Classification of Industries - Manufacturing and Basis of Location and Development of Iron and Steel Industry, Cotton Textile Industry, Chemical Industry, Aluminium Industry, Oil Refining Industry

Prepared By: Dr. Kanhaiya Lal, Assistant Professor, DDE, K.U.K.
1.1 Introduction

- In industrial geography locational aspects of an industry is very important.

- Any type of industry requires some inputs and using them a range different output are generated.

- All consumer product outputs go to the market while all intermediary product output go to other industry.

- Transportation of various inputs and outputs entails transportation costs and normally an industry is likely to be located where such costs are low.

- So, various consideration influences industrial location.
2.1 Objective

❖ Here, first we understand a simple classification of industries.

❖ Then what are the important factors which in general play important role in deciding where an industry is to be located.

❖ Finally a discussion will be presented about locational aspects of some important industries and also an account of the changing pattern in location of these industries, if any, over the time.
3.1 Classification of Industries

- There are various kinds and range of goods and services, so industry may be also of various types.
- Based on the value addition and tangibility broadly we can have three types of industries - **primary industries**, **secondary industries** and **tertiary industries**.

3.2 Primary Industries

- Primary industries are usually very simple industries involving processing of raw materials to give input goods for secondary industries.
- Here value addition is usually minimal and they are usually material oriented.
Scale of operation may be small or may be very large.

Examples are: coal mining and washing, oil-refining, flour milling, metal smelting, stone crushing, etc.

3.3 Secondary Industries

Secondary industries are very complex and diversified which took input from primary industries and add significant value to it in different processing stages.

The value additions are so significant that they may have a locational preference in favour of market.

Secondary industries may again divided into heavy industries, light industries, footloose industries, etc.
3.3.1 Heavy Industries

- Heavy industries are identified by nature of their bulky product or very high capital inputs or units which may have high capacity to influence environment adversely.

- Examples are: heavy chemical, heavy machinery, locomotive, shipbuilding, heavy electrical, etc.

3.3.2 Light Industries

- Light industries are less capital intensive and more inclined to consumer products.

- Products are usually lighter in weight, require less power, less polluting and can be established in small areas.
3.3.3 Footloose Industries

- Footloose industries are those industries which nearly remain indifferent with locational aspects of plant.

- Their products are having very high value addition and smaller in size and so transportation cost is only a small fraction of total cost.

- These industries usually requires a very small production space, are usually less polluting and but requires highly skilled workers.

- Examples are: watch, camera, diamond cutting, precision electronics, etc.
3.4 Tertiary Industries

- Tertiary industries are not related to production process.
- They are basically trade and services providing industries.
- The scale of operation is so large that it is regarded as an industry.
- Examples are: banking industry, insurance industry, consultancy industry, etc.

**NOTE:** Above classification is a broad classification of industries and other classifications and subdivisions are also possible depending upon our criteria of selection.
4.1 Factors Influencing Location of Industries

- Different industries require different kinds of inputs.

- Importance of different inputs varies due to their varying cost or they require in various proportions or ease/difficulty in availability of different inputs or various scale of industrial operation or any such reason.

- These factors are non-ubiquitously distributed around the world, so exert different pull to locate an industry in their favour.

- These pulls are known as locational factors in industrial location.
It is important to note that it is usually a combination of factors which also satisfies availability of other factors to a reasonable extent guides the location of an industry.

The importance of different factors may subject to change with time and also same location may reacquire or keep its importance due to emergence of a new factor there.

In all cases, theoretically an ideal industrial location always gives maximum cost advantages or minimum cost disadvantages.
4.2 Some Traditional Locational Factors of Industries

 Traditionally raw materials, fuel and power, human resources, transport, market, capital, government policies, industrial inertia, etc., are regarded as important locational factors of industries.

4.2.1 Raw Materials

 Raw material is one of the most basic inputs to an industry without which no industry can breathe or survive.

 An industry can require various kinds of raw materials like crude mineral, semi-processed mineral, semi-finished product or even finished product of an industry.
Some raw materials required in bulk while others in relatively small fractions; some raw materials are perishable while others are long lasting and some raw materials lose weight in industrial processing while others not.

- Usually bulky, difficult and costly to transport, perishable, lose weight on processing and linked to small scale and technologically poor industrial operations exerts greater pull in their favour.

- As the proportion of cost of a raw material rises in total input cost, its capacity to exert greater pull, increases.
Higher the proportion of an input raw material to its output value, higher be its capacity to influence industrial location.

Examples are: iron and steel industry, pulp and paper industry, agro-processing industry, heavy chemicals and oil-refining industry, heavy machinery industry, heavy electrical industry, etc.

4.2.2 Fuel and Power

Keeping other conditions constant, normally as the scale of operation increases power requirements of an industry also increases.
There are various ways by which power can be supplied like human power, wood, charcoal, coal, electricity, petroleum, solar energy, etc.

Use of human power, wood and charcoal are limited these days but was very significant before industrial revolution in running small and cottage industries. They are still significant for such industry of smaller scale.

Industrial revolution had put coal as a prominent source of power supply. Coal itself is very bulky and at that time due to poor technology about twelve times of coal is required to smelt iron and so probably it has exerted one of the strongest pull on industrial location of iron and steel industries. Other industries were followed them.
Later electricity also becomes an important source of power supply due to its cheapness, easiness to transmit and cleanliness. It can be generated by using variety of sources. It helped in freeing industrial location from the pull of coal.

Petroleum also helped in freeing industry from source of power supply as it can be conveniently transported, can be converted into electricity and their many source area are underdeveloped and desert location.

Solar energy and many other non-conventional energy uses are limited by the lack of efficient and cheap technology and they also easily converted to electricity.
Thus coal helped mostly in industrial concentration while electricity helped mostly in industrial dispersion.

4.2.3 Human Resources

- Usually an industrial set up is influenced by highly skilled inventing labour, highly skilled managerial labour, highly skilled technical experts, semi-skilled labour and unskilled labour.

- Highly skilled inventing labours are usually few in numbers residing in well developed regions where different kinds of technical and financial support are there to run an invention project.
Highly skilled managerial staff and technical experts coordinate among different factors of production for maximum profitability and different machines for efficient and maximum output respectively. Usually they work in individual capacity and so they are highly mobile to any place with better employment opportunity.

Semi-skilled labours are required relatively in large numbers in contrast to aforesaid labour groups but they have less skill to offer. So, they have limited migration opportunities for better employment.

Unskilled work forces usually required in large numbers and they are least mobile due to lack of any significant skill to offer.
Thus it is only unskilled labour force and to some extent semi-skilled labour force have some capacity to influence industrial location particularly of labour intensive industries in their favour.

4.2.4 Transport

Various mode of transport are used to assemble at a place different factors of productions as well as to distribute the produce to desired locations.

Among different modes of transport, water transport (sea, river, canal, lake, etc.), land transport (road and rail) and air transport are important from industrial location point of view.
In general as one moves from water and land to air transport the speed and transportation cost both increases.

Transportation cost usually increases with bulk, perishability, special care required and as the objects technologically mature (transportation charges for unfinished, semi-finished and finished product are becoming progressively higher).

Per unit transportation cost for long haul journey are usually less than short haul journey and transportation costs for back haul journey are lesser than onward journey.

Purer the raw material lesser be the transportation cost.
As the ratio of transportation cost to market value of goods increases, the capacity of transportation cost to influence industrial location also increases.

For examples: heavy machine tool industry favoured nearness to iron and steel plant; watch, camera and other precision instrument industry entails very low transportation cost to output value and not influenced by transport cost; coal exerted significant impact on the location of iron and steel industries in early time, etc.

Keeping in mind the above considerations generally bulky goods are favoured by water root, if available, and by rail on land while perishable and those having very high market value are transported by air routes.
4.2.5 Markets

Market is a place where finished or semi-finished product of an industry is normally sold at economically profitable margin.

The sufficient numbers of economically capable buyers, as existing in the West, are necessary for a good market. Thus all industries in general have biasness towards a good market as far as possible.

Specifically, perishable items, fragile products, bulky and low value goods, labour intensive goods, industry involving much personal contacts, require small raw materials, etc. are located close to the market.
4.2.6 Capital

- Capital is also a very basic input in any industrial establishment since it facilitates the arrangement of all factors of production.

- Capital has probably least influence on industrial location as it is the most mobile factor, if opportunities of profit are present.

4.2.7 Government Policies

- Government is the ruler of an area whether it is communist or capitalist or any other form of government.
It has certain ruling goals viz. balance regional development, adequate employment generation, proper utilisation of different physical resources, maintaining healthy living environment, national security concerns, etc.

Thus, through different policy initiatives like, tax concession/higher tax rates, cheap land/putting ceiling on industrial land use, transport concession/green belt policy, facilitating easy concessional loans/restricting disbursement of any loan, licensing policies, etc., it tries to achieve them.

Thus under government policies economic consideration may be just ignored for other reasons.
4.2.8 Industrial Inertia

- Industrial inertia is the resistance exerted by an established industry in economic terms to move immediately to a new location even when its earlier locational advantages change to disadvantages.

- When an industry is established in an area, it leads to many industry-friendly developments in the area with its own expansion like transport; highly skilled, semi-skilled and unskilled labor force; ready market; adequate source of power; financial institutions, industrial agglomeration with supportive industries, etc.
If one or some of earlier advantages change to disadvantages then also industry may not move to newer location since in the meantime it has acquired other advantages which has the capacity to outweigh the so called disadvantage and also cost of establishing a new industry at new location is very-very high.

However industrial inertia has limitation in the form of excessive land and transportation cost, expensive labour, power shortage, discouraging government policies, etc. which after a certain limit strongly started working in favour of industrial shift.
5.1 Location of Some Important Industries

- In the light of above generalised knowledge locational aspects of some important industries need to be understand.

5.1.1 Iron and Steel Industry

- Iron and steel is one of the most basic industry.

- In early days demand was low and mostly of local nature. Charcoal obtained from nearby forest were used to locate small plants. This led to dispersion of this industry up to mid-eighteenth century.
Latter the use of coal in iron smelting began which attracted this industry. Attraction to coalfield regions was governed by then available technology and demand in coalfield areas, forest area were shrinking (about one acre of forest log required to smelt five tone iron), demand for iron increased considerably due to starting of heavy engineering works, required iron ore to coal ratio was 1/8, coal producing regions already had some iron work history, pool of labour required available in many coalfield region, at some places iron ore was found associated with coal and like factors.

Upto the end of nineteenth century coalfield enjoyed this unique position and during this period it has developed sufficient industrial inertia at many places.
In twentieth century, the technology of iron smelting further improved and now less coke, only half of iron ore, is required.

This has freed establishment of new industries in favour of iron ore regions and in setting of industries also at coastal locations.

In last fifty to hundred years the role of market also become significant. A big market helped in setting large integrated steel plant and in providing scrap iron as raw material to reduce transportation cost.

Location of iron and steel industry effectively responded to the changing nature of different locational factors.
5.1.2 Cotton Textile Industry

- Cotton textile industry is one of the oldest industry in the world.

- It requires raw cotton (a tropical and sub-tropical crop), cheap and large labour pool (automation has reduced its importance in some areas), power, good transport, humid climate (large plant may maintains it artificially), capital, large market, etc.

- Cotton is regarded as nearly pure raw material, so its pressure on industrial location is very low and other locational factors particularly transport, labour, power and market become important.
Electricity has reduced its dependency on the source of power supply and automation has diluted the need of skilled large labour pool requirement and thus considerations of market to link the industry effectively with the consumer become important.

Thus, initially it was in the form of scattered small and cottage industry but invention of spinning and weaving machinery latter made it a regular industry with United Kingdom and other western country as main producer upto the entire nineteenth century.

In twentieth century these techniques spread to cotton growing areas where cheap large labour pool and local strong market already existed.
Thus over the period cotton textile sector remain one of the highly dispersed industry in the world.

5.1.3 Chemical Industry

The chemical industry presently comprises of very vast sector of modern industries.

It was invented only by the middle of nineteenth century but by twentieth century it has practically touched each and every corner of our modern life with more than seventy thousand types of industrially significant chemicals.
It is a capital intensive industry requires specialised labour force, considerable degree of automation, careful handling of products and ample raw materials in the form of chemically significant minerals, industrial byproducts and also natural plants produces. Power and adequate quantity of water are also essentially required.

If other things remain favourable this industry usually located either near to source of raw materials or near to its market.

Capital, automation and skill requirement has restricted them mainly to developed world and to some extent in some areas of developing world.
If raw material is to be imported or based on byproduct of industries which uses imported inputs or if market is abroad then a coastal location is usually preferred.

In developing countries it is usually found associated with petroleum refining, coal and other mineral producing regions, etc.

Thus due to immature necessary specialisation and capital required, the trend of dispersion has poorly developed in this sector.

5.1.4 Aluminium Industry

Aluminium is regarded as metal of twentieth century.
Aluminium is light in weight, ductile, durable and has good electrical and alloy properties and so quickly become very popular industrially after the invention of Hall-Herault process by the end of nineteenth century.

Aluminium is industrially derived from alumina which is dominant found in tropical and sub-tropical areas. Further, the smelting of aluminium requires large amount of power (18000kWh per tonne aluminium).

Since its raw material is bulky, so if possible, it is concentrated near its source. However in many underdeveloped countries it is exported as raw material due to lack of adequate facility.
So coastal locations with adequate sources of power are ideal location for it.

In developed countries which themselves have good source of raw material, the plants are usually located near to them.

The cost of power is so significant in this industry that plants are also located near a distant source of raw material with suitable electrical power but if good transportation facility are present. Such plants operate at a very large scale to achieve higher economies of scale.

Thus aluminium industry has localisation tendencies influenced by raw material, power and transport facilities.
5.1.5 Oil Refining Industry

- Oil refining is a modern industry by which a range of products are obtained from crude petroleum, a combination of various hydrocarbons with some impurities.

- A variety of refining methods like fractional distillation, catalytic cracking, etc., are used to get refined products.

- A refinery may be located either near the source of crude oil or near the major market of their produce or at some intermediate location depending upon various circumstances.
Presently not only crude petroleum but also refined products can be easily transported to distant locations by means of big oil tankers through sea, using truck and train tankers on land and through various pipelines.

Location of oil refinery is most importantly influenced by availability of adequate amount of crude oil and then by other considerations related to availability of people with technical and commercial knowhow, construction and maintenance of plants, distance from market, physical obstacle in oil/product transportation, security and maintenance concerns, etc.

Source of developed regions of the world close to the market area have very large scale of operation.
They have advantages of minimising transportation cost for both crude oil as well as finished product and also easy availability of other requirements.

Those crude oil source based refineries which are located at a distance from the market have advantage of saving transportation cost of crude oil to the plant and providing higher revenue by the export of finished products instead of crude oil. Such plants usually have large scale of operation to minimise per unit cost.

Intermediate oil refining plants are favoured if due to some obstacle plant establishment not possible or shipment of crude oil/finished product not convenient.
Such intermediate plants may be near to source area or near to market area. As such plants moves closer to market area usually their scale of operations increases.

In fact it is unique distribution pattern of crude oil sources (mostly found in coastal areas), transportation modes they suits (oil tankers, pipelines, etc.) and marketing areas restricted mostly to developed west and some rapidly developing countries have mostly guided oil refinery location to coastal areas.
6.1 Summary

- An industry is usually located only at certain advantageous locations so that its total cost of operation can be minimised, output can be maximised and it become qualitatively better.

- There are various factors which govern these concerns and relative importance of these factors may changes with time due to change in innovation, aspiration, etc.

- So locational aspect of any industry must be considered taking into account of dynamism involved in different locational factors.