GENERAL STUDIES : WORLD INDIAN INDUSTRIES

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

Primary, secondary and tertiary sectors

There are **three** main types of **industry** in which firms operate. These **sectors** form a chain of production which provides customers with finished goods or services.

- **Primary production**: this involves acquiring **raw materials**. For example, metals and coal have to be mined, oil drilled from the ground, rubber tapped from trees, foodstuffs farmed and fish trawled. This is sometimes known as extractive production.
- **Secondary production**: this is the **manufacturing and assembly** process. It involves converting raw materials into components, for example, making plastics from oil. It also involves assembling the product, eg building houses, bridges and roads.
- **Tertiary production**: this refers to the **commercial services** that support the production and distribution process, eg insurance, transport, advertising, warehousing and other services such as teaching and health care.

The chain of production shows **interdependence**: firms rely on other businesses in different sectors for raw materials, components or distribution.

There are three places you can setup an industry

1. near raw material site
2. near market
3. In between them two: depending on transport, energy and labour convenience.

Land

The factory needs sufficient flat land to build on. The price of the land is important.

Raw materials

If raw materials are bulky or heavy, the industry will locate close to save on transport costs.

Environment

Industries nowadays are far less restricted in their location requirements. Many now look at what the area can provide for its workers before deciding to locate there.

Labour

The availability of a labour force is more important to some industries than others. Labour intensive industries like car assembly need a readily available supply of labour.

Transport/Communications

The availability of a good transport network, roads, railways and airports is very important to modern industries. They wish to receive their components quickly and despatch the finished goods to market with the greatest speed.

Energy

This was a more important factor in the past: factories needed to locate close to a source of power, originally water, and then coal. This is not so important now because many industries use electricity.

Markets

The importance of nearness to markets is dependant on the goods being produced.

For example:

Fragile goods – need to be produced near to their markets so that they do not get damaged on route.

Bulky goods – Need to be made close to the market because of high transport costs.

Service industries must locate at their market. Market is not so important to other industries.

Capital

This is the money that is invested to start a business. The amount of

Government policy

The British Government has withdrawn many of its incentives, which it used to encourage industries to

capital will determine the size and location of the factory	locate in depressed areas. The EU now provides grants to these areas. Industries that locate there will receive assistance in the form of low rent and rates.	

1.

Nature of raw material	Bauxite=>alumina; Copper ore=>blister copper; Sugarcane=raw sugar. Weight loss is significant, during above processes. So, where should we setup these factories?
energy	Despite having no significant bauxite reserves, Canada and Norway have aluminum refineries, why?
transport	Why is Switzerland famous for wristwatches but not bulldozers? Why do port cities have lot of industries surrounding them? Inland water transport helped in the development of Great lakes-Pittsburg industrial area in US. Then on the same logic, why is Africa underdeveloped despite having so many rivers?
labor	Sierra Leone is famous for rough diamonds but not for jewelry, why? Largest assembly for iPhone is in China and not in US, why?
market demand	Australia is a major supplier of wool but not major supplier of finished woolen garments, why?
Government policy	Pharmaceutical industries that once had shifted from Gujarat/Maharashtra towards Hill states, are now returning back to the original states, why?
Capital	Even after local coal-iron resources are depleted, the steel and heavy engineering industry doesn't frequently shift its location, why?
Physical geography	How does Canadian winter help in commercial exploitation of timber? Fishing industry more developed in Northern Hemisphere than in Southern Hemisphere, why? How can the dairy products of New Zealand compete in American / Europeans market despite additional transport cost?

Other factors: entrepreneurship, availability of technology, location of competing firms etc. Each factor has different level of attractiveness for individual industry.

types of industries

Primary	They use natural raw material: Hunting-gathering, pastoral activities, fishing, forestry, agriculture, mining and quarrying
Secondary	They make complex products using the material obtained from primary industry. • wooden pulp=> rayon • Steel=> automobiles, railway engines • aluminum, copper=> electronics • fibers=> readymade garments Secondary Industry can be sub classified into 1. **Heavy Industries**= engineering, metal goods, heavy chemicals, shipbuilding, locomotives 2. **Light industries**= electronics, plastic, textile, cosmetic etc.
Tertiary	It is not a branch of manufacturing but it sells the product of primary and secondary industries via transport, wholesale, retailing + provides services such as: tourism, education, entertainment, advertisements, consultancy, Administration, healthcare etc. Note: for detailed classification of service sector industries, refer to Page 56 of NCERT Class 12: Fundamentals of Human geography.

Timber Based industries

Factor: raw material

- When this wooden logs are processed in the sawmill, significant weight loss occurs. Barely 40% is used and rest discarded as waste.

- Therefore most pulp mill and saw-mills are located near the jungles to reduce the cost of transporting waste matter.

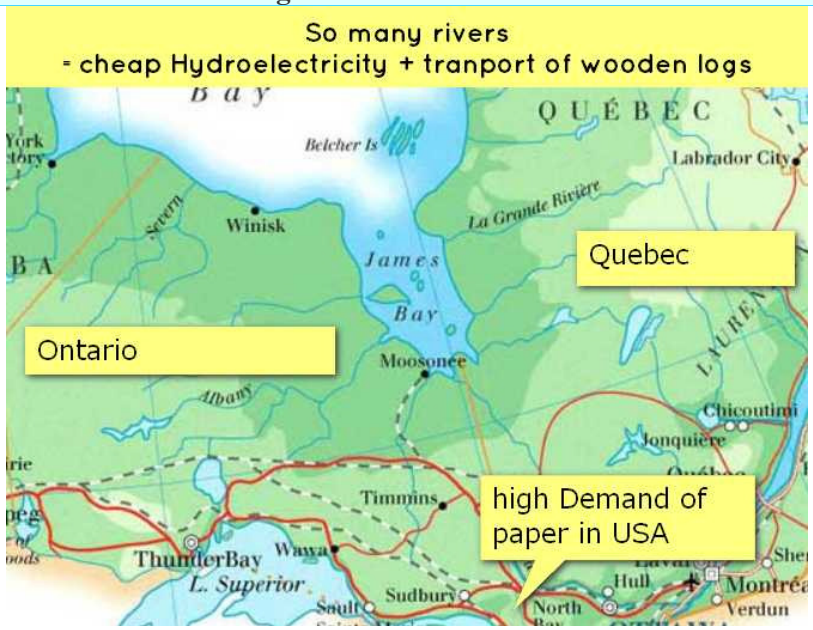
Factor: River

- Even in jungles, they're located near rivers and streams because Logs=bulky and awkward to transport. Rivers provide cheap and convenient mode of transport. E.g. Myanmar, the teak logs are floated down the Irrawadi river upto Yangon and then exported.
- The paper/pulp mills require clean water free from chemical/pollutants. This is one the reason why they were setup in forest locations away from polluted rivers.

Factor: River direction

towards market	away from market
• Southern Canada, Sweden, Finland, Himalayas	US West Coast, Siberia
• rivers flow in general direction of final market=keeps production, transport cost low	• Rivers flow in the opposite direction from market areas=higher transport cost. • + in Russia, rivers remain frozen in winter and create flood like problems in springtime=makes difficult to exploit Siberian forest.

Lumbering on commercial scale: Canada



In Canada, lumbering is a large-scale organized activity because of following reasons

Raw material	• softwood= easy to chop • In coniferous forest, trees of same species are concentrated in one particular area = mass exploitation easier compared to tropical areas.
Transport	• During winter, the Jungle surface is covered with snow= slippery surface= easier to move logs to rivers. • the forests are comparatively less dense than in tropical areas= easy to access. Areas connected by railroads
Labour	• The winter season in Canada is long = agricultural activities are limited. • Farmers have plenty of leisure time and there is no work in the field during winter • During winter, they migrate to northern (coniferous) forests along with their families => Easy availability of lumberjacks. • Lumbering is highly mechanized with the help of chainsaws, bulldozers etc = low population-density doesn't create much problem.
Market	• These forests are close to economically developed regions, where demand for wood is higher e.g. USA for newsprint paper.

Commercial lumbering: temperate vs tropics

temperate: opportunities	tropical: challenges
trees of same species concentrated in a particular area=easy to exploit on commercial scale	• In tropical areas some tree-species are extremely valuable, but they are scattered • This heterogeneous supply of timber= cost of gathering is high.
• frozen ground helps transporting logs from jungle/hills up to rivers.	• Valuable trees are scattered throughout jungle, you need some land transport before logs reach the rivers. But road construction is difficult due to rain, dense vegetation.
• softwood = easy to float down the river streams	• In Amazon and Zaire Basin, some trees are so heavy, it is difficult to float logs=high extraction cost
• major industrial/urban areas are near=market	• Settlement is sparse, economies are non-industrialized, away from demand areas (e.g Africa). • (Exception) Malaysian timber= finds ready-made market in Japan and Australia.
• replantion programs, silviculture, strict government regulation on lumbering= jungles regenerate = lumbering is continuous economic acivity.	• Lax regulations, slash-n-burn type agriculture, jungles are permanently destroyed. (+people like Veerppan given political patronage)

Paper-Pulp Industry

- Canada is one of the largest newsprint producer of the world.
- Its Québec and Ontario provinces= largest concentration of paper-pulp industries, Why?

Raw material	Forest area is large enough to supply timber on a constant basis.
Transport	Ideal location for mill= riverside. It minimizes transportation problems.
Energy	• one ton of newsprint may require 2000 kW hours of electricity • Canada has mountainous terrain + fast flowing rivers= Cheap hydroelectric Power available.
Labour	• Paper and pulp mills are highly mechanized and require little manpower. (again cheap hydroelectricity helps running the machines) • they can be located in remote regions with an without experiencing labor shortage
Market	• USA has highest paper consumption in the world, provides a ready-made market for the paper pulp industry of Canada.

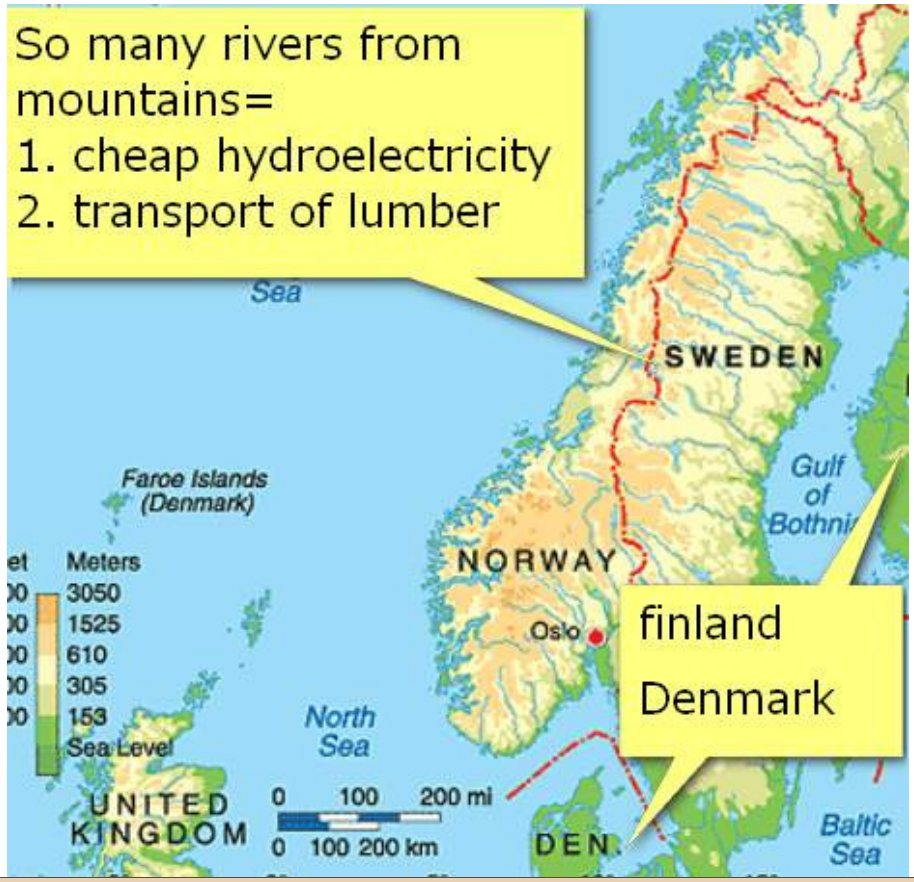
Britain

Raw material	Its timber output is negligible but still a major paper-producer thanks to pulp-imports from Sweden and Canada..
Transport	• Mills located @coastal areas, to process imported material (=less transport cost) Example Mill near Thames estuary, Manchester Ship canal. • (In later articles, we'll see that Manchester canal was developed to turn Manchester into a port for textile business but then Manchester textile industry declined due to competition from Cheaper Asian garments.).

Norway, Sweden, Finland

Factors more or less the same:

1. cheap hydro electrical power,
2. mechanized operations to make do for lack of laborers,
3. Rivers flow towards ports=easy for transport.



South East Asia	
Malaysia, Philippines	Forests found on islands/peninsulas @no point very distance from sea, Hence can be extracted easily. hardwood much in demand by Australia and Japan
Myanmar, Thailand	• Best wood found inland, has to be transported through rivers towards coast.

India	
near raw material	Dependent on bamboo, softwood. E.g. South Gujarat, Odisha, MP
near market	• **Kolkata:** raw material brought from North Eastern States, cheap labor, coal, water available. • **Lucknow:** Depend on bagasse (from sugarmills), rags, wheat bran. Sabai grass brought from Terrai region.

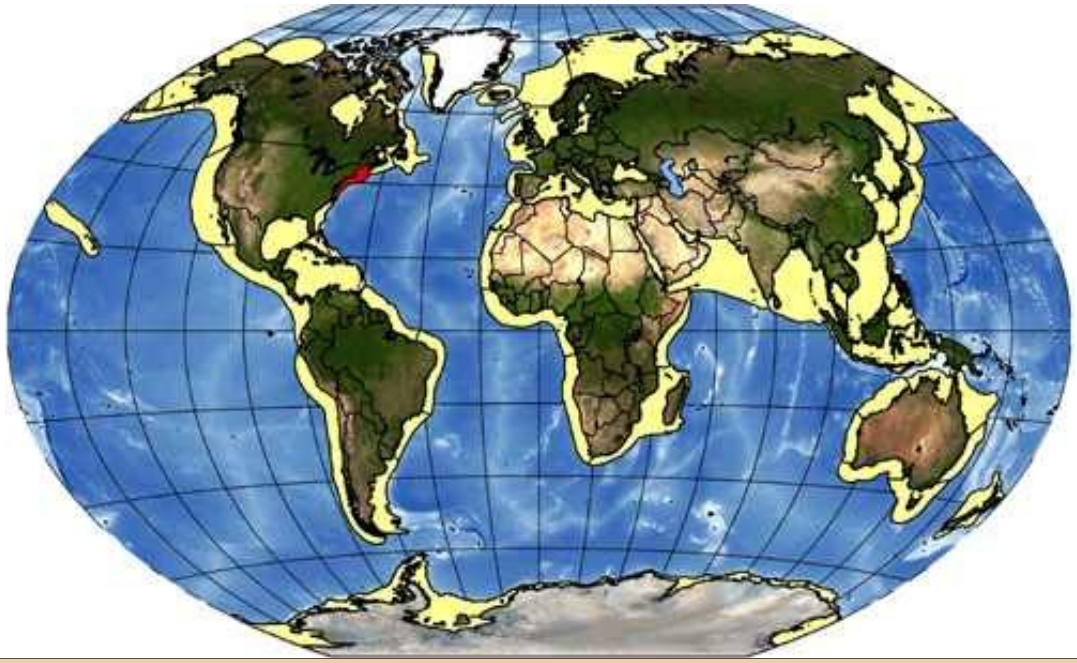
Commercial fishing

Why is commercial fishing developed in middle to higher latitudes of Northern hemisphere?

Plankton availability

- Fishes eat plankton.
- Phytoplankton require sunlight = they can develop well in continental shelves and shallow seas because of Sunlight penetration and minerals from coastal water.
- Planktons reproduce more in cooler waters

Observe the following map: yellow areas= continental shelf/ shallow areas=better for fishing.
Observe the indented coastlines in N.America and Europe.
Locate South China Sea. You can understand one of the reasons why China and neighbours keep fighting over it=rich-fish resources.



Ocean Currents

When cold and hot current meet=lot of planktons=lot of fishes.

warm	cold	fishermen of ____ benefit
gulf stream	labrador	US+ Canada (North Western Atlantic coast)
Kuroshio	Oyashio	Honshu, Japan

Coastline

Highly indented coastline=many sites for harbors and ports.

Climate	• The cool temperate climate favors large scale commercial fishing, preservation and storage of fish. • While tropical areas= hot, moist = fish cannot be stored for long.
Equipment	In the medieval times, temperate forests provided following 1. Both soft and hard wood for construction of fishing boats. 2. Naval stores (Raisin, pitch, tar and turpentine). They are derived from resinous materials from coniferous trees, were used to make wooden vessels watertight. Today, commercial fishing vessels don't need any of above, but steel and heavy engineering industry also developed in surround the coastal regions (e.g. Great lakes-Pittsburg) =shipbuilding industry.
Labor	hilly terrain = less cultivable areas. Cold long winters= not good for agriculture= more people switch to fishing. Eg. Iceland, Japan, Norway.
Market	• In the mountainous regions of Asia and Europe, agricultural production is quite low =Fish important source of protein. Example Japan and Norway. • Asia= fish + rice= main diet of many were Asian countries. (because Fish is cheaper than meat) • When Europeans started migrating to North America, most of the early urban settlements were on or near the Eastern coast = ready market for selling fish products. • During weekly fast of Catholics, fish must be eaten instead of meat. • Before electricity/petroleum, whale oil was the chief source of fuel and lubricant. • in developed countries, fishes even used as animal food, fertilizers • Medical uses of cod liver oil, demand for fur products (walrus, seals) and so on.

Fish gutting = significant weight loss. Hence fish processing is either done on the vessel or near the coastal plants.

location	prominent fishing area
Northern Europe	1. Dogger bank, 2. great fisher bank
US Canada	3. Grand bank, George bank, 4. Nova Scotia, Newfoundland

Commercial Fishing: (Europe+America) VS Asia

Within Northern Hemisphere, Commercial fishing is more developed in North Europe and North America, compared to Asia (Except Japan), why?

Factor	impact
climate	• Tropical climate= fish cannot be stored for long.
coastline	• Asia has relatively smooth coast line = less natural harbors than Europe/N.America • Continental shelves are narrower than Europe, North America
capital	• Commercial fishing requires large ships- multiple varieties of fishes caught, separated, processed for packing on the ship itself, high-tech equipment to scan fishing waters for optimal location and so on. • Such vessels and technology require massive capital investment= available in Europe, America but not much in Asia.
species variety	• But in the tropical regions of Asia, multiple variety of fishes occur, but in smaller groups=not good for large scale commercial exploitation. • Tropical fishes=higher oil content= less desirable for eating.

Commercial Fishing: VS Southern Hemisphere

- Northern Hemisphere= more land than Southern Hemisphere=large population = fish demand is large.
- In Southern hemisphere nations such as Argentina, New Zealand and Australia, meat and dairy products are plenty =not much demand for fishes.
- Continental shelves are narrower than Europe, North America=less plankton=less fish

Let's check two leading fishing nations:

Norway	Japan
extensive continental shelf=good for plankton=more fishes	1. Sea of Japan=shallow water=more planktons 2. North-West pacific continental shelf=more planktons 3. meeting of kuroshio (warm) and oyashio (Cold) currents= more planktons
long, fiorded coastline with many offshore islands= good sites for fishing and villages	more than 3000 islands, indent ended coastline
• soil, climate not suitable for agro=people shifted to fishing • They're skilled at fishing, due to long seafaring generation, right from the times of Vikings and Norsemen.	• Mountainous country=less area for cultivation= people shift to fishing • Already good experience for whale fishing. • Genuine pearls rare, in the early 1900s of Japanese invented method to cultivate pearls artificially=shows their expertise.
• well established shipbuilding industry • hilly terrain + fast flowing river=cheap hydroelectricity=helps in canning industry.	• Steel industry, marine engineering developed in costal areas using imported coal and iron ore • ^provides material for sophisticated fishing vessels with processing and refrigeration facilities onboard.
• Most settlements on or near coastal areas=diet is marine dependent • Cold climate=fish preservation easier.	• Livestock/dairy farming=not much hence fish = main source of protein. • exports to nearby Asian countries

India: east vs. West

In India, fishing is more developed along western coast than in Eastern coast because

1. continental shelf in Western Coast=wider=more plankton = more fishes
2. Commercial varieties like Prawns and Mackerel are mostly confined along western coast.

Other than that, these books don't contain much *wisdom* on "Location factor" for Indian fisheries (just list of species found, fisherman use outdated equipment, problem of overfishing etc.)

In the next article, we'll see the location factors for industries based on natural fibers (Cotton, silk, wool and jute)

Iron-Steel industry

- Iron ore + coke + limestone ==heat==> pig iron.
- pig iron=more processing=>cast-iron, wrought iron, steel and variety of alloys

Thus, Essential inputs are

1. iron ore, coking coal and limestone
2. water for cooling
3. energy for heating

Steel industry also requires dolomite, manganese etc. but in small quantities=> their presence is not the main deciding factor for the location.

The three locations

1. Near Forest
2. Near Coalmines
3. Near Coastal Areas

#1: Near Forest

- Until the end of medieval period, iron production was done on small scale.
- Energy was immobile (No wires to move electricity, No trains to move coal).
- To produce five tons of iron, you had to chop down one acre of forest to get sufficient charcoal.
- Therefore, wood supply=primary factor for deciding location. And smelters were usually setup near forest areas
- Even in Modern times, Visvesvaraya Iron and Steel Plant (Karnataka) was setup near jungle to get wood-charcoal. (Later switched to hydro-electricity from Sharawati river)

#2: Near coal fields

During the Industrial Revolution, iron and steel industry were setup near coalmines, due to following reasons:

1. The coalfield region had a tradition of iron working based on charcoal as a result coalfield areas already had the labour and technology.
2. In Britain, iron ore was found embedded with coal seams= same area provided both iron ore + coal
3. During that era, to process 1 tons of iron ore, you needed 8-12 tons of coal. Railway engines were also inefficient. So, weight-wise, it was cheaper to transport iron ore to coalfields rather than transporting coal to iron ore site.

Examples of Iron-industry near coalmines:

Germany	Ruhr Valley, Saxony region
Britain	Lancashire, York shire, South Wales
United States	Appalachian-Pennsylvania-great Lakes
Australia	New South Wales region
China	Wuhan, Anshan, Chongqing

by the way,

Why do we need "Coking coal"?

Because Iron ore=has iron oxide. But We're only interested in iron. So, we've to get rid of the "oxide" part.

- Then how can we remove the "oxide" part? Ans. Make him marry with carbon and form "Carbon dioxide".
- But where will you get the carbon? Ans. Coking coal. Because Coking coal has high concentration of carbon, compared to cheap varieties of coal like Lignite. Therefore you've to mix the coking coal with iron ore.

Iron Ore (Iron Oxide) + Coking Coal (source of Carbon) + Limestone (reducing agent)=heat*=> Iron + CO_2 + slag.
*for heating you can use other variety of coal / even electricity.

#3: Near coastal areas

- By early 20th century the coal and iron ore mines in US-Europe started getting depleted. So, they started importing iron ore from other countries.
- As a result the iron space and steel industry started moving toward coastal sites to reduce cost of transporting ores from port to factory via railways.

Japan	Iron steel industry is developed @coastal areas/port location because they rely on imported coal and iron-ore. E.g. steel industry in Osaka-Kobe
India	Steel plants @Vishakhapatnam, Ratnagiri, Mangalore
Malaysia	Has iron ore but not enough coalTherefore steel plants located near coastal area to get imported coal @minimum transport cost.
USA	In the coastal cities of Cleveland, Detroit, Chicago (using imported ores from Canada)

Factor: Empty Wagons

Ural-Kuznetsk combine

- Ural=rich iron ore deposit
- Kuznetsk Basin in Western Siberia = rich coal deposits- sent to Ural region by Railways.
- The returning wagons after emptying coal, bring iron ore from Ural region.
- Result=> iron-steel industry developed @both places.

Bokaro Rourkela Combine

- Just like Ural-Kuznetsk, In India, Bokaro and Roukela steel plants:

- Trains bring iron ore from Rourkela => Bokaro
- and return with Coal from Bokaro =>Rourkela
- This optimizes the use of transportation (because wagons are never empty), and helped in growth of iron-steel industry @both places.

The curious case of Cleveland

- Pittsburgh (Pennsylvania State) =steel industry was started using local iron ore and coal.
- But Local iron ore depleted so they started importing iron ore from Lake Superior region
- **Problem:** ships would bring iron ore but on their return journey, they'd be empty=> uneconomic use of transport.
- So, they started transporting Pittsburg coal to Lake Superior region in those returning ships=>steel industry developed in the lake region as well.
- But Since Pittsburgh itself is not a coastal city, so the coal/iron had to be transported to a port (Cleveland) first using railways.
- Thus, Cleveland (Ohio State) didn't have iron ore or coal, yet got access to both => iron-steel industry developed in Cleveland. Same reason for Duluth in Minnesota.

Factor: Coking coal Shortage

Sweden has high quality iron ore, yet it specializes in non-ferrous metallurgy and light engineering, (rather than iron-steel industry), why?

- Because Sweden lacks cocking coal.
- Sweden exports its own iron ore to Ruhr (Germany) and in return imports pig iron from Ruhr.
- Then Sweden converts imported German Pig iron into steel, using electrical furnaces. (Advantage: cheap hydroelectric power, because Sweden = hills + fast flowing rivers).
- but since imported pig iron=costlier (than if they had made it locally)=> the steel thus manufactured, is used for making high value items e.g. Volvo Cars, Bofors Guns etc.

Factor: Technology

New technologies for steel production reduced the "pull" factor of coalmines in deciding location. For example:

Open hearth system	even scrap metal can be used to make steelreduced fuel consumptionEven natural gas can be used.
Oxygen converter process	Further reduced coal/energy requirement.

Combined with the invention of electric smelters, technology helped in development of Mini-steel plants near industrial cities (And away from iron-coal reserves).

Industrial Inertia

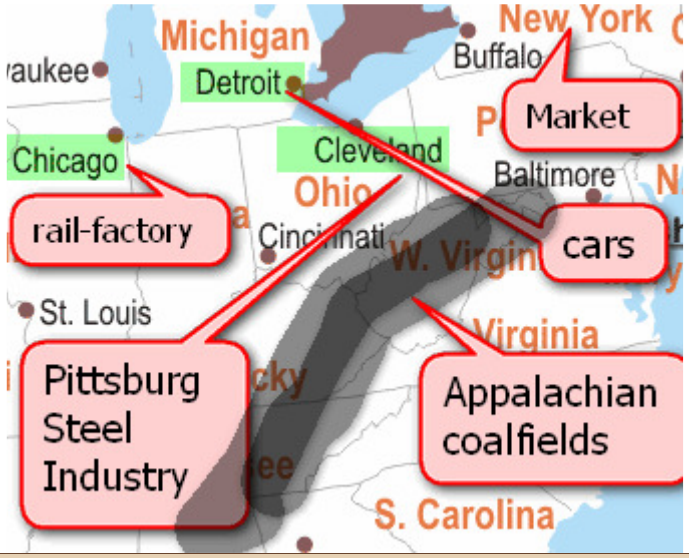
- Today, coal is not the only source of energy. We've natural gas, hydel electricity even nuclear power.
- + Thanks to new technologies in steel production, you don't need massive amt. of coking coal.
- But still traditional industrial areas are located in and around the coalfields- sometimes even after the coal mines have exhausted, these industries are not shifting to a different location. Example Lancashire in UK; Ruhr in Germany; Pittsburg in USA.
- When industries don't move away from an area, despite the locational disadvantage= this phenomena is called **industrial inertia.**

Why industrial inertia?

Factor	Impact
Labour	As time progressed, area near coal fields developed into industrial cities=There is already a large pool of skilled and experienced workers, support services. New area may not have the same labour supply (atleast for the first few years, until people permanently migrate.)
Transport	The railroad, transport and communication infrastructure = well-developed in the old area. Therefore, even if local raw material supply is exhausted, they can be imported from other areas.
Capital	1. It takes a lot of time and money to build a factory and equip it with necessary machines. This discourages the entrepreneur from shifting to a new location, especially for steel industry, heavy engineering works, petrochemical refinaries. 2. It is usually cheaper to modernize or expand an existing location rather than move to a new site. For example, as cotton industry of Lakeshire declined, they converted textile mills into light engineering goods factories, rather than moving to a different location.
Market	• Iron and steel industries provide raw material to many secondary manufacturing industries such as automobile, heavy engineering etc. • If the primary industries moved to new location but the corresponding Customers (automobile/heavy engineering industries) don't change location, then it will affect profit levels. • This is like "*pahele Aap, Pahele Aap*" (you go first, no no you go first..) but nobody moves from old area for the fear of losing profit=>industrial inertia.

Inertia due to Government Policy

- The industrialists in old area usually have deep pockets and political connections so they lobby to government for favorable *protectionist* policies +large labour population in old area=vote bank.
- For example, Pittsburg is not a coastal city and nearby coal-iron ore reserves are getting depleted=> it was becoming more expensive to produce steel using imported iron-ore.
- But then Pittsburg industrialists lobbied, and US government made steel-pricing policies like "Multiple Basing system", "Pittsburg plus" etc. (in the early 1900s).
- The impact of such policies => even if you can make cheaper steel in some other place of US (e.g. Southern Coastal areas), you still need to sell it @prices equivalent of Pittsburg steel industry. This demotivates entrepreneurs from setting steel-factories elsewhere, because they can't sell their product cheaper than Pittsburg, to attract more customers.



India

- In July 2013, POSCO (Korean steel giant), pulled out from the steel-mill project in Karnataka worth almost $6 billion FDI, due to bureaucratic red tapes in environmental clearances and land acquisition. We can only speculate the vested interests and powerplay going on behind the curtains involing bureaucrats, politicians and mining mafias.

Factor: strategic reasons

USA

After WW2 and from the lessons of Aerial bombings destruction in Britain, US government decided that it was not wise to let entire steel-industry concentrated in the East (Great Lakes-Pittsburg region). Therefore, some plants were setup in the west (California). They get coal from Utah and Iron Ore from Eagle Mountains.

USSR

- Before Second World War, Ukraine-Donbas region was famous for iron steel and heavy industry.
- But these region suffered great destruction during Second World War. (as the Enemy Germans came from the West.)
- Due to this bad experience, the Soviet government adopted a policy to disperse Soviet industries on the Eastern side, towards the Pacific coast.

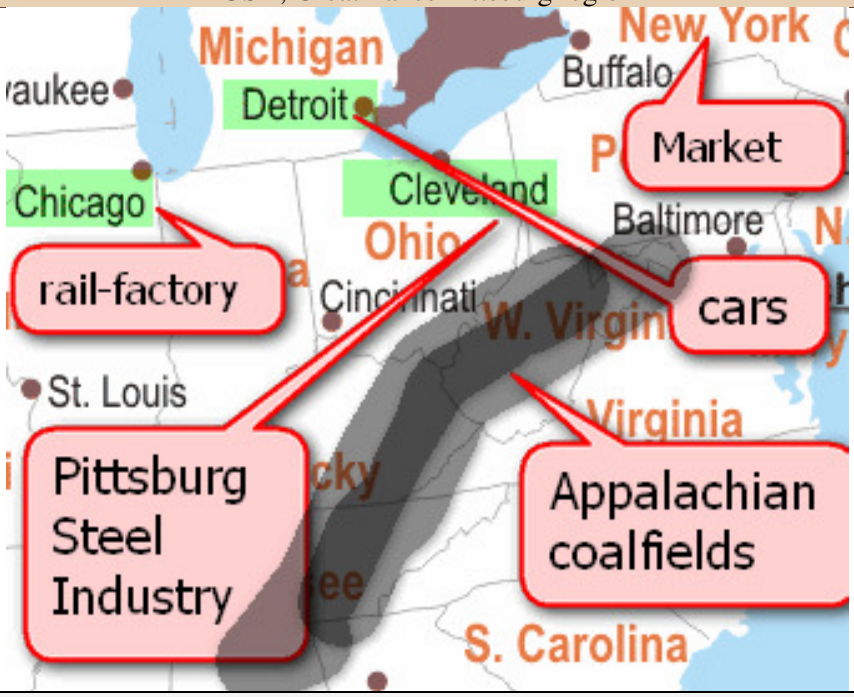
Factor: Developmental policies

India	• Steel industry was setup specifically @Bhilai to reduce the regional backwardness. • Location of Salem plant in TN was due to political considerations. (But what political considerations?=> books are silent about that!)
China	• "Backyard steel furnaces" were setup in every *commune* under the "*great leap forward*" policy of Mao. Although it was an #Epicfail, we'll see after a few paragraphs.

Steel Based Industrial Regions

- Since most of the coalfields are located in the middle-latitudes=> iron-steel industry developed here.
- Since steel is the raw material for many secondary industries (heavy/light engineering, machine tools, automobiles etc.). => Important industrial regions of the World usually found @middle latitudes.
- On the other hand, tropical belt doesn't have any significant coalmines => hardly any industries belts.
- Africa doesn't have coal or iron ore (Except some parts of S.Africa)=> hardly any industrial development.
- anyways, let's check out a few *Videsi* steel based industrial regions (list not exhaustive)

USA, Great Lakes-Pittsburg region



Factor	Impact
Raw Material	• Good-quality Coke from Pennsylvania • iron ore from the mines Lake Superior region • Limestone from Lake Huron, Appalachian Mountains • cooling water =from local rivers and lakes
Energy	Coal locally available and hydroelectric power from Niagara falls (Cleveland)
water4cooling	lake Erie etc.
Transport	St Lawrence seaway facilitates transporting raw material and finished products
Labour	Large population with diversified skills, due to years of "brain gain"
market4steel	The region has diversified industrial activities, one feeding raw material to other.for example 1. Pittsburgh, Youngstown and Cleveland= iron, steel and machineries 2. Pontiac and Flint = car spare parts 3. Detroit= automobile 4. Chicago=railways (+ beef industry as we saw in previous article)

Canada: St Lawrence Valley

Raw Material	• iron ore from steep rock, Québec Ontario • coal from the Appalachian region • softwood from the coniferous forests
Energy	Hydro electricity from Québec
Transport	1. cheap water transport to great Lakes and St Lawrence River 2. Canadian pacific railway
market4steel	Machine building for paper-pulp and lumber industry + shipbuilding

Germany, Ruhr Valley	
Raw Material	• Saxony coalfield • iron ore from Bavaria, France, Spain and Sweden
water4cooling	• Ruhr river
Transport	• Rhine river=inland water transport + access to sea
market4steel	**Dusseldorf**=automobile hub, Volkswagen, Mercedes etc.**Ship building industry**in Hamburg

Britain: Birmingham, Midlands	
Raw material	Staffordshire, Warwickshire coal field.Although, nowadays iron smelting industry moving towards coastal locations for imported iron ore.
Transport	Central location=>Dense network of railroads.
market4steel	1. **Automobile:** Coventry= HQ of British Leyland company. Cars, coaches and trucks. 2. **Light engineering:** region makes anything from a pin to a battleship, but specializes in smaller metal goods manufacture: nails, locks, keys, brassware and jewelry. Staffordshire coal field has long supported this thriving metallurgical industry

Sweden, Central region	
Raw Material	Sweden has one of the richest iron ore resources of Europe. Although they mostly rely on German pig iron as we saw earlier, due to lack of coking coal.
Energy	Mountainous terrain + fast flowing river= abundant hydroelectric power (HP).Cheap HP=electric furnaces @steel plants, and electro-chemical industries.
Transport	• Goteborg, the premier port, shipbuilding centre • Stockholm's connected to Gotebore via Gota Canal = easy transport and export of engineering products. • Other industrial towns well connected by railways, roads and inland waterways.
Market4steel	Volvo cars, bofors guns, Electrolux refrigerators etc.

CIS: Ural region	
Raw material	• Ural=rich iron ore deposit • Kuznetsk basin in Western Siberia = rich coal deposits- sent to Ural region by Railways. • The returning wagons after emptying coal, bring iron ore from Ural region. Thus iron-steel industry developed @both places. • This is known as **Ural-Kuznetsk combine.**
Energy	Volga River= Kuybyshev dam= hydroelectric power
Transport	trans-Siberian Railway
Market4steel	Agricultural machinery, because Agriculture developed in Central Volga region.

China: Steel industry

In the late 19th century, in Britain, the coal production and urban industrial growth occurred parallel. Same story repeating in China.

During Mao's era,

- The railways was in nascent stage and lacked the capacity to move massive quantities of coal to industrial areas.
- Various regions of China did not have interconnected electricity grid.
- Therefore, many industrial regions were setup in North, near the coal mines.

1. **Manchuria**	• steel industry was setup by Japanese colonialists (after Sino-China war, Japan had occupied this region) • Coal from Fushan.
2. **Northern China**	• Around Shantung and Beijing. • Coal from Shantung and Shensi.
3. **Yangtze Valley**	• Runs along with the Yangtze river, Around Chongqing, Wuhan etc. • Coal from Chongqing + hydro electricity from Yangtze river. • Iron ore deposits on South of Yangtze River. • Yangtze river itself provides cheap inland transport.

China: Backyard Furnaces

- At the end of 1950s, Chairman Mao had started a campaign called "Great Leap forward" with the aim to transform agrarian Chinese economy to industrialized economy (similar to Russia).
- One of the tool under "great leap forward"=backyard furnaces.
- Mao had ordered each commune, to setup small furnace and produce steel using local wood-charcoal and metal scrap. But this *communist-experiment* was an epic fail. Because:
- Peasants did not have the skills for metallurgy, work was done in haste, sometimes villagers would just melt their kitchen utensils and product an unusable metal lump meet ridiculously high steel production 'targets' given to each commune.
- Although Mao wanted to "double" the National steel production, But result was:

1. Steel produced by such backyard furnaces was very weak and non-uniform in quality. If you made any machinery or building with this substandard steel, it would breakdown in a few years.
2. Farm laborers were shifted to collect scrap-metal and cut jungles for charcoal=>agro productivity declined and led to famines in later years.
3. Forests were cut down to make charcoal => environment problems, soil erosion etc.

before going into Desi steel industry, let's understand the difference between

Integrated vs Mini steel plants

Integrated steel plant	**Mini steel plant**
handles everything in one complex – • from processing raw material, making the Coking coal, • blast furnaces, production pig iron, • steel & other alloys, • even upto final rolling and shaping of ingots and rods.	• Runs on **electric furnaces**. • input=scrap metal, sponge iron • Located near industrial towns for recycling the waste metal. e.g. in Maharashtra
takes years to construct an integrated steel plant	Low gestation period.

in India, they're concentrated in Damodar Valley region (Eastern India)	They're usually away from areas having integrated steel plants (Western India), to meet local demands + to avoid competition from integrated steel plants of the East.

Desi Steel Plants

Note: maps for most of the following steel plants are given on page 88 and 89 of NCERT Class 11 (India People and Economy), do refer to it.

Factor	TISCO, Jamshedpur	Bokaro, Jharkhand
Iron ore	• Noamundi-Singhbhum, Jharkhand • Mayurbhanj, Odisha • Both within 100 kms radius	• Noamundi in Jharkhand • Kiriburu, Odisha
Coal	• Jharia, Raniganj • Both within <200 kms radius	• Jharia Mines just 65 kms away
Limestone	• Sundargh district, Odisha • Maganese from Joda mines, Keonjhar, Odisha	• dolomite from Palamau
Energy	• Hydroelectricity from Damodar Valley corporation	
Water for cooling	• Via pipelines from Subarnarekha and Kharkhoi rivers	• Damodar river
Labour	Abundant supply of Cheap labour from Jharkhand, Bihar, Odisha and the tribal belt of Chhota-Nagpur platteau.	
Transport	• Railway connectivity to Kolkata, Mumbai, Chennai	• rail-water connectivity to Kolkata, just 300 kms away
Market	• Secondary industries located in the region that use steel to manufacture machine tools, automobiles, agro-machines, tine-plates, wires etc. • TELCO (Tata Engineering and Locomotive company) produces • Consumer cars /SUVs like sumo, safari, indica, sierra etc. and heavy vehicles, including armored carriers for army.	• sludge-slag from the plant provides raw material to Sindri fertilizer industry. • produces crude steel and pig iron
Trivia	• Setup in 1907, just two years after Lord Curzon partition Bengal. • TISCO =Tata Iron and Steel company • TISCO plant wasn't setup by Jamshedji Tata but his son Sir Dorabji Tata • Manganese is used for hardening steel.	• with Soviet help in '72
Factor	Durgapur, WB	Burnpur, WB
Iron ore	• Singhbhum, Jharkhand • Kendujhargah, Odisha • Mayurbhanj, Odisha	• Singhbhum, Jharkhand • Mayurbhanj Odisha
Coal	• Raniganj, WB • Jharia, Jharkhand	• Jharia, just ~130 kms away
Limestone	• Birmitrapur, Odisha • Managanese: Bonaigarh, Barbil in North Odisha	• Sundargarh, Odisha, just ~300 kms
Energy	Damodar valley	
Water for cooling	Damodar river	
Labour	No shortage of cheap labour.	
Transport	• plant on the main railwayline between Delhi-Kolkata	• good rail connectivity sea ports @Odisha + Kolkata

	• Navigable Canal from Durgapur to Hugli and Kolkata Port	
Market	• pig iron, tools, alloys, light structural products	• rails, galvanized steel, billets
Trivia	• '64 with collaboration from UK	• initially a private plant, nationalized in '72
factor	Rourkela, Odisha	Bhilai, Chhattisgarh
Iron ore	• Sundargarh, Keonjar District of Odisha • within radius of ~70kms	• Dugar, Chandrapur and Bastar • Dalli-Rajhara range 80km away
Coal	• Jharia, • Telchar, • Korba	• Korba, Chhatisgarh (~225kms) • Bokaro, Jharia (~720 kms) • Raniganj, WB
Limestone	• Birmitrapur	• Nandini mines ~25 kms away • Manganese from Balaghat (MP) + Bhandara (MH)
Manganese	• Barajmda	• Balaghat
Energy	• Hirakud (just 150 kms away)	• Korba Thermal station
Water for cooling	• Bramani river • reservoir on Mandira Dam (Sankh River)	• Tandula Reservoir
Labour	cheap labor available.	
Transport	• Both connected to Kolkata Nagpur Railway	
Market	provided special steel for • ISRO's launch vehicles • Vijayenta tanks • building Mathura refinery	• itself uses steel to make rails, beams and other structural products.
Trivia	• setup in '59, With help from West Germany	• first Swadeshi steel plant • with help of former USSR, 1959 • **Main location factor=Government policy** to setup plant here**, <u>to remove backwardness</u>** of this region.

Steel Plant: South India

factor	Vishveshwarya, Karnataka	Salem, TN
Iron ore	• just 40kms away Baba Budan hills, in Chikmanglur.	Bailadila mines, Odishalocal iron ore also available-has low phosphorous-sulfur content=>helps making special grade Iron and Steel.
Coal	• Bhundiguda • Manganese: Shimoga, Chitradurga just 50kms away	Either imported or brought from Jharkhand depending on price factor
Limestone	• available within 50km radius	Birmitrapur
Energy	• In early days, used charcoal from forest wood. • now uses hydroelectric power from Sharawati and Mahatma Gandhi project	Mettur has both thermal and hydro projects
Water for cooling	• Bhadra river	don't know and too tired to google
Transport	• located on main railway line of Biru-Shimoga.	Chennai port
Market	• billets, rails, wheels alloy steel and sleepers for railways.	Salem steel is useful in TN's automobile industry, elevators, lifts, coins, ceiling fans.Also caters Government mints (for making coins).

Trivia	• In 1923 as private company "Mysore Iron and Steel". Nationalized in '89	Started in 82. Location chosen due to political considerations.

Vishakhapatnam, AP

Iron ore	Bailadila, Chhattisgarh
Coal	Damodar Valley, Jharkhandalso imports metallurgical coal from Australia
Limestone	From MP, Odisha, Chhattisgarh
Energy	Natural gas from Krishna-Godavari Basin
Transport	Vishakhapatnam itself a Port= rail connectivity with other states.+ helps in import of raw material and export of final products.
trivia	First shore based plant of India.

Secondary industries

- these industries rely on the raw materials produced by other industries
- therefore seconded industries are often located near the companies which make their raw material industry, for example

Industry	located near
1. Heavy engineering	steel factories
2. petrochem / synthetic fibers	crude oil refineries

Engineering industries

engineering	**Light**	**Heavy**
examples	kitchen utensils, refrigerators, vacuum cleaners and variety of home and office appliances.	shipbuilding, railway wagons, hydro turbines, thermal generators, transformers etc.
Location	Can afford to transport steel over longer distances and therefore scattered in distribution.	Need large quantities of steel => located fairly close to iron-steel industry to reduce transport cost.

Heavy engineering industry

They require:

1. huge amount of power
2. large capital investment
3. skilled labor

But main factor is: transport cost for heavy and bulky raw material (steel)=> Heavy engineering industry is usually located near steel plants.

Earlier we saw that steel plants themselves are located in the Damodar Valley and surrounding region (WB, Odisha, Jharkhand) for easy availability of iron ore, limestone, coking coal, energy and cooling water. Now let's see examples of how heavy engineering industry is also located in the same region, because of those steel plants.

Place	Heavy Industry
Jharkhand	Heavy engineering Corporation Ltd in Rachi. They make blast furnaces for steel plants, heavy crushing and grinding equipment, rolling mills, rigs for oil wells
WB	○ **Durgapur**: heavy engineering factory for mining equipment • **Chittaranjan Locomotives**: steel from Durgapur (~70 kms) and hydroelectricity from Damodar Valley.
	○ Textile machinery Corporation has more than 60 units in Kolkata-Howrah region, for assembling jute mill machineries
Odisha	○ machineries for paper Mills are manufactured @Rourkela
Chennai	○ Thanks to Salem steel plant ○ factories for agricultural, mining machinery: earthmovers, excavators, bulldozers, power readers, threshers, harvesters, cutters, tractors

For videshi heavy industry, we already saw the examples in those industrial region tables above.

Shipbuilding industry

Location factors:

physical factors	economic factors
• large, level coastal land	• steel availability

• deep navigable waters	• capital • demand • skilled workers

Japanese Shipbuilding industry

Located @Nagoya, Tokyo-Yokohama, Hiroshima

1. Japan relies on imported iron= steel mills are @costal location => heavy marine engineering industry also @costal location = heavy machinery, boilers, engines, cable ropes and electric installations….all the raw material and spare-parts are locally available for shipbuilding.
2. Auxiliary industries already developed because of automobiles.
3. robots: to compensate for less number of workers
4. Excellent harbours and bays for launching ships.
5. Mild climates to keep water of the rivers and estuaries free from freezing.
6. Great domestic as well as foreign demand for fishing boats and merchant vessels respectively.

German Shipbuilding

1. Availability of tidal estuaries of the Elbe, Weser, Oder and Lubec Bay
2. Advantage of highly developed iron and steel industries in the country.
3. Possession of technical and skilled labour.
4. Patronage of technical institutions of the country.
5. large domestic and foreign demands for her vessel.

Now some passing references

Boston

- Chief center of shipbuilding is Mid-Atlantic coast region.
- The area has easy access to tidal waters and availability of large quantities of steel.

India

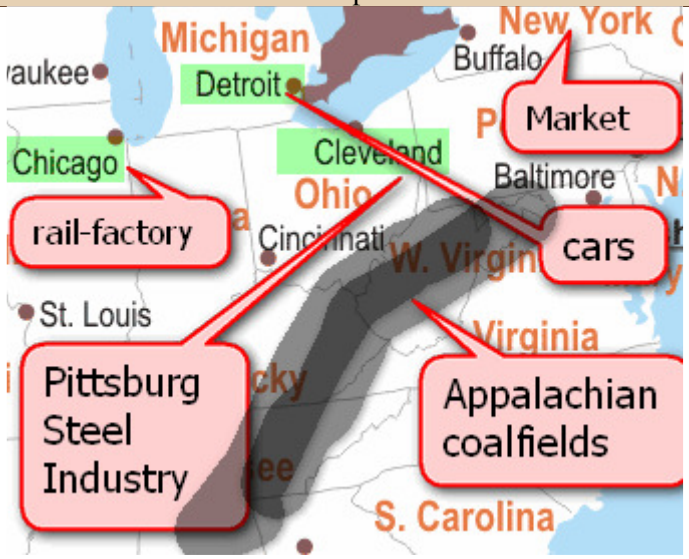
- Vishakhapatnam itself has steel industry and Kolkata well connected with steel industries of Jharkhand and WB = raw material available nearby.
- flat/level coastal land available
- rich hinterland with excellent railroad connectivity for transport of labor and ancillary components
- Indigenous demand from ONGC, for offshore platforms, drilling rigs and steel jackets + from Indian Navy and Coast guards.

Other than that, not much wisdom is given on location *factors* for shipbuilding industry in India, just establishment years, naming-renaming, types of ships made/repaired etc.

Automobile industry

- Automobile industry requires large variety of raw materials from other industrial sources viz. steel, nonferrous metals, window-glass, plastic, rubber, wood, paint, textile, electronic cables, seat cushions etc.etc.etc.
- For continue mass production on the assembly line, you need continuous supply of those spare parts, raw material.
- Therefore, best location for automobile industry=established industrial region that has tradition of manufacturing such components. (e.g. we saw earlier Midlands, UK=Layland; Mercedes/Volkswagen near Ruhr Germany; Volvo Sweden.)

Detroit: Car Capital of World



Factor	Impact
Transport	• on the bank of Detroit River, linked to Lake Huron • Detroit is connected to Windsor, Canada via tunnel across the river. Detroit cars find market in Canada as well. • Great lakes = cheap and easy water transport.
Labor	• In early 19th Century, flour mills developed using running water from river as energy source. later internal combustion engines for boats • consequently, many repair shops opened in the region • They also started building machines needed for the iron-steel smelters in Pittsburg region. • Thus, Destroit has a long tradition of building machines=generations of skilled labour + sparepart industry available
Entrepreneurs	• William Durant (the father of General Motors), initially used to manufacture railway carriages in the same region. • Henry Ford, earlier worked in Detroit Automobile Company, later setup his own Ford Automobile here.
Raw Material	• Iron-steel from the Pittsburg • Since Detroit has long tradition of machine-building, there are numerous intermediate industries providing raw material for seat-cushions, spray-paint, tyres, electronic circuit and various car accessories to the trinity of Ford, GM and Chrysler.

Detroit Bankruptcy

Without going into all details:

- This bankruptcy is filled by Detroit Municipality and not by Detroit Automobile industry
- Detroit Municipality had sold "bonds" to finance their operations (fire dept., police dept. and various municipal works, social services, healthcare, pension expenses)
- Now they don't have the ca$h to repay money to bond-holders (need around 18 billion dollars). So, Municipality filled Bankruptcy under Chapter 9 of Bankruptcy Act
- This Chapter 9 protects financially-distressed municipalities from legal prosecution from their creditors while they negotiate a plan for arranging money / re-writing the loan conditions.
- Although Automobile industry was a factor in Detroit Bankruptcy. How?

era	population of Detroit
1950s	around 18 lakh
present	around 7 lakh and among them, barely 280,000 people are of working age.

- so why ^this growth and decline in population? because in the 50s, Detroit was a booming automobile industry. But later, other States of USA also offered tax benefits to Automobile giants so they started setting up plants elsewhere.
- Competition from Japanese automobiles
- + recession => auto-sales declined
- As a result: automobile and spare part factories of Detroit began to shut down and workers started moving to other cities for jobs= less workers in Detroit=less tax payers. And many of Detroit-folks barely earn ~27,000 dollars per year =you cannot extract a lot of tax out them.
- Since people left the city, many houses are vacant=less property tax.
- Thus Detroit Muni. doesn't have lot of 'incoming' money
- On the other hand, outgoing money is high because of pension-healthcare to old people; unemployment=>crime rate=>more expenditure on police; vacant properties=>more fire-incidents=>more expenditure fire department and so on.
- Therefore, Detroit Muni. unable to pay back the bond-money and hence the bankruptcy.

Toyota-Nagoya region, Japan

labor	Toyota Motor Company setup plant in Koromo.Koromo =silk industry was on decline= high unemployment= cheap labour force was available.
technology	innovation by reverse engineering US-technology
transport	Nearby Nagoya= metropolitan area= ideal for auxiliary corporate services + port for exporting cars to US and other countries of Asia.
government policy	Koromo's local government provided cheap land for the factory.

And thus, a rural silk growing area turned into a majour industrial district in automobile production.

Later, majority of Japanese automobile companies set up plants in the Tokyo-Nagoya regions. (Except Mazda in Hiroshima)

Sanand, Ahmedabad: the Nano Factory	
Raw Material	• Ahmedabad-Vadodara industrial region has many factories for spareparts, car-accessories, tires, circuit, glasses etc. • Nano having small-cheap model, doesn't require that much iron-steel compared to a Truck or SUV. + located near ports for easy import.
Transport	• Located in Delhi-Mumbai Industrial corridor (DMIC)=>easy transport of spare parts, raw material and finished cars. • Mundra port ~180 kms: has container depots for vehicles + ro-ro terminal for loading and unloading vehicles • Similarly Kandla Port: just ~250 kms away.
Labor	• Tata said they'd train the local youth for working in the Nano plant. • Ahmedabad district large population + urban amnesties=> no need to setup special township for workers and their families.
Market	A'bad to Mumbai: developed region with lakhs of middle-class families.+proximity to ports=easy car export.
Energy	• Tata working on 4000MW Ultra Mega Power Project in Mundra (~180kms) using imported coal.
Land	• Most of the land belonged to Anand University (and hence to State government). Hence, Land acquisition done without much problem.

Machine tools

Unlike heavy engineering industry, the machine tool industry doesn't need to be right besides steel plants. Proximity to market and skilled labor = deciding factors. For example:

HMT	Hindustan Machine tools.has units in Bangalore, Pinjore (Haryana), Ajmer (Rajasthan), Srinagar etc.
Rajasthan	○ Instrumentation ltd @Kota, ○ magnetic, electromagnetic equipment's
Kerala	○ @Palkkad, hydraulic and pneumatic instruments

Observe that none of above places are famous for iron-steel production.

Light engineering industry

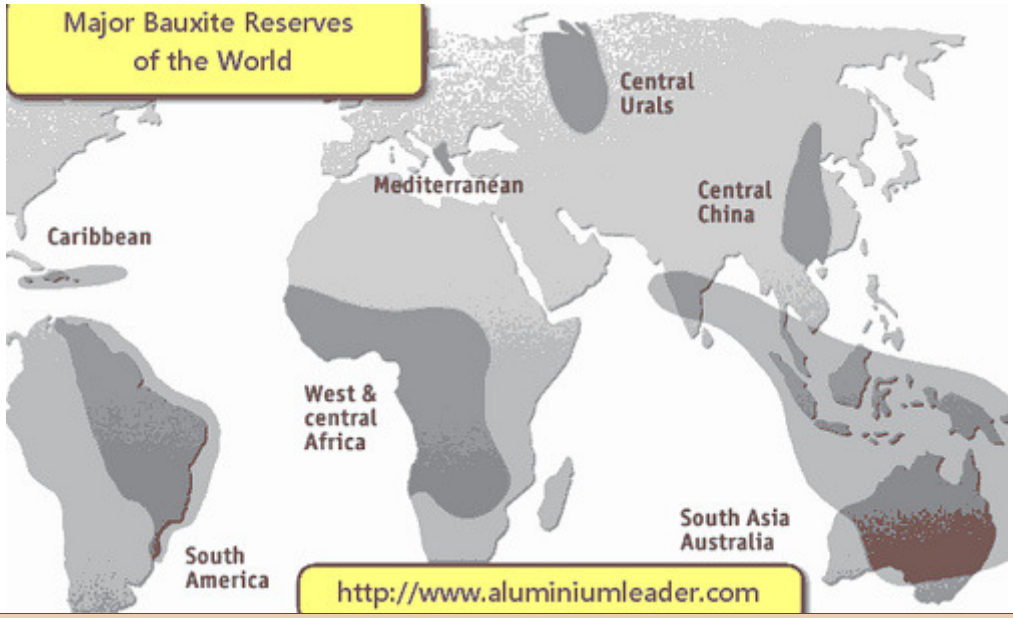
- These articles are fairly light and require small amount of raw materials. (e.g. various household and office equipment)
- Such industries rely on electricity rather than coal or oil for power.
- For them skilled labour, transport, market, favorable government policies (SEZ/Taxation) are more important factors than proximity to raw material.
- They can be found near major cities rather than in traditional industrial areas near coalmines.
- We'll see about them in detail later in the articles for market/labour factors in industrial location.

Aluminum

To understand the reason behind location of aluminum refineries, first we need to understand how aluminum is produced from bauxite?

Phase: bauxite to Alumina

- Aluminum is an abundant mineral in the crust of earth but for mining or commercial scale exploitation, you require significant concentration of bauxite ore at one particular site.
- Bauxite occurs frequently in the tropical areas where limestone rocks are exposed to weathering
- First, Bauxite ore is crushed, washed and mixed with caustic soda to remove impurities.
- Then it is dried in large furnaces to remove moisture content=> you get alumina.
- During this phase, ~50% or more weight loss happens.
- Hence, this process (of converting bauxite to Alumina) is done near the raw material side. Because less weight= less transportation cost.



Phase: alumina to aluminum

- Involves electrolysis.
- The white powder of alumina is dissolved in a bath and electric current is passed through it using carbon electrodes. Result- alumina is converted to aluminum.
- But this stage requires massive amount of electricity
- Therefore, aluminum smelting facilities are set up near sources of cheap electricity, rather than near to raw material or near to final market.

Aluminum industry: Foreign Locations

Canada and Norway	• don't have any significant quantities of bauxite ore, yet they have many aluminum processing industries in the country. Why? • Because both of them have cheap hydroelectric power.
Japan	• used to have aluminum smelters in its domestic soil but with rising cost of electricity, now they've shifted their refining to Australia, Indonesia etc. by leasing, long-term supply agreements Merger-acquisition etc.
Australia	• Has largest deposits of Bauxite. • **Queensland & Victoria:** use coal based thermal powerplants. • **Tasmania:** use hydroelectricity
USA	• **Eastern USA:** Arkansas, Georgia and Alabama • **Western USA:** Arizona, Utah, and New Mexico states. • Declined because various environmental taxes & regulations had increased the cost of production. • As Dollar strengthened against Chinese, Australian currency, it became cheaper to import aluminum than produce it using expensive electricity +taxes @USA.

Cheap electricity =deciding factor for location of Aluminum refinery.

LEADING Refiners IN THE 70s	**LEADING Refiners TODAY**
Japan, United States and Western Europe	Australia, Canada, Brazil, Middle East, Russia and China.
Declined because of rising cost of electricity + pollution related taxes and laws.	Cheap electricity from coal/hydro.

Largest producer (2012 data)

Alumina	China
Aluminum	Australia

Still China imports a substantial amount of Aluminum from Indonesia. Why?

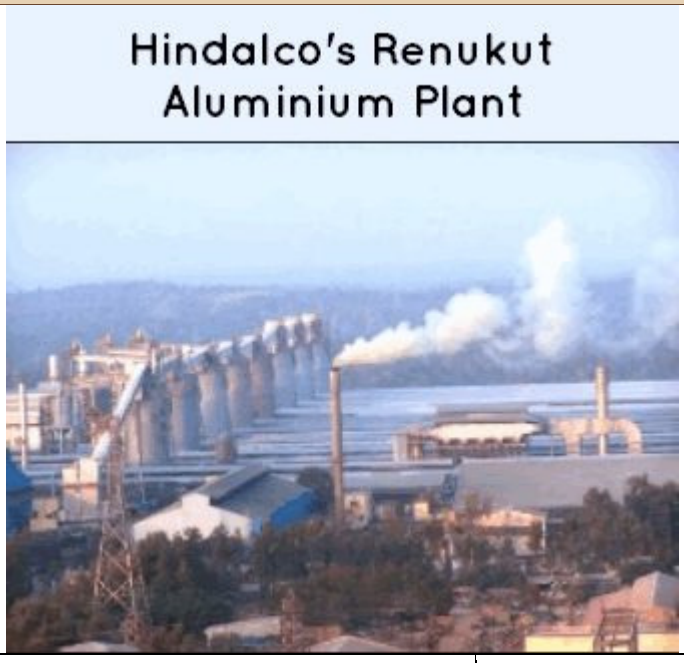
1. Aluminum is cheaper substitute of Copper.
2. used backing plates for flat screen TVs (a lightweight alternative to steel), tablet computers, mobile phones, laptops or as a laminated film used in exterior packaging for batteries;

3. Aluminum in green applications such as solar paneling (used in the frame) and wind farms (in submarine cables for off-shore wind farm projects.

Chinese industry involved manufacturing all of above, hence need large-scale supply of aluminum.

Aluminum Industries: Desi Location

Hindalco/ Birla



FACTOR	Renukoot, UP	Hirakud, Odisha
RAW MATERIAL	• Lohardaga-Pakhar region @Jharkhand, • Korba-Bastar region @Chhattisgarh	• Odisha itself rich in bauxite reserves, particularly Kalahandi-Koratpur region.
ENERGY	• Hydro electricity from Rihand Dam on Rihand river in Sonbhadra district, UP. • The reservoir behind this dam, known as Govind Ballabh Pant Sagar	• Hirakud dam on Mahanadi river. • + captive coal blocks @ Talabira, approximately 45 km from Hirakud
MANPOWER	• Aluminum Refining required skilled worker. • Skilled labour=mobile (compared to uneducated, unskilled labour). • Besides, this plant has its own residential colony cum mini township, hospital etc.	• Hirakud has a township • nearest city Sambalpur just 15 kms away.
CONNECTIVITY	• connected to all important industrial regions and ports via rail-road network. • Nearest airport ~160 kms in city of Varanasi.	• It is situated 6 km away from NH-6 connecting Kolkata and Mumbai

Vedanta Aluminum

- Vedanta is an integrated producer of Aluminum in India with mines, smelters and associated power plants.
- Korba (Chhattisgarh) and Jharsuguda (Odisha)
- Both places have bauxite and coal deposits.
- Vedanta uses that coal for generating thermal electricity in its own captive power plants. Same electricity used for refining alumina to aluminum.

Niyamgiri hills

Located in Odisha. Considered sacred by the tribal groups such as the Dongria Kondh, Kutia Kandha etc. Vedanta Resources ltd. wanted to extract Bauxite from here, project worth more than $1.5 billion.

2010	• The whole "Rahul Gandhi" episode. • Union environment ministry rejected environment clearance to Vedanta's project in the Niyamgiri hills citing serious violation of forest and environment laws

2013	• Supreme Court said under the Forest Rights Act (**FRA**), the gram sabhas of this area have the ultimate powers to take a decision on whether the Vedanta group's can go forward or not. • **FRA** protects a wide range of rights of forest dwellers and STs including the customary rights to use forest land. And gram sabha has the power to decide on protecting forests and natural heritage.

After this Vedanta verdict, Andra also facing crisis because their state government has given bauxite mining projects in Visakhapatnam and East Godavari districts. Local tribal demanding similar 'environmental referendum' under FRA.

OTHER PLAYERS in Aluminum smelting/refining

BALCO	Ratnagiri, Maharashtra
NALCO	Koratpur, Odisha
MALCO	Mettur, TN

Copper

- With 20th century, copper became important for electric industry.
- As the demand for copper increased, new mining-smelting technologies are developed to utilize even lower quality ores.
- Location principle for copper and aluminum industries same, but smelting process is different.
- In case of aluminum, we saw that process is bauxite(ore)=> alumina (weightloss)=> aluminum(need electricity).
- In case of copper, the first stage=concentrating.

Stage: Concentrating ore

- The copper ore is soaked in water and mixed with oils. The copper revering matter floats on the top, and is separated out for further processing.
- After this "concentrating" stage, barely 2.5% of the original matter remains. And less weight= less transportation cost.
- Therefore, copper concentrating mills are set up near the raw material(mines)
- During this stage, sulfur and oxygen impurities are separated from the concentrated copper ore. Thus we get "blister copper".
- Even in the state, the weight loss ratio is significant, therefore smelting is usually done near raw material.

Stage: blister to copper (refining)

- So far we got copper ore => Blister copper.
- Although Blister copper is 99% pure metal, but still unsuitable for manufacturing electronic wires, utensils etc. Why? Because it contains impurities of gold, silver, lead and zinc.
- Therefore, blister copper is refined via electrolysis method.
- The blister copper is immersed in a bath of copper sulphate, electricity is passed and impurities are removed.
- Here, the weight loss ratio is extremely small. (~1%). So, there is no economic factor to setup copper refining factories near the raw material.

Copper: Foreign location

Location	Comment
Zaire and Zambia	• had significant copper ore reserves and even refineries. • But governments nationalized those refineries= they became loss making white elephants just like our Air India.
USA	• Utah, Montana, Arizona (UMA) states • In United States, many copper refineries were closed down due to increased competition from foreign refiners, higher cost of electricity, increased costs associated with legal requirements to cleanup sulphur dioxide emission etc.

Copper Refining: Desi Locations

Hindustan Copper	• @Khetri, Jhunjnu district, Rajasthan. • **Ore:** from Malanjkhand-Balaghat region of Madhya Pradesh.
BACLO	• @Korba, Chhattisgarh • **Ore:** from Amarkantak Region • Energy: Korba thermal plant
HINDALCO (Aditya Birla)	@Dahej in Bharuch district of Gujarat.
Sterlite Industries.	Tutikorin, TN

Acid Industry

- From the Copper refining process, by products can be used for making phosphoric acid, sulphuric acid. How?
- Copper smelting=>SO_2 gas=>**Sulphuric Acid**
- Same Sulphuric acid + Rock Phosphate*==>**Phosphoric Acid.** Further it can be used for making fertilizers.
- *by the way, Rock Phosphate is usually imported. (Food for thought: why not setup Phosphoric acid plant abroad then? Ans. Because se SO_2 gas is difficult to transport. So, better important rock phosphate here!)
- Hence, such acid industries are located in the vicinity of Copper refineries.
- Nowadays, the copper refining companies have integrated plants to produce such acids within their premises. example

HINDALCO (Aditya Birla)	• plant @Dahej in Bharuch district of Gujarat. • has both Copper refining +Acid production • From Copper refining, they even extract the impurities of pure gold, silver and selenium, platinum and palladium- which are sold separately. • Another favorable factor: Dahej port just 45 kms away. Helps exporting sulphuric acid.
Sterlite Industries.	• Tuticorin, TN. • But in 2013, State pollution board ordered them to close down after emission of sulphur dioxide gas = people in the area complained of suffocation, and burning sensation in the eye. • Matter went to SC, while Sterlite denies emissions from the plant are dangerously high. This plant produces more than half of India's total refined copper. • Business GK: Vedanta=London based company. and Sterlite Industries is the subsidiary of Vedanta resources

Desi Copper Industry: Challenges

1. Special copper alloys are still imported. Because we don't have technology to produce them locally. E.g. Beryllium copper,.
2. Mining & smelting technology is obsolate. Causes substantial air pollution because sulphur dioxide emission.
3. Still don't have technology for downstream copper products e.g. copper tubes for refrigeration/AC etc. majority of them still imported.
4. Still don't have technology for complete recovery of precious metals such as Cobalt, Nickel etc from copper concentration.
5. Producing 1 ton Copper from ore=takes almost 14000 kwh energy. But producing 1 ton copper from scrap/recycling=takes only 1700 kwh. However, scrap based copper smelter are not yet well established in India. Very few plants using scrap metal to recycle copper (e.g.Lonavala, Hyderabad.)
6. Manpower requirement per tonne of finished copper=very high compared to developed countries.
7. There is huge gap between demand and supply. Almost 70% copper is imported.
8. There is no smelter @Malanjkhand (MP). The concentrate has to be transported to Khetri (Rajasthan). =cost of production increases.
9. Overall, Indian copper ore is average quality, hence mining/refining is a costly because copper yield is low.

Lead and Zinc

- Dig the ore=>concentrate=> refining.
- it runs on the principle that certain minerals have an affinity for certain oils.
- Hence the ore is mixed with water, oil and chemicals.
- The mineral particles attach with oil bubbles and float on the surface.
- The foam (containing mineral particles) is skimmed off.

Location:

- Concentration stage: procedure involves significant weight loss=> carried out near mining site.
- Refining stage: require lot of electricity=> done near large thermal plants /hydroelectric sites.
- India doesn't have sufficient ores of Lead/Zinc. So majority of our requirement met through imports.

State	metal	smelters location
Jharkhand	lead	**Tundoo**
AP	lead	Vishakhapatnam, based on imported lead concentrates
Rajasthan	Zinc	@**Debari**: ore comes from Rajpur-Dariba mines + import.@**Chanderia**: ore comes from Bhilwara.
Kerala	Zinc	@**Alwaye**. Based on imported zinc concentrates

Natural gas

Natural Gas compared to Petroleum:

GOOD	BAD

1. cheaper 2. does not require extensive refining 3. burns clean	1. Storage and distribution is difficult. 2. With the help of pipelines, the gas can be transported to the consuming centers, but the construction of pipeline and its security and maintenance is expensive. Hence export=problematic. 3. once the pipeline is laid- its size/capacity cannot be increased. 4. leakage detection is difficult incase of underground pipelines. 5. If market/buyers are not found, then gas is wasted by burning. (flaring). 6. Therefore it is economical only to mine gas near market areas/ only if pipeline is established.

After the Second World War, United States was the first country to lay a comprehensive pipeline network for natural gas.

International Pipeline Projects

1. Iran-Pakistan-India
2. Myanmar-Bangladesh-India
3. Turkmenistan-Afghanistan-Pakistan-India (TAPI)

ONGC Hazira, Gujarat

INPUT	Natural gas from Bombay High
PROCESS	• They remove sulphur impurity from the (sour) natural gas, and send it to other regions via pipeline. (process called "Sweetening the gas")
OUTPUT	the "sweet" natural gas is used in 1. LPG cylinders 2. Nitrogen based fertilizers 3. Household via pipelines as cooking gas.
Labor	Not the deciding factor. Because skilled labour=mobile. and Hazira has township for them.
TRANSPORT	Hazira-Bijaipur-Jagdhishpur(HBJ) pipeline passes through Gujarat, Madhya Pradesh, Rajasthan, U.P., Delhi and Haryana= all big markets are connected through pipeline.

GAIL: Pipelines

	JAMNAGAR LONI LPG PIPELINE	• **VIZAG-SECUNDERABAD PIPELINE**
INPUT	• Reliance refinery Jamnagar • Essar refinery Vadinar • Imported LNG from Kandla port	• Vizag-HPC Refinery • Imports from Vishakhapatnam port
MARKET	• Ajmer & Jaipur in Rajasthan, • Gurgaon in Haryana, • Delhi • Loni-Gaziabad (U.P)	• Vijayawada • Secunderabad, Near Hyderabad
LENGTH	• 1300kms	• 600

Reliance KG Basin

Refining done @ Kakinada in Andhra Pradesh

Input	gas from offshore block in Krishna-Godawari Basin
Refining	Onshore Gas Terminal at Gadimoga, about 30 Km south of Kakinada in the state of Andhra Pradesh.
Transport	• East West Gas Pipeline (EWPL) transports gas from Kakinada, the landfall point of KG-D6 gas, to Bharuch (Gujarat) and traverses through Andhra Pradesh, Karnataka, Maharashtra and Gujarat. • From Bharuch, they use the pipeline network of Gujarat State Petronet to take the gas to end-consumers as well as connect to Hazira-Bijaipur-Jagdhishpur(HBJ) pipeline. • Through this entire Pipeline networking, gas reaches to fertilizer plants e.g. Tata Chemicals (Mumbai) and Rashtriya Chemicals & Fertilizers (Trombay), IFFCO's (Phulpur), GSFC(Vadodara), Kribhco etc.

Related issue: Gas pricing controversy. click me

Fertilizer Industry: Location

Urea/ Nitrogen Based industries are located near Natural gas source. **Why?**

- Natural Gas has Methane. (CH_4)

- You mix it with Oxygen, Nitrogen and heat in presence of catalysts=> the Hydrogen part combines with Nitrogen, thus you get Ammonia (NH_3). This is known as Haber process.
- This Ammonia (NH_3) can be used for making nitrogen based fertilizers e.g. Urea.
- Therefore availability (and price) of Natural Gas, affects the location of Fertilizer industry.
- Similarly Neptha (obtained from crude oil) is also used in production of nitrogen based fertilizers. Hence proximity to oil refinery is also considered a favourable factor.
- Thanks to oil and gas from Bombay High, the Gujarat-Maharahstra region got fertilizer plants at Hazira, Mumbai, Trombay, Vadodara etc. (Nowadays they also source gas from Reliance KG basin).
- Similarly, Hazira-Bijaipur-Jagdhishpur(HBJ) pipeline=> fertilizer industry in Bijapur, Sawai Madhopur, Shahjahanpur etc.

FERTILIZER	location
PHOSPHATE	Near raw material Rock Phosphate**USA:** Florida, North Carolina, Utah and Idaho. **India**: UP, MP, Rajasthan.
POTASH	Near raw material Potash.**Canada:** in the Prairie-Saskatchewan region. **India:** we don't have potash reserve. We rely on imports. India Potash ltd. settingup port @Bhavnagar, Gujarat.
GUANO	Guano=excreta/dung of seabirds. Large deposits at Peru-Chili coasts.Problem: Ocean temperature/acidification affecting plankton=>fishes=>seabirds: hence Guano production declined.

Petroleum Refineries: Location

- There are two stages: 1) production (drilling) 2) refining.
- For Petroleum refineries, the raw material sources were less decisive factors for industrial location. Because industries were already setup in coalfields and did not move away due to **industrial inertia.**
- Petroleum refining does not lead significant weightloss, unlike the aluminum/copper/sugarcane/timber processing.
- Virtually all the by-products can be used. Therefore, refineries can be set up

1. near the raw material or
2. near the market or
3. at an intermediate break of the bulk location (ports/coastal locations)

@raw material site: Disadvantages

NOT INFINITE	1. Refinery will become useless after oil is exhausted from oil well. So whatever millions of dollars you had invested in setting up that refinery=wasted.
WEIGHTLOSS	2. Oil refining close to production site represents a weightloss of 10-11 % only= not much cost saving in transport even if located near raw material site. 3. **Counter argument:** refined products have higher rate of evaporation, therefore it is better to set up the refinery near the source.
NATIONALIZATION	4. After 1970s, many of the Middle East and African countries started nationalizing their oil operations. The ownership of refineries/oilwells were transferred from MNCs to government owned PSUs. Hence nowadays, MNCs are reluctant to setup refineries in this region for the fear of nationalization.

Unrest/Instability as a location factor

Multinational companies do not feel confident to setup refineries inside the middle-east or South America because

1. During Arab-Israeli war, OPEC members stopped supplying oil to countries that had supported Israel.
2. There have been war/war-like situations due to Israel-Palestine conflicts, Iran-Iraq, Iraq-Kuwait. Such instability, destruction, aerial strikes=not good for business.
3. In South America, there have been frequent (and violent) changes in the regimes.

Examples of Refineries @Raw Material Site

- Assam: Digboi, Guwahati and Bongaiaon
- Gujarat: Koyali

Refineries @ port locations

- Middle-east/West Asia is a large producer of crude oil but there is little domestic demand because region is not industrially developed.
- Therefore, many petrochemical complexes are **located on the coast to facilitate export**. Examples

Saudi Arab	Ras Tanura
Kuwait	Mina-El-Ahmedi

- The development of large tankers and pipelines =bulk-transportation of petroleum possible.

- this provides favorable condition for locating refineries and petrochemical industries near the market and near the ports

Challenge: the latest vessels are so big in size, they cannot pass through Suez and other canals

USA	refineries on East Coast of USA: • get crude oil from Venezuela and West Asia • the transport the final products via pipelines and tankers to markets of Philadelphia, Chicago and great Lakes region • use of pipelines to transport oil first begin in Pennsylvania USA, before that, oil was transported via Railways in wooden barrels but was far too expensive and inefficient
EUROPE	refinery clusters are found near port locationse.g. Rotterdam and Thames: making it easier to transport the final products via pipelines, river-barges and railroads
JAPAN	Since Japan depends on imported oil, the refineries are setup @ coastal industrial regions e.g Honshu island.
INDIA	• Reliance refinery (Jamnagar, Gujarat) near sikka port. • other refineries near coastal areas: Trombay, Mangalore, Kochi, Chennai, Vishakhapatnam, Haldia

Reliance Jamnagar Refinery: Location Factors

@ village Motikhavdi, Taluka – Lalpur, District – Jamnagar, Gujarat.

FACTOR	impact
RAW MATERIAL	• Sikka all-weather Port. Proximity to the Gulf of Kutch, permits easy import from the Middle-East crude oil sources. • Reliance has setup a pipeline to directly transport crude oil from Sikka port to its Jamnagar refinery.
TECHNOLOGY	• The refinery has a capacity of processing ~600,000 barrels of crude oil per day • Even makes Aviation Turbine Fuel (ATF).
ENERGY	• Reliance has its own thermal power plants in this district.
LABOUR	• Refineries need skilled workers. And skilled workers=mobile. Hence labour is not the deciding factor for location. • Reliance has setup a self-contained township, for over 2,500 of the employees – with schools, hospitals, supermarket etc.
TRANSPORT	• District connected to National Highway 8 • State highways connect it to industrial regions in A'bad, Vadodara, Bharuch (helps its synthetic textile units in those districts). • Same Sikka port facilitates exports to more than 25 countries, including to the US and Europe.

Refineries @Market Location: Advantages

- You can use raw material (crude oil) supply from more than one oilfield of more than one country. So even if oil well is exhausted from country X, you can shift to country Y.
- After refining, the finished petroleum products can be supplied to interior areas pipeline connection and trucks/tankers.
-

EUROPE	• In Europe, manufacturing industries also consume a large portion of petroleum products therefore refineries are also located in major manufacturing centers, where petroleum products are demanded. e.g. Antwerp, Rotterdam and Southampton.
USA	• Refineries in Chicago, Philadelphia and New Jersey.
FORMER USSR	• After Second World War, Soviet government aimed for decentralized industrial development. • Because in WW2, they had suffered massive damages in bombings because industries were concentrated only at a few places near Ukraine and Moscow. • Therefore new refineries were constructed near the markets / consumption centers
INDIA	• Baruauni @Bihar • Mathura @UP • Panipat @Haryana

Challenges: environmental activism/laws/regulations fears of explosion, terrorism. Hence becoming difficult to setup refineries near market location.

Synthetic fibers

CELLULOSIC FIBERS	TRUE SYNTHETICS
• Rayon • from natural cellulose from wood pulp	• nylon, and polyester • they are produced chemically from coal or petroleum byproducts
Near pulp mills	near petrochemical refineries

Location factor

input	• The base material for most of the true synthetic fibers= benzene fraction of crude oil • Benzene= liquid, evaporates quickly, hazardous to transport. • Therefore synthetic fiber factories located near/inside petrochemical industry.
output	• Synthetic fibers =non-bulky, non-perishable =easily transported. • Therefore, synthetic fiber industry need not be setup near market location.

- Although, with the progress in transport-cargo facilities, nowadays synthetic fiber industry is not always in close proximity with petroleum industry. Example in USA- while Petroleum refining business is concentrated in Southern parts, you can find synthetic fiber industry scattered throughout the country.

India

- In the late 60s, Dhirubhai Ambani started Reliance for textile manufacture @ Naroda near Ahmedabad, Gujarat.
- But since polyester is made from petrochemicals, so he entered in Petrochemical business. But petrochemical is derived from Petroleum refining, so he moved into Petroleum refining as well.
- Finally Jamnager refinery @Gujarat. Thus he achieved complete vertical integration in the supply chain from crude oil to synthetic fibers (even garments via "only vimal" brand).
- Now Jamnagar refinery=> intermediate raw materials to Reliance's textile units @Dahej, Naroda, Vadodara in Gujarat.
- Similarly Oil discovery in Ankaleshwar-Sanand-Kalol led to growth of Synthetic textile industry in this region of Gujarat.

- **What are the Essential Factors that Influence the Location of Chemical industiries?**

- The chemical industry is considered as 'knowledge intensive high technology industry'. Therefore, conventional factors like raw material availability, cheap labour and market facilities are not enough fort development of this industry. The technological advancement and attainment of know-how is a requisite for this type of industrial development.
- 1. Raw materials: used for the manufacture of chemicals are bulky and weight losing. So, some ofthe plants develop within raw material source.
- 2. Power Supply: Abundant and regular good quality power supply is necessary for the manufacture of chemical products.
- 3. Capital: Chemical industry is the capital-intensive industry.
- 4. Land: Market and raw material sources exert pull on the location of chemical industry. Availability ofl land is also a significant factor, which sometimes influences the location.
- 5. Transport and Communication: Most of the raw materials used in chemical plants are bulky andI weight loosing. It is desirable to have a good transportation network.
- **Distribution of Chemical Industry**
- The major producing countries are United States, CIS, Germany, France, Italy, Britain, Belgium, Japan, India, China, Israel, Brazil, Australia, etc.
- **United States of America**
- Several reasons are responsible for the supremacy of US chemical industries. These are:
- 1. High degree of industrial development and stable economy.
- 2. The development of science and technology.
- 3. Abundant raw material reserve.
- 4. Steady demand of the products. Distribution
- The largest agglomeration of chemicai industries is visible, in the northern states of Pennsylvania, Ohio, Kentucky, Indiana, Tennessee, Alabama, Virginia, etc.

- Apart from these states, almost all other states have at least few chemicals producing units the Atlantic coastal tracts ranging from New York New Jersey. Maryland to the south-eastern state of Florida contributes more than 70 per cent of the chemical output.
- **CIS**
- i. Leading chemical producing centres are Ukraine, Volga, and Siberia. Urals, Armenia. Kazakhstan and Central Asia
- ii. The industries using coke and non-ferrous materials to produce nitrogen and potash fertilisers developed near Ukraine, West Siberia and Urals. The industries producing sulphuric acid were concentrated around Ukraine. Caucasia and Moscow-Gorky area
- iii. The largest concentration of heavy chemical industry, however, occurred near petroleum producing areas. This type of industry has developed near Volga, Ukraine, Caucasus, Baku and Ural regions. The larger plants are located around Chernigov, Shchokino, Sumgait, Balkovo, Nevinnamysk, etc.
- **Japan**
- i. Japan is inefficient in raw materials. More than 80 per cent of its factories are entirely dependent on imported raw materials. The only raw materials abundant in Japan in sulphur, deposited extensively by volcanic eruptions
- ii. Most of the chemical plants in Japan are located within the industrial agglomerations of 'Osaka- Kobe', Tokyo-Yokohoma, Nagoya, Hemagi and Kyushu.
- **United Kingdom**
- i. The chemical industry in Britain is widely diffused.
- ii. The leading producing centres are Lancashire, Glasgow, Manchester, Birmingham, Yorkshire, etc.
- Italy: Italy is now considered as a leading producer of both light and heavy chemical products.
- Germany: The major chemical industries are concentrated in Ruhr industrial agglomeration, Bavaria and Elbe area. Larger concentration occurs in Munich. Frankfurt, Strassfurt, etc
- France: The industry is well-developed in regions of Lorraine, Marsai, Bordo, etc.
- China: The major chemical-producing centres in China are located in its northern part. The urban centres of Nanking, Shanghai and Shantung contributes maximum of the chemical output. The other noted chemical factories are located at Manchuria, Fushun, Penki. Dairen and Anshan The largest of the Plants are located at Manchuria.
- India: India is now one of the leading manufacturers of chemical products. The urban centres .of Delhi, Kolkata, Chennai, Bangalore, Kanpur, Ahmedabad are leading producing centres.
- **Other Countries**
- In the present era, several other countries have developed their own chemical industry. They are:
- Spain, Belgium, Poland, Canada, Australia, etc most of these countries concentrated on the production of fertilisers, caustic soda, soda ash and different petro-chemical products.
- Germany
- (a) Ruhr-Westaphila Region
- i. Largest industrial region of Germany.
- ii. Essen and Dortmund - Important for iron and steel centre.
- iii. Wuppertal and Krefeld - Textiles making centre (b) The Middle Rhine Industrial Area
- iv. Frankfurt - Railway engineering centre with electrical, engineering, automobile and che" industries
- v. Mainz - Leather, brewing and engineering industries. Other Industries of Germany
- vi. Hamburg - Major port, with important shipbuilding and marine engineering works.
- vii. Munich - Manufactures beer, musical instrument, and photographic equipment.
- viii. Stuttgart - Known for automobiles, optical and surgical equipment, car components and water,
- ix. Hanover - Metal and chemicals industries.
- x. Aachen and Saarbrucken - Iron and steel, engineering and textile industries.
- xi. Leipzig - Famous for its optical instrument.
- xii. Jena - Photographic equipment.
- xiii. Karl Marx Stadt - One of the major textile centres of Germany.
- xiv. Dresden - China clay and porcelain.
- **Belgium**
- i. Liege - Iron and steel centre. .
- ii. Mons - Textiles and brewery industries.
- iii. Namur - Agricultural engineering.
- iv Antwerp - Known for its ancient specialisation in diamond cutting.
- **Poland**
- i. Lodz - Manchester of Poland

- ii. Other important industrial towns include Wroclaw, Czestochwa Bytom, Krakow, Warsaw Gdansk.
- **Netherlands**
- i. Rotterdam - Marine engineering, shipbuilding and oil refining are important.
- ii. Eindhoven - Electrical engineering and linen textiles.
- iii. Amsterdam - Centre for diamond cutting.
- iv. Arnhem - Important centre for tin smelting and rayon textiles.
- **Scandinavian Countries Sweden**
- i. Most industrialised country of Scandinavia.
- ii. Richest iron ore resources of Europe, Eskilstona - 'The Sheffield of Sweden', produces excellent cutlery and ornamental goods.
- **Norway**
- i. Odda and Ardal - Aluminium smelting plants are important.
- i. Stavanger - Port serving the North Sea oil and gas fields and fishing industry.
- iii. Mo-i-Rana - Iron and steel Industry.
- Denmark: Dairying and agricultural industries are important.
- iv. Copenhagen: Dairying and agricultural industries and also chemicals, textiles, fishing Vessels, beer, silverware, machinery, electrical equipment and diesel engines.
- **Switzerland**
- i. Watch making, engineering, chemicals and textiles.
- ii. Swiss plateau has the greatest concentration of industrial plants based on cheap H.E.P. from the Alps.
- iii. Zurich, Basel, Baden, St. Gallen, Jura Towns and Appenzell are important industrial towns.
- **Italy**
- i. Milan - Known as ' Manchester of Italy', having textiles (silk in particular) and engineering works.
- ii. Turin - Known as 'Detroit of Italy', having automobiles, rail coaches and aircraft industries.
- iii. Genoa - Shipbuilding and repairing industries.
- iv. Venice - Long established craft industries.
- v. Naples - The most important town with wine making and food processing.
- vi. Taranto, Bari, Naples - Iron and Steel and petrochemicals.
- vii. Catania- (Sicily) - iron and steel and petrochemicals.
- **North America**
- **The USA**
- World's leading industrial nations its main industrial regions may be divided into- (a) Southern New England
- Boston: One of the earliest industrial centres. It is known for shipbilding.
- **(b)** The Mid-Atlantic States
- i. Most densely populated part of the United States.
- ii. This region is known for Iron and steel, engineering, printing, electrical goods, we and consumer goods.
- iii. Important cities are Baltimore, New York, Philadelphia.
- **(c)** Pittsburg - Lake Erie Region
- i. Pittsburgh: 'iron and steel' capital of the world.
- ii. Akron: world's largest synthetic rubber and the making centre.
- iii. Cleveland: specialises in wearing approach.
- iv. Buffalo: Have chemicals, metal goods and flour mills. The Detroit Industrial Regions
- v. Detroit: Have greatest automobile manufacturing region of the USA The Lake Michigan Region
- vi. Chicago (Southern shores of Lake Michigan) - Known for iron and steel plants, me grain-milling, agricultural machinery and transport equipment.
- vii. Milwaukee (North on the Western shores of lake Michigan)
- viii. Gary: iron.and steel production. The Southern Appalachian Region
- ix. Birmingham: Cotton textiles, chemicals, metal works and machinery. Eastern Texas
- x. Fort Worth: Aircraft and aerospace industries.
- xi. Dallas: consumer goods industry, cotton textiles and fashion industries.
- xii. Houston: oil refineries, chemical plants, synthetic rubber factories, steel milling. Other Industrial Cities of the USA
- xiii. St. Louis: meat packing, flour-milling, footwear and agricultural machinery industries.
- xiv. Kansas City: Similar manufactures as St. Louis and aircraft and oil refining.
- xv. San Diego and Los Angeles: Oil refining, steel, aircraft engineering, food processing a making.
- xvi. Seattle: Lumbering, fish canning, aluminium smelting, aircraft and electrical engineering. Canada
- xvii. Main industrial region stretching from the Lake Peninsula to Montreal.
- xviii. Good accessibility, cheap HEP. And the investment of American Capital has encouraged growth.

- xix. Toronto: Engineering, automobiles, chemicals, textiles, saw-milling and pulping.
- xx. Hamilton: Also called 'Birmingham of Canada', it manufacturing iron and steel, cars, Poland agricultural machinery.
- xxi. Windsor: Automobiles and tyre-making industries.
- xxii. Sarnia: World's largest oil refineries.
- xxiii. Kingston: Locomotive manufacture.
- xxiv. Guleph: Electrical engineering units.
- xxv. Montreal: It is famous for ship-building, oil refining, railway engineering, chemicals, paper and pulp.
- xxvi. Quebec: Known for marine engineering and shipbuilding.
- xxvii. Ottawa: Saw milling, paper, pulp making industries and also food processing.
- xxviii. Winnipeg: Wheat milling, brewing, textiles, fur dressing and tanning.
- xxix. Edmonton: Local extraction of oil, natural gas, potash and coal are important.
- xxx. Vancouver: Centre for lumbering.
- **CIS**
- **(a)** The Moscow - Gorki Region: Oldest and the greatest of Soviet industrial regions.
- i. Moscow: Textiles, machines, chemicals and light industries.
- ii. Gorki, Tula: Have heavy engineering steel mills, railway equipments, automobiles, aircraft and food processing.
- iii. Ivanovo: Manchester of CIS.
- **(b)** The Ukraine Industrial Region
- i. Donetsk, Dnepropetrovsk, Krivoi Rog, Rostov are important industrial centres.
- ii. Iron and steel, machinery and chemicals as well as smelting are important.
- **(c)** The Urals Industrial Region
- i. Magnitogorsk, Perm, Chelabinsk, Nizhnytagil. And Sverdlovsk are important industrial centres.
- ii. Heavy engineering and metallurgical industries, chemicals, steel mills are important industries in the region.
- **(d)** The Kuzbas Region - Important coal region and also has thermal and HEP plants.
- i. Novosibirsk - HEP engineering units.
- ii. Novokuznetsk - Iron and Steel.
- iii. Barnaul - Textiles.

Mock Questions

1. Discuss the significance of the Forest rights act with special reference to Niyamgiri Bauxite Mining Issue.
2. Give an account for the petroleum refineries in India with factors responsible for their particular location
3. Examine the location and growth of fertilizer industry in India.
4. Discuss the location characteristics of Aluminum Industry in India.
5. Give a brief account of the copper smelting in India? What are the constrains faced by them.

Cotton and textile industry

- Cotton as a raw material=lightweight, non-perishable.
- Cotton to yarn/textile =hardly any weightloss.
- Therefore, proximity to raw material site=not essential, doesn't offer great cost-saving in transportation. (unlike sugar, cement or steel industry)
- Result=other factors become more important in industrial location viz.
    1. nearness to market
    2. nearness to waterbody (for dyeing, bleaching)
    3. Energy to run powerlooms and textile machines
    4. cheap labour supply
    5. availability of capital/finance

Climate

- In dry climate, the cotton-threads will break quickly during spinning. Machine halts, you've to join the threads again to restart operation=not good for mass production.
- on the other hand, humid climate= thread will rarely break. So, cotton textiles were setup near costal areas. (e.g. Mumbai, Osaka, Lancashire).
- Today we've humidifiers that can artificially increase the air-moisture in factory/workshed= you can setup factory anywhere, run it efficiently, irrespective of climate outside.

Anyways, let's examine from *desi-videsi* cotton industries

	Mumbai	Osaka, Japan

nickname	Cottonopolis of India	Manchester of Japan
Raw material	• black soil of Maharashtra good for cotton (short, medium staple) • port location= easy to import long-staple cotton from Egypt, foreign textile machinery.	• Black lava soil=good for cotton cultivation but not sufficient to meet the demand. • Osaka=port location, majority of production done with imported cotton from India, Egypt etc.
Climate	Location near sea=humid climate = threads don't break	
Power	• from Tata hydroelectric grid in Western ghat	Hydel power station near Osaka
Transport	Mumbai=well connected via rail, road, airways, seaways.	Osaka=Sea port + important railway junction.
Water	Mithi river=Soft water for dyeing, bleaching.	Yodo river
Capital	• During American Civil War capitalists of Mumbai earned big profit by exporting cotton. This money was used to establish textile mills. • Today, Mumbai has good facilities for banking-finance.	Available from both government and private sector.
Labour	Cheap, Abundant, skilled	• Skilled, but not abundant. • High production using latest machines and automation technology.
Market	Mumbai and India=large population =vast market	Local market + export by sea to Australia, US. + Japan also uses petro-refinery byproducts for mfg. **synthetic**fibers.

let's look @some more cotton mills

factor	Ahmedabad	Coimbatore
Raw material	Available from nearby districts.	same + cotton variety known as "Cambodia cotton" is grown.
Energy	Thermal power plant near Sabarmati	Pykara Hydel project
Water for dyeing, cleaning, bleaching	Sabarmati, Khari river	Noyyal river
Market	• Large market in Gujarat and neighboring states • proximity to Mumbai port=yarn also exported to Japan	Large demand in Southern States+ Chennai port for export

Although in the 80s, most of the Ahmedabad mills fell sick and closed down. Industry shifted towards Surat-Khambhat region of Gujarat.

Manchester & Lancashire industry

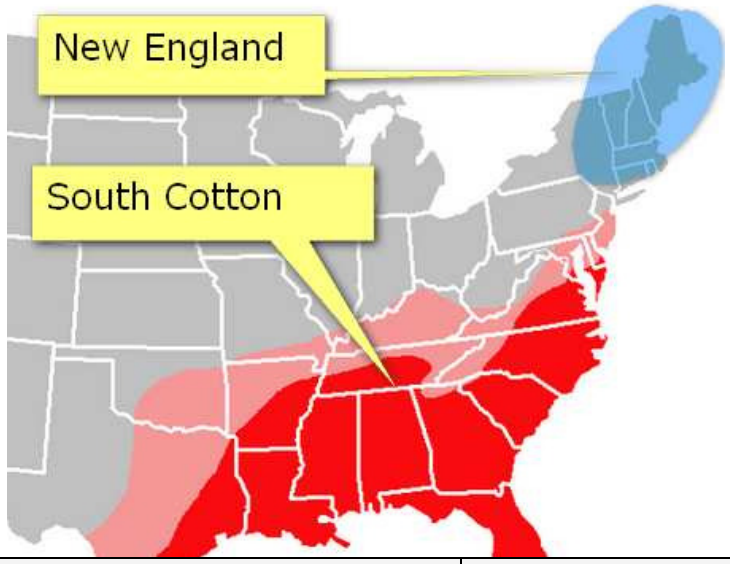
The rise of Cotton Industry in Britain	
Climate	moist Westerlies =humidity=threads don't break
Raw Material	Cheap Cotton from its colonies (India, Egypt).
Transport	• Liverpool port • Later Manchester Ship Canal was developed to turn Manchester itself into a port.
Water	Streams from Pennine hills=soft water for dying bleaching.
Energy	• In the initial phase of Industrial revolution, same water was used as source of energy for running Arkwright's spinning machine. • later, coal utilized from Northern England and Wales
Labor	By 1600 production of a fabric called "fustian" started in England. Fustian makers settled in this region because humidity helps in cotton spinning.
Market	Demand in Europe + Lancashire faces American ports.

The decline

- After WW2, Britain lost its colonies one by one, dirt cheap cotton=no longer available.
- during 20th century cheaper imports from Hong Kong, Japan and other parts of Asia. Even the former colonies of Britain also started using those cheaper clothes, so Lancashire=no longer receiving large orders.
- Business moving towards coastal areas for better opportunities in shipbuilding, marine engineering, soap, heavy chemicals industries.
- Hence, Textile industry fading away, old factories are refitted for production of light-engineering items. (Reason? = industrial inertia, we will see that in Iron-steel industry article later on.).

American cotton industries

Two important regions



New England region	Cotton belt in south
6 States located in the North East corner of US	North Carolina, South Carolina ,Georgia, Alabama, Mississippi. Include parts of Texas and California.
Proximity to Boston and New York= ports and domestic market.	large cotton growing areas: US cotton belt is 1200+kms broad and 4000+kms wide.
• immigrant workers	• slave labor during colonial era helped in growth. • Today farming is mechanized=lack of labor doesn't create much problem.
• coal from Appalachian region	• hydroelectric power along major rivers (e.g. Tennessee)
• The New England factories little room for expansion due	• Vast land provides more room for

to mountains. • Today New England industry is concerned mainly with high-end specialized fashion products for New York etc. While Southern Mills produce garments for masses.	expansion. (and use easy use of large machineries on farmland) • Southern state also had pulp mills for production of rayon= growth of both cotton+synthetic industry.

Chinese textile industry: Shanghai

Observe the map and think about the factors that are helping Shanghai

Factor	How does it help?
Climate	port city=humid=threads don't break
Raw Material	Yangtze-kiang delta=good for cotton cultivation
Transport	• Shanghai itself a port city • good railroad connectivity with hinterland. • Yangtze river =inland water transport.
Water+ Energy	Yangtze river
Labor	of course available
Market	1. Kobe, Taiwan, S.Korea, Hong Kong : all located within 1000 nautical miles 2. market within china: Nantong, Wuhan, Chongquing etc. connected via Yangtze river.

Apart from Shanghai, Cotton also produced in the areas around Hwang-Ho valley, Sichuan, Nanjing, Beijing and thanks to labor availability (and domestic demand), textile industry is found in those places as well.

Wool

Let's examine *videsi* (foreign) wool business first. Majority of wool production comes from southern hemisphere: Australia, NZ, Argentina and South Africa. So, first question, why does Southern Hemisphere lead in Wool production?

Climate factor

- Damper, cooler condition in the temperate areas of the Northern Hemisphere=not so good for wool production.
- Dry warmer climates of Southern hemisphere= provide better conditions for wool production. e.g. Interior Australia, South Africa and the rain shadow area of Pantagonia in Argentina

Land size

- Australia, dry continent= large-scale agriculture is not possible anyways.
- sheep can survive in bad climatic conditions
- Therefore, sheep rearing provides the best economic use of the land for the farmers.

Economies of Scale

- Economies of scale = if you do something on large scale, then unit cost of production will decrease.
- In Australia, Sheep rearing is done on a large scale = economies of scale = lower cost of production.
- This enables wool producers from southern hemisphere to compete with Indian, European or North American producers despite the added cost of transporting wool from South to North hemisphere.

So far so good: Australia leads in wool production. But Australia doesn't lead in finished woolen textiles (e.g. sweaters, mufflers, coats, socks etc.) why?

1. For woolen textile, the Customers/target audience= colder northern countries. Australia's own local market is small.
2. Woolen textile business require skilled workers. In Australia, low-population =wage rates higher.

Therefore, Australia leads in wool production but not in textile.

Woolen Mfg: Rise and Decline of Britain

During Industrial revolution phase, Yorkshire of Britain= major woolen Manufacturing region because

1. local supply of wool
2. Water from nearby streams for washing and dyeing processes.
3. Coal available to run machines.

- But later, large-scale sheep rearing started in the southern continents: Australia, New Zealand and South Africa and Argentina.
- Pricewise, the British could not in wool production= sheep rearing activity declined. Today sheep are raised mainly for meat industry.
- Woolen cloths also face competition from cheaper synthetic fibers.
- Thus, Yorkshire Woolen textile industry still continues to operate using imported wool from Southern hemisphere, to meet the European demand but the former glory is gone. (just like of Manchester in Cotton-textile biz)

Now let's come back to India

India: Wool business

Factor	Why?
Nature of raw material	• Wool as raw material =non-perishable, lightweight. • **for Apparels** : Indian wool = coarse fibers=irritates body. If you want to make decent apparels, you've import Australian wool anyways. (exception Kashmiri Shawls) • **For non-apparels**: Even to produce decent Carpets, blankets, you've to mix it with New Zealand's wool. • Hence location of woolen textile not tied to raw material site.
Market	• Winter in North India=brutally cold =good demand. • ~75% of industries concentrated in Northern States because of market factor. • Parallel to wool-market factor, you can see that Cotton textile industry is profound in southern half of India because warm-humid climate=more demand for Cotton garments than woolen.

India: woolen textile regions

Near Raw Material	1. Srinagar: Kashmiri Shawl using Kashmiri goats. 2. Punjab: raw material from Ludhiana, Dhariwal, Amritsar 3. Jamnagar: raw material Kathiawar (and parts of Rajsthan) 4. Rajasthan: Bikaner, Barmer
Near Market	• Kanpur: In 1870s, Kanpur became major center of woolen textile to meet the requirements of British India Army. • Mumbai, Chennai= they mostly utilize imported wool for making apparels.

enough of wool, let's move to silk

Silk Industry

Europe: Labor no, Market yes

- One important requirement for sericulture = cheap female labour.
- In the ancient-medieval times, both China and Japan had lot of poor peasants. Silk production=source of side-income for them.
- Later, sericulture was even introduced in Europe (France, Italy).
- But, French and Italian peasants were used to higher standard of living, they were unwilling to undertake such painstaking work for little reward.
- France- in the mid 1800s, a disease wiped out most of silkworms, sericulture industry could never recover. Thus, France has no local production of silk, yet **Lyon** city is famous for its silk garments. Why?

Labour	• Lyon city of France= important fashion center= skilled labor, fashion designers available.
Raw Material	• Silk= easy to transport, non-perishable, non-bulky. Can be easily imported from China.
Market	• Natural silk is considered a luxury item and fashion statement among rich in US, Europe. Good demand of silk ties, scarves and lingerie.

America

Sericulture was even introduced in America but failed because lack of labor and better opportunities in other crops. Example

1. **Virginia**: sericulture was tried but, farmers found better income in Tobacco.
2. **Georgia**: farmers tried sericulture but found better returns in cotton- even for using cheap Slave labour (recall the Georgia falls in the "Southern cotton belt")

Japan: No labour + No market=#EPICFAIL

For long, Japan was a major producer of silk, but today it doesn't even produce 0.5% silk in world. So, What factors caused decline of Silk industry in Japan?

Factor	how did it lead to decline?
Labour	younger generation of peasant /weavers shifted to industrial sector for higher wages.
Capital	Investors found better returns in automobile and electronics industry= lack of investment in silk industry.
Market	• Japanese Women shifted from traditional garment "Kimono" to western jeans and skirts=local demand of silk declined. • Today Kimonos mainly worn for ceremonial/festival purpose- that small demand is met by cheap chinese silk. • After WW1, Silk was in high demand for women's stockings in USA but later cheaper stockings were locally produced using American nylon=market lost.
Entrepreneurship	• One dramatic example is Koromo town of Japan. Their silk industry was on decline= land and labour available @cheap price. Toyota took the opportunity to setup factory. Thus a rural silk growing area turned into a major automobile industry.

Today, only two big players in Silk-production: China and India. Quoting the numbers from Central silk board, India:

nation	share in world Silk production% (2011)
China	~80%
India	~18%
Jap, Brazil, Thailand, Vietnam	each has 0.5% or less

China: Why Top Silk producer?

Climate	• Temperate and tropical climate suitable for growth of unvoltine, bivolting and polyvoltine silk varieties. • Lower Yangtze valley=finest white mulberry silk. This is near to Shanghai and locational advantages of Shanghai already mentioned under cotton textile biz.
Technology	Chinese scientists developed hybrid varieties using Japanese and European silkworms. It is possible to rear silkworms seven times a year.
Labour	China was the first country to start sericulture =labour is abundant and skilled. For additional income, they combine Sericulture with fish rearing in the Pearl-River valley=Mulberry leaves fed to Silkworm and dead silkworms fed to Fishes.
Government Policy	• Sericulture done via cooperatives (Silk Communes) =more efficient and standard production compared to individual farmer. • Government provides extension service, training etc. • In the 90s, Chinese government upgraded silk machinery with imported parts=improved quality of silk yarn

India: Labour+market

- India grows all important varieties of silk: Mulberry, Tasar, Oak Tasar, Eri and Muga
- But demand >greater than> production. So even we have to import from china. (particularly bivoltine mulberry silk)

Mulberry silk	Non-Mulberry
mainly in Southern states 1. Karnataka 2. TN 3. AP + WB and JK	1. Jharkhand 2. Chhattisgarh 3. Odisha 4. NE

India: Why 2nd Largest Silk producer?

Raw Material	Mulberry plants • can be grown in any type of soil even in forest fringes, hill slopes • can withstand draught =works well in non-green revolution, non-irrigated areas of East and NE India.
Labor	Sericulture does not involve hard labor.Silkworms can be reared by women and old people=sideincome. In Eastern States, Farmers earlier used to grow Jute but Jute demand declined so they shifted to Sericulture.
Capital	works on simple technology, no sophisticated equipment neededcan be done by small and marginal farmers, tribals.

Karnataka: factors

factor	how does it help?
Raw material	Mulberry grows easily due to climateBombax variety of silk worm can be reared throughout the year Karnataka uses hybrids of silkworm= can harvest five to six times a year.
Water	Soft water, Free from iron and alkaline salts.
Labour	1. Men : mulberry plantation 2. Women: rearing silk warms
Capital	During WW2, entire production of Mysore silk was used for parachute manufacture. Hence silk prices escalated, good profit, more area brought under cultivation.(Recall how American War of Independence helped in expansion of Mumbai textile industry)
Technology	• Central Silk board located @Banglore • Technical knowledge sharing by Japan Japanese International Cooperation Agency (JICA)

Kanchipuram: factors

factor	how does it help?
Raw material	Raw silk from KarnatakaZari threads from Surat, Gujarat (raw silk=lightweight, non-perishable)
Water	Softwater from River Vegavathi.
Labour	generations of silk weavers=skilled
Market	Still good demand for Silk Saris in India.

moving to the next natural fiber

Jute Industry

Jute industry is a too clichéd 90s topic as far as UPSC is concerned but for the sake of completion:

Why did Jute Industry grow in West Bengal?

Raw material	90% of Jute is cultivated in the Kolkata hinterland. Jute is the only crop that can withstand flooding of this region.
Energy	Raniganj and Jharia coalmines
Water	Jute processing require large quantity of water for washing, bleaching, retting. Hubly river helps.
Labour	Jute-processing = labour intensive. Cheap labour available from Bihar, Odisha, W.Bengal.
Capital	Kolkata had good banking-finance facilities because initially it was the capital of British India. Hence Jute mills flourished

Challenges

1. Wage rates need to be linked with productivity, new sophisticated machinery needed, but labour unions resistant = businessmen not doing new investment.
2. After partition, mills remained in India, jute producing areas went to East Pakistan (Banglades). So Bangladeshis are now using more modern machineries than while we're still using outdated technology. (Because businessmen not doing new investment). Hence Bangladeshi jute products are better and cheaper than ours in International market.
3. Competition from synthetic packaging material.
4. Lack of marketing strategy to promote Indian jute as eco-friendly, biodegradable packing material among environmentally conscious customers in US and Europe.

Flax

Just passing reference:

- From flax crop=>linen is made. Linen used for table cloths etc.
- Flax processing also involves "retting" similar to Jute=>needs cheap labor and proximity to water bodies.
- Done in poorer parts of Europe e.g. Poland, Romania, Czechoslovakia etc.

What about synthetic fibers (Nylone, Polyester etc)=> we'll see that in another article later on. For the curious souls: synthetic fibers=>near to raw material (refineries)

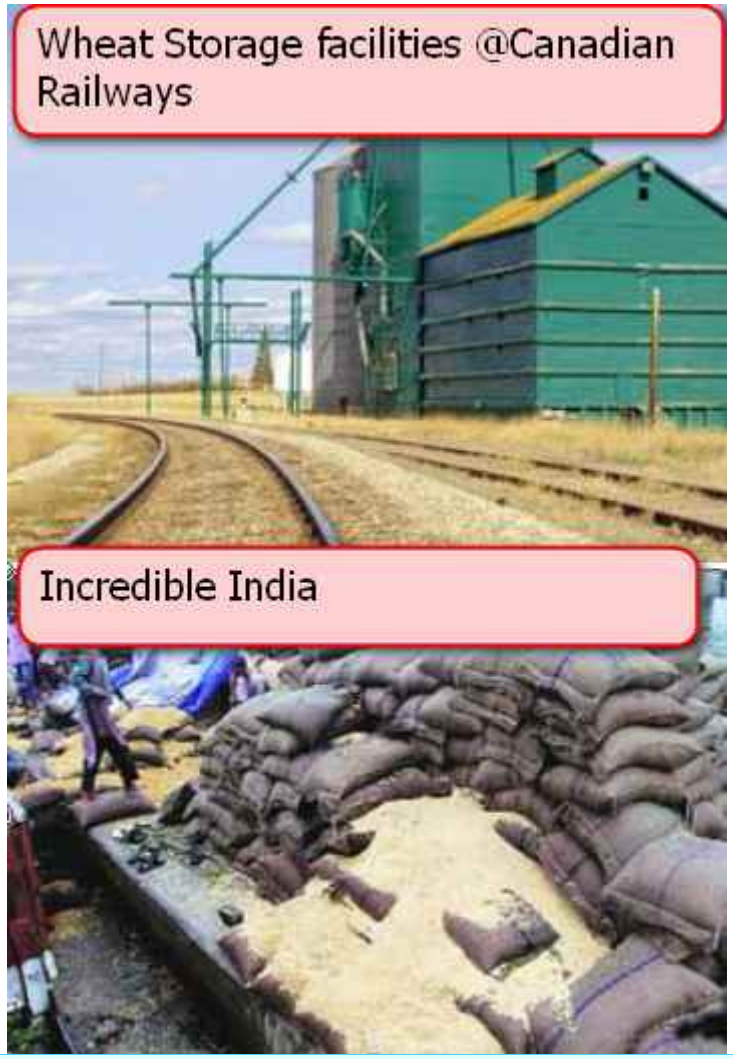
Mock Questions

12 marks each

1. Japan barely grows any fibers except silk, yet has a thriving textile industry. Explain
2. Although Southern hemisphere dominates wool production but woolen textile industries are concentrated in Northern Hemisphere. Explain
3. Why is Sheep rearing carried out on a large and profitable scale in Southern Hemisphere?
4. Examine the geographical basis of development of cotton textile industries in monsoon Asia.
5. Describe and account for the shifts in the textile industries of the world.
6. Location of Cotton textile industry depends on multiple factors.
7. Factors responsible for turning Mumbai into the Cottonopolies of India
8. Factors that have contributed to development of woolen industry in Jammu and Kashmir.

Wheat: Prairies, Canada

Factor	Impact
Soil	• The prairies = temperate grasslands. centuries of grass rotting has produced fertile soil • high phosphorus content= good for wheat • topography suitable for wheat cultivation because wheat cannot tolerate stagnant water • Flat terrain= machines can be employed @every production stage (=useful because population is scarce=laborers hard to find, and expensive to hire, unlike Asia).
Land Holding	• in the early days of colonization, land was abundant in the Canadian prairies • European settlers seized opportunity, bought large farm holdings @throwaway prices=> farms have area of several thousand acres. • Since farm is large=mechanization possible= don't need many farm-workers.
labour	• Canada =less population density =hard to find cheap labour, but since farm holdings are large and on flat terrain=most of the work is mechanized.
Transport	• Railroad connectivity via Canadian Pacific Railway • Many branch lines are constructed to connect even the remotest farm regions with the mainline = easy to send your produce to market. • most of the wheat moves by rail through Rocky Mountains to Vancouver /Prince Rupert for export
Storage	• Grain elevator storage facilities along the railway lines: here wheat is cleaned, graded, processed and stored. • storage complexes and milling operation @bulk of the bulk location, where Railways intersect major waterways
Government Policy	• Canadian wheat board, a statutory body= sole purchaser and seller of foodgrains for export. • The board coordinates movement of wheat to major terminals. • Farmers are given schedules to send their wheat to nearby railway station. • This system minimizes price fluctuations/distribution inefficiencies • + provides quality control for exported wheat.



Rice: China

Much of the rice is grown in South of Yangtze River:

Climate	mild temperature, good rainfall= can grow two crops on the same farm in a year
Soil	Suitable for rice cultivation + as we saw earlier in the silk article, the waste from sericulture is used as fertilizer.
Water	good rainfall + irrigation from Yangtze and numerous other rivers and streams
Labor	Obvious
Technology	with government help, farmers now • use diesel operated special tractors to plough rice field • Mechanical rice planters to plant the rice seedlings. • high yielding seed varieties
Transport	Yangtze river=inland transport, connects many important markets/cities.+good railway network.

Government policy

Let's examine the factors why China is leading producer of Rice? (Other than soil, climate)

1. When Mao assumed control of the nation, he emphasized more on food crops rather than cash crops. (Because famine was a problem in China)
2. Agriculture collective system was established

tier		size (Approx.)	Function
I.	commune	3000 households	supervision and coordination of tiers below it
II.	brigade	300 households	Leasing land to "team", soil conservation, Road construction, small scale plants, reforestation and other local Administrative functions.

III.	team	30 households	Producing crop as per the 'quota' given to them.

Later more reforms were taken viz.

1. Work points/cash: farmers were given these rewards for producing more than the quota given to them.
2. **"Responsibility system"**: farmers leased land directly from collectives, if they produced more than "quota", they could use/sell the surplus on their own.
3. Loans directly made to farmers (instead of brigade/teams). Private ownership of agro-machinery allowed.

vs. India

1. China has more area under irrigation
2. China grows food crops grown on its best lands. India grows cash crops (Cotton, sugarcane, Jute) on its best lands.

Dairy Biz

Near Market area

- Fresh (Liquid) milk=bulky, perishable=>dairying should be done near market. e.g. those *DUDH-wallas* in most Indian cities
- If the cattle to be raised for milk alone, then you don't need large area.
- Hence dairy farmers can risk to buy/rent their farms on expensive land near towns. Because demand of milk products is high in urban areas. (same reason for vegetable growing, truck farming)
- Pig rearing and poultry farming requires little land, products perishable and in high demand =located near market area.

Away from Market area

- New Zealand, Switzerland, Holland, Denmark: their domestic population is low, so they've to export surplus milk/milk product to foreign market.
- They convert raw material (fresh liquid milk) into more 'concentrated' form (Cheese/butter/powdered milk). It gives two benefits:

1. Product Shelf life is extended. (butter/cheese doesn't deteriorate quickly like liquid milk)
2. New product has higher value per unit of weight=>it can withstand the greater transport cost to the faraway markets.

- When milk is turned into butter, the byproduct is skimmed milk= excellent feed for pigs
- Therefore the **dairy farming regions are also famous for pigs, pork, and bacon.**

Dairy: New Zealand

Auckland and Taranaki areas famous.

Factor	Impact
Climate	• cold and humid climate+ low undulating plains= luxuriant, perennial growth of nutritious grass. • possible to graze the animals throughout the year =low cost of "fodder"
Labour	• Dairy farming carried on for generations = skilled.
Tech.	• Scientific breeding of animals, vaccination, disease control • infrastructure for refrigeration, transport of milk products
Government Policy	• Government exercises strict quality control over export of milk and meat products= New Zealand's dairy-products commend respect and good prices in international market.
Transport	• Geographically, New Zealand is located far away from the market of milk products. • Liquid milk is converted into such as butter, cheese and powdered milk meaning 1. Longer shelf life, can withstand long sea journey. 2. Higher value per unit product (compare to liquid milk) can withstand transport cost.

Dairy: Europe

Switzerland	• Alpine areas with natural grassland =good for grazing. • Swiz. also uses imported cocoa + local milk=>export quality premium chocolate. • has MNC level dairy-choco companies like Nestle.

Denmark, Holland, Netherlands also famous for dairy products. by and large the factors are

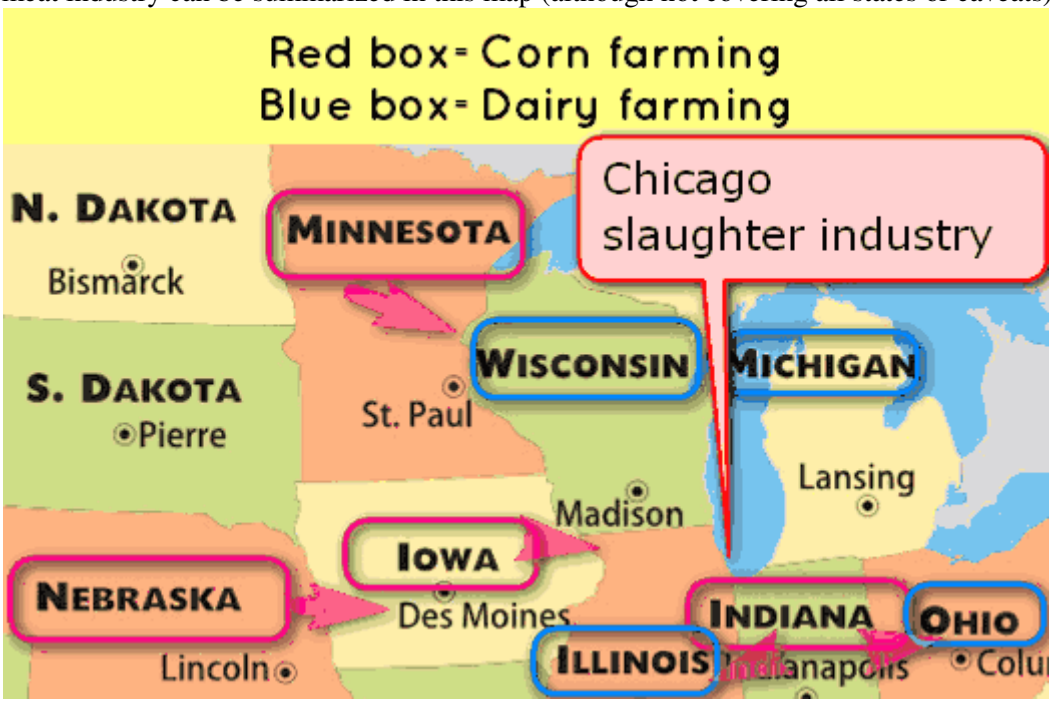
1. ample grassland for grazing
2. traditional skill
3. scientific breeding
4. Again same "concentration" principle: milk turned into cheese, butter, chocolate etc. for sending to other countries.

Dairy: Africa: Why non-existent

Factor	impact
Climate	• The best milk producing cattle breed belong to the temperate regions (Holand, Netherlands etc) They don't have resistance to certain tropical diseases. Even if they're exported, they'll not survive long in African climate.
Raw Material	• In the African grasslands, the grass = thick, rough and tall but lacks in nutrients. Therefore even with cattle-population, high milk yield not possible • In some years, African locust swarm eats all the green vegetation= no pasture /grass left for cattle.
Labour	• in Africa, Those who own cattle, follow are nomadic lifestyle. e.g. Massai, lack the education/training for raising cattle scientifically. • lack of veterinary services,
Transport	• Lack of transport services + many nations have ethnic conflicts with each other, many areas under rebel control= smooth movement between countries =not possible. • While New Zealand can easily export its animal products to European/American market, and a landlocked African country cannot. (Except via air-transport but then product prices cannot compete due to high transport cost)
Market	• Domestic demand for milk products (Because people don't have money). so product has to "concentrated" into butter/cheese and export but it can't compete with New Zealand/Denmark in US/EU market due to the "transport" factor.

Dairy: USA

US corn/dairy/meat industry can be summarized in this map (although not covering all states or caveats):



1. red box states=grow corn on mass scale, sell it to blue box states
2. blue box states use corn feed to fatten pigs and cattle
3. finally they're slaughtered in Chicago

The dairy farming in North America spreads from Lawrence Valley, upstate New York, Ontario, Michigan, Wisconsin, Minnesota, Pennsylvania and Ohio. Covers an area of 2000 miles

Factor	impact
Climate	Severe winter region. Agro difficult, but cattle can be raised indoor.
Soil	• due of earlier glacial depositions, this land is very stony and has steep slopes= not good for agro. • Hence they raise cattle + buy cheap corn feed from other states =most economic use of land for the farmer.
Labour	• Cattle-rearing=lot of labour required but they use automated feeding, cleaning and watering apparatus.

	• Thus labour shortage= fixed with the help of elaborated buildings, expensive machinery, and large capital investment.
capital	• USA =rich country, living std. higher=demand of milk product = high, hence dairy industry well developed, banking finance available.
Transport	Truck based refrigerated collection-distribution network, owned by farmer cooperatives.

Regional specialization: ice cream/cheese/butter

Milk=> ice cream: doesn't lead to significant weight loss. On the other hand,

final product	amt. of fresh liquid milk necessary
1 pound cheese	10 pounds of milk
1 pound butter	20 pounds of milk

Therefore, in US, as we move away from the market (highly urbanized area such as NY/LA): the dairy specialization is found in this order: ice cream>cheese>butter. Because farther place can only compete in market if they 'concentrate' their produce to decrease weight and increase value.

place	distance from urban market (Los Angeles)	specialization
California	nearest	ice cream
Minnesota	farthest	butter

US corn & livestock belt

- It extends nearly thousand miles from Central Ohio to Illinois, Indiana, Iowa, Minnesota and eastern Nebraska.
- In the heart of US Corn Belt, most of the revenue is earned from beef and pigs. Some large-scale operation have more than one lakh cattle at a time.
- Therefore some observers label the corn belt as *"feed grain and livestock region"*

American farmers prefer to grow corn because of two reasons

1. corn gives high yield per acre compared to wheat
2. It is effective for fattening animals.

We already saw that location away from market:= product is 'concentrated' to compensate for transport cost. Same happens here.

Corn=>fed to cattle/pigs/poultry=>meat exported.

Corn Belt

factor	effect
soil, climate	chernozem soil= good for corn. Soil-climate suitable
labour	• only small labour force needed because planting+harvesting =highly mechanised • once seeds are planted, no labour needs arise other than spraying pesticides for weed control and fertilization but that too is done with help of aero planes because farm holdings are so large. • for harvesting, outside contractors with crew and machines are hired. • This has led to new type of farmers known as **suitcase farmers**: they live more than 30 miles away from their farm, in large urban cities.
market	• Most of the corn produced=used for fattening animals=> animals sent to slaughterhouses in Chicago and Omaha. • Railroad transport well developed.
government policy	• Federal Government spends billions of dollars per year in subsidy to corn farmers.

These farmers also grow soya bean, because

1. Soyabean =high amt. of protein=good for fattening animals
2. Soyabean = hundreds of industrial and commercial uses from plastic, cosmetic and candy

Meat industry: USA

Chicago=known for its beef industry.

Often, Animal is reared in three different regions during its lifetime

Observe the following map:

stage	Where?	location from market(Chicago slaughter houses)
1. **breeding**	ranches in Wyoming, Colorado	farthest
2. **initial growth**	Nebraska, Missouri	medium
3. **fattening**	• Iowa or Illinois (corn belt) • final 90 day fattening program before slaughter	nearest

So, why this peculiar distribution/pattern?

place	factor	impact
1. **Wyoming, Colorado**	not good for agro because of its soil, topography and climate	Ranching is the most economic use of land for the farmer. (recall the wool article, why Australians rear sheep)
2. **Nebraska, Missouri**	part of US corn belt	corn=cheap and used for fattening animal before slaughter.+use of genetic engineering, veterinary science to make the animal gained weight faster
3. **Chicago**	port city, urban area, railroad infra.	finds market all the way to New York, Canada Europe.

Similar pattern is found in Western Europe where sheep are bred on rough pastures upland then transferred to lowland farms for fattening before being slaughtered near cities.

Shifting locations of US Meat business

- from the map, we've seen that in beef industry, raw material moves from West (Colorado ranches) towards East (Chicago's slaughterhouses)
- But now, the slaughtering business is moved westwards, towards the farms in corn belt. Why?

Factor	impact
1. **Weight Loss**	1. When Bones, skins etc removed=weightloss upto 25%. 2. less weight=less transport cost
2. **Transport**	3. live cattle is much more difficult and bulky to transport 4. Today refrigerated transport facilities more developed. There is no need to transport a live animal all the way to Chicago.
3. **Quality**	5. Nearest to cattle-farm= uniformity of the finished product=better prices (Because specific breed of cattle available)

Pig rearing

Done both near market and away from market. Reasons are following:

1. Pigs can live in variety of climates from monsoon Asia to temperate regions of Northern and Southern continents.
2. Can survive on anything: kitchen and farm waste, roots, leaves and rice bran
3. Can be kept indoors or outdoors. Don't need large grazing area.
4. They breed easily and multiply rapidly [compared to sheep/buffalos etc.]

5. They mature quickly for slaughtering.

Pig rearing: Near market

Example: Pigs reared near and inside every city of China. Why?

Raw material	Near city areas, pasture land is scare.But pigs can be kept indoor, don't need large grazing area and can be fed anything.
Demand	There is no religious restrictions on pork eating= Chinese cities have large demand.

Pig rearing: away from Market

- **Example**: New Zealand, Denmark, corn/dairy belt of US are also leading producer of pork/bacon. Why?
- Piggery is an important activity in almost all countries where dairy farming is developed because the skimmed milk is available as pig feed.
- When milk==>butter + skimmed milk.
- Pigs can survive on skimmed milk.
- In Corn belt of USA, on abundant fodder supplies, cereal and soya bean. Pigs are raised here and sent to slaughter houses of Chicago.

Poultry: India

away from market	Chicken reared in village because eggs=cheap source of protein for poor families. Example WB, Assam, Odisha….Almost everywhere.
near market	Poultry farms exist near almost every big city: Mumbai, Kolkata, Delhi etc. to meet the urban demand (+ eggs being a fragile product and meat being a perishable product)

let's look @USA , they're leading country in chicken production, yet most their poultry farming is done far away from cities/market areas. Why?

Factor: bogus agro-land

The Poultry industry can work in remote areas better than animal farming activities because it takes less feed to produce one pound of meat.

1 pound of ___ meat	Pounds of ___ cornfeed required
chicken	2
pig	4
cattle	8-10

- Poultry farmers can take advantage of cheaper, rougher and more isolated land, because soil quality =irrelevant for rearing chicken/turkey.
- Therefore large scale poultry farming done in the less fertile, less irrigated areas of Arkansas, Virginia etc.

Factor: Contract farming

- USA = booming fast-food industry (KFC, McDonalds etc)= high demand for broiler chicken throughout the year= has led to contract farming.
- Major food corporates lineup the farmers and sign contracts. They provide standard equipment, feeding material to farmers (so that final meat product is 'uniform' in taste and softness).
- Economies of scale =lower production cost= offsets the high transportation costs in running poultry business away from urban areas.
- Hence commercial poultry is done away from the urban market areas.

Vegetables

Fresh vegetables are widely grown near major markets because

1. Product=perishable.
2. Urban Consumer want it fresh and has the purchasing power.
3. high value product= veggie/fruit farmer can risk to buy/rent the more expensive land near city areas (compared to a wheat/corn farmer)

Exception: Apples, Oranges, Mangoes etc. they need particular climate, they can't be grown everywhere.

California: veggies and fruits

California=leading producer fruits, veggies and nuts, viz

1. Asparagus, cauliflower, broccoli, spinach etc.
2. orange, lemon, melon, grapes, peaches
3. fig, dates, wallnuts, almond, pistachios

so, Why is California a leading producer?

Factor	impact
Climate	Mediterranean type = suitable for the fruits/nuts
Water	• Dams on Sacramento River and feather River • Contra Costa Canal for irrigation • Efficient system of user-fees for getting water in farms
Labour	• Weeding, harvesting in veggi/fruit =require a sizeable labor force. • Mechanization= not *that* easy like in Corn/cotton. • But problem solved with the help of illegal/less-educated Mexican immigrant workers.
Transport	• Since product =perishable=has to be transported via truck quickly to market. • California has good roads/highways=trucks cover a greater distance in the given time= area under **truck farming** is higher than in India or elsewhere.
Market	• Los Angeles=Hollywood + Silicon Valley. • Lot of people in service sector=Standard of living is high= junta diet conscious=good demand for fresh veggies/fruits. • Farmers have turned into agri-business manager: marketing and distribution in corporate level efficiency. • Costal location =processed/frozen products can be exported to Singapore, Hongkong, Japan etc. where std. of living high=demand

Curious case of oranges

Orange are grown in both California and Florida, But

state	What is done to oranges?
California	most of them sold fresh as 'fruits'
Florida	Most of them turned into concentrated juice.

Recall the dairy sector: area faraway from market=high transport cost=product has to be 'concentrated' to increase its value and shelf-life. In case of oranges

Cali	itself has a big domestic market due to Silicon Valley and urbanized, service sector oriented economy=higher std. of living=junta consumes more fruits.
Florida	Florida is far away from the urban posh people of NY, LA or Europe.Florida is surrounded by *'backward'* states like Georgia and Alabama. Hence local/regional demand=not that high=> product must be concentrated (fruit to concentrated-preserved juice) before sending to faraway market.

Fruit for thought: Analyze the situation for Himachal Apples, Nagpur Oranges and Andhra Mangoes.

Von Thunen Agro land use model

- farmers near cities grow vegetables, fruits, milk
- while famers faraway from cities grow foodgrains
- farmers extremely faraway from cities rear sheep/goat etc.

Why ^this type of pattern/distribution? Von Thunen explained it with a theory:

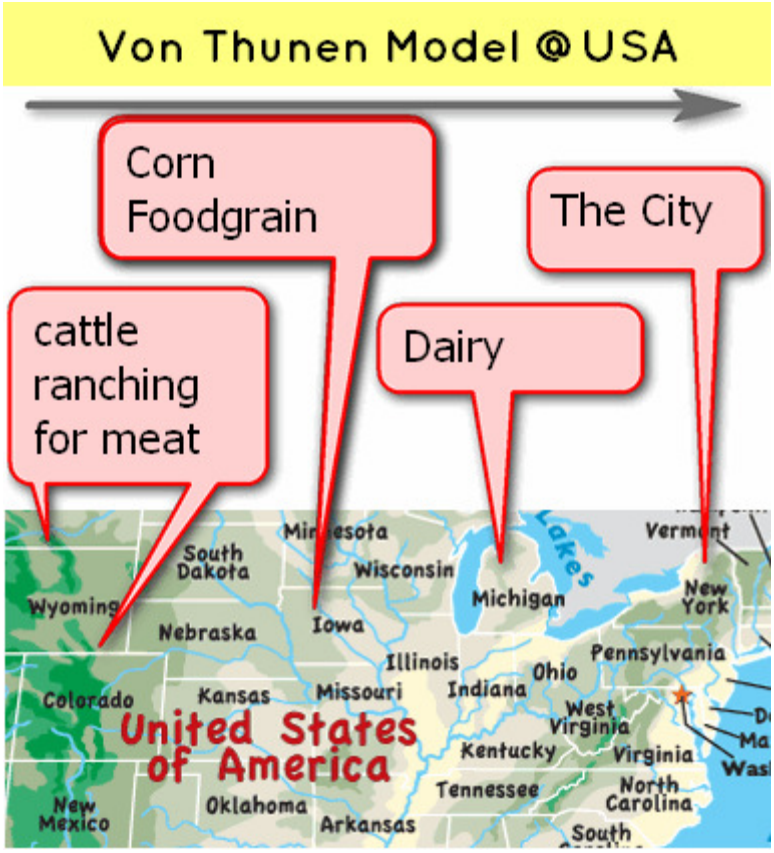
- Farmer like any other businessman wants to maximize profit. But his profit depends on three variables:
- P=V-(E+T)
- Profit P=Value of his produce (V) MINUS [production expenses (E) + transport cost(T)]
- without going into all details, when you plot a graph of distance vs profit for various crops/agro-activities…the ultimate wisdom is:

As the farmer moves away from the city, number of profitable options decreases. Since Transport cost gets higher, he has to pick an activity with lower production cost (e.g. sheep grazing.) to make any profit.

if you apply Van Thunen on Delhi:

place	Relative distance from Delhi	What will they do?
Haryana, Agra	nearest	dairy
Punjab	medium	wheat
Jammu	farthest	sheep/goat grazing

For USA, if you consider New York as only "city" of the whole USA, then observe following map:



If you consider London as the only city of the world, then

place	Relative distance from London	What will they do?
Denmark	nearest	dairy
Canada	medium	wheat
Australia	farthest	sheep rearing

- Although it doesn't mean nobody grows vegetables or milk in Australia. At local scale they too have their vegetable, dairy production near their big cities.
- Van Thunen doesn't apply to specialty crops such as oranges, apples- they'll only be grown where climate/soil permits them, irrespective of proximity from market.

Viticulture, Grapes, Liquor

Q. Why do Mediterranean countries lead in this grape/wine business?

factor	impact
Climate	Grapes hate cold=> not grown beyond 50 Degree North and 40 Degree south latitude.
topography	Grapevines like plenty of sunshine • in northern hemisphere, grown on the hills facing South • in southern hemisphere, grown on the hills facing north ^This is done to provide maximum sunlight
Water	• grapevines do not require plenty of water. (unlike Sugar) • Their roots can penetrate deep for sucking water. = can grow in semi-arid regions of Mediterranean • The grapevines themselves shed the ground in summer= soil remains cool + less moisture loss.
soil	Grapes like calcium. France-Italy hill have chalk/limestone=good for growth.
labor	• grapes requires personal attention • The grapes grown in one farm are not same as those from another farm. • Even slight variation in temperature, precipitation, sunshine, soil, drainage, manure, method of fermentation and storage can make all difference in the final wine. • Mediterranean countries have dense population and long history of cultivation =skilled labour available • In California, Grapevine harvested using machine but not possible in Europe because hill slopes and small farms.

raw material	• Grapes= perishable. • Wine=non-perishable, can be stored for years, infact its vale increases with age. • Wine=high value product=can withstand transportation cost. • Therefore, wine is made near the raw material site (grape cultivation areas.)
Market	• Mediterranean region =long established wine producing areas have reputation and given exclusive names. Example sherry from Spain, Champagne/Cognac from France etc. • Because of Geographical indicator (GI) system, other areas cannot use the same name. (Even if you make same type of liquor in India) =less competition • + Liquor has high demand in any part of the world.

Factor: Government policy

- When French occupied Algeria they started grape cultivation.
- Why? Because French wanted to export their own premium wines to other countries, so for local*consumption* in France itself, cheaper variety had to be imported from Algeria.
- Thus, Algeria became a leading grape producing country in the region.
- But When Algeria won independence, the new government did not allow wine industry anymore (because Algeria=Muslim population, alcohol forbidden) =grape cultivation declined.

Some more 'factors' on liquor industry

Just passing reference given in the books:

	factor
Beer	• is made from barley • in countries too far north = grape-cultivation not possible. • Barley=gluten content too high=can't make good breads= better make beer. Recall the 'concentration' principle.
rice wine	• In China, Japan and many Asian countries because grape is not cultivated and rice abundantly available.
rye	• gluten content too high=can't make good breads. • can grow in the adverse climate of central Europe. • Used for whiskey making. Again recall the "concentration" principle.

Viticulture India

Factor	impact
Climate	vineyards in Himachal, Nashik, Banglore due to favorable climate,soil
Government Policy	State governments giving tax benefits to encourage wine industry. e.g. Maharashtra give stamp and Excise duty exemption, sale tax holiday etc. to new wine units.

Other than that, books don't give much *wisdom* about "location-factors" of wine industry in India.
But on a non-serious note, why are desi-liquor dens located close to slum areas?

Factor	impact
Climate	irrelevant
Soil	irrelevant
Water	freely available from nearest sewer
Raw Material	• discarded /bad quality gur (Jaggery), rotten barley etc • raw material =non-perishable=>industry need not be setup near raw material site.
Energy	• In case of Aluminum refining, industry should be setup near a cheap electricity source. • On the same logic, this unit should be setup near jungle/city outskirts for getting free firewood for distillation process. • But in that case, finished goods has risk of getting caught while in-transit to city. • Therefore it is more logical to set industry near market (Slum), rather than @energy source.
Labour	• can be done by even single man, as long as he has the *jigar* (guts) and the brewing-skill, otherwise hooch will be produced =>deaths= no repeat customers.
Market	• If the unit is farther away from market (slum)=risk of getting caught during transport. Therefore, proximity to market (slum) =prime factor in deciding industrial location.
Government policy	although with corrupt police, government provides indirect support to the industry but to increase the per capita availability of desi liquor, following reforms are necessary :

	1. Afforestation programs outside city using MNREGA labour, to increase firewood availability. 2. Rotten grain from FCI should be handed over to these *entrepreneurs* 3. Some scheme named after *you know who*, for providing skill upgradation and subsidized equipment, implemented with the help of local NGO.

anyways, In the next article we'll see location factors for plantation crops such as tea, coffee, rubber, sugarcane and later iron-steel industry etc.

Mock Questions

For UPSC General Studies Mains Paper I

12 marks

1. Why do European producers have supremacy in the wine industry?
2. World production of wine is concentrated in the Mediterranean shorelands. Comment
3. for any area of your choice, examine the relationship between development of wheat farming with respect to following factors
    - climate
    - relief and drainage
    - labor Supply
    - government policy
4. What factors give rise to truck farming industry near urban areas? Illustrate with examples.
5. Farmers away from urban areas usually grow cereal crops. Comment.
6. Analyze the factor responsible for underdevelopment of Dairy industry in tropical regions.

25 marks

1. In USA, certain groups of states are known as dairy belt, cotton belt and Corn Belt. Explain the factors responsible for such regional specialization of agriculture.
2. Discuss the major geographical and economic factors influencing the location of livestock farming in different parts of the world.
3. Examine the factors responsible for large production of corn and Wheat in the North America and compare it with suitable states of India.

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