

**Operations Management**  
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**Lecture – 17**  
**Factors Affecting Plant Location**

[FL] Friends, welcome to session 17 in our course on Operations Management as you are where we have started the discussion in week 4 of our course. In the last 3 weeks we have seen the fundamental aspects of operations management, we have seen product design and development and we have seen sales and demand forecasting.

So, once we know what the company wants to make and we understand that in what quantity or in how much quantity we are going to produce, we have to take a very cautious call on where the facility or where this production has to be carried out and in that aspect we have to understand the Nitty Gritties of plant location and the plant layout.

So, discussion in week 4 and 5 will focus on plant location and plant layout and if you remember in the last session we have covered the basic of facilities location or basics of facilities location in session 16. In 16 we have covered the decisions of the strategic decisions related to the location of a factory, we have seen starting from a country, we have to decide a region or a state and within the state we have to decide a site.

So, once the site is selected we have to see that how physically the facilities will be located in that site in order to meet the overall objective of operations management, that is to produce the right quantity of material at right time in right quality at reasonable cost. So, 4 important catch words that I have been explaining once and may be number of times that are we have to ensure the quality, quantity time and the cost.

So, here also our major objective of this decision making or strategic decision making related to plant location and plant layout is to ensure that we meet the overall objectives of the operations management.

So, in the last session that is session number 16 we have covered that what are the critical success factors related to the selection of a country, what are the success factors related to the selection of a state or region and what are the critical success factors

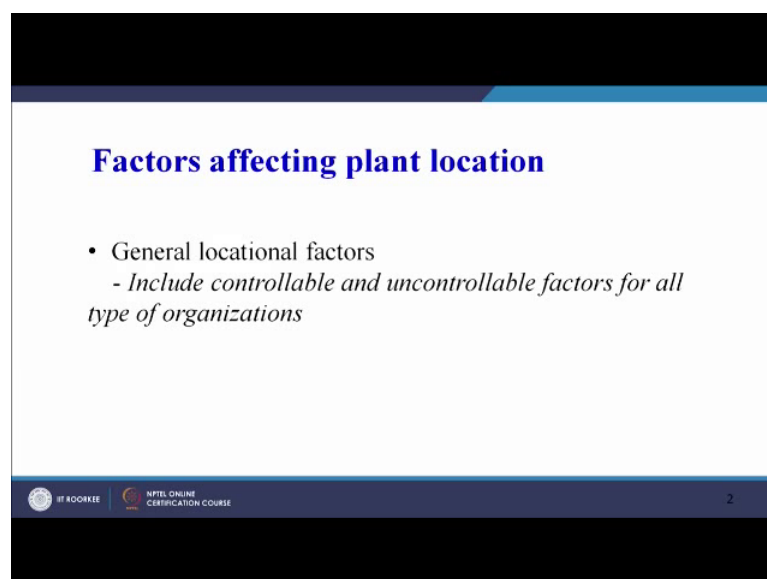
related to the selection of a site and then we had a very brief overview of plant layout and we have seen the definitions of plant layout.

Today our focus will be to slightly understand with the help of an example or a number of examples that how or what are the factors that are responsible for plant location we have already seen that once we have to decide a country, what factors we have to take into account once we have to select a region what factors we have to take into account sorry once we have to select a site what are the factors.

So, in general maybe there are space there are few factors which are common to each of these decisions related to country region and site there are few factors, which are specific to a when we have to select a country there are specific factors, which are related to the decision regarding the selection of a region and there are specific factors which are related to the decision regarding the selection of a site.

So, there are few factors which are common which we club them as the controllable and uncontrollable factors. So, there are number of factors which we have already covered, but we can further classify them as controllable factors and uncontrollable factors that we are going to study today and then with the help of certain examples, we will try to understand that how these factors help us to take a judicious decision regarding the plant location. So, let us quickly maybe understand the controllable and the uncontrollable factors.

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**Factors affecting plant location**

- General locational factors
  - *Include controllable and uncontrollable factors for all type of organizations*

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Now, what are the factors affecting plant location general locational factors include controllable and uncontrollable factors for all types of organisations. So, basically there are 2 types of factors controllable and uncontrollable. Otherwise we have seen if you remember in the previous session that is session number 16 which was the first session of week 4 we have covered specific factors when we have to decide a country.

Maybe for any multinational company decides India has it is plant location or India as a country where they want to establish their factories or plants or manufacturing facilities they will focus on certain factors. Within India suppose (Refer Time: 05:23) they have to decide which state can it be Himachal Pradesh or it can be Karnataka or it can be Bihar. So, they have to focus on the state.

Then within the state maybe in Karnataka suppose they 0 down that we are going to set up a plant in Karnataka awards is a consultancy company, awards is a software based company, why not to decide on Karnataka where already certain companies are functioning. So, they may focus on Bangalore within Bangalore they will focus on a specific site that this is the area where we are going to start our company.

So, starting from country to state to a city and then to a site all this comes under plant location and for making this decision there is a complete list of parameters that are taken care by the company. So, all these parameters or this list of parameters we can divide into 2 1 can be controllable parameters others can be uncontrollable parameters. So, maybe one example that I can share is the climatic conditions.

Now, maybe Patna may have specific climatic conditions a thermal or may be a temperature cycle around that is beyond the control of the or maybe beyond the control of the company people or the people who are managing the company. This is one decision which is out of control weather of a particular location is beyond the control of people working for the organised so that you can be one of the uncontrollable factors.

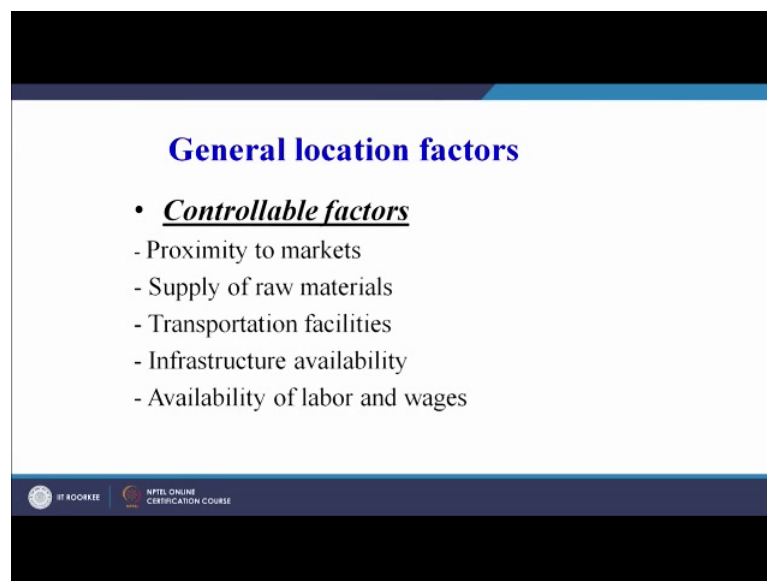
Controllable factors can be that they can take a conscious call that maybe we will be able to get more skilled people in this particular region of maybe a particular state. So, that can be a conscious call controllable factor where they can take a decision that yes this is the region based on the skill set of the people involved or required for the production facility. So, we can say both controllable and uncontrollable factors can have different examples.

Even all the learners can think of may be case studies or can think of examples which fit into these factors that we are going to cover today. So, maybe the list of factors may not be that interesting for all of you, but if you focus on the examples of each and every factor you will be able to understand the develop understand the thought process that can be used for making this decision.

So, basically the memorizing the factors may not be that important, but the examples based on these factors will definitely enrich your knowledge based and will definitely make your thought process more aligned in this strategic decision related to the plant location.

So, the factors we are going to cover maybe in today's session are the controllable and the uncontrollable factors.

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The slide is titled "General location factors" in blue text. Below the title, there is a bullet point for "Controllable factors", followed by a list of five items: "Proximity to markets", "Supply of raw materials", "Transportation facilities", "Infrastructure availability", and "Availability of labor and wages". At the bottom of the slide, there are two logos: "IIT ROORKEE" and "NPTEL ONLINE CERTIFICATION COURSE".

So, general location factors which are controllable are proximity to the markets. Now there can be a market of a particular product in a particular part of the country. Now one example is coming to my mind suppose there is a particular region in a country where it is the temperature is always above 35 degree centigrade.

What can be maybe suppose ours is a Ice Cream making organisation we are making ice creams it is always advisable that the temperature is always above 35 degree centigrade. So, all round the year there will be a demand of the ice cream so why not to set up our

facility at that location only. So, that since the demand is continuous we can produce continuously and we can make more profit instead of locating our facility in a region where you have maybe half the year the temperature is just maybe around 0 to 5 degree centigrade.

And in the remaining 6 months the temperature may go highest maybe 12 to 15 degree centigrade only. So, the maybe the demand for the ice cream may not be that sharp in that region. So, maybe that is one thing that is proximity to the market that we need to understand that this is the market, why not to fix or why not to fix this location for setting up our manufacturing plant. So, that is one example that is readily come into my mind.

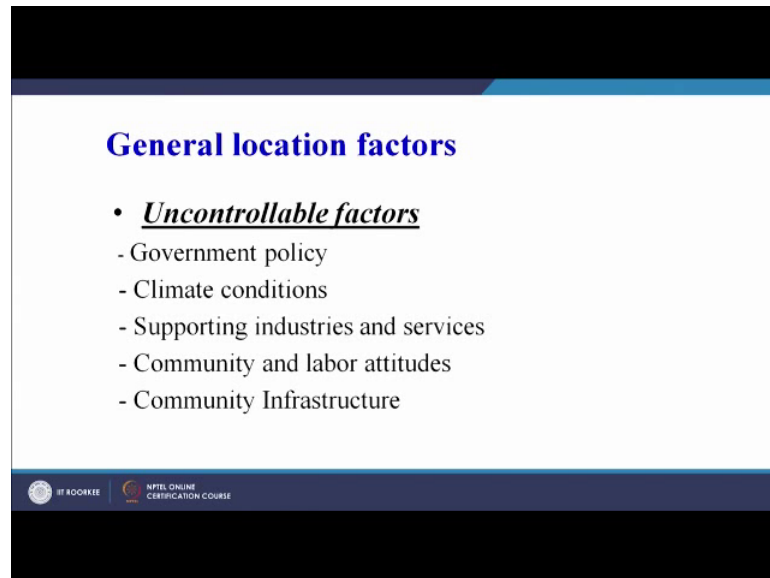
Then the supply of raw materials we can further try to take one example suppose we want to set up a thermal power plant in which cock or coal is the important raw material. So, you will see that most of thermal power plants will be located near the coal fields only. So, that the transportation cost is saved. So, supply of raw materials will also maybe influence our decision related to the location of the plant of the manufacturing facility transportation facilities.

Now, suppose the raw material has to be transported by railway as the source of medium or as the medium of transportation. We will try to locate our facility in such a way that it is near to the railway line or near to the existing railway line. So, transportation facilities are also important infrastructural facilities are important, now suppose maybe this can be related to the civil infrastructure or the communities where people can live and work for our organisation.

Availability of labour and wages the wages prevalent in a specific location may be different from the average wages of a other location. So, what is the availability and how much do we need to pay to labour in order to make them work for our organization. So, these are controllable factors why they are controllable, because all this data is available with us, we know the availability of labour, we know how much is the prevalent wages in the particular region, we know the infrastructural development of that particular region, we know the transportation facility or transportation mediums or sources available.

So, most of the things are known. So, we can control or these are controllable factors which will help us in the decision making related to our manufacturing facility.

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The slide is titled "General location factors" in blue text. Below the title, there is a bullet point for "Uncontrollable factors" followed by a list of five items: Government policy, Climate conditions, Supporting industries and services, Community and labor attitudes, and Community Infrastructure. At the bottom of the slide, there are two logos: one for IIT ROORKEE and another for NPTEL ONLINE CERTIFICATION COURSE.

Then there are uncontrollable factors on your screen you can see the government policy as organizers or as company people or as corporate decision makers, it may be beyond our control the government may have different thought process related to a specific policy.

So, government policies are beyond our control climatic conditions as I have already explained in the beginning of today's session are beyond our control. So, that is one thing that we have to live with which is maybe a particular temperature or temperature profile all-round the year, that is what the is maybe the climate of that particular region that we cannot control and if you see that most of the companies have come up in regions which are climatically soothing for or may be climatically comfortable for the workers.

Then supporting industries and services maybe another parameter which is uncontrollable, because we may wish that we will set up our plant here all the ancillary units will be developed around our plant, but that is beyond our control that is supporting industries and industries, industries and services is an important factor which is beyond our control, community and labour attitudes we cannot control the labour attitudes of specific region attitude may be different we have seen that cultural differences are there. So, those are beyond our control.

Community infrastructure is also beyond our control. So, we can that there are a large list or there is a large list of factors that we have seen in the previous session and most of these factors now we are trying to classify them as controllable factors and uncontrollable factors.

So, as a decision maker what must be my focus my focus must be on those factors which I can control and I should leave those factors which are beyond my control, because as a corporate person I may not be able to influence the government policy. So, government policy we have to leave with whatever the government has decided. So, government is of the people they will definitely take care of the business interests of the organisation.

So, that is beyond our control climatic conditions we cannot help it that is also beyond our controls our focus must be on the controllable factors, whatever information is available with us, whatever data is available with us we must focus on the data and information and make a judicious choice about the location where we are going to establish our factory.

Now, let us see the controllable factors as one by one and as have been listed in the previous to previous slide.

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**Proximity of markets**

- Location of facilities close to the market
  - *Provide goods and services at time and reasonable price*
  - *Reduce the transportation cost*
- Location of facilities close to market (based on product)
  - *Delicate and susceptible to spoilage*
  - *Services are promptly required very often*
  - *Shelf life of the product is low*

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First one is the location of facilities close to the market. So, one thing is very sure I have taken an example also that we must decide on the plant location, which is near to the

market. How it will help us it will provide goods and services at time and at reasonable price, because we are close to the market will be able to deliver the requirement posed by the customer quickly, reduce the transportation cost which is a common sense thing only that if we are close by to the market we need not have may be lot of transportation cost it can be easily controlled.

Now, location of facilities close to the market again maybe from product based on the product we can have another advantage the delicate and susceptible to spoilage. If our product is very delicate there are chances that it may break during transportation in that case also we must decide on the location which is near to the market where the product is going to be sold.

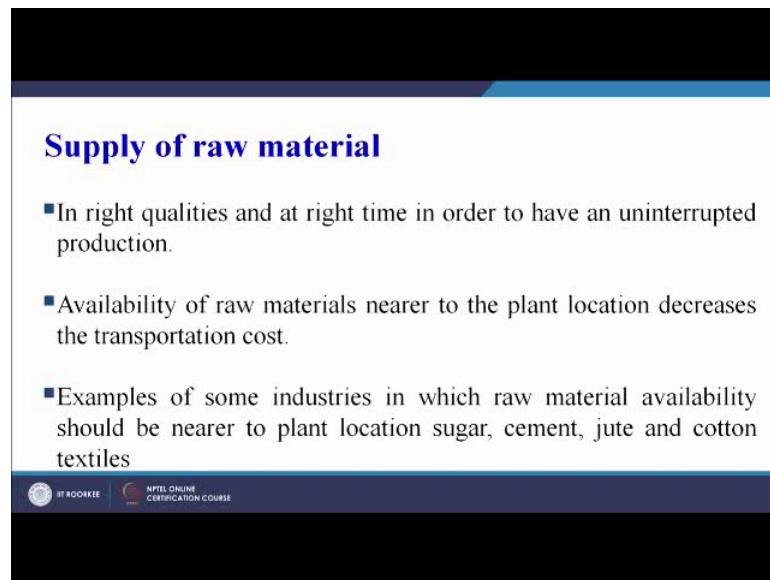
Similarly, if it is susceptible to spoilage over suppose we make a product and it has a shelf life of 3 days only and the most of the customers are maybe in a particular state. We must try to decide the location of our manufacturing facility within that state only, because if the shelf life is 3 days and we make it at a 2 2000 kilometres to the 2,500 kilometres away and it has to be transported by railways, it may take may be 48 hours to travel this 2,500 kilometres distance.

Therefore, it may get spoiled as a shelf life is very low. So, why not to locate the facility where the demand actually is. So, if the product is delicate if it is susceptible to damage services are promptly required very often shelf life of the product is low. So, from product point of view also we have to look that where the location must be. So, proximity to the market is most of the time and advantage when we decide to locate our facility.

So, if we are able to locate our plant near to the market in 99 percent cases we are going to be at an advantage only. Supply of raw material I have already given one example that our location must be near the raw material or near the source of raw material.



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**Supply of raw material**

- In right qualities and at right time in order to have an uninterrupted production.
- Availability of raw materials nearer to the plant location decreases the transportation cost.
- Examples of some industries in which raw material availability should be nearer to plant location sugar, cement, jute and cotton textiles

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So, as a raw material what do we require we require it in right quality and at right time in order to have an uninterrupted production.

So, maybe thermal power production or thermal power plant I have told it requires regular supply of the raw material, which can be taken as one example of the supply of raw material or the factor supply of raw material and how it influences our decision related to the location of the manufacturing facility. Availability of raw materials nearer to the plant location decreases the transportation cost.

So, once our location is closed to the market as well as it is close to the raw material. So, our transportation costs on both sides of the supply chain are saved. So, we are getting the raw material from a nearby location only we are selling our finish product in the nearby location only. So, the complete supply chain raw material transported to manufacturing facility converted into a tangible product product moved to the market and sold to the customer. So, this complete supply chain if it is the total distance is shortened it will save lot of transportation cost from the raw material source to the manufacturing facility from the manufacturing facility to the customer. So, that is very very important from the point of view of selection of a location for setting up of our plant facility.

Examples of such industries where the distance between the raw material and the manufacturing plant must be as low or as little as possible is the sugar industry, cement

industry, jute and cotton industry. So, maybe the examples maybe such that if you have to travel or if these raw materials have to travel a long distance there are chances that they may get spoiled. So, an example of some industry which raw material availability must be near to the plant as is given in the last slide is sugar.

In sugar industry what is the raw material the raw material can be sugarcane. Now you cannot make the sugarcane may to move from the field to the sugar industry may be over a period of 24 hours or maybe 36 hours it would be advisable that the sugar cane even after it is cut it must be used as a raw material in the sugar industry as soon as possible. So, that is one condition that that is one example of an industry where the distance between the factory and the source of raw material must be as minimum as possible as has been highlighted for jute and cotton industry also.

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**Transport facility**

- Transport facilities are very important for bringing raw materials to the factory.
- Transport facilities are very important for finished goods to the market
- A place which is well connected by rail, road, air and water transport facilities is suitable for plant

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Transport facility maybe another important point waterways railways airways roadways the different mediums of transportation. So, when we are deciding that where our plant will be located we have to focus on all these 4 aspects.

This is not only related to may be let us take the discussion on a slightly other side this is not only related to the decisions related to manufacturing facilities, where the raw material is getting converted into the final product. Let us take an example of our educational institute and the location of this institute has to be decided pan country, pan country means across the country we have to decide where a this particular institute must

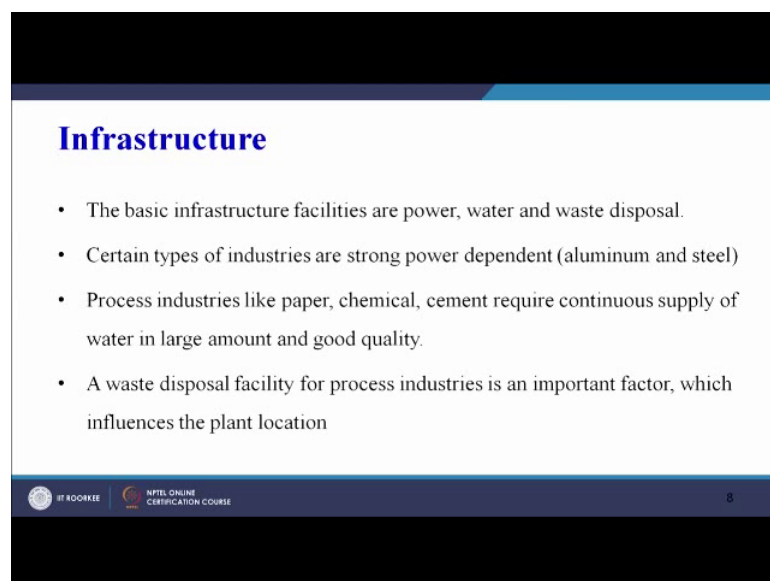
be located the institute is very important institute establish by the government how we will decide.

The country already is known to us. So, we will decide first the state within the state then the district within the district then the location and when the location is being finalized it is always important to focus on the transport facility. Because it is an educational institute the students will have to travel to that institute from all across the country the faculty has to travel to that institute from all across, the country the recruiters the companies have to travel to that educational institute for making the recruitments.

Even may be a conference is organised the international experts have to travel to that institute in order to attend the conference. So, therefore, the transportation facility is also very very important when we have to decide that where the location has to be and, similarly when you are making a product out of a raw material we need to transport the raw material from the source to the factory and from the factory we need to transport our finished goods to the market.

So, the availability of transportation facilities is very very important. So, transportation facilities are very important for bringing raw materials to the factory transport facilities are also important to transport the finished goods to the market. So, a place which is well connected by rail, road, air and water is suitable for setting up of a plant.

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**Infrastructure**

- The basic infrastructure facilities are power, water and waste disposal.
- Certain types of industries are strong power dependent (aluminum and steel)
- Process industries like paper, chemical, cement require continuous supply of water in large amount and good quality.
- A waste disposal facility for process industries is an important factor, which influences the plant location

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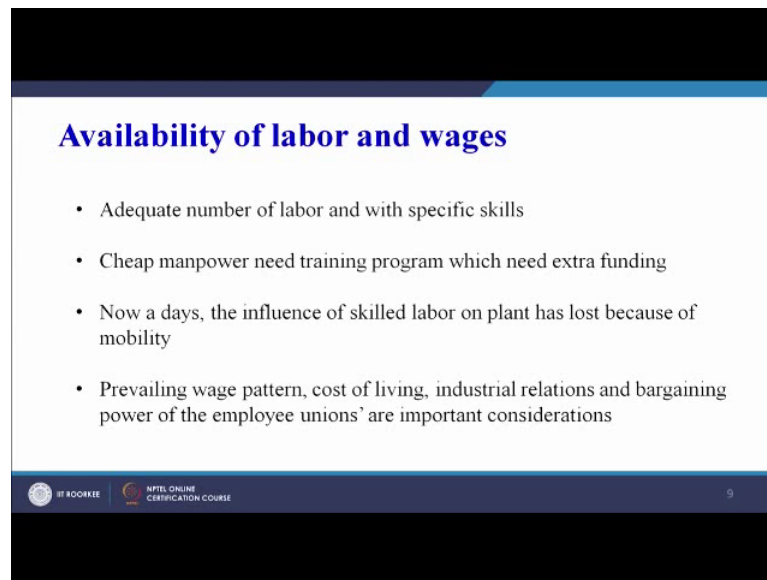
Then the infrastructure the basic infrastructure facilities are power water and waste disposal. So, whenever we are setting up a plant we need to see that whatever by products or whatever waste is being generated by the factory how we are going to manage that waste the government policies are very very stringent these days and the waste disposal is an important point based on which the location has to be identified. So, the basic infrastructure includes the power available the water available and the waste disposal.

Certain types of industries are strongly power dependent for example, aluminium and steel. So, source of power of the rate at which we are able to get the power is also equally important. Process industries like paper chemical cement require continuous supply of water in large amount and in good quality. So, infrastructure means that whether we are able to get whatever is the important requirement for the manufacturing activity for example, in making of aluminium and steel we require lot of power.

So, whether power surplus state is there. So, if there is it is a power surplus states we will get the required amount of power for converting our raw materials into the final product that is also important decision, then a waste disposal facility for process industries is an important factor which influences the plant location. So, the infrastructure is again an important plays an important role in our decision related to the plant location just to revise from infrastructure point of view, we need to study the power availability of power the availability of water the may be the possible means and mechanisms of waste disposal maybe sometimes water may be required in good quantity and quality.

So, these are important parameters or infrastructural support that is required for making a product and for that we need to decide on a location where we are able to have a good infrastructural support, which will help us in our objective of making our products which are cost effective.

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**Availability of labor and wages**

- Adequate number of labor and with specific skills
- Cheap manpower need training program which need extra funding
- Now a days, the influence of skilled labor on plant has lost because of mobility
- Prevailing wage pattern, cost of living, industrial relations and bargaining power of the employee unions' are important considerations

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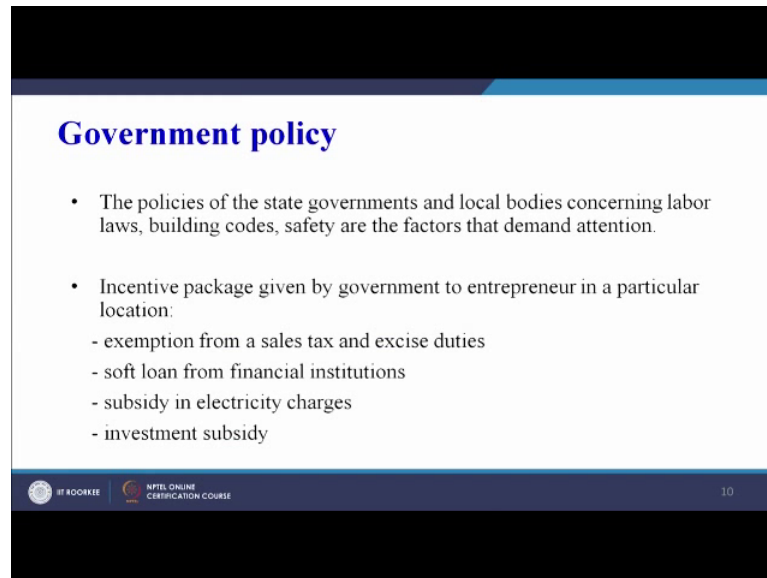
Availability of labour and wages also we need to understand adequate number of labour and with specific skills, whether they are available or not cheap manpower need training programs which need extra funding. So, that also we have to see that whether the manpower is available can we train them in order to make them skilled. So, that they can work or help us in achieving our overall objective that is important.

Now, a day's influence of skilled labour on plant has lost because of mobility. So, maybe these days it is also possible that you may hire the people from other regions also who can travel to a specific location and work for the organisation. So, this particular point availability of labour may have lost most of its significance, but the wages is an important point because minimum wages are set and these wages have to be met by the organisation.

Then the prevailing wage pattern of the salary structure to be more specific cost of living in that particular area industrial relations and bargaining power of the employees union also plays an important role. So, all these points can be explained in much more detail, but maybe just to tinker your thoughts related to the factors or the multiplicity of the factors that are required of that are important, while making a decision that that is the basic objective of these sessions that we are able to just tinker your thoughts and maybe open up the thought process in such a way that you focus on a plethora of factors and make a judicious choice related to the selection of a plant.

Or selection of a location for a plants you can see that cost of living is also an important parameter you may be getting more salary as compared to location b, but the cost of living at location x location a is much more as compared to the cost of living in location b. So, may be the cost of living will also influence your decision related to the location of the plant.

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**Government policy**

- The policies of the state governments and local bodies concerning labor laws, building codes, safety are the factors that demand attention.
- Incentive package given by government to entrepreneur in a particular location:
  - exemption from a sales tax and excise duties
  - soft loan from financial institutions
  - subsidy in electricity charges
  - investment subsidy

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Then the government policies are equally important the policies of the state governments and the local bodies concerning the labour laws, building codes, safety are the factors that demand attention. There may be certain safety standards of a particular state which must be adhered to by the organisation. So, we have to ensure that we comply with all the safety standard all the government policies all the government rules and regulations in order to in order to set up our plant in a specific state.

So, that is important from the point of view as we can see the building codes are also different from state to state. How much high rise building you can make, how much feet you can go in the wide domain what are the numbers of stories that you can make in a particular state may be different from state to state. So, that is also going to influence our decision related to the location of our plant facility. So, the incentive package given by the governments to entrepreneurs is a in a particular location.

So, in order to give a boost to the industry many states usually gives certain incentives to the entrepreneurs or the businessman who in order to attract them to their state. So, these

can be the type of benefits can be exemption from sales tax and excise duties they can give them soft loans from the government approved financial institutions subsidy can be given in electrical charges or they may give them investment subsidy. So, government can support the industry in a may be positive manner by a may be incubating the industry in the state by giving them certain advantages.

So, different states may have different policies related to the establishment of the industry maybe one point, which is not mentioned here is the single window clearance where our in which all clearance is can be given from a single window only from a single source only, because in certain states entrepreneur or a businessman may have to run from one office to another office in order to get the clearances, but may be a particular state may give single window clearance only.

And therefore, a entrepreneur may be interested to set up a location there. So, generally trade-off is done there can be no place where you have all the factors which are going to help you in the positive manner. Only all the factors may not be satisfied or may not be culminating into positivity at single location. So, you have to do a trade off if you list 10 factors that are important to you we will focus on may be 7 or 8 factor these 7 are best at this location and the other 3 are not the best, but are not the worst also they are average. So, let us decide on this location.

So, the first point is listing out the factors and we have tried to list these factors in the last 2 session in session 11 we saw the critical factors related to the decision regarding plant location from country point of view from region or state point of view from site point of you, today we have divided these factors into 2 broad factors the controllable factors and the uncontrollable factor. We are focusing on the controllable factors only and try to understand that how these factors govern our decision related to plant location and each and every factor we have try to understand with the help of certain example.

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**Supporting industries and services**

- Now a day the manufacturing organization will not make all the components and parts by itself
- The source of supply of component parts will be the one of the factors that influences the location.
- The various services like communications, banking services, professional consultancy services and other civil amenities services will play a vital role in selection of a location

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So, last factor is there on your screen that is supporting industries and services. So, now, a day's manufacturing organisation will not make all the components are or parts by them. So, the depend on the ancillary units who will make certain parts for them and these parts are finally, assembled by the company in order to make their product. So, the source of supply of component parts will be one of the factor that influences the location the various services like communication banking services professional consultancy services and other civil amenities will play a vital role in selection of a location.

So, maybe there is a automaker or a big automobile company large scale automobile company wants to set up a plant. So, they will see that where the ancillary units will be located who will be working for them for making the parts and component. So, that is also an important parameter which will influence their decision regarding the location of a plant.

So, I think with this we come to the end of today's session and we will carry forward this discussion in the subsequent sections also the subsequent sessions also we are left with 3 sessions in this week in which we will be covering the other entry cases involved in plant location. Then we will focus in the next week on plant layout types of plant layout. And then we will see with the help of certain example that what are the advantages and limitations of different types of layouts.

Thank you.