processes.

1. **Moriculture:** the cultivation of mulberry leaves.
2. Silkworm rearing: promoting the growth of the silkworm by feeding mulberry leaves.
3. Silk reeling: the extraction of silk filaments from the silkworm cocoons.

4. Silk yarn: the silk filaments are woven together to form a thread. These threads are often plied together to form a yarn.

Mulberry Silk Production: People & Process



- Mulberry plant that can be **grown under varied climatic conditions** ranging from **temperate to tropical**.
- The plant grows well in slightly acidic soils that receive an annual rainfall ranging from 60 to 250 cm.
- Today, **China accounts for over 70% of the global silk production** and **90% of the world's silk exports**.
- **India is a distant second with 18% of the world's silk production.**

6.1. Silk Industry in India

- There are mainly four types of silk varieties produced by different species of silkworms.
- **Mulberry silk (white)** is secreted by the caterpillar of ***Bombyx mori*** which feeds on mulberry leaves.

- Wild Silks — Tussar (creamy), Eri (coppery) and **Muga Silk (golden)** — are secreted by wild silkworms.
- India is the only country producing all known commercial varieties of silk.
- Mulberry silk (80 per cent of the country's total silk; Eri silk is second) is of superior quality and is produced in the states of **Karnataka, Andhra Pradesh, West Bengal, Tamil Nadu and Jammu and Kasmir**.
- Wild silks are mostly produced in the forests of Jharkhand, Chhattisgarh, Madhya Pradesh, Bihar, Odisha, Assam, Meghalaya, Manipur and Nagaland.
- Muga silk (golden silk) is exclusively obtained from the Brahmaputra valley of **Assam**.
- Assam has received a **geographical indication (GI)** for the production of **Muga silk**.

State	Production of silk in Tonnes (2016-17)		Silk producing regions
1. Karnataka	9571	31.5 %	Mulberry silk in Mysuru (Ramanagara), Kolar , Bengaluru Rural (Devanahalli) and Chikkaballapura districts in the Old Mysore region
2. Andhra Pradesh	5971	19.7 %	Anantapur, Chittoor Districts (Rayalaseema region)
3. Assam	3810	12.6 %	Muga silk in Brahmaputra Valley region
4. Jharkhand	2631	8.7 %	Tussar (tasar) silk in Singhbhum District
5. West Bengal	2565	8.5 %	Murshidabad and Birbhum district
6. Tamil Nadu	1914	6.3 %	Coimbatore, Dharmapuri and Salem district
Total	30348		

- Important centres of silk industry are
 - ✓ **Mysore** in Karnataka;
 - ✓ **Varanasi** in Uttar Pradesh;
 - ✓ **Dharmavaram**, Pochampalli, Venkatagiri, Narainpet in Andhra Pradesh;
 - ✓ Kashmir division;
 - ✓ **Bhagalpur** in Bihar and
 - ✓ **Murshidabad** in West Bengal.
- **Varanasi, Kanchipuram, Murshidabad** (W.B.), **Dharmavaram** (Anantapur District) in Andhra Pradesh and **Bhagalpur** in Bihar are famous for **silk sarees**.
- There is a massive demand for these sarees in the local market.
- Silk and silk products are exported to USA, U.K., Kuwait, Russia, Oman, Saudi Arabia, Singapore, and UAE.

6.1.1 Factors Responsible for the Localization of the Silk Industry in Karnataka

- Silk textile industry in Karnataka is concentrated in the Old Mysore regions and Belagavi district.

Historical aspects	<ul style="list-style-type: none"> Tipu Sultan was the first to import silk cocoons from China in the 18th century. He sent craftsman to Bengal to learn sericulture. More impetus was provided by the demand for Mysore silk for the manufacturing of parachutes during WW II.
Raw material	<ul style="list-style-type: none"> Karnataka is the largest raw silk producing state in India. It produces only mulberry silk and accounts for over 50 per cent of India's mulberry silk. Sericulture is concentrated around Mysuru (Ramanagara), Kolar, Bengaluru Rural (Devanahalli) and Chikkaballapura districts in the Old Mysore region.
Labour	<ul style="list-style-type: none"> Cheap labour is readily available.
Technology	<ul style="list-style-type: none"> The Central Sericultural Research & Training Institute (CSRTI) is located in Mysore. The institute has developed many high yielding varieties of mulberry and silkworms. GOI has set a goal of making the nation self-sufficient in bivoltine silk, a high-grade variety made with silkworms that lay two batches of eggs per year. In response, the Japan International Cooperation Agency has provided technical co-operation to the country since 1991. Karnataka, Andhra Pradesh, and Tamil Nadu saw the widespread adoption of bivoltine production techniques since then.
Water	<ul style="list-style-type: none"> Cauvery and Arkavathi rivers provide water for washing, bleaching and dyeing.
Market	<ul style="list-style-type: none"> The crepe silk saris (made of pure silk interwoven with gold zari threads) have market throughout India. Silk and silk fabric produced in Karnataka are exported to famous silk saree making centres like Varanasi, Kanchipuram, Bhagalpur, Jammu and Kashmir, etc.
Government support	<ul style="list-style-type: none"> Mysore Silk, crafted under the aegis of the Karnataka Silk Industries Corporation, now has the additional distinction of a GI tag.

6.1.2 Factors Responsible for the Localization of the Silk Industry in Varanasi

- Banarasi silk sarees are famous for intricate weaving and craftsmanship with a tinge of **Mughal** and Indian cultures.
- The sarees are worked on both handlooms (85% of the silk consumption) and power looms.

Historical aspects	<ul style="list-style-type: none"> The Mughals heavily patronized the Banarasi silk industry. Muslim craftsman are involved in weaving silk sarees in Banarasi since the Mughal era.
Labour	<ul style="list-style-type: none"> Highly skilled Muslim craftsman (Muslim weaver community known by the name of An-sari) are involved in weaving silk sarees in Banarasi since the Mughal era.
Raw material	<ul style="list-style-type: none"> Silk is obtained from Karnataka. (Silk Industry is not a weight losing industry) Fine quality silk is also imported from China. Zari thread (thread made of fine gold or silver) is obtained from Gujarat
Water	<ul style="list-style-type: none"> Varanasi is located on the left bank of the Ganges (provides water for washing and dyeing of silk).
Market	<ul style="list-style-type: none"> Banarasi saris are very popular all across India.

Government recognition	<ul style="list-style-type: none"> In 2009, weaver associations in Uttar Pradesh secured Geographical Indication (GI) rights for the 'Banaras Brocades and Sarees'. This means, saree or brocade made in the six districts of Uttar Pradesh, that is Varanasi, Mirzapur, Chandauli, Bhadohi, Jaunpur and Azamgarh districts, can be legally sold under the name of Banaras saree and brocade.
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6.1.3 Factors Responsible for the Localization of the Silk Industry in Kanchipuram

Historical aspects	<ul style="list-style-type: none"> During the reign of Krishnadevaraya (Vijayanagara Dynasty) two weaving communities from Andhra Pradesh, the Devangas and the Saligars moved to Kanchipuram and started their hereditary profession there.
Labour	<ul style="list-style-type: none"> Highly skilled weavers with generations of experience are available throughout the region. The sarees are handwoven.
Raw material	<ul style="list-style-type: none"> Silk is obtained from Karnataka. Cotton yarn is available in the vicinity. Zari thread (thread made of fine gold or silver) is obtained from Gujarat.
Water	<ul style="list-style-type: none"> Kanchipuram is located close to the left bank of the Palar river.
Market	<ul style="list-style-type: none"> Kanchipuram saris are worn as bridal & special occasion saris by most South Indian women.
Government recognition	<ul style="list-style-type: none"> Kanchipuram saris have been recognized as a Geographical indication by GOI.

6.1.4 Factors Responsible for the Localization of Silk Industry in Jammu and Kashmir

Historical aspects	<ul style="list-style-type: none"> Jammu and Kashmir was one of the centres of the ancient silk route.  <ul style="list-style-type: none"> The modern silk industry was started in Srinagar in the 1890s under the patronage of British.
Labour	<ul style="list-style-type: none"> The famous shawl industry of Kashmir which had provided means of livelihood to a sizeable section of the population had started to decline. In order to compensate for this decline, the state took several measures for the development of the silk industry.
Raw material	<ul style="list-style-type: none"> Jammu and Kashmir produces the best quality bivoltine mulberry silk because of conducive climatic conditions.
Technology	<ul style="list-style-type: none"> Reeling machinery was imported from Europe early on.
Market	<ul style="list-style-type: none"> Kashmiri Silk Saree has a good market in India.

6.1.5 Issues faced by Indian Silk Industry

- India imports a considerable amount of silk (**bivoltine mulberry silk**) from China as the domestic raw silk is nowhere near the quality of the Chinese silk. Chinese silk can be easily worked on power looms.
- Domestic raw silk is not of uniform thickness due to poor quality of cocoon, and our producers use obsolete reeling machines to make yarn.
- The **synthetic fibres (nylon) and artificial silk** being less expensive and easy to maintain, have been responsible for reducing the popularity of silk.
- Investment is had to find as most of the silk industry operates in the unorganized sector at the household level.

6.2. Factors Responsible for the Localization of the Silk Industry in China

- China has dominated the global silk industry as the world's largest silk producer, exporter, and consumer.

Historical aspects	<ul style="list-style-type: none">• Silk was discovered around 3500 BC in China. It was a closely guarded secret for centuries.
Labour	<ul style="list-style-type: none">• Low-cost labour for producing silk are readily available.• Highly skilled labour force with generations of experience in weaving silk fabric is also available.
Raw material	<ul style="list-style-type: none">• China is the world's largest silk producer.• Chinese silk is of high quality and is easy to be worked on power looms.• Silk is mainly produced in the south of the Yangtze River Delta (Jiangsu, Zhejiang and Guangdong provinces).
Climate	<ul style="list-style-type: none">• China's climate is highly favourable for cultivating multiple varieties of silk.• Unvoltine (hatch once a year), bivoltine (hatch twice a year) and polyvoltine (hatch more than twice a year) mulberry silk cocoons are successfully reared.
Economic Linkages	<ul style="list-style-type: none">• Cities such as Hangzhou and Nanjing are well known for their silk industries.• Their proximity to the Shanghai textile industries has been an advantage.
Technology	<ul style="list-style-type: none">• The Chinese scientists have developed hybrid varieties using European and Japanese silkworms, which makes it possible to rear silkworms up to seven times a year.
Innovation	<ul style="list-style-type: none">• In Pearl River valley, additional income is obtained by combining sericulture with fisheries (dead silkworm and their wastes are fed to fishes) for higher income.
Water	<ul style="list-style-type: none">• Yangtze River provides water for washing, bleaching and dyeing.
Market	<ul style="list-style-type: none">• India, Europe and the U.S. import a large quantity of Chinese silk and silk fabric.
Government support	<ul style="list-style-type: none">• The Chinese government encourages the formation of silk cooperatives (silk communes) for greater efficiency.• It also provides various incentives for the modernization of the industry.

- As the land cost and workforce cost is increasing on the east coast, business is shifting to the west.
- Western parts are more focused on raw silk production due to its natural weather and soil conditions.

6.3. Silk Industry Outside India and China

- Sericulture outside India and China was not successful.
- Several textile industries in Europe import Chinese silk and cotton to cater to the nearby markets.

6.3.1 Japan

- During the medieval times, poor peasants in Japan used silk production as a secondary source of income.
- After the Meiji Restoration of 1868, the port of **Yokohama** (South of Tokyo) was developed for trading silk.
- By the early 20th century, rapidly industrializing Japan was producing as much as 60% of the world's raw silk.
- The Japanese silk fabric was in demand in Britain and the U.S.
- Post-WW II, the continued rise of synthetic fibres (nylon in the U.S.), high labour costs, competition from shipping, automobile & semiconductor industries contributed to the decline of Japan's silk industry.
- For example, in **Toyota in Aichi Prefecture near Nagoya** (previously, Koromo town), the less profitable silk industry was replaced by Toyota Motor Corporation's manufacturing plants.
- The demand for silk fabric in the domestic market also fell due to westernization of Japan.
- By 1975, Japan was no longer a net exporter of silk.

6.3.2 The U.S.

- There was some limited silk production in Virginia and Georgia from 1600s to 1760s.
- A blight on mulberry trees in the 1840s forced American factories to switch to importing Chinese raw silk.
- America's silk experiment finally failed as the **comparative advantage** of sericulture in the

Gulf region (that had suitable climatic conditions) was never higher than that of tobacco (Virginia), soybean (Virginia) and cotton (Georgia).

6.3.3 Europe

- Sericulture was even introduced in Europe (France & Italy) in the early 19th century.
- Several epidemics in silkworms across Europe in the 1840s wiped out most of the sericulture industry.
- Due to high labour costs, the sericulture industry never took off after the epidemics.

Cotton Textile Industry in Italy (Lombardy and Prato) and Silk Textile Industry in France (Lyon)

- In the world of high fashion, the "Made in Italy" and "Made in France" tags have a distinct brand value.
- Some of the finest fashion designers and textile companies are based in France and Italy.
- Hence, apparel and other fashion goods with these tags command a higher price across the world.
- The Italian and French fabric producers are closer to high-value markets (Europe, U.S. and rich royal families in the Middle East), and in the fast-paced world of high fashion, this matters.
- These factors along with the **Chinese capital, raw material and workforce** have given rise to modern
 - ✓ **cotton textile industry in Lombardy and Prato (Italy)** and
 - ✓ **silk textile industry in Lyon (France)**, even though these regions have no raw material base.
- To accommodate the Chinese workforce, direct flights are run between China & Italy (Go Corona Go!).

7. Sugar Industry

You must first read GS3: Major Crops and Cropping Patterns > Major Cash Crops of India > Sugarcane



- Producing sugar involves the following steps:
- 1. extracting the juice from the **sugarcane (in tropical regions)** or **sugar beet (a tuber crop in the temperate areas)** — used as an alternative to expensive sugar imports from tropical countries,



- 2. removing the impurities from the juice,
- 3. crystallizing the **sucrose** content in the juice to obtain raw brown sugar.
- 4. refining raw sugar to obtain refined white sugar.
- The production of raw sugar is done in a sugar mill.
- The refining (removal of impurities) of the raw sugar is done in a sugar refinery.

	Sugar mill	Sugar refinery
Inputs	<ul style="list-style-type: none"> • Raw sugarcane, water, power 	<ul style="list-style-type: none"> • Brown sugar, water, power
Output	<ul style="list-style-type: none"> • Brown sugar that contains impurities like molasses. • Molasses: provides the raw material for manufacturing alcohol (ethanol). • Bagasse (cane residue): used for manufac- 	<ul style="list-style-type: none"> • White refined sugar

	<p>turing paper and also as fuel in the mills.</p> <ul style="list-style-type: none"> • Pressmud: used as soil amendment (compost) to increase fertility. 	
Most determining locational factor	<ul style="list-style-type: none"> • Sugarcane (and also sugar beet) is bulky, highly perishable and significantly weight losing (sugar accounts for only ~10% of the bulky sugarcane). • Sugar mills can be operated only during the cane harvesting period. • Hence a sugar mill must be located close to the cane growing areas. 	<ul style="list-style-type: none"> • Brown sugar is neither perishable nor weight losing. • Sugar refining can be done year-round. • Hence a sugar refinery can be set up near or relatively at a distant location (near ports for export — Mumbai port, Kolkata and Haldia ports, etc.) from a sugar mill. • Markets are the most determining factor.

7.1. Major Factors that influence the location of sugar industry

Raw material	<ul style="list-style-type: none"> • The quality of sugarcane plays the most important role in production costs. • Fifty per cent cost of production is accounted for by sugarcane alone. • Hence the sugarcane mills are confined to the sugarcane growing regions of the tropics (hot, humid, less windy areas).
Transportation	<ul style="list-style-type: none"> • Sugarcane is highly perishable and significantly weight losing raw material. • Once the sugarcane is harvested, the cane starts to dry up, and the sucrose content starts to decline rapidly. • It is prohibitively expensive to transport sugarcane over long-distances. • Hence the sugar mills are always located close to the cane growing areas (Hence the cane is always grown close to the mills — usually within a 100 km radius).
Water	<ul style="list-style-type: none"> • Sugarcane is a water-intensive crop with a crop season of 12 to 18 months. • The germination to ripening phase is itself close to a year. • Hence the availability of water year-round is a critical factor for cane cultivation.
Labour	<ul style="list-style-type: none"> • Sugarcane is not harvested year-round & the crushing season varies from 4 to 8 months. • Hence the availability of seasonal labour is critical for both harvesting and processing. • In India, harvesting and milling is done by migrant workers.
Capital	<ul style="list-style-type: none"> • Sugarcane processing is a capital intensive industry. Financial services and policy support are critical for the industry to remain competitive.
Policy	<ul style="list-style-type: none"> • In India, lack of proper policy support and timely financial services have severely hampered the modernization of the industry.
Power	<ul style="list-style-type: none"> • Power is readily available in the form of bagasse. • Hence sugar mills can be set up far away from coal and other power sources.

7.2. Major Sugar Producers

- Approximately 80% of the world's sugar is produced from sugarcane in tropical and subtropi-
- cal climates with the remaining [20% derived from sugar beet](#).
- In the 2018-2019 crop year, sugar production was [179 million metric tons](#) (MT).

- **India (33 MT)** became the world's largest sugar producer in 2018/2019.
- It overtook **Brazil (29.5 MT)** for the first time in 16 years.
- **Brazil**, Thailand, Australia, India are the leading exporters of sugar.
- **Uttar Pradesh** is the leading sugarcane producing State.
- Sugar production in U.P. in 2018-19 is estimated to be around 13.5 MT.
- Sugar production in **Maharashtra** in 2018-19 is estimated to be around 11.5 MT.
- In Feb 2020, for better use of surplus sugar stock, GOI approved an increase in the price of ethanol to be procured by public sector oil marketing companies (OMCs) from sugar mills for blending with petrol.



- The decision will help in further increasing the ethanol blend levels in petrol from the current 6%.

- For 2019/2020, India expects sugar production to drop to 26%.
- This is because of droughts in 2018 and floods in 2019 in Maharashtra.
- Sugar mills in India are concentrated in the sugarcane growing regions.
- Uttar Pradesh: The western belt includes Meerut, Saharanpur, Muzaffarnagar, Bijnor and Moradabad, and the eastern belt includes Gorakhpur, Deoria, Basti and Gonda.
- Bihar: extension of the eastern UP belt, which includes Darbhanga, Saran, Champaran and Muzaffarpur.
- Maharashtra: Ahmednagar, Kolhapur, Solapur, Satara, Pune and Nashik districts.
- Tamil Nadu: Coimbatore, Tiruppur, Karur and Tiruchirappalli districts.
- Karnataka: Belgaum, Mandya and Mysore districts.
- Andhra Pradesh: East Godavari, West Godavari, Krishna, Vishakhapatnam, and Chittoor districts.

7.2.1 The rise and fall of Cuban Sugar Industry

- Cuba is known as the sugar-bowl of the world. But it is nowhere in the list of top exporters.

The rise

- In the 18th century, Cuba became a prosperous sugar-producing colony of Spain.
- Just like cotton in the American South, the Cuban sugar industry benefited greatly from slavery.
- Cuba's independence from Spain in 1898 led to financial and technological investments in the Cuban sugar economy from the USA.
- The USA remained the biggest importer of Cuban sugar.
- Cuba remained unchallenged as the world's largest sugar producer until the 1960s.

The fall

- Cuba's sugar production suffered greatly at the outset of the industrialization drive in 1962.
- The industrial restructuring (formation of collectives) created a severe labour shortage.
- The fragmentation of landholding due to Castro's policy of redistribution of the confiscated American owned plantations among

workers led to higher production cost per unit area.

- USA's embargo against Cuba restricted sugar imports and export of machinery.
- The loss of the single largest market – the USA – meant that Cuba had to rely heavily on USSR.
- After the collapse of the Soviet Union in 1991, the Cuban sugar industry collapsed.

7.3. Sugar Industry in Peninsular India vs Sugar Industry in North India

North India (Sutlej-Ganga plain from Punjab to Bihar)	South India (Maharashtra, Karnataka, Tamil Nadu, Andhra Pradesh)
<ul style="list-style-type: none"> • Low yield and productivity. • High summer temperatures ranging from 30° to 35°C and Loo (dry, scorching wind in May and June with a desiccating effect) leads to low growth and fibrous crop. • In winter months (December and January) the crop is likely to be damaged by severe cold and frost. • Hence it must be harvested before frost season. • Perennial rivers and large scale irrigation facilities. 	<ul style="list-style-type: none"> • The tropical climate gives a higher yield per unit area as compared to north India. • No winds like 'loo' during summer. • Reasonably high temperature during winter. • Frost-free climate throughout the year. • High maritime influence = moderate climate = decreased crop duration and higher sucrose content.
<ul style="list-style-type: none"> • The crushing season ranges from 4 to 8 months. 	<ul style="list-style-type: none"> • Non-perennial rivers. • Irrigational facilities have improved over time.
<ul style="list-style-type: none"> • Has more mills than the south but they are of comparatively smaller size and use antiquated technology. • The co-operative sugar mills are under the pressure of undue political & social interferences. 	<ul style="list-style-type: none"> • Yearlong crushing (factories keep running throughout the year) • Mills are comparatively large and modern.
Uttar Pradesh <ul style="list-style-type: none"> • Vast alluvial plains with soils rich in lime and potash. • Abundant water for washing and processing. • Seasonal labour is readily available. 	Maharashtra <ul style="list-style-type: none"> • The regur soils (black clayey soils) of the Deccan Plateau are good at soil retention. • The major sugar belt lies along the river valleys of Western Maharashtra which is close to the Mumbai port.
	Tamil Nadu and Andhra Pradesh <ul style="list-style-type: none"> • Maritime influence (moderate climate) and fertile soils — high yield per hectare, higher sucrose con-

- As a result of better conditions prevailing in peninsular India, the sugar industry is gradually shifting from north India to peninsular India.

7.3.2 Mains Question

Mains Practise: South India offers more favourable climatic conditions for the growth of sugarcane, but the most important sugarcane belt is in north India. What is the reason for this paradoxical situation?

- Before World War I, the northern plain area was mainly used for growing indigo.
- With the introduction of cheap aniline dyes, indigo lost its market by the time of WW I.
- Consequently, indigo's place was taken by sugarcane cultivation in the north.

Other factors

- Sugarcane needs good irrigational facilities throughout the year.
- Such facilities were available in the north due to perennial river systems.
- On the other hand, south has only non-perennial rivers.
- Also, irrigational facilities were previously non-existent in most parts of the south.
- In the southern states, sugarcane faces tough competition from cotton, tobacco, groundnut, coconut, etc.
- The peninsular sugarcane is not grown in compact blocks (close to mills), as in Uttar Pradesh and Bihar.

Mains 2013 Question: Do you agree that there is a growing trend of opening new sugar mills in the southern states of India? Discuss with justification (5 marks) (100 words)

- Previously, north India used to produce about 90 per cent of India's sugar.
- It has now reduced to around 40%.

More sugarcane cultivation = More sugar mills.

- Most favourable weather conditions (free from loo and frost).
- Development of extensive irrigational facilities in the past few decades.
- Yearlong crushing season. (In the north, the crushing period is restricted to 4-8 months)
- High maritime influence = moderate climate = does not reduce sugar content (extremely high temperature and low rainfall lead to fibrous crop).

7.4. Challenges faced by the sugar industry in India

- The Indian sugarcane has low sucrose content and gives poor yields compared to the global average.
- The production cost of sugar in India is one of the highest in the world.

Issues faced by mills

- Since the harvesting can be done only in a particular season, the crushing is confined to a limited period, and the sugar factories remain idle for the rest of the period.
- Most of the machinery used in Indian sugar mills, particularly those of UP and Bihar are old and obsolete.
- Due to low profitability, the industry is unwilling to modernize.
- Low rate of recovery: the average rate of recovery in India is less than 10 per cent compared to other major sugar-producing countries (14- 16 per cent).

Fluctuating availability of sugarcane for mills

- Sugarcane requires **10 to 18 months** to mature.

- This makes it extremely vulnerable to vagaries of the monsoons.
- **Too heavy rainfall results in low sugar content & deficiency in rainfall produces a fibrous crop.**
- Two-thirds of the total sugarcane produced in India is used for making jaggery and khandsari, and the rest goes to sugar factories.
- Since khandsari industry is free from excise duty, it can offer higher prices of cane to the cane growers.

- Sugarcane has to compete with several other crops like cotton, oilseeds, rice, etc.

Government apathy

- GOI imposes high excise duty on sugar exports.
- GOI has made it mandatory to use jute bags instead of synthetic bags to store 20% of the produced sugar.
- Through it is done to save the jute industry, it has turned out into a problem for the sugar industry as jute bags lead to more spillage.

8. Tea Industry

You must first read GS3: Major Crops and Cropping Patterns > Plantation Crops in India > Tea & Coffee

Major steps involved in the cultivation and processing of tea leaves:

- Plantation: tea plantations are managed as large estates with a dedicated labour force.
- Pruning: tea plants will grow into a tree if left undisturbed. Hence, they must be **pruned** (trimming away dead or overgrown branches) for ease of plucking of leaves by women labourers from the ground.
- It also enables the growth of new shoots bearing soft leaves.
- Plucking: hand picking is done by **skilled women labour**. Proper picking is essential to maintain the quality of the leaves and for enabling the quick growth of new leaves.

- **Fermentation:** The tea leaves are placed in a controlled humid atmosphere allowing the leaves to oxidize.
- The duration of exposure to oxygen affects the degree of fermentation, resulting in darkened leaves.
- **Black tea leaves** (consumed with milk in India) are fermented leaves whereas **green tea leaves** (consumed without mixing with milk in countries like Japan where dairying is absent) are unfermented.
- Drying: the leaves are dried with hot air to prevent further fermentation. The flavour, aroma and character of the tea are controlled at this stage.
- Auctions: The various grades produced by the tea estates are tasted and auctioned by traders.
- Blending: The tea leaves are blended at this stage to create many varieties of tea.

8.2. Factors that determine the location of the tea industry

Climate	<ul style="list-style-type: none"> • Tea bush requires warm (20°-30°C), moist (150-300 cm), frost-free climate through the year. • Tea plantations in India are rarely above 1,800 meters. Above this height, low temperatures and frost become the detrimental factors. • Frequent showers evenly distributed over the year ensure continuous growth of tender leaves. E.g. Darjeeling tea. • High humidity, heavy dew, and morning fog favour rapid development of young leaves.
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	E.g. Darjeeling tea.
Vegetation	<ul style="list-style-type: none"> Tea is a shade-loving plant and develops more vigorously under shade.
Topography	<ul style="list-style-type: none"> Waterlogging is detrimental to its roots. Hence good soil drainage is a must for tea cultivation. The undulating topography of hilly areas with virgin soils is ideal for tea cultivation.
Soil	<ul style="list-style-type: none"> Virgin forest soils rich in humus and iron content are considered to be the best. E.g. Darjeeling tea. A relatively large proportion of phosphorus and potash in the soil gives a special flavour to the tea. E.g. Darjeeling tea.
Capital	<ul style="list-style-type: none"> Tea cultivation and processing is a capital intensive industry. Tea plants take about four years to mature. Labour costs have accounted for around 45-60% of the total cost of production. In the initial stages, the tea plantations were entirely financed by the British. At present, the formal banking sector is playing a crucial role in supporting the organized tea industry.
Labour	<ul style="list-style-type: none"> Tea has to be processed within the tea garden to preserve its freshness and quality. Everything from fermentation to auctions occur at the tea estate itself. Mechanization is not feasible as the tea cultivation is carried out on undulating topography of hilly areas. This makes tea cultivation a labour-intensive industry that requires abundant, cheap, and skilled labour at every stage (from plantation to blending).

8.3. Major tea producing areas in India

- Upper Assam (upper Brahmaputra valley), Lower Assam and Darjeeling, Nilgiri Hills of South India.**

8.3.1 Tea industry of the Darjeeling district

- Climate:** frequent showers, heavy dew, and morning fog **improve tea quality**.
- Cold winters retard plant growth and result in low yield compared to other regions in the NE.
- Soil:** deep clayey soils rich in potash and phosphorous give the tea a distinctive flavour.
- Topography:** Less steep hills (low gradients) is an added advantage.
- Labour:** large estates with permanent labour force thrived since the time of the British.

- The Plantation Act permitted bonded labourers from Bihar & Bengal to work and settle on the plantations.
- Capital:** initially, in the 1830s, it was the British that infused the capital and created a thriving tea industry in Darjeeling. The tea industry is now self-reliant.
- Market:** Darjeeling tea, because of its distinctive aroma, is highly valued in the international markets.
- Initially, the British had a full monopoly over the Darjeeling tea trade. With India gaining independence, the Darjeeling tea thrived in the international market.
- Transport:** Kolkata port for exports.

Mains 2014 Question

Whereas the British planters had developed tea gardens all along the Shivaliks and Lesser Himalayas from Assam to Himachal Pradesh, in ef-

fect, they did not succeed beyond the Darjeeling area. Explain.



- In the 1830s, the British had to concede their monopoly over Chinese tea trade to other competing powers.
- This forced the British to shift their attention towards India and Sri Lanka.
- They started tea plantations along Shivaliks and Lesser Himalayas from Assam to Himachal Pradesh wherever the climatic conditions were similar to tea growing regions in China.
- However, the British efforts did not bear fruit beyond the monsoon belt — Assam, West Bengal, the eastern foothills of the Himalayas and the moist slopes and the plateaus of the Western Ghats.

Reasons

- Lesser Himalayas = more than 1800 m above sea level = high risk of low temperatures and frost.
- Monsoon rainfall decreases from east to west along the Himalayas due to continentality (Western Shivaliks do not receive enough rain to sustain tea plantations).
- Darjeeling is close to Kolkata port compared to other areas tried by the British.
- The Plantation Act permitted bonded labourers from Bihar & Bengal to work on the Darjeeling plantations. Hence, Darjeeling always had a skilled labour advantage.
- The presence of sizeable tribal population in Himachal Pradesh, Doon valley etc. reduced the scope of tea plantation.
- However, after independence, tea cultivation was successful in some parts of Lesser and Shivalik Himalayas. E.g. tea cultivation in **Dehradun (Uttarakhand)** and **Kangra Valley (Himachal Pradesh)**.

8.3.2 Tea industry of the Western Ghats and Nilgiri Hills of TN, Kerala, and Karnataka

- The tea estates are quite large in number but quite small in size.
- Climate: temperatures are uniformly high, and the annual rainfall exceeds 400 cm. There is no fear of frost.
- Therefore, productivity is higher, although the **quality of tea is inferior**.
- Labour: skilled labour with generations of experience are readily available.
- Market: mostly caters to the domestic market.

8.4. The rise and fall of the British Tea Industry

The rise

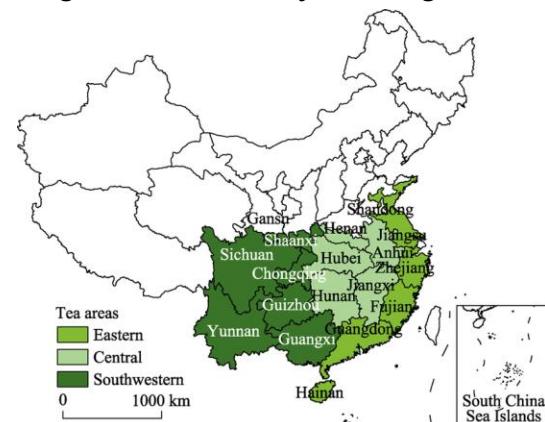
- In the early 17th century, the British controlled Indian, Sri Lankan and Chinese tea exports.
- London became the centre of tea imports from Asia and exports to Europe and USA.

The fall

- The Tea Act was passed by the British Parliament in 1773.
- The act imposed taxes on colonists and granted competitive advantages to East India Company.
- In Boston, the colonists dumped the crates of British tea into the water as a mark of disobedience.
- This incident is popularly known as 'the **Boston Tea Party**'.
- The crisis escalated, and the American Revolutionary War began near Boston in 1775.
- The British tea export to the USA declined (similar to cotton). Americans gradually shifted to coffee.
- After the independence of India and Sri Lanka and the Chinese Revolution of 1949, the London tea industry collapsed utterly.

8.5. Tea Industry in China

- China is the largest producer of tea in the world.
- Tea cultivation in China is concentrated in the Yangtze-Kiang and Sikiang valleys.
- The climate of the region is influenced by monsoons and is suitable for tea cultivation.
- The region to the north of Yangtze-Kiang and Sikiang valleys is not suitable due to severe winters.
- Tea is cultivated in the hilly areas as a secondary crop. Rice remains the primary crop of the region.
- Shanghai Port is the major trading hub.



9. Coffee Industry

Major steps involved in the cultivation and processing of coffee beans:

- Plantation: coffee plantations are managed as large estates with a dedicated labour force.
- Picking: coffee berries are harvested as and when they become ripe.
- Sorting: Unripe fruits are sorted out before using the fruits for pulping.
- Pulping: the freshly harvested berries are pulped to remove the skin and pulp of the bean.
- Roasting: before roasting, coffee beans are green in colour and do not smell like coffee at all.
- Roasting coffee at high temperatures transforms the chemical & physical properties of green coffee beans.
- It is during this process that the coffee acquires its characteristic colour and flavour.
- Coffee starts to lose flavour after the roasting stage. Therefore, **roasting is done near markets**.

9.2. Factors that determine the location of coffee industry

Climate	<ul style="list-style-type: none"> • Coffee plant requires hot (15°C and 28°C) and humid climate (150 to 250 cm). • It does not tolerate frost, drought, high temperature (>30°C) and strong sunshine. • Northern and eastern aspects of slopes of Western Ghats are preferred as they are less
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	<p>exposed to intense afternoon sun and the south-west monsoon winds.</p> <ul style="list-style-type: none"> In the highlands of western Yemen, western Saudi Arabia, and Ethiopia, though the annual rainfall is very less, coffee grows well because of the thick sea mist that provides moisture and shade for the coffee bush.
Vegetation	<ul style="list-style-type: none"> Like tea, it is also generally grown under shady trees.
Topography	<ul style="list-style-type: none"> Stagnant water is harmful. So, this crop is grown on hill slopes at elevations from 600 to 1,600 meters above sea level. Sea facing slopes are ideal as the sea breeze, and mist provides continuous moisture.
Soil	<ul style="list-style-type: none"> Well-drained, rich, friable loams rich in humus and minerals like iron and calcium are ideal for coffee cultivation.
Capital	<ul style="list-style-type: none"> Coffee cultivation and processing is a capital intensive industry. Coffee bush takes about five years to mature. Labour costs account for a significant part of the total cost of production.
Labour	<ul style="list-style-type: none"> Except for the roasting of the beans, everything else is carried out at the coffee estate itself. Mechanization is not feasible due to sloping terrain. This makes coffee cultivation a labour-intensive industry that requires abundant, cheap, and skilled labour.

9.3. Coffee Industry in Brazil



- Coffee cultivation in Brazil is confined to the eastern and southern slopes of the Brazilian Highlands.

Climate	<ul style="list-style-type: none"> The sea-facing eastern and southern slopes of the Brazilian Highlands have the most ideal climatic conditions for the cultivation of coffee.
Topography	<ul style="list-style-type: none"> Brazilian Highlands (formation similar to Ethiopian Highlands)
Soil	<ul style="list-style-type: none"> The soil formed out of the flood basalt volcanic rocks is rich in minerals. The soil remains fertile even after many years of coffee cultivation. Once the fertility is exhausted, the planters destroy forests and move interior to make new plantation — reduced cost of fertilizers (the current leadership encourages this).
Capital	<ul style="list-style-type: none"> The European colonizers had the plundered financial muscle.

	<ul style="list-style-type: none"> Some coffee fazendas (large plantations) in Brazil are still managed by Europeans.
Labour	<ul style="list-style-type: none"> The European colonizers brought slaves and indentured labourers from Africa and South Asia to work on sugarcane and coffee plantations.
Market	<ul style="list-style-type: none"> After the Boston Tea Party revolt, the Americans switched from tea to coffee. The growing coffee market in America paved the way for large scale coffee plantations in the South American countries like Brazil and Colombia. In the 1870s, a blight disease destroyed Sri Lankan Coffee plantation. Brazil seized the opportunity to capture new markets. At present, Brazil dominates the world's coffee markets.

9.4. Coffee Industry in Nilgiris

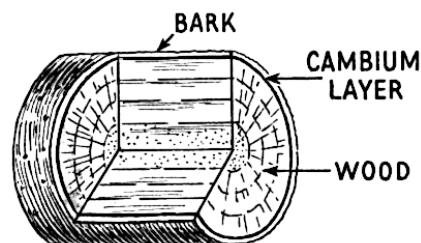
- Initially, coffee cultivation was introduced on the **Baba Budan Hills**, and even today its cultivation is confined to the northern and eastern **highlands of Nilgiris in Karnataka, Kerala and Tamil Nadu**.
- The red soils of the Nilgiris are best suited for coffee cultivation.
- Almost the entire production is shared by three states, namely **Karnataka (71%), Kerala (22%) and Tamil Nadu (6.5%)**.
- Although India contributes only a small percentage of world production, Indian coffee has created a niche for itself in the international market.

10. Rubber Industry

You must first read GS3: Major Crops and Crop-ping Patterns > Plantation Crops in India > Rubber

- Rubber industry majorly involves the following stages:
 - obtaining and processing of natural rubber latex **near the rubber plantation site**
 - producing synthetic rubber from the by-products of the petrochemical refining industry (synthetic fibres and synthetic rubber industry is explained under the petroleum refining industry)
 - manufacture of tyres and other items using natural and synthetic rubber in a factory set up **near the ports (if export-oriented) and markets**.

- The major commercial source of natural rubber latex is the **Amazonian rubber tree (*Hevea brasiliensis*)**.
- Latex is collected in vessels by making slanting incisions in the bark of the tree in a process called **tapping**.
- In places such as Kerala and Sri Lanka, half-shells of the coconuts are used for latex collection.
- Tapping is done in the mornings to take advantage of the high pressure in the tree and stable weather.
- One tapper can tap latex from almost 250-300 trees per day.



10.1. Natural Rubber



- The economic life period of rubber trees in plantations is around 32 years — up to 7 years of immature phase and about 25 years of productive phase.
- The economic life of the tree depends on how well the tapping is carried out.
- The incisions should not be too many or too deep.
- Deeper incisions damage the **cambium layer**, which is responsible for the growth of the tree.
- Hence, tapping is a **high accuracy task that requires skilled and experienced labour force**.
- After a particular area of the tree is tapped out, a new portion of the tree will be tapped.
- It generally takes seven years for a tapped area to heal sufficiently to be tapped again.
- A tree will typically produce about half a cup of latex per day.
- Latex coagulates in the cups if kept for long and must be collected immediately.
- In some places, latex is allowed to coagulate, and the coagulated lumps are processed into dry rubber.
- Timely collection and processing of latex **require abundant labour force**.
- The latex contains only 30-40% of rubber content. Hence it is **processed near the plantation itself**.

- The processed dry rubber is exported for the manufacture of tyres, tubes, surgical gloves, etc.
- In India, natural rubber is mainly grown in **Kerala (90%)**, Tamil Nadu and Karnataka.
- **Thailand, Indonesia, Malaysia, Vietnam**, India, China and Sri Lanka are the world's largest producers of natural rubber.
- Tropical African countries such as Liberia, Nigeria, Zaire, Côte d'Ivoire, etc. and South American countries such as Brazil and Bolivia are minor producers.

10.1.1 Evolution of the natural rubber industry

- Natural rubber was extracted and used by the Amazonian tribes since time immemorial.
- But commercial exploitation of natural rubber was not possible until the early 19th century as natural rubber softened with heat and hardened with cold and was **perishable**.
- The invention of vulcanization in 1839 by Charles Goodyear removed these weaknesses.
- **Vulcanization** is a chemical process for converting natural rubber into materials of a variety of hardness, elasticity, and mechanical durability by heating them with **sulphur**.
- Rubber gained commercial popularity in the late 19th and early 20th century with the use of rubber in car & bicycle tyres (initially solid but later they were made pneumatic — hollow tyres with pressurized tubes).
- **South America (Brazil & Bolivia)** remained the primary source of latex rubber until the early 20th century.
- During the late 19th century, the rubber plantations were introduced by the British planters in India, Sri Lanka and Southeast Asia.
- Cultivation of Hevea in Brazil, its native habitat, was virtually destroyed by blight early in the 20th century.

- By 1930s, **Southeast Asia** became the major exporter of natural rubber.
- The automotive industry remained entirely dependent on natural rubber until World War II.

10.2. Synthetic Rubber

- Synthetic rubber is produced from the by-products of the **petrochemical refining industry**.
- During the refining process, naphtha is produced.
- The **naphtha** is collected and combined with **natural gas** to produce monomers such as isoprene.
- The monomers are then subjected to the polymerization process.
- The idea is to create chains of polymers which results in a latex or rubber substance.
- These substances can then be processed into useful rubber using techniques such as **vulcanization**.

10.2.1 Evolution of the synthetic rubber industry

- The wild and widely dispersed rubber trees in the Brazilian jungle were not producing enough rubber to meet the demand of the late 19th and early 20th century.
- The plantations in Southeast Asia were still in a nascent stage.
- This created a need for synthetic alternatives to natural rubber.
- The first synthetic rubber was produced by polymerizing isoprene in 1909.
- By 1925 the price of natural rubber was so high that the automobile companies started exploring methods of producing synthetic rubber to compete with natural rubber.

- After **Japan** entered the war in 1941, Asian sources, except for Sri Lanka, were cut off from the Allies.
- This created severe shortages, and the U.S. was forced to develop a synthetic rubber industry in no time.
- At the war's end, with natural rubber again available, the U.S. synthetic rubber industry went into a sharp decline, but by the early 1950s superior and more uniform synthetics had become available.
- In the early 1960s production of natural rubber was surpassed by that of synthetic alternatives.
- At present, around 30 million tonnes of rubber are produced each year, of which only 30 per cent is natural.
- Since the bulk of the rubber produced now is synthetic, which is derived from petroleum, the price of natural rubber is determined, to a large extent, by the **prevailing global price of crude oil**.

10.3. Tyre Manufacturing

- Both natural and synthetic rubber is used in the manufacture of tyres, tubes, surgical gloves, conveyor belts, hoses (rubber pipes), etc.
- More than half of all the rubber produced worldwide goes into the manufacture of tyres and tubes.
- Tyre manufacturing is a highly decentralized industry.
- The industry is located close to the automobile industry (Japan, Germany, Chennai), ports (Mumbai, Chennai) and markets.
- India has attained self-sufficiency in manufacturing a wide range of tyres.
- Large tyre manufacturers in India are MRF Ltd., Apollo Tyres, JK Tyres, CEAT, etc.
- Significant cost generating raw materials in tyre manufacturing are natural rubber, synthetic

rubber & crude derivatives like **carbon black** (increases the stiffness, tensile strength and abrasion resistance of rubber).

- The Indian Tyre Industry is an integral part of the Auto Sector.
- Most of the tyre manufacturing is concentrated near Chennai, Mumbai, Kottayam (Kerala), Goa, Dahej (Gujarat) and Thrissur (Kerala).
- Largest tyre manufacturing and exporting countries in the world: China, Germany, Thailand, Japan, the United States, etc.

10.4. Southeast Asian vs South American Natural Rubber Industry

- For the first few years of the 20th century, Brazil was the primary supplier of rubber to the world.
- However, the Amazonian wild rubber industry was unable to compete, in either price or quality, with the Asian plantation rubber that began to appear on world markets after 1906.

Factors responsible for the rise of the Southeast Asian natural rubber industry and the subsequent fall of the South American natural rubber industry:

	Southeast Asia (Thailand, Malaysia & Indonesia): Dominance since 1930s	South America (Amazonian Brazil & Bolivia): Dominance & Collapse 1879-1912
Climatic conditions	Favourable: Warm, humid tropical climate	
Soil and terrain	Lateritic soils (rich in iron content; aids growth) and hill slopes up to 700m in altitude	
Domesticating the rubber tree	<ul style="list-style-type: none"> British planters were successful in domesticating the rubber tree. This enabled the plantations to be operated on a scientific basis in an economical way within a confined area. Hence, these plantations were able to produce latex with greater efficiency and productivity. 	<ul style="list-style-type: none"> Brazilians never succeeded in domesticating the wild <i>Hevea</i> tree. They relied on the trees in the wild and had to venture deep into the forests for more rubber.
Labour	<ul style="list-style-type: none"> The British planters brought Indian indentured labourers into Malaysia. Poor Chinese migrated to Thailand to work on rubber plantations. High population densities and poverty meant that there is an abundant labour force available. At present, rubber plantations are synonymous to labour exploitation (labourers gets meagre wages while the landowners and the tyre companies get the king's share). 	<ul style="list-style-type: none"> The European planters used American Indian slave labour. Labour shortages were a usual occurrence as many suffered death by tropical diseases such as malaria and yellow fever and by poisonous snakes and scorpions.
Political stability	<ul style="list-style-type: none"> Britain had colonized Burma (Myanmar) to the west and Malaya (Ma- 	<ul style="list-style-type: none"> Uncontrolled extraction of rubber and venturing into each other's territories in-

	<p>laysia) to the south, while France had colonized Indochina (Cambodia, Laos and Vietnam) to the east.</p> <ul style="list-style-type: none"> • Britain and France allowed Thailand to exist as an independent buffer between their respective colonies. • During WW II, Japan occupied the entire region. • Hence, there was some sort of political stability in the region. 	<p>creased tensions between Brazil and Bolivia.</p> <ul style="list-style-type: none"> • The planters had to deal with revolting Amazonian tribes regularly. • Post-WW II, the socialist revolutions across South America led to frequent regime changes and fragmentation of landholdings (no economies of scale or quality control).
Diseases and predators	<ul style="list-style-type: none"> • These plantations used high-yielding varieties and did not suffer the effects of fungal infections. 	<ul style="list-style-type: none"> • The trees in the wild were highly vulnerable to South American leaf blight, and other natural predators. • Attempts to revive the Brazilian industry in the 1920s failed catastrophically when Henry Ford, the American carmaker, tried to break the Asian rubber monopoly by establishing a giant plantation in the heart of the Amazon. • The project, known as Fordlandia, failed miserably, again partly because of the rubber-tree fungus.
Technology	<ul style="list-style-type: none"> • In 1925, Rubber Research Institute of Malaya, Kuala Lumpur, was incorporated. • It improved the breeds and optimized the tapping techniques. 	<ul style="list-style-type: none"> • High reliance on wild varieties in their natural habitat meant that there was not much room for technological advancements.
Yield	<ul style="list-style-type: none"> • As the yield reduces as the trees grow older, the older trees are replaced with new trees every few years. • Hence the yield and quality remained high throughout. 	<ul style="list-style-type: none"> • Replanting (replacing old trees with new trees) was not followed and hence yield and quality remained poor.
Quality control	<ul style="list-style-type: none"> • Quality control was always an essential part of the export-oriented industry. • Southeast Asian rubber commands good prices in the international market for its uniform quality. 	<ul style="list-style-type: none"> • Brazil commanded an absolute monopoly over natural rubber trade until the arrival of Southeast Asia. • Hence it never focused on quality control, and by the time it did, it was already too late.
Competition	<ul style="list-style-type: none"> • With lower costs and a lower final 	<ul style="list-style-type: none"> • By 1945 the Brazilian rubber industry,

	price of the Southeast Asian rubber, the British Empire assumed control of the world rubber market.	overwhelmed by Asian production, had virtually disappeared.
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The future

- With the growing environmental consciousness, the share of the synthetic rubber would ultimately decline, and the natural rubber would gain back its prominence.
- Brazil might again play an essential role as a significant natural rubber exporter.
- The Natural Rubber Industry of Kerala is very much similar to that in Southeast Asia.
- The significant difference is that the plantations in Kerala are much smaller in size.

11. Lumbering, Pulp and Paper Industry

- In North America, timber processed into beams and planks in a sawmill is called lumber.
- Lumbering is an economic activity of cutting and preparing lumber.

11.1. Lumbering Industry in the Temperate Regions vs Lumbering Industry in the Tropical Regions

Mains Practise: Despite the presence of dense forests, countries in the equatorial regions are net importers of timber and timber products. Comment.

Lumbering Industry in Temperate Regions	Lumbering Industry in Tropical Regions
<ul style="list-style-type: none"> North-western Russia, U.S.A., Canada, Fen-noscandian countries (Finland, Norway and Sweden), New Zealand, etc. 	<ul style="list-style-type: none"> Teak in Myanmar and hardwoods of Amazon, Congo, Southeast Asia, etc.
<ul style="list-style-type: none"> Softwoods like conifers (pines, spruces, cedar, Douglas fir, yew, larch, hemlock, etc.) are obtained from the temperate forests. Softwoods are in general less dense and less hard than hardwood trees, but with a few exceptions. Softwood is the source of about 80% of the world's production of timber. 	<ul style="list-style-type: none"> Hardwoods are obtained from the tropical and subtropical evergreen and deciduous forests. The tropical evergreen and semievergreen hardwood species: mahogany, ebony, rosewood, dyewood, etc. The tropical deciduous hardwood species: teak, axlewood, rosewood, red sanders, etc. Subtropical hardwood species: oak, eucalyptus, etc.
<ul style="list-style-type: none"> Very little softwood is burnt as fuel as its industrial uses are far more significant. They are mainly used in construction materials and to produce paper pulp and papercard products. Softwoods are less expensive than hardwood. The softwoods are limited in species. They occur in homogeneous or pure stands (the 	<ul style="list-style-type: none"> Hardwoods are mostly used to make durable, high-quality furniture, flooring, and construction. E.g. Burma teak. Most of the hardwood is wasted as fuel in the poor tropical countries. Multiple species of trees occur in a particular area making commercial exploitation a laborious task.

<p>same kind of species are distributed over a large area) making commercial exploitation easy and profitable.</p>	
<ul style="list-style-type: none"> Softwoods readily float on water, and hence they can be easily transported with the help of water bodies. In winters, the snow makes haulage (commercial transport of goods) easy. 	<ul style="list-style-type: none"> Many of the tropical hardwoods (very heavy) do not float readily on water, and this makes transportation an expensive matter. Teak logs are so heavy that they will not float readily on water. It is therefore necessary to 'poison' the tree several years before actual felling so that it is dry and light enough to be floated down the Chindwin and the Irrawaddy to reach the sawmills at Rangoon.
<ul style="list-style-type: none"> The open forests with sparse undergrowth mean that logging and haulage can be easily mechanized. Also, less dense forests and low population densities make it easy to build the necessary infrastructure. High labour productivity: temperate regions have the optimum climate for maximum human output. 	<ul style="list-style-type: none"> The dense undergrowth in tropical evergreen forests makes it challenging to mechanize logging and haulage. The construction and maintenance of roads and railways in tropical forests comes at a high social (tribal uprising) and economic costs (labour costs).
<ul style="list-style-type: none"> Capital: lumbering is a highly profitable and very well organized industry. Investments are easy to secure in the region that has a relatively high per capita income. 	<ul style="list-style-type: none"> Low labour productivity: excessive heat (sun-stroke), high humidity (communicable diseases) and poisonous snakes and insects create severe physical and mental handicaps. Capital: lumbering is expensive, and capital inflows come with many social (persecution of tribals) and political costs (neo-colonialism by China in African countries).
<ul style="list-style-type: none"> Market: most of the nearby regions have developed economies with major urban and industrial hubs. 	<ul style="list-style-type: none"> Market: countries in the region are mostly underdeveloped or developing. Most of the expensive hardwood is exported to the developed world.
<h3>Sustainable lumbering</h3> <ul style="list-style-type: none"> Softwood trees grow much quicker, sometimes in as little as 25 years. Silviculture: As the temperate forest soils and climate are less suitable for agriculture, the governments are actively involved in regenerating the lost forest. After a patch of the forest is cleared, it is quickly replanted and just within a couple of decades, the 	<h3>Unsustainable lumbering</h3> <ul style="list-style-type: none"> Hardwood trees are slow-growing and take many decades to fully mature. Once the forest is cleared, the chances of regenerating the forest are bleak due to economic, social, and political pressures. The forests would be permanently replaced by plantations (e.g. palm in Indonesia, soya in Brazil), agriculture, cattle ranching (e.g. Brazilian Ama-

forests can be harvested again.

- The vast reserves of replenishable softwood forests (including Siberian Taiga belt) mean that the prospects for the industry are encouraging.

zon), mineral exploration (e.g. oil exploration in Colombia), etc.

- Quickly depleting tropical forests offer no hope for the future.

11.2. Factors affecting the location of the sawmills (lumbering) industry

Raw material	<ul style="list-style-type: none"> Roundwood (wooden logs) being a bulky and weight losing raw material (less than 60% of the roundwood is turned into lumber), the sawmills need to be located closer to the forests.
Power	<ul style="list-style-type: none"> Lumbering is an energy-intensive industry. Availability of cheap, uninterrupted electricity is essential for the economic success of a sawmill. Cheap hydroelectricity from the mountainous uplands of North America and Europe has greatly assisted the lumbering industry there.
Transportation	<ul style="list-style-type: none"> The means and modes of transportation need to be economical both for importing roundwood and for exporting lumber. Slippery (snowy) surfaces (e.g. winters in the temperate region), rivers (e.g. teak transport by Irrawaddy river) and lakes (e.g. Lake Ladoga and Lake Onega in Western Russia) reduce the transportation cost of the raw material. Well-connected roads, railways and waterways make the export of lumber profitable. E.g. Saint Lawrence Waterway connecting the Great Lakes region with the Atlantic Ocean.
Labour	<p>Temperate Region</p> <ul style="list-style-type: none"> In the earlier times, contract labourers called lumberjacks used to temporarily move with their families to the forest regions in winters to fell the trees. In the modern times, logging (felling of trees) and dellimbing (the process of removing branches from a tree trunk) is carried out by a feller buncher (harvester used in logging).   <ul style="list-style-type: none"> The roundwood is loaded into trucks by forestry cranes (log loaders) and carried to the sawmills. The sawmills are highly mechanized, and most of the operations from sawing to grading are computerized.

- Hence, the labour force required is minimal.

Tropical Region

- In the tropics, most of the industry is based on obsolete technology and manual labour.

Capital

- Lumbering is a capital intensive industry. It is well-developed in the prosperous North American Region.

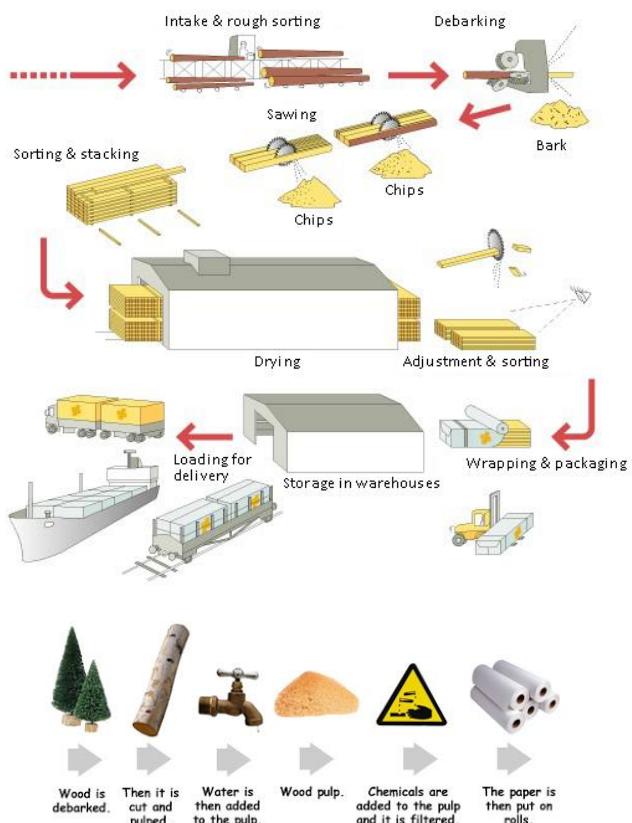
Market

- The presence of markets near sawmills is useful but not essential as lumber can be economically transported worldwide with the help of a good transportation network.

- Hence, the availability of timber resources, excellent transportation facilities and cheap electricity are the major factors that determine the location of a sawmill.

11.3. Factors affecting the location of paper pulp industry

- Pulp is fibrous material prepared by separating cellulose fibres from wood, fibre crops, waste-paper, etc.
- Pulp is the primary raw material used in paper, paper cardboard and newsprint making.

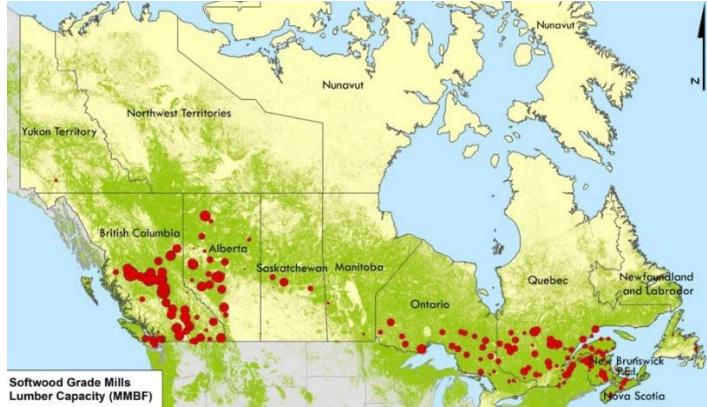


- Softwoods & wood chips from sawmills are the basic raw materials for the paper pulp mills in the mid-latitudes.
- Imported softwoods & wood chips, imported softwood pulp, hardwoods like eucalyptus,

bamboo, some grasses, etc. are the basic raw materials for the paper pulp mills in the tropics.

- Additionally, the pulp mills use a **lot of chemicals** for pulping the wood, bleaching the pulp and for producing paper of various quality and finish.
- Chemicals are needed in small quantity and can be economically transported even over long distances.
- The locational factors for the paper pulp industry are similar to that for the sawmills industry.
- One additional requirement is the availability of **abundant unpolluted water** for the paper pulp industry.
- Water quality determines the quality of the pulp & the additional purification costs.
- Hence the paper **pulp mills tend to be upstream** from cities to avoid the polluted waters.
- In an integrated unit, pulp and paper are produced at one single factory setup.
- But in many pulp mills, only the pulp is produced and is exported to paper mills located far away.
- For example, wood pulp is produced in Canada and exported to the U.S.A., Europe & Asia for paper, papercard and newsprint (inexpensive, low-quality paper for newspaper printing) making.

11.4. Lumbering, Pulp and Paper Industry in Canada

Raw material	<ul style="list-style-type: none"> Coniferous forests cover as much as 60 per cent of Canada. Although timber is exploited in almost every province, there are only two important areas of production — Quebec and Ontario in the east and British Columbia in the west. Modern systems of forest management are organized in such a way as to produce a constant supply of timber for the mills. 
Transport	<ul style="list-style-type: none"> Quebec and Ontario: numerous rivers and St. Lawrence-Great Lakes Waterway. British Columbia: numerous rivers and lakes and proximity to the west coast.
Water	<ul style="list-style-type: none"> The rivers provide clear, unpolluted water for soaking and bleaching the paper pulp.
Power	<ul style="list-style-type: none"> Quebec and Ontario: Cheap hydroelectricity from numerous rivers falling from the highlands to the lowlands of St. Lawrence valley. British Columbia: Cheap hydroelectricity from rivers flowing down the western slopes of the Rockies.
Capital	<ul style="list-style-type: none"> The U.S. and the British have significant investments in Canadian forest industries.
Mechanization	<ul style="list-style-type: none"> Lumbering in Quebec and Ontario was traditionally a seasonal occupation. The trees were felled and dragged over the frozen ground in winter to the riversides. The logs were then floated downstream in the spring when the rivers thawed. However, mechanization has reduced the dependence on seasonal climatic conditions, and the occupation is becoming more of a permanent activity.
Market	<ul style="list-style-type: none"> Because of its small population, Canada has a large surplus of timber products for export. Canada is the largest newsprint producer in the world. Canada's pulp and newsprint production find ready markets in north-eastern U.S.A (long-established publishing industries; high consumption rate of pulp and paper products; relatively little newsprint is made as the production of packaging materials and quality paper are more important). Lumber, pulp & newsprint are also exported to U.K. & Germany where timber is in short supply. Pulp is also used in the St. Lawrence-Great Lakes industrial belt of Canada, in the northern U.S.A. and New England for making rayon, since the spruce wood pulp is particularly suitable for this purpose.

- The forests of the Prairie provinces (Alberta, Saskatchewan & Manitoba) and other interior regions are little utilized because they are far from the sea.
- Eastern Canada makes all types of paper and also produces sawn wood, furniture, and other

timber products, but the most important product is still newsprint.

- The main producing centres are **Quebec, Montreal, and Toronto** (all located along the **Saint Lawrence Waterway**).

11.5. Lumbering, Pulp and Paper Industry in Russia



- The greatest single band of the coniferous forest is the **taiga** in Siberia.
- However, Russia is only able to exploit northern European Russian Taiga.
- Logs from these areas are floated to sawmills and pulp mills in
 - Arkhangelsk (Archangel — Northern Dvina River) on the White Sea,**
 - Petrozavodsk on **Lake Onega** (Svir River connects it to **Lake Ladoga**), and
 - Saint Petersburg** (Neva River connects **Lake Ladoga with the Baltic Sea**) on the **Gulf of Finland (in Baltic Sea)**.
- Russia lags behind the west in the development of timber industries such as pulp and paper.
- Most of Russia's timber production is still in the log or sawn wood form.

11.5.1 What are the challenges faced by Russia in exploiting its vast Siberian Taiga forests?

- Despite the recent developments in Siberian Taiga, only northern European Russian Taiga (north-western Russia) supports the sawmilling and timber processing plants.
- This is because of the **rivers of the Siberian Taiga that flow away from the markets into the Arctic Sea which is frozen for the most part of the year (the Barents Sea and the White Sea are ice-free only in Summer — due to North Atlantic Drift; the rest of the seas are ice-bound for most of the year).**
- The rivers are frozen in winter, and in summer months they experience severe flooding.



- Nowadays, however, timber is cut and floated down the **Ob and Yenisei rivers** in summer for export via the **Northern Sea Route**, which is kept open by ice-breaker fleets.



11.6. Lumbering, Pulp and Paper Industry in U.S.A.

- Though the U.S.A. has relatively fewer forest resources, its forests are much more exploited than those in Canada.

Raw material	<ul style="list-style-type: none"> With the depletion of forest resources around the Great Lakes region, lumbering has moved into the western states of Washington, Oregon, and California.
Transport	<ul style="list-style-type: none"> The Rockies and the absence of connecting rivers make it hard to export sawn wood from west to east. Hence U.S.A exports sawn wood from the west coast to Japan and China and imports paper pulp and newsprint from Canada.
Water	<ul style="list-style-type: none"> Lack of abundant water resources in north-west means that the sawmills far outnumber the pulp mills.
Power	<ul style="list-style-type: none"> The Columbia River supplies power for the sawmills.
Market	<ul style="list-style-type: none"> The U.S.A. (north-eastern region) is the largest per capita consumer of pulp and paper products in the world.

11.7. Lumbering, Pulp and Paper Industry in other regions

Scandinavian countries	<ul style="list-style-type: none"> The Scandinavian countries (Norway, Sweden, and Finland — small populations) have a surplus of timber which they export to the rest of Europe. In Sweden, matches form a major export item. The lumbering industry here has similar advantages like that in Canada.
U.K. & Germany	<ul style="list-style-type: none"> In many parts of Europe, e.g. Britain, Ireland, the Netherlands, and Denmark almost all the original forest cover has long been removed. The lack of local timber has not prevented the development of paper and newsprint making industry in Britain and Germany. The pulp industry has grown up on the major estuaries and in coastal locations.

	<ul style="list-style-type: none"> Pulp is imported from Canada and the Scandinavian countries and made into paper in Britain and Germany and exported to the rest of Europe.
China	<ul style="list-style-type: none"> In the late 1990s, after depleting much of their own timber stocks, Chinese logging companies began moving into the tropical rainforest areas (Chinese Neo-colonialism). Chinese timber firms have been particularly active after the government banned domestic logging in much of the country following catastrophic flooding in 1998. China feeds its highly subsided pulp and paper industry by importing timber, wood chips, pulp and recovered paper from North America, Southeast Asia, tropical Africa & America.
Brazil	<ul style="list-style-type: none"> Brazil is one of the important producers and exporters of paper pulp. The Brazilian industry is fuelled by the Chinese appetite for paper pulp. But it comes at a high cost of deforestation in the Amazonas.
Japan	<ul style="list-style-type: none"> Japan is a major producer of both coniferous timber and hardwood timber. As a major industrial region, it imports a large volume of timber from Russia (softwood) and Southeast Asia (hardwood).
Malaysia & Philippines	<ul style="list-style-type: none"> Malaysia and the Philippines have many advantages. Their luxuriant forests are found on islands or peninsulas and are at no point very distant from the sea. This is in contrast to the forest resources of Thailand or Myanmar where the best forests are found well inland and logs have to be transported by river to the coast. Malaysia and the Philippines also have the further advantage of being near the major timber markets of Japan and Australia, both of which are short of local timber. The timber industry has been encouraged by the governments in both countries. The clearance of large areas of land for plantation agriculture has also promoted the timber industry.
Australia & New Zealand	<ul style="list-style-type: none"> Australia has natural eucalyptus forest in the moister south-east and in Tasmania. Eucalyptus yields rather poor quality timber. New Zealand has softwood reserves, mostly in the South Island.

11.8. Lumbering, Pulp and Paper Industry in India

- In India, lumbering is discouraged for the sake of conserving the environment.
- Sal, teak, neem, rosewood are the few species exploited for furniture making.
- Eucalyptus plantations are nowadays discouraged due to their groundwater depleting potential.
- A favourable tariff structure supports log imports from Southeast Asia, U.S.A, New Zealand, etc.
- However, due to poor levels of processing by domestic sawmills, India imports more lumber than logs (lost employment and wealth generation opportunities).

11.8.1 Paper Industry in India

- The first successful paper mill in the country was set up at Ballygunj near Kolkata in 1870.
- The raw materials for the industry include **bamboo, sabai grass**, wastepaper, imported pulp and bagasse.

- 60-70 per cent of the total requirements of cellulosic raw material is met by bamboo.
- Bamboo has the advantage of the possessing **long fibre, dense stands and quick regeneration.**
- It reaches maturity in 2-3 years and provides a continuous flow of renewable source of raw material.
- **Assam, Odisha, Andhra Pradesh**, Telangana, Madhya Pradesh, etc. are important producers of bamboo.
- **Sabai Grass** mainly grows in the sub-Himalayan tracts of Shiwaliks and **Terai area**.
- It is hence the chief raw material in the paper mills of Uttar Pradesh.
- Although sabai grass has long fibre and requires low chemical consumption, it is intermixed with other vegetation, and it is often difficult to separate impurities from it.
- Only half of the bagasse produced in the sugar industry is used for manufacturing paper.

Localization of the Industry

- The location of the industry is influenced by **raw materials** and to a lesser extent by market.
- Therefore, there is a strong tendency among the paper mills to be located near the forest tracts along the Western Ghats, the Eastern Ghats, central India and the **Terai-Bhabar** area.

Geographical Distribution

- Maharashtra, Andhra Pradesh, Gujarat, UP and W.B. are the main producers of paper and paper board.
- Mills located in Maharashtra use rags, wastepaper or pulp imported from Sweden and Canada as the principal cellulosic raw material. Hydroelectricity is used as a power resource in place of coal.
- The paper industry in West Bengal is based on bamboo which is available locally or is obtained

from Assam, Odisha and Jharkhand, and sabai grass which is obtained from Chhattisgarh and Madhya Pradesh.

- Coal is abundantly available from Jharia and Raniganj.
- Ganga and other rivers provide sufficient water for processing.
- The high density of population along the Hugli river provides cheap labour.
- Madhya Pradesh has large tracts under bamboo, sabai grass, eucalyptus, etc.

No paper mills in the Himalayan Region

- The vast temperate forests in the Himalayan region hold large quantities of softwood.
- But because of the rugged terrain and poor means of transportation, these areas are inaccessible.
- Moreover, the costs of environmental damage outweigh the economic benefits.
- Also, the regeneration of softwood forests takes more than two decades, while **bamboo forests are replenished within 2-3 years**.
- Hence, no paper mill has been set up in the Himalayan region.

11.8.2 Problems of Indian Paper Industry

- There is a shortage of raw material, including bamboo and sabai grass.
- Cost of production is high due to labour troubles, low grade of coal used and high transportation costs.
- The current per capita consumption of paper and newsprint in India is too meagre.
- Only 15 per cent of the total output of paper and paper board is based on recycled material against the world average of 30-35 per cent.
- Even now, large quantities of bagasse used as fuel in the sugar industry is not made available to the paper industry.

- The small size of the manufacturing units with obsolete technology makes them uneconomic.
- The cost of imported wood pulp and wastepaper is ever increasing.
- The production of paper, paper board and above all, newsprint has always fallen short of the demand.
- This has forced the country to resort to heavy imports. Pulp, paper, paper board, newsprint and wastepaper are imported from **Norway, Sweden, Canada**, etc.
- Effluents released by the paper mills into open drains and rivers cause severe environmental issues.

11.9. International lumber, pulp and paper imports and exports

Major exporters of forest products (2018)

- Sawn wood: Russia (20%); Canada (19%); Sweden (8%); Germany (6%); Finland (6%); U.S.A. (5%).

- Pulp for paper: Brazil (24%); Canada (15%); U.S.A. (11%); Chile (8%); Indonesia (7%); Finland (6%).
- Recovered paper: U.S.A. (34%); United Kingdom (8%); Japan (7%); Netherlands (5%); Germany (5%).
- Paper and paperboard: Germany (12%); U.S.A. (10%); Finland (9%); Sweden (8%); Canada (6%); China (4%).

Major importers of forest products (2018)

- Sawn wood: China (25%); U.S.A. (18%); United Kingdom (5%); Japan (4%); Germany (4%).
- Pulp for paper: China (35%); U.S.A. (9%); Germany (7%); Italy (6%).
- Recovered paper: China (31%); India (12%); Germany (9%); Indonesia (6%).
- Paper and paperboard: Germany (10%); U.S.A. (8%); China (5%); Italy (5%); United Kingdom (4%).

[Source](#)

12. Commercial Marine Fishing Industry

- **Aquaculture** involves cultivating aquatic (freshwater and saltwater) populations (fish, crustaceans, molluscs, shrimp, crab, etc.) under controlled conditions, and can be contrasted with **commercial fishing**, which is the harvesting of wild fish (fish, whales, seals, etc.).
- In 2018, an estimated 59.5 million people were engaged in the primary sector of fisheries and aquaculture.
- In total, about 20.5 million people were employed in aquaculture and 39.0 million in fisheries.
- World aquaculture production of farmed aquatic animals has been dominated by **Asia** (89 per cent share).
- **China, India, Indonesia**, Vietnam, Bangladesh, etc. are the major aquaculture producers.

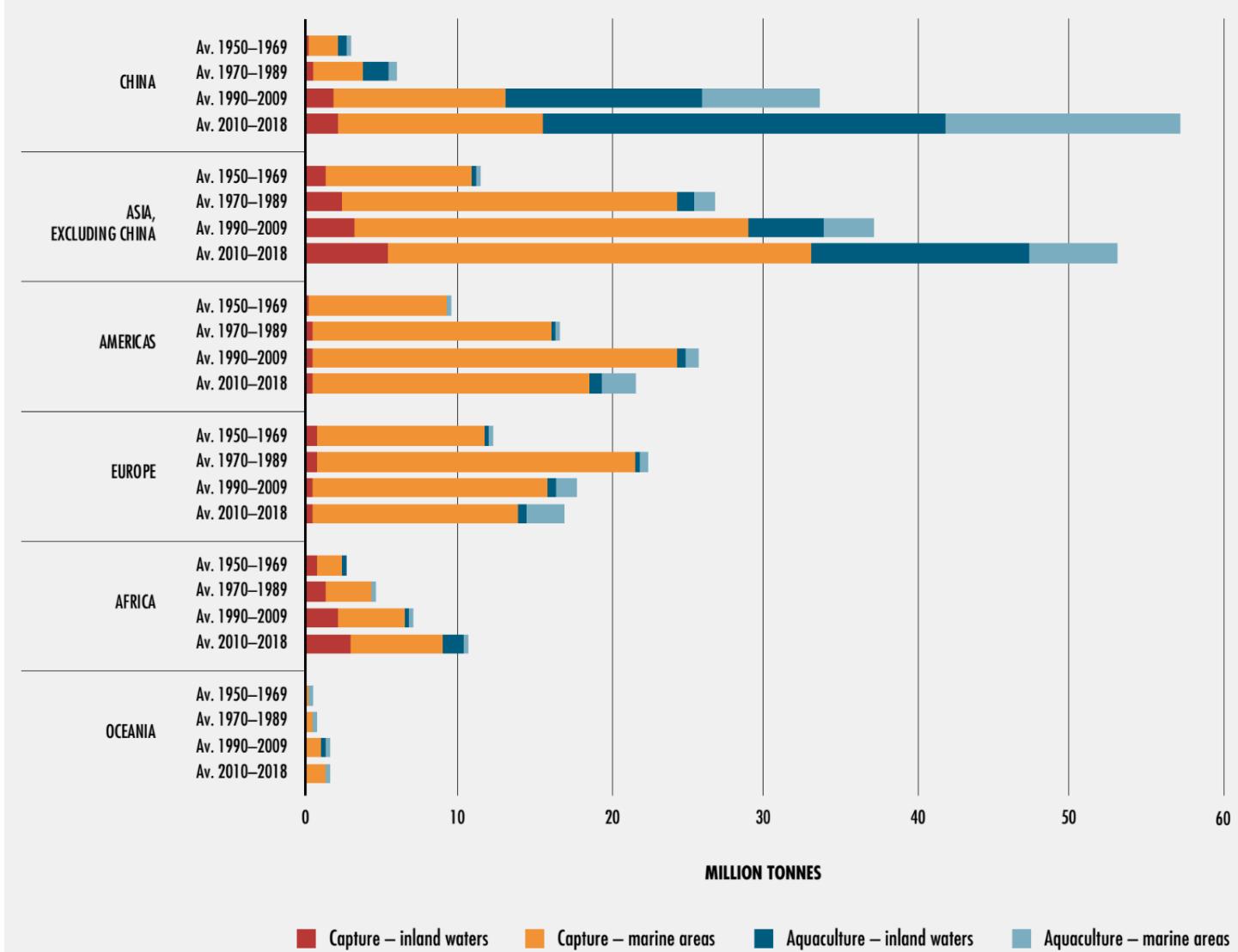
12.1. Marine Capture Fisheries

- Commercially, marine fisheries are a lot more important than freshwater (inland) fisheries.

Production of fisheries & aquaculture	2017	2018
Capture		
Inland	11.9	12.0
Marine	81.2	84.4
Total capture	93.1	96.4
Aquaculture		

Inland	49.6	51.3
Marine	30.0	30.8
Total aquaculture	79.5	82.1
Total world fisheries and aquaculture	172.7	178.5

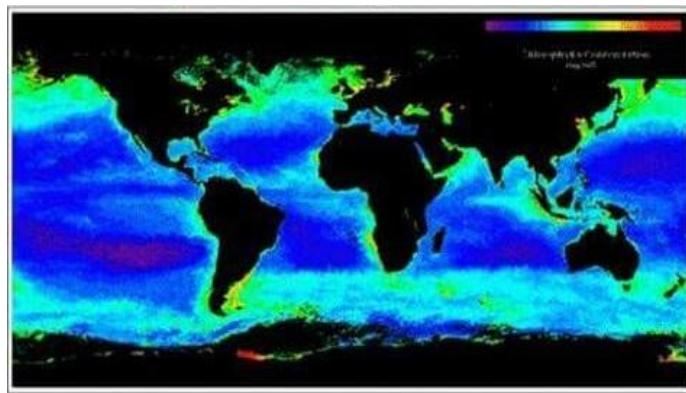
REGIONAL CONTRIBUTION TO WORLD FISHERIES AND AQUACULTURE PRODUCTION



- **China, Indonesia, India, U.S.A., Russia, Peru, Japan, Vietnam, Norway, Denmark, Canada, etc.** are the major marine fishing nations.
- Tropical countries like Indonesia, India, Vietnam, etc. are mostly involved in intensive **inshore (near the shore)** fishing by small fishers and small to medium scale fishing trawlers.
- **China, U.S.A., Russia, Japan, Norway, Denmark, etc.** are focused on **both inshore and deep-sea fishing**.
- The deep-sea fishing operations are carried out by highly mechanized trawlers.
- Modern canning and **refrigeration** facilities have greatly helped the fish export trade of these countries.
- Canada, the U.S.A., Greenland, Norway, South Africa and Argentina are the major sealing nations.
- Japan, Norway & Russia are the leading whaling nations. Most of the whaling happens in the North Pacific.
- In recent years, whaling and sealing have decreased due to pressure from conservationists.

12.2. Factors that create the most fertile marine fishing grounds

Water temperature	<ul style="list-style-type: none">Marine life is best developed in oceans of the high latitudes whose waters are at temperatures lower than 20 °C.This is because the fish feed on minute marine organisms called plankton, and the plankton multiplies best in colder waters.In the tropics, the warmer waters significantly inhibit the growth rate of the plankton population.Hence the temperate and sub-polar seas (seas in the higher latitudes) offer better fishing grounds compared to the tropics.
Ocean topography	<ul style="list-style-type: none">Plankton of all kinds are abundantly available in shallow waters (continental shelves) where they have access to both sunlight as well as nutrients (brought by rivers).Hence the most exceptional fishing grounds are found above continental shelves in the higher latitudes.
Ocean water mixing and upwelling zones	<ul style="list-style-type: none">Plankton need both sunlight and nutrients (such as nitrate and phosphate) to be able to photosynthesize.Sunlight is only available in the uppermost layers.During photosynthesis, the nutrients are quickly used up by phytoplankton, so they are not available for long periods in the upper layers under normal circumstances.To escape this problem, the seawater needs to be mixed regularly to bring the nutrient-rich deep waters up to the sunlight zone.



Phytoplankton production is highest at high latitudes

- Furthermore, in surroundings where atmospheric temperatures are often colder than oceanic temperatures, the top layers of the ocean are cooled by the atmosphere.
- This increases the density of the surface waters and causes them to sink and therefore causes mixing (nutrient-deficient water sinks and nutrient-rich water is upwelled).
- Hence the **cold & warm current mixing zones (e.g. Grand Banks)** and **nutrient-rich cold water upwelling zones (e.g. upwelling near Peruvian coast)** form fertile fishing grounds.

12.3. Factors that determine the location of the commercial fishing industry

Proximity to the fishing grounds	<ul style="list-style-type: none"> • Proximity to the fishing grounds reduces refrigeration and transportation costs. • However, with the highly mechanized modern trawlers, proximity to the fishing grounds is no longer a significant factor. • For example, Japanese trawlers venture into waters as far as Antarctica & Grand Banks.
Climate	<ul style="list-style-type: none"> • The cold climate of the higher latitudes makes refrigeration (preservation and storage of fish) economical. • Whereas in tropics, the warmer climate and higher humidity (fungal and bacterial attacks) make preservation and storage (refrigeration) more expensive. • Hence the commercial marine fishing industry is less viable in tropics.
Ports	<ul style="list-style-type: none"> • Sheltered inlets and estuarine coasts make ideal sites for fishing ports and villages. • Both the Atlantic and Pacific coastlines of the middle and high latitudes in the northern hemisphere are very much indented and are backed by strong relief. • Here, ports exclusively for fishing industry are developed. The fishing ports have all the necessary infrastructure from processing to canning units. • Fishing ports make the fishing industry efficient and cost-effective.
Capital	<ul style="list-style-type: none"> • The commercial success of marine fishery depends on the cost optimization with the help of efficient technology. • Hence a lot of capital is required for R&D, mechanization and infrastructure. • Europe, Japan, U.S.A. and Canada have the requisite capital and well established financial services for the cost-intensive and risky marine fishery industry.
Market	<ul style="list-style-type: none"> • Fish are used as food, and raw material for fertilizers, lubricants, cosmetics, etc. • Seals and whales are hunted for meat, fur and oil. • Fish, fish meal, and fish waste are widely used as animal feed and feed for aquaculture and as fertilizer for paddy fields. • Fish oil represents the richest available source of long-chain polyunsaturated fatty acids (PUFAs), which perform a wide range of critical functions for human health.
Fish as a primary food source	
<ul style="list-style-type: none"> • Europe is a net exporter of horticulture products and a net importer of food grains and meat. • Fish meat is the most affordable option in many countries like Norway (hilly terrain; ice-covered land; little scope for agriculture and dairy; most of the population living along the coast). • Just like Norway, Japan has very few dietary alternatives to fish. 	
Fish as an essential part of the diet	
<ul style="list-style-type: none"> • There is a great demand for fish along the North American coasts which are mostly inhabited by European settlers. • With the rapid economic development in Asia since the 1990s, fish is gaining a lot of importance as an inexpensive alternative to meat in the densely populated coastal re- 	

	<p>gions.</p> <h3>The insignificant market in the southern hemisphere</h3> <ul style="list-style-type: none"> On the other hand, commercial fishing is not of prime importance in the southern hemisphere (Peru, Falkland Islands are an exception) where cattle rearing and dairying are more economical options. (Cattle rearing in Pampas of South America and Eastern Australia, dairying in New Zealand and agriculture in South Africa).
Employment	<ul style="list-style-type: none"> Lack of viable alternate employment opportunities in the primary sector since time im-memorial has played a significant role in high dependence of Japan and Norway on the fishing industry. Japan has high population pressure, hilly terrain & forests and very little cultivable land. Norway is mostly hilly and experiences long, harsh winter months. Hence, venturing into deep-sea fishing has remained the most practical and feasible primary economic activity for these countries.

12.4. The major commercial marine fishing grounds of the world

- The **continental shelves** of **North-East Atlantic, North-West Atlantic** and **North-West Pacific** are the most important global commercial fishing grounds.
- The **continental shelf around the Falkland Islands** and **upwelling zones** along the **Peruvian and Chilian coast** are other major fishing regions.
- This explains the abundant fish resources in the region (**Iceland continental shelf & North Sea continental shelf**).
- Fishing is done on a highly organized basis by **Norway, Denmark, Spain, Iceland and the U.K.**
- Fishing goes on all round the year in the shallow waters of the North Sea.
- Dogger Bank** is the most vigorously exploited region.



12.4.1 North-East Atlantic Region

- Colder atmospheric temperatures, and warmer oceanic temperatures (influenced by warm **North Atlantic Drift**), cause mixing and nutrient upwelling in the North-East Atlantic Region.

12.4.2 North-West Atlantic Region

- The North-West Atlantic Region extends from Newfoundland to the New England states of the U.S.A.
- Mixing of **warm Gulf Stream** and **cold Labrador currents** and **gently sloping continental shelves** makes the region around the **Grand Banks of Newfoundland** the **world's largest fishing ground**.
- The gently sloping continental shelves stretch for over 200 miles south-east of Newfoundland.

- Fish of all types and sizes feed and breed here and support a **thriving fishing industry**.
- In Newfoundland, the fishing industry employs almost the entire population.
- All the fishing activities are carried out by highly mechanized trawlers which can store fish in refrigerated chambers for months.
- **St. John's, chief port of Newfoundland** is the headquarters of the Grand Banks fishing industries.



- All processing activities like cutting, gutting, cleaning, packing (canning) are done at the ports itself.
- Along with Canada and U.S.A., countries like Norway, U.K., Portugal, Denmark, Russia and Japan, also send fishing fleets to the Grand Banks.

12.4.3 North-West Pacific Region

- The North-West Pacific Region extends from the **Bering Sea** to the **East China Sea**.
- **China** leads in the catch, followed by **Russia**, **Japan**, South and North Koreas.

- Within the enclosed seas — the **Sea of Okhotsk**, **Sea of Japan**, **Yellow Sea** and the **East China Sea** — intensive forms of inshore (close to the shore) as well as deep-sea fishing are carried out.
- In the case of inshore fishing, processing (gutting to meat cuts) and canning is done at the fishing ports.
- In deep-sea fishing, processing happens on the vessel, and the meat is **refrigerated** for canning at the ports.
- Commercial fishing is best developed in **Japan**, where the industry is very highly organized.

Pearl Fishery in Japan

- Natural pearls are derived mainly from oysters.
- It was the Japanese that invented cultured pearls in 1913.
- Young oysters are first collected, and grains of mother-of-pearl (the inner lining of oyster shells) are inserted into them. They are then placed in wire cages and lowered into shallow coastal waters.
- After about two to five years, these oysters will be collected, and the artificial pearls will be extracted.
- **Japan** is the leader in the production of artificial pearls.

Why is fishing the dominant primary sector occupation of Japan?

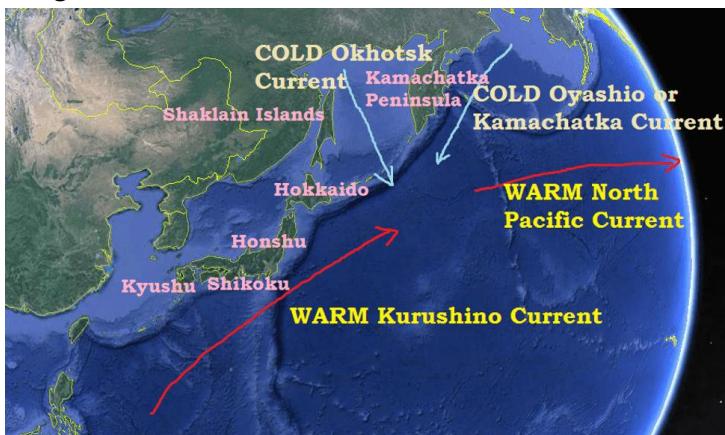
Fishing is the only reliable primary sector activity

- The **rugged (mountainous) nature of Japan** and parts of mainland eastern Asia support little agricultural activity (80 per cent land in Japan is classified as 'non-agricultural'. Around 50% is covered by forests).
- Japan is **not well endowed with natural resources**.

- Hence fishing forms a dominant aspect of the primary economy.

Geographical advantage

- The continental shelves around the islands of Japan are rich in plankton, due to the meeting of the **warm Kuroshio** and the **cold Oyashio currents** and provide excellent breeding grounds for all kinds of fish.



Cold and warm ocean current mixing zone off Japan

- The **indented coastline of Japan** provides **sheltered fishing ports**, calm waters and safe landing places, ideal for the fishing industry.
- Hakodate** and **Kushiro** are large fishing ports with complete refrigeration facilities.

Ready market

- The scarcity of meat (there is little pasture in Japan for livestock farming of any kind) popularised fish as the principal item of diet and the chief protein food of the Japanese and the Chinese as well.
- There exists a great demand for fish and fish products in the nearby countries where the fishing industry is under-developed.
- The Japanese make use of fish wastes, fish meal and seaweeds as fertilizers in their farms.

Capital, technology and infrastructure

- Japan has huge stakes in international fishing enterprises, and her advanced fishing techniques give her an edge over competitors.

- The Japanese fishing trawlers venture far and wide into the **Arctic, Antarctic and the Atlantic waters**.
- Advanced financial services, encouraging government policy, an advanced technology at hand, skilled workforce with decades of experience in fishing make Japan a leader in the fishing industry.

Whaling

- Hunting and eating whales is a part of Japanese culture.
- Whale meat consumption became widespread after World War II when other food was scarce.
- In 2018 **Japan withdrew from the International Whaling Commission** (I.W.C.) for banning whale hunting.
- This means Japan will **no longer hunt whales in the Antarctic**, as it did earlier under the guise of research.
- The whaling will be conducted within Japan's territorial waters and Exclusive Economic Zone.

12.4.4 China, India and South-East Asia

China

- China** and **India** are the world's leading producers of **inland fish and aquaculture**.
- When it comes to commercial marine fishing, China was nowhere in the scene until the 1980s.
- Opening up of the economy in the 1980s, the inflow of foreign capital and the subsequent rise in income levels has made China one of the major marine (inshore) fishing countries.
- It is now far ahead of Japan in marine fish production.
- However, for China, **aquaculture and inland fisheries are far more important** compared to commercial marine fishing.

- Most of China's marine fishing happens in the **Yellow Sea, the East China Sea and the South China Sea**.
- From the table, it is clear that **aquaculture in the dominant form of fisheries in the tropics and China and in the higher latitudes commercial marine fishing is dominant**.
- **By 2030, most of the fish production is going to come from aquaculture.**

India & South East Asia

- In India, the **west coast is more significant for fishing than the east coast as the west coast has a more extensive continental shelf.**

World fisheries harvest for 2018			
Country	Capture	Aquaculture	Total
Productio in 2018 in Million Tons (MT)	93.7 MT	101.1 MT	199.7 MT
China	17.8	63.7	81.5
Indonesia	6.6	16.6	23.2
India	5.1	5.7	10.8
United States	4.9	0.4	5.4
Russia	4.8	0.2	4.9
Peru	3.8	0.1	3.9
Japan	3.3	1.1	4.3
Vietnam	2.8	3.6	6.4
Norway	2.2	1.3	3.5

12.4.5 Southern Hemisphere (Peru and Chile Coast)

- The **continental shelf along the South American west coast is quite narrow**.
- However, the **Walker Circulation** causes upwelling off the coasts of **Peru, Chile and Ecuador**.
- This brings **nutrient-rich cold water to the surface**, increasing **fishing stocks**.
- The bulk of the fish caught is not eaten but is used in the manufacture of fertilizers.

Normal Conditions

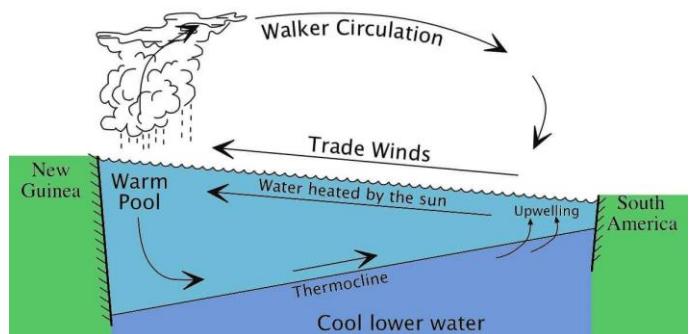
- **Coast of Peru and Ecuador == Cold Ocean**

- However, just like in China, **aquaculture and inland fisheries produce far more fish (70-80%) than commercial marine fishing**.
- Technological lag and financial constraints have been the major bottlenecks in the take-off of the commercial marine (inshore and deep-sea) fishing industry in India.
- The case is the same in the South East Asian nations.
- In South-East Asia, the **South China Sea** and the **Sunda continental shelf** are major fishing grounds.

Water == Good for Fishing.

El Nino

- **Coast of Peru and Ecuador == Warm Ocean Water == Fishing industry takes a hit.**



Falkland Islands (British overseas territory)

- Off the Argentine coast, the continental shelf is wide, and the **cold Falkland current** meets the **warm Brazilian current**, thus providing fertile grounds for fishing.

12.4.6 Commercial marine fishing is little developed in the southern hemisphere. Explain

- Topography:** The continents in the southern hemisphere have very narrow continental shelves (**except for the region around the Falkland Islands**).
- Market:** Cattle rearing in Pampas of South America and Eastern Australia, dairying in New Zealand and agriculture in South Africa means that the southern hemisphere has more affordable alternatives to fish.

12.4.7 Commercial marine fishing is little developed in the tropics. Explain

- Climate:** Warm ocean waters are less favourable for plankton growth. Warm and humid climate increases the cost of refrigeration.
- Economies of scale: Fish occur in smaller and scattered groups** which make fishing relatively expensive.
- Market:** Fish are not the primary dietary choice as the tropics have abundant agricultural resources and cheaper proteinaceous foods like poultry.
- Export potential:** Tropical fish have **higher oil content compared to the proteinaceous temperate fish**.
- Capital:** The poor tropical countries do not stand a chance against their affluent temperate counterparts in the capital intensive commercial fishing industry.
- Coastline:** Most of the **tropics have a straight coastline**, unlike the temperate region where most of the coast is **indented and deep**. Hence

commercial fishing ports are hard to develop in the tropics.

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