

**Industrial Engineering**  
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**Module - 4**  
**Lecture - 10**  
**Facility Design Part-I**

A very warm welcome to all of you, we are in the middle of discussing lectures related to industrial engineering. So, our topic for today is facility design. Facility design is an important aspect of industrial engineering. Let us begin the lecture with the help of an example. Suppose, we want to make a home, we have to take so many decisions that in which city our home should be located, in which zone of the country our home should be located. So, starting from the zone we come on to a particular city. We zero in on a particular city that my home should be located in this particular city. Then, within the city also there may be so many localities, so many different areas where I can place my home.

Then, after selecting the zone of the country and selecting the appropriate city within the country, I have to take a decision that at what particular locality, in which particular locality, I should place my home. So many factors would be guiding me, so many criteria would be used to select an appropriate location for my home. Similarly, as an entrepreneur or as an industrialist, a decision has to be taken where to plan a facility, where to locate a facility or where to locate, a factory or an industry.

The industrialist takes a decision that in which state he is going to place his industry or his factory and within the state also at what particular border or at the center of the state he is going to place his factory. So, all these decisions have to be taken by a particular industrialist or by a particular chief executive officer of the company regarding the location of his factory. So, not only we have to locate, but we have to design. So, once we have decided that this is the area where we are going to place our factory or our industry, we have to design the layout of the industry.

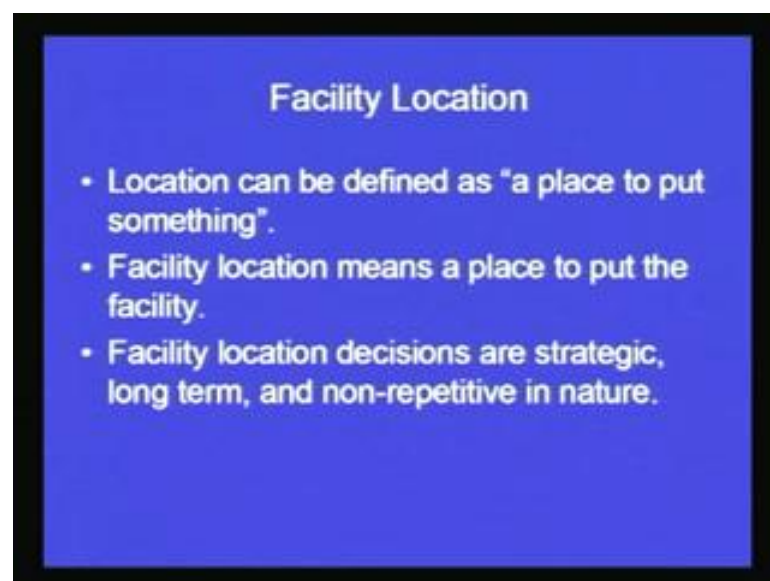
So, there are different types of layouts like: we may have a process type of layout; we may have a product type of layout fixed position layout, cellular layout. Different types of layouts are there and appropriate decision has to be taken. For example, we have again reverting back to our initial example of placing our home in a particular locality of a city.

So, coming on from the zone of the country to a particular city and within the city also, coming on to appropriate locality we know that in this locality in such and such area I am, going to place my home.

Now, when the area has been identified, I have to see what is going to be the layout of my home. How many bedrooms I have to place? How many kitchens? How many wash rooms? And whether, it will be a single story a double story? So, all those decisions are the layout decisions that where the rooms would be located? Where the kitchen would be located? So, it is basically the birds I view of the home, that at which particular place? Which particular facility has been set up? Or which particular shop? Or which particular room or kitchen or washroom has been set up?

So, kitchen, washroom are the examples of a layout of a home. Whereas, different shops, different offices and different other recreational areas, housing, building all those things would form a layout of an organization or an industry. So, in these lectures, may be on facility design, we will see that what are the factors that govern the facility design? What are the factors that influence the facility design? What is facility design at the outset? And then we will see, what a different types of layouts? And what are the various factors that have to be taken into account in deciding the type of layout? So, layout selection is also equally important. So in today's lecture, we are going to start our discussion related to the facility design.

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So, facility location; location can be defined as a place to put something. Now, I have given you an example, a place to put something means, a place to put your home. From the industry prospective we can say a place to put here factory or a place to put your industry. So, location can be defined as a place to put something. So, it is a kind of area in, at which we want to develop our facilities. Then facility location means, a place to put the facility.

So, coming on from a place to put something, we are now coming on to place in which, we want to develop our facility. Now, that facility can be a manufacturing facility, that facility can be a service sector facility. Now, service sector facilities, I mean to say; it can be a bank, it can be hospital, it can be any other public serving institution. So, we have to take appropriate decision that at which particular location we should set up a facility, so that it the purpose for which the facility has benign set up or the facility has been develop is solved.

Sometime, the purpose is maximizing the profit from the industry prospective. And on the other hand, if we talk about certain service sector industry or service sector facility like hospital; our main aim is to for social service or the main aim is that we should be able to serve the society. So, a societal cause has to be seen that whether, we are locating the facility in such an area, where it is going to be beneficial for the people of that particular area. Sometimes there are certain areas which are underdeveloped. So, we have take a decision that if we put such and such facility at such and such place, the overall development of the area would takes place.

So, all these things have to be taken into account when we decide on setting a facility at a particular location. So, facility location means to place or put the facility at a appropriate location or in an appropriate area. Now, coming on to the facility location decisions are; strategic, long terms and non repetitive in nature. So, a huge amount of capital is involved in setting up a facility.

For example, you see if an auto manufacturer plans to set up his manufacturing plant in 1 particular state of the country, a huge amount of capital is involved in that. So, it is a strategic issue. In the previous class also I have told that there are 3 different levels of management: top-level management, middle-level management and lower-level management. So, the basic elements of top-level management are that the decisions or

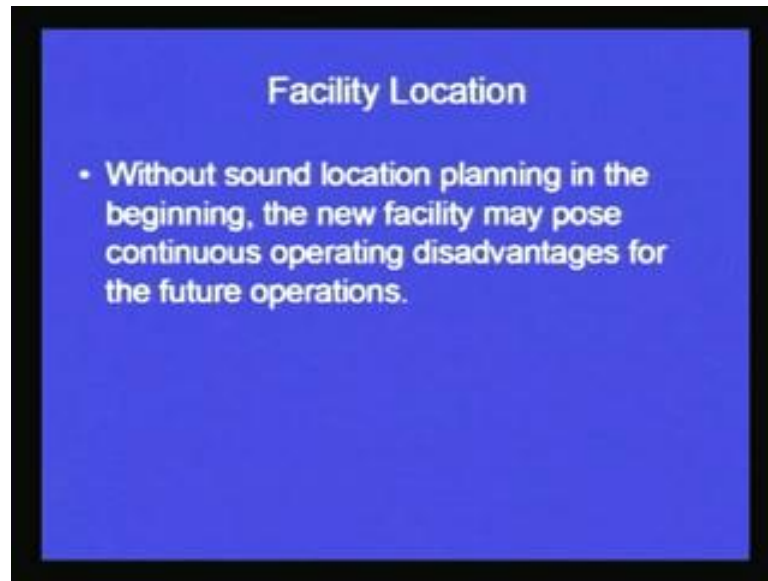
the planning that is done at the top level of the management is a long term planning and the issues related are strategic in nature and these are high risk involving issues.

So, at high level management, this decision is taken that at which particular location we have to set up a facility. So, the issues related are strategic in nature. The issues related involve very higher risk. As well as, the issues related are non repetitive in nature most of the times. Why because once a decision at the top-level of the management has been taken to set up a facility at an appropriate location or at a specific location, then it is very difficult and as it is going to amount to a huge amount of loss, If you shift the location from 1 place to another place.

So, facility location decisions are strategic; means, it involves a huge amount of strategic thinking and they are long term. Already, I have told that it is a long term decision. It is not that for 6 months you place your facility at a 1 particular point, and then again you pick up everything related to that facility and shift it to some other place. And third important thing is that these are non repetitive type of decisions that are taken. So, all these decisions are taken at a very higher level of the management. So, higher level means top-level management decisions are taken, if we want to take a decision related to location of a facility at a particular point or in a particular area.

Now, we come on to, we have seen that; it is very important, it is a strategic issue, it is a high risk involving issue, it is a non repetitive type of decision. If we are not able to take appropriate decision that where to locate the facility, then it may result in to certain kind of unavoidable circumstances. So, without sound location planning.

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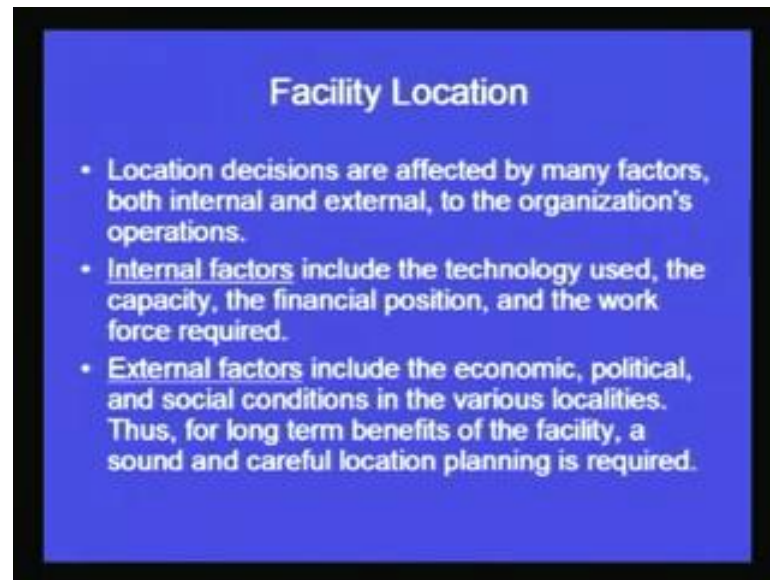
In the beginning, the new facility may pose continuous operating disadvantages for the future operation. Now, if we have not taken an appropriate decision while the, while beginning to take at decision related to location of the facility at the very onset only. What I mean to say here is that; when we are started to think in that direction that where we have to place our facility. We are not taking all the factors into consideration, we are not considering all the criteria that is, decisive in for us to take a decision related to the location of the factory.

Then, if certain, criteria certain factors are missed, while the decision is being made, then at a later stage we may have to repent and we may be in a disadvantages position and may incur a huge amount of losses. Because once the facility has been created, it is going to generate if it is a manufacturing facility. Huge amount of products will be made and because of the wrong selection of the location, we may not be able to minimize the total cost involved in the manufacturing of that particular product.

So, this would result in a non competitive position in the market. If our product that we are manufacturing, is being manufactured in a location which is not advantages for the company and the total cost involved in manufacturing that product, is much more as compare to our competitors, then our product will not be able to hold a substantial share in the market or substantial market share. And we would be incurring a huge amount of loss.

So, the appropriate decision related to locating our facility at a most optimal point within the country and in a particular state is very important, for the well being of our industry or factory or organization or institution

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Now, facility location. Location decisions are affected by many factors, both internal and external, to the organization's operation. So, according to the organization operation there may be certain internal factors and certain external factors. And the decisions related to the location of the factory, are affected by both of these. There are there, will be certain internal factors that will be, would be influencing that decision. There would be certain external factors that would be influencing the decision.

Now, let us see 1 by 1 that what are these factors that influence, the decision making related to the location of a facility. Now, internal factors are on our screen, you can see include the technologic used, the capacity, the financial position and the work force required. Now, these are the internal factors which are within the organization. Now, let us take an example of a manufacturing plant.

So, the first point is; the technology used. So, what kind of technology would be used for manufacturing the final products from the raw material? So, that is an internal factor, that will help us or that will guide us for appropriate selection of a location. Now, how we can say that? Now suppose, we are trying to put a industry which is a textile industry or yarn manufacturing industry. So, we require an area where the humidity is more. So,

there technology is such that it requires high humidity area. So, that kind of technology for, yarn manufacturing requires controlled environment.

So, wherever we have that kind of environment already available, we can choose that particular area for the location of our textile industry. So, that would be helpful in maintaining the environment. So, if we place this such kind of a facility in a area, where that kind of humidifying environment is not possible; what is going to happen is; artificially we would have to maintain that kind of a condition of the air or that kind of artificial environment. And for that we will have to spend a huge amount of money.

So, if we place the factory in such a area, where that humidifying requirement is less, because the environment is already quite humid or the climate is such that we have a relative humidity very high. In those circumstances what is going to happen is the, money that we are spending in maintaining and artificial environment would be, considerably less. So, that kind of technology if it is there, then we can make use of these technology and the appropriate selection of the location and we can save some money for the company.

Similarly, the capacity, that what is the capacity? Is that amount of area available? What capacity we want to set up? Already, we have taken certain lectures on capacity planning 1 and capacity planning 2, in which we have seen that what we mean by capacity and how capacity is going to influence the location of the industry. So, when we know that this is the capacity, then this will be internal factor for deciding that where to locate our factory.

Now, third factor is the financial position of the company. That is also going to influence the location of the industry. And the workforce required, may be financial position and capacity; these are 2 factors which are not that significant, but the labor force and the technology or the 2 relative more important factors that those govern, the appropriates location selection of the industry. The labor force required. Now suppose, we want to place a factory, which require high skilled labor force. We cannot plan to set up such a facility in a county side area or at a distant location from a metropolitan city.

Why because, the skilled labor force may not be that interested to be relocated to such a facility, at a distance from the metropolitan city. So, we can think of planning industry or a factory or a organization which require high skilled labor, may be in the of

metropolitan cities, so that the highly skilled labor force may be living in the big cities and for their work they may venture out, may be 20 kilometers, 25, 30, 35 kilometers outside the city and then by evening, they can come back to their houses.

So, the kind of labor force required in the organization or in the factory or in the enterprise is very important in deciding that where should a plant be located or where should the factory be located. There are numerous examples, like the software industry. Where the software industry is mushrooming? Because, it requires high skilled labor force

Similarly, there are certain auto manufacturers, there are certain manufacturing companies. And if we look into the entry cases of their location, we would be able to very easily understand that why these particular factories or industry has been located in such and such area. What are the factors governing their location? So, the kind of labor force, because usually we say that the industry is run by the man power, not by the machines. We may have the most sophisticated machines available with us, but until and unless we have the right kind of people to manage those machines, we will not be able to generate a huge amount of profit for organization.

So, man power and the appropriate availability of the man power is very important for deciding, a location of an factory or an enterprise. So, these are the internal factors, the kind of man power required the kind of finance is available, the kind of technology that is they are using. So, all these factors club under the broad umbrella of internal factors that govern the selection of a location of our enterprise.

Then, we come on to the next important factor; those are the external factors. So, these include the economic, political and social conditions in the various localities. So, this is also very important. So, let us first come to the economic condition. Certain times whenever we want to place our industry, in a very poor area of the country, so we will be able, to get the work force very easily and this labor cost that is being added to the total cost of the product, would also be less, because we are getting the labor at a substantially lower rate when, we are placing our industry in a very poor area.

So, wherever we find that the people are easily available and they are unemployed also, we are giving them work. They are also getting benefited, then the economic condition of that particular area is improving. Moreover, the competitive position of the



organization is also improving, because they are able to make the product at a considerably lower price, because a labor force is easily available and at a cheaper rate. So, that is the economic condition which will govern the selection of a location.

Similarly, we can say that if we place our industry in an area, where the labor is very scanty means: there are less number of people available to work. In those circumstances, as there is a dearth of labor, the rates will be high and when the rates will be high this labor charges will add on to the total cost of the product and the total cost of the product will be high and it may not be competitive in the market.

So, both the, we have seen both the conditions, we have the labor force is available in huge amount, we are using that labor force. On the contrary we have seen that labor force is not available, then this is going to result in a non competitive position of the industry. So, there are other economic factors also like, we can say that if economy of a particular state is booming For example, we have seen most of the software industries are putting their plants or putting their enterprise in one particular state of the country only. So, if they feel that all the kind of infrastructure that is required is available. So, the economy is at a high.

Moreover, there may be certain areas where the economies not that good means: the company, the government policies are not that good. So, the companies may not try to enter into that particular area of the country, so that they are not able to make the profit. So, basic aim of every company is to make profit. So, they will see that where the economic conditions are good, where they can make the profit and then they would try to venturing to that particular area. So, these are certain points like economic points are there.

Similarly, we have certain political points also. For example, certain governments may frame certain policies to invite the industry to their particular state. So, may be, they may be providing electricity at a cheaper rate. They may be providing certain other facilities like; takes holidays. Then, there are certain other advantages being offered by these governments. So, this is the political condition. There may be different governments in a country. Certain particular governments give certain incentives, they invited the industry to setup there plant. So, when the company comes and set sets up the plant, the overall area development take place. So, societal development takes place; people get

employment. So people, who are not having employment; who are unemployed may seek employment in any of these industry.

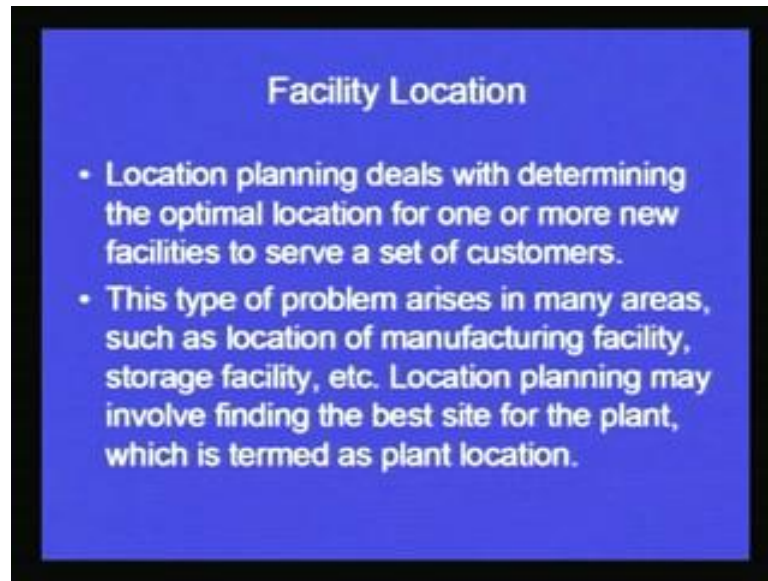
Moreover, there are other small scale industry that may develop, because of a big industry coming to a area. Similarly, there may be taxis that may be required, some educational institutions that may get benefited because of the location of such a industry. So, the government of the political interference may be helpful in a location of a industry in a particular area. So, when the political leaders feel that they have to setup industry in their particular state and they feel that the government should provide certain incentives for the industry to come and setup their plants in their area, which is going to lead to a society, upliftment of their particular state or that particular area. These policies are going to be benefited by the company also; the company will also get benefited as well as, the people of the area would also get benefited.

So, these are certain political implications of the society of the location of a plant. Similarly, social conditions already, I have told the society upliftment may take place because of the setting of a industry in some particular area. So, these 3 important points are the external points; being the economic, the political and the social conditions that govern, a decision related to the setting up of a industry in a particular area. So, we have seen that it is not that easy to setup a plant in a particular area.

So, we have to take a decision and we have to consider so many different factors. Some factors may be internal factors related to the industry and on the contrary, there are certain external factors. So, we have taken with examples, may be some of the examples might not have been too relevant, but these are the examples which help us to understand that the facility location decision is not as simple as possible. There are so many different criteria, so many different factors that we have to consider, when we decide on a particular location, that the facility will be developed in such and such location.

Although, we have seen only 3 4 important factors, there may be so many other factors which we may have to decide, when we have to finally, make a decision related to location of the plant. So, we have seen, now we will subsequently carry forward the discussion and we will further try to get into the intricacy of the problem of facility location and facility design.

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So, facility location, facility location deals with determining the optimal location for 1 or more new facilities, to serve a set of customers. Now, we can say this already we know, why facility location is decision is very important? So, location planning deals with determining the optimal locations. Optimal location means: why, I would like to address this word optimal. Optimal means: that the company or the organization which is setting up a facility at a particular location; it should also get benefited, because no company is doing business to make loss. So, the optimal locations means: that the company which is setting up a facility should also get benefited. Moreover, the people or for the other subsequent industry for which this facility is being developed, they should also get benefited.

For example, we say hospital is being developed by a private company or by a private player in the business. So, he would like or the company would like that the hospital should be such located that it is able to cater to the maximum people of, that particular society and it should always make profit. Moreover, from the society point of view, more and more people should be able to access that hospital. Its location should be such that more and more people should be benefited by that particular facility, which has been set up.

So, optimal location for 1 or more new facility is, to serve a set of customer. So, customers here are the people and the facility we can say is the hospital. So, the location

should be such: that both the parties should get benefited. The person or the company that is setting of the facility should also get the profit and for the customer, for whom this facility is being set up should also get benefited.

Let's taken another example like, a company wants to set up their service center. For example, auto manufacturing company wants to setup their service center. So, if they set a service center may be 20 kilometers outside the city. Nobody is going to visit 20 kilometers to get their vehicle checked. They may visit to some vendor who or some person who is not authorized to do the service. Because they do not want to travel 20 kilometers and then come back 20 kilometers, because that would not be beneficial or they may not get benefited by the service center, which is place 20 kilometers outside the city.

But, if that service center is located inside the city. Then, these people who are the customers will also get benefited and the company that is setting up the auto service station will also gets benefited, because they will have more number of customers now. So, these are very obvious things, but certain times the companies they are not able to make a judicious decision regarding the location of the particular facility. So, certain other constraints like, the financial constraints; already we have seen that the land or the area that is required to set up that facility, may be very costly, if you plan that facility within the city and the land may be cheaper at a distance of 15 or 20 kilometers from the city.

So, kind of break even analysis has to be done. And at decision has to be made that which facility and as we, have already that this is a very strategic issue. It is a long term issue; it is a non repetitive issue. So, we have to take a decision that down the line may be 10 years from now. If we place this service center within the city, we would be able to make so much of profit. Whereas, if we place this service station, because now, we may feel that the land that we are getting 10 kilometers outside the city is cheaper but, may be after 10 years so much of computation would be there, nobody would be liking to go to that distance. So, that long terms that facility may not be of use, but today we feel that as the land is cheaper we would be able to get more land.

So, these are certain decisions, very tricky decisions which have to be taken. And the certain tools and techniques that will see in facility location help us, to decide that which

locating would be better. So, optimal location has to be always chosen; which is beneficial to both the parties, which is stated in the very first point on your screen. Now, coming on to the second point.

This type of problem arises in many areas such as: location of a manufacturing facility, storage facility etcetera. Location planning may involve; finding the best site for the plant which is termed: as plant location. So, location planning, already we have seen, that we have to take a decision; it is a decision making process in which we have to take a decision, that where should we locate a work facility, which may be a manufacturing plant or a service sector providing facility. This kind of problem may arise in case of a manufacturing plant. This may arise in a storage facility.

For example, we say that there is a big show room in the heart of the city. Now, the showroom space is limited. They have to place or store there, other materials may be there they have to manage warehouse. So, the show room may be of electronic items. So, they cannot keep all the electronic items in the showroom. So, they have to maintain a warehouse or a storage place at a distance from their showroom.

So, if they decide on making a showroom at a centrally located place and now, they decide that the distance between the showroom and the storage facility should not be that much. And they require huge amount of floor area to manage that store. So, within the city limit, they may not be able to get that much area at a considerably nominal price or at optimal price. So, what they can decide is; they can think of placing their warehouse at a distance from the show room. Because, showroom is placed in one of the busiest market and the storage place can be at a distance, because this is not a thing or this is not a kind of a product, which the customer would readily want that now only I have order, just now I want it.

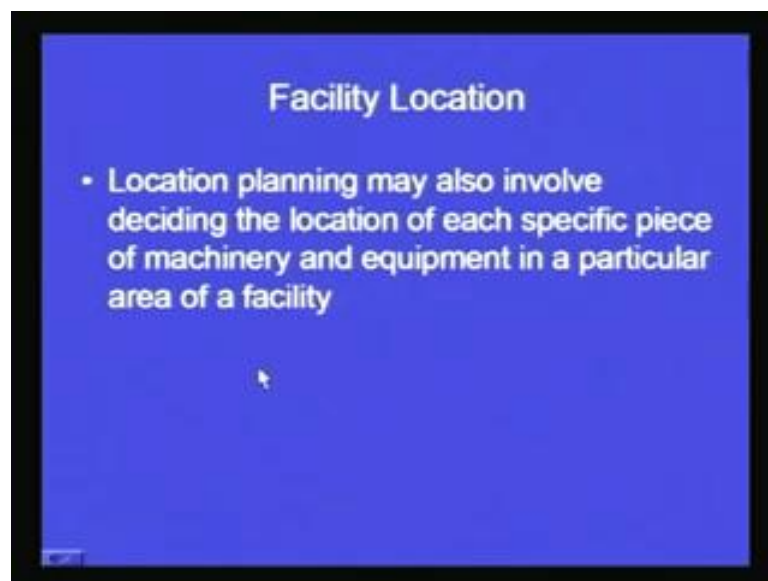
Maybe, you can say certain particular samples of the products, may be there in the showroom. The customer selects the product, and then the delivery can be done from the store house. So, we are saving certain amount of money which would have gone into managing the floor space in the most, busiest of the market in a very big city. So, such type of decisions always helps, an entrepreneur or a business man in saving the money.

So, all these things have to be taken into account, but these decisions are very tricky. And sometimes certain industrialist or certain entrepreneur's, struggle in making these types

of decisions and later on they may incur huge amount of losses. So, this facility location decision or location planning may involve, finding the best site for the plant, which is termed as the plant location. So, we have taken a decision that such and such location would be best for setting up a plant big. May be with the help of certain criteria, with the help of certain factors that we have already consider the internal factors, the external factors and considering all these factors, then an appropriate decision has to be taken related to the plant location.

Now, as we have already decided that the location of the plant, would be in such and such territory, in such and such area, in such and such zone of the country. Then, after selection of the particular area we have to decide that within the plant how the facilities would be located. That once the area has been decided and now we have to decide that within the area, this is a particular point that where we are going to establish our factory.

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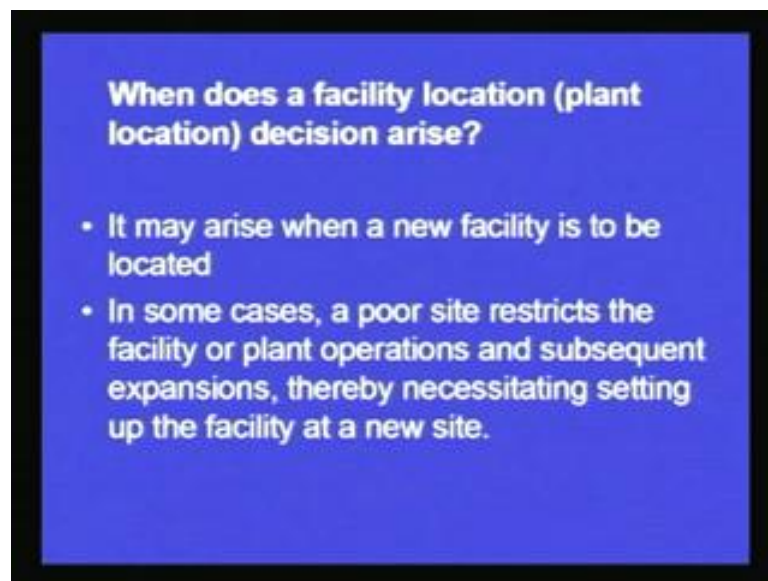


Now, within the factory also we have to take a decision like, you can see. Location planning may also involve, deciding the location of each specific piece of machinery and equipment in a particular area of a facility. Now, the facility location decision has already been taken, that the facility would be located, suppose in city x and within city x, this would be located in particular area may be pq area. So, we know that the location of the facility would be city x and it would be in pq area.

Now, within that area also, when we have a specific piece of land available with us we have to take a decision, that where particular machinery would be setup? Where the houses would for the workers would be set up? Where would be the recreational creativity activities be setup? So, all these decisions also have to be paid. Also, we have to decide that which type of layout we are going to follow.

So, different types of layouts are there. Already, I have name them, once again I will name so that you are mentally ready to understand those type of layout. So, product layout, process layout, fixed position layout. Then, we also have a cellular type of layout. So, we will see, what are these types of layouts? Where the facilities are located? What are the salient advantages and disadvantages of these types of layouts? That, all these things we are going to understand, but till now we have see if that there are number of factors which govern the appropriate location of a facility. And then within the facility we have to see, that where the particular areas or services would be provided within the facility.

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When does a facility location decision arise? Or plant location? So, facility location or plant location, one is the same thing. That where should be locate our plants. So, when these type of decisions we have to take? It may arise when a new facilities to be located.

So, already whatever we have been discussing for the last half an hour or so is; when we have to take a decision that where we have to establish our plant, it is a new plant. So, it

may arise when a new facility is to be located. Whenever, we decide that in the market there is a need of such and such product and we are the manufacturers of the related products. We want to venture into manufacturing of that particular product for which, there is a huge amount of demand in the market or huge demand in the market. We not have to decide that where should we locate our plant.

So, it is a new plant or new facility that we want to create. And then we have to make a judicious decision, depending upon a large amount of factors or large criterion. And on the basis of those criterions, we will decide that this is the best position from, where we would always be in an advantages position.

For example, another thing that comes to my mind is that whenever there is a war between 2 countries. Each country or the army of each country would always like to hold certain advantages positions. Why, because from those locations or those positions they would be able to strike the enemy and they would be able to satisfy their basic aim of winning the battle.

Similarly, whenever a company decided or decides on a particular location, they have this think in their mind. Their aim is, their goal is, their objective is; to maximize their profits and minimize the costs involved in manufacturing their product. So, whenever a company is making a decision, they would always like, whenever a new facility has to be created they would always like to see, that which particular location will result into minimum costs to the company and would result in maximum profit to the company.

So, facility location decision arises, whenever a company decides to set up a new facility, but it is not the only case when we have to decide such a, when we have to take such a decision or when we have to decide that we are going to place a facility in such and such locality. There are other times; there are other circumstances also, where we have to take a decision related to the location of a facility. So, what are those circumstances? Like in some case, a poor site restricts the facility or plant operations and subsequent expansions there by necessitating, setting up the facility at a new site.

So, let's breakdown this sentence into 3 parts: In some cases a poor site restricts the facility or plant operations. So, we have not been successful at the very onset, in selecting the appropriate side. In the beginning, we have done all kinds of analysis, but somehow because of certain dynamics scenario, we were not able to find out that which



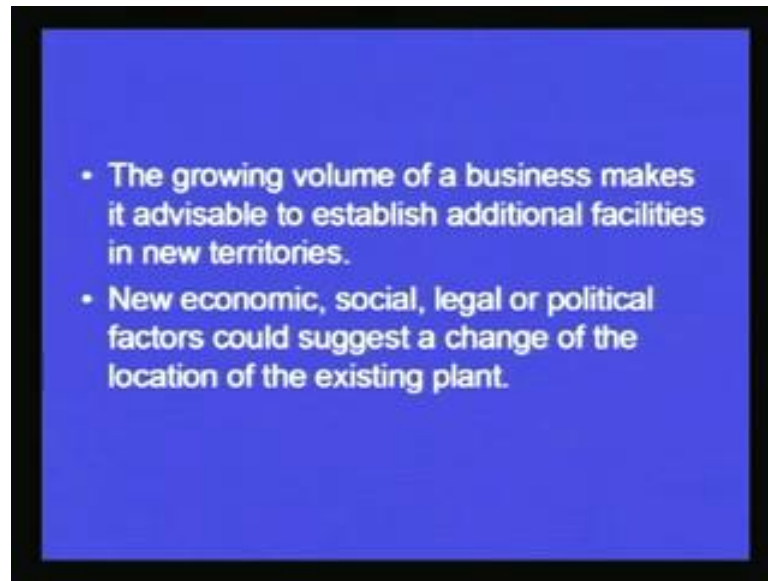
is the best site. And now we are see that the site that we are selected is up, was up wards and it is restricting our plant operations. And it is also not able or settable for further expansion.

So, our operations are not being performed optimally and we are not able to expand our base also or there is no place to expand our base. So thereby, it necessitates setting up the facility at a new side. So, there are 2 problems: first the poor side selection resulting into non optimal operations. And then we want, whenever we want to expand our plant base or whenever, we want to expand our facility, those kinds of opportunities are not available in the site at which we are placed right now. So, then we have to take a decision that what should we do? Then we are left with no other decision, but to shift to a new site

So, whenever these type of scenario arises, whenever we have to setup a new plant or our old plant is not manufacturing or not doing the operations according to our will or is not a profitable preposition, then we have to take a decision; why not to shift this particular location to some other location. There are other reasons also for shifting, that we will covering the subsequent slide, but 2 important points to note here are that we have to take a decision regarding the location or plant location in 2 important ways.

First is, whenever we want to set up a new plant and the second one is that whenever the old plant is not manufacturing properly or the operations are not optimal and there are no and there is no scope for further expansion of the plant; then we take a decision that guess, now it is a time to shift to a new plant location.

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The growing volume of a business makes it advisable to establish additional facilities in new territories. So, in capacity planning decision making, we have seen that whenever we do capacity planning, we have to see that on the basis of demand forecasts. We make a decision that; yes the demand is going to be more in 2009, 2008. I have given so many examples that how the companies make demand forecast.

So, whenever there is a huge amount of demand that is been generated in the market, we have certain capacity constraints and on those capacity constraints, we cannot match the demand that is there in the market or we cannot satisfy the demand that is being created in the market. So, then we have to do the expansion. So, the growing volume of business, we can say a more demand is being generated, makes it advisable to establish additional facilities in new territories.

Now, the company has made the decision that we have 4 manufacturing say 4 manufacturing plants, which are not able to meet the demand that is there in the market. Then, additional facilities have to be setup. In those circumstances we have to take a decision that where our new plant or new facilities should be located. Similarly, new economic, social, legal or political factors could suggest a change of the location of the existing plant

So, there are so many examples, where the existing plants have been shifted from 1 place to another place Because of these reasons that you see on your screen. I would like to

give you an example here is, that in certain areas or in certain cities, people were operating there small scale business units from their houses only. Now, these small scale business units generate a huge amount of noise and vibrations. The government has taken a decision that all these small scale plants that are operating from the residential area, should be shifted out to certain industrial areas so that the life of the people who are leaving in those residential areas, become a lot more better. This is the kind of a legal decision which has been taken and which has to be adhered to.

So, it means that the facility or the location that was there in the residential area, because of certain legal obligations, has to be shifted to a industrial area. So, that has to be born in mind that has to be taken into account that there are certain legal factors that may affect the location of the plant or the location of the facility. Then, we can say there are there factor, some of these already we have seen; economic factors, social factors and as well as political factors

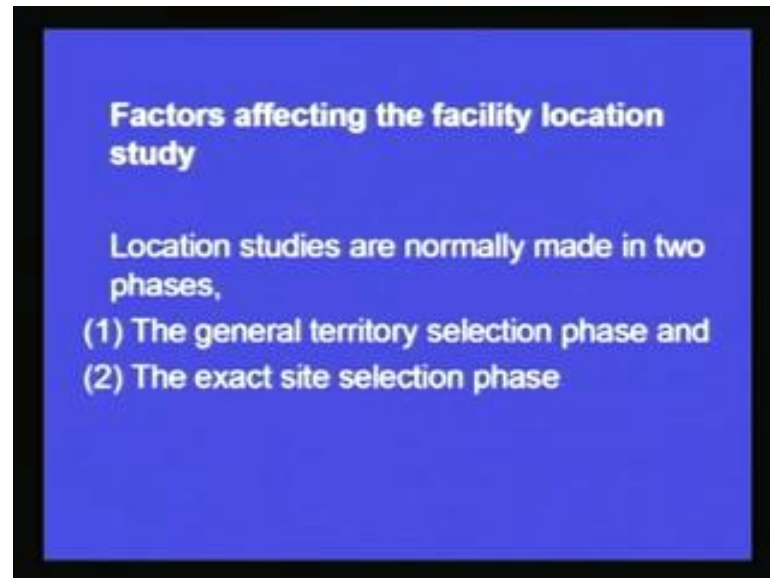
So, if political interference is much more in a particular state, the people may feel that it is not write to do business here. Let us shift our locality, our facility to a different locality in some other state. Similarly, there are other economic problems also, certain times the rate at which like electricity is being supplied to the industry, is also one of the factors which is governing the location of the industry.

Similarly, there may be certain states where the electricity is being provided at a very nominal price, plus round that lock electricity is being provided to the industry. The people who are into the business would like to setup their plants in those state, where uninterrupted electrical power supply is beings put, for those people who are coming to that particular state, for setting up their business ventures.

So, there are certain economic, social, legal and political factors which suggest that whether, this location is better or there is some other location which would yield better returns on same kind of investment. So, when the investment is being done by the people or the business man, they want that it should result into profit or the returns should be high. And on the basis of all these decisions, making a complete comprehensive exhaustive study like, business people or the company people are able to make a decision that and which particular area we should setup our plant.

So, these are certain points which result into a decision related to the plant location or the facility location.

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Now, let us see the factors affecting the facility location study. Now whenever, we have seen that there are so many different factors. So, many different criterion, which are the guiding pillars or which are the guiding forces for any particular company to set to setup a plant in particular locality. Now, let us club these different factors into 2 broad factors.

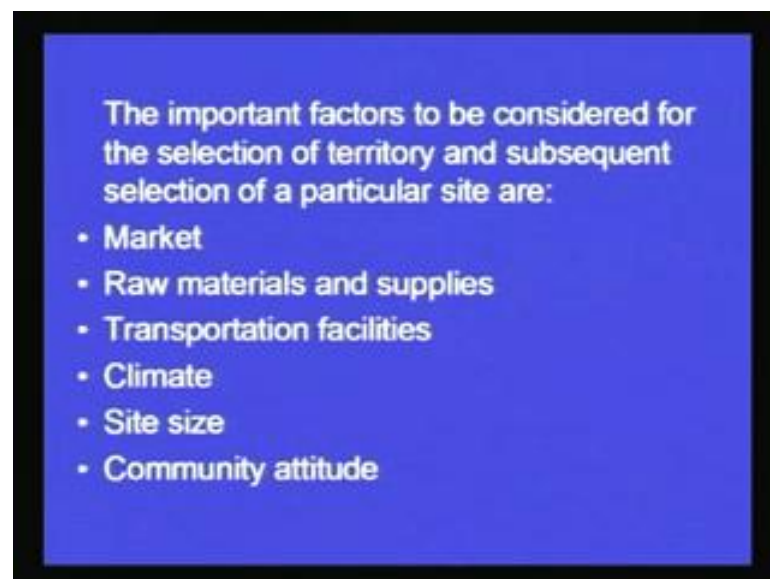
Now, factors affecting the facility location study are; location study is normally made in 2 phases. Now, we have seen that there are so many factors; we cannot say verbally, we have done a study or just in our mind we have our study and we have decided that this facility is going to be the best facility in such and such area. This is not possible; a comprehensive study has to be carried out seeing all the positive points as well as the negative points of a location.

There may be certain positive point; there may be certain negative points as well and then a trade of has to be made that these are there are certain negative points also in such and such area, in such and such location, but the positive points, out way the negative points and we have we will decide that we are going to establish our company or our enterprise in such and such area.

So, there are so many factors on the basis of which we will do this study. So, whenever we do the study the comprehensive study, it can be divided into 2 important parts. So, this can be the general territory selection phase; the general territory selection phase and the exact site selection phase. Already I started today's lecture, by giving you an example that if you want to setup our home, we have to see that whether we want to setup it in north zone or south zone or east zone or west zone of the country or a center zone of the country. So, that that amounts to the selection of the general territory, that in which territory I want to setup.

Then the second point is the exact site selection phase. So, if I have decided that yes I want to be in the north zone. So, the territory now is fixed, that it is going to be north zone. Now, within the north zone, I will see that which the cities where I can settle down are, and then I will decide that these are 5 different choices I have; which is the best choice according to me? I will do a analysis, I will see that this particular location is having these advantages and these disadvantages. Then, coming on to the second location I will see, what are the advantages, what are the disadvantages. May be I may be doing certain weight age analyses, in which I will give relative weight ages to all the positive and negative points and then finally, make a decision that this is the exact location where I want to setup or where I want to make my home. So, they this the study has be done in 2 different stages. So, first stage is the general territory selection phase and the second stage is the exact site selection phase. Now, summarizing all the factors.

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The important factors to be considered for the selection of a territory and subsequent selection of a particular site. So, in the previous slide we have seen that the study for selection of a location has to be done in 2 different stages. First stage is the general territory selection and the second stage thereafter, is the exact site selection or the exact location of the site.

So, what are the various factors that are considered in that? First is the market. So, any industry that is being setup is setup for making profit. I have been repeating this thing, this thing 2 and 3 times, I will already I have told that profit making is the first purpose of setting up of a facility. So, it has to be seen whether the market is there or not. It would not be advisable to setup a facility in such a area where, the market is not at all available. So, I mean to say is the customers are not available. If the customers are there it is good, if the customers are not, there the location is bad because the market is not therefore, the product for which we are setting up a facility.

Then a second point is a raw material and supplies. The transportation of the raw materials, from their availability site to the processing site is a big issue. If we locate the industry in such a area; where the raw material is easily available, the transportation is very cheap, the transportation cost is very less and we know that the supplies have to go and there is a certain root of supplies also available with us;, then there are certain mathematical tools, may be certain techniques, methods, which help us to decide the appropriate location on the basis of the distance is that we will say may be in the subsequent lectures.

But, the distance of the raw material as well as the suppliers that is also very important and we have to optimize on that that wherever we place our facility, the raw material as well as the supplier should easily be available. So, just to give you an example: If a very big industrial house is being setup, there are so many different small scale suppliers or vendors who setup their plants in the vicinity of that big plant, so that the transportation costs are minimized.

So, that is the kind of scenario or business scenario that is prevailing these days. Because if suppose, I set up a plant at point x and the person who is supplying the raw material to me or a sub assembly to me is located at the other part of the country. So, the distance and the transportation cost will be too much. Instead, I would like to advise to that

vendor is that he sets up a small plant in the vicinity of my big plant so that the transportation cost is minimized.

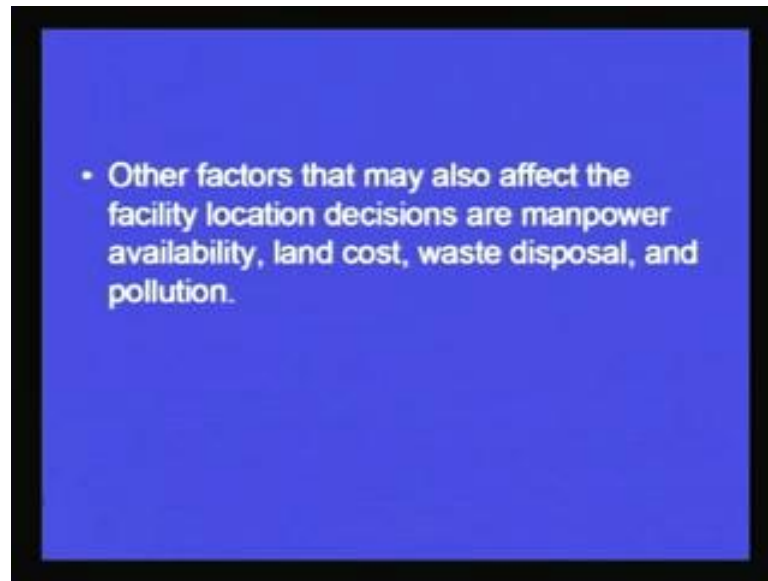
So, the supplies of the raw material as well as the people to whom I want to sell my product should not be at far flung places, in order to optimize the transportation cost. So, the market should be there, the raw material and the supplier or the supplies should be easily available. Then the transportation facilities should be there. I cannot think of setting up a plant, in such a area where the transportation facilities are not available. I would like to see, that the airport is there, I should be connected by air. The company should be connected by rail. The connect company should be connected by bus also

So, all these 3 kinds, even if you want to do certain things, these certain products that we are manufacturing have to be exported also and these are very bulky products, I would see that the sea root should also be close to me, so that the transportation costs are minimized. So, transportation facilities should be easily available. Then, the climate of the region.

The climate of the region also plays a important role; in deciding the location. Already, I have told in case of textile industry, we want a very humid climate or a humid environment which would not allow the yarn to break. So, the climate also plays a very important role. In some of the industries we may require very low temperature. So, if we place that facility in a area where the temperatures are very high during the summer, then we have to do the artificial cooling or artificial air conditioning; which may add to the total operating costs of the plant. So, why not to locate that facility in a area, where the temperature do not rise to a very high level. So, climate also plays a very important role in the decision related to the location of a plant.

Similarly, the site size also plays a very important role. We cannot plan of setting up a facility, which runs into acres in the middle of the city. So, if the size of the plant is very high, we cannot think of setting up this facility within the city. It has to be at the outs cuts or in the county side only. Similarly, the community attitude plays a very important role. So, overall every area has certain inherent qualities, certain attitudes. So, those attitudes also have to be taken into account, whenever we have to make a decision regarding the location of a plant.

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Then there are other factors also, that may also affect the facility location decisions. So, what are these factors? These factors are man power availability. This example already I have given that if, we place a plant in a area which is very poor or most of the people are below the poverty line, then we would very easily be able to provide employment to these people and the rate at which we have to pay them, may also be substantially less as compare to a very developed area. So, man power availability also is a very important point

Similarly, the land cost already I have told. Waste disposal is also a very important issue, whenever we think of environmental concerns and the pollution. So, all these factors also have to be considered, when we take appropriate decision or whenever we want to take a optimal decision, related to the location of our plant. So, facility location decision making is a very important area and very important decision that a company has to make. So, we will see that what are the requirements for setting up a plant in a country side? What are the requirements of setting up a plant in a town or in a city? All those things we are going to see.

Next lecture, we would see that what are the facility design procedures? We will see that what are the different types of layouts? Like process layout, product layout, fixed position layout and cellular layout. We will also see that what is the layout selection problem and how do we solve these layout selection problems.



Thank you.