Project Management for Managers
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Lecture – 30
Product Mix and Plant Capacity Analysis

Hello friends. I welcome you all in this session. So, we will continue what we have been doing in last couple of sessions. So, let us start with technical analysis of a project, how to choose a particular technology or what are different points one should consider in technical analysis. So, let us look at product mix.

Let us say if you are a company making laptops and mobiles, so product mix means how many units of laptops and how many units of mobiles you should produce. So, that is product mix. It will be decided by the profit which you are earning from each of those products and the resources which are available to you. So, that product mix is to be decided precisely.

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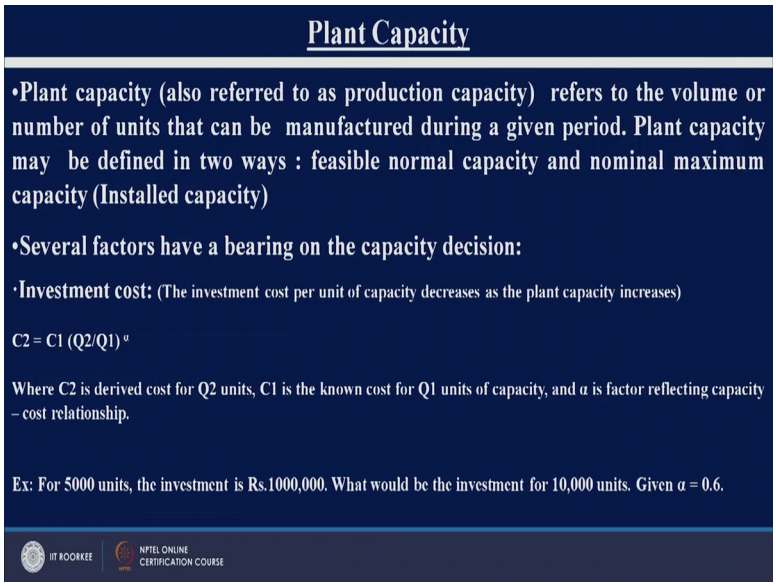

Plant capacity, plant capacity plays an important role in technology selection. So, let us see if you want to expand plant capacity, then definitely you will go for a higher level of technology and higher level of technology when you go for, you need to invest in the technology. When you invest, the cost per unit will come down, right. So, you have to take appropriate decision, but should you go for technology upgradation for increasing

plant capacity or you can have other means of increasing plant capacity, right. So, this decision is very carefully taken, right. So, as I said when you go for a better technology, the cost of producing one particular unit will come down, right because we will have more production. So, basically you have got two types of plant capacities. You have got feasible normal capacity and the second one is installed capacity.

So, let us say installed capacity of a machine is to produce 100 parts per hour, but due to several constraints that machine would not produce 100 parts, but less than that, right. So, it could be due to let us say power failure, let say maintenance of the machine, let say a labor problem or non-availability of material. So, all those things will reduce the installed capacity of the machine. So, you will have normal capacity, right. So, these are two types of capacities.

So, there are several factors which have bearing on capacity decisions as I said investment is one of them. When you invest in new technology, the cost per unit produced would decrease, right. So, there is a relationship between quantity and investment. Let us say this is the relationship, it is C2 is equal to C1 into bracket Q2 divided by Q1 bracket close to the power alpha, right.

So, what is this alpha? Alpha is nothing, but relationship between quantity and investment, right and this relationship is linear or non-linear. What do you think? Let say you are producing 100 units and you want to produce 200 units and for 100 units, you have made let say X 1 investment, right. So, how much would be the investment for increased quantity? You can apply this particular formula, right. So, let us take this example. For 5000 units, the investment is this much right, 1000. What would be the investment for 10000 units, given alpha is equal to 0.6 and what is this alpha? It is the factor reflecting capacity cost relationship, right. So, what do you think what would be the answer to this question? Let me solve this question. So, you have got C2 is equal to C1, Q2 divided by Q1 alpha, right. In this question, C1 is this, right. Q2 is 10000, Q1 is 5000, alpha is 0.6, right.

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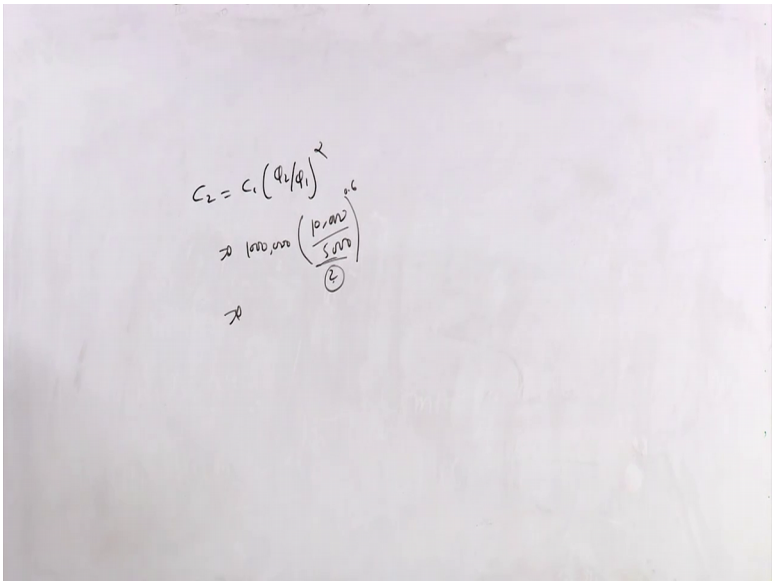

So, this is 2, right. This value is 2. So, it is 2 to the power 0.6 into 1000, right. Would it be 2000? What would be the answer? Since we have doubled the quantity, do you think the cost would be doubled? No, it will not be doubled, right. It would be less than that, right and this is the answer.

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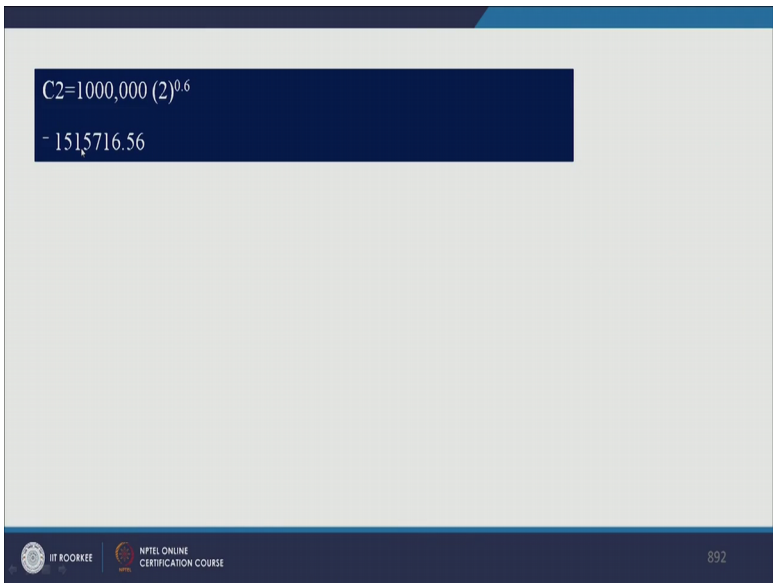

So, it is very simple question, but there is a relationship between capacity and quantity and this relationship is not linear, right. It is non-linear, right. So, when you let say when

you increase quantity, the investment would increase, but that at decreasing rate, right. So, that is the relationship between capacity and investment, right.

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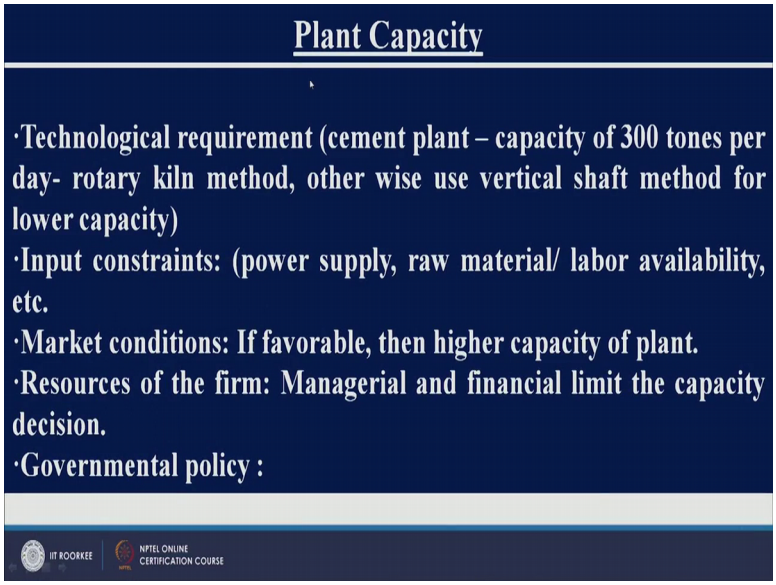

Let us look at plant capacity in detail. The plant capacity would be determined by input constraints. Whatever is your plant capacity, it is difficult to run at its installed capacity as I said because of several reasons, right. So, there are some input constraints. Let us say you are not getting sufficient power, non-availability of raw material, labor tools and so on, right. Market conditions if favorable, then you need to have more plant capacity. If not, then whatever is the capacity of the plant, you would not be using even that particular capacity also, right. So, resources of the form managerial and financial resources will limit the capacity decision because to increase plant capacity, you need investment, right and of course, you need appropriate skilled people also to increase plant capacity and of course, governmental policies. These will play very important role in plant capacity.

Yes, in one of the lectures we have discussed that let say if you are into business of telecom and the government does not want to give you more spectrum, then you cannot increase the capacity of your business, right.

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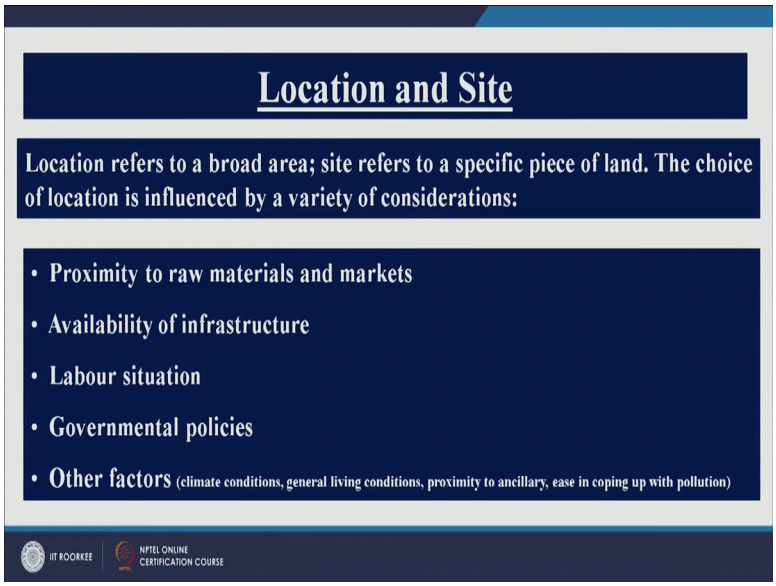

So, government policies and there are other factors also, right. Location and site is another point which you should be considering while going for technical analysis. So, when I say location, it means broad area. Let say if I want to start a jute plant, right, let say cement plant. So, I can either go for say Maharashtra or let say some other state of the country, but when I say site, it means a particular location, right. So, location refers to a broad area while site refers to specific piece of land, right. So, the choice of location is influenced by variety of considerations and it is again an important point how to decide location of the plant. Now, it depends on what product you are making, what market you are serving, availability of resources, availability of man power, availability of funds, the government rules regulations, isn't it. So, there are again hundreds of factors which would affect location of the plant and site of the plant, right. So, it should be again it depends on what kind of product it is, right. If it is a cement plant or if it is a cement project, then it should have proximity to raw material, right. You cannot have cement plant in city, right.

So, most of the services are in the city, but most of the manufacturing plants are outside the city, right. So, you should look at what are different markets which you are going to serve, then only decide your location, right because if you are let say coming up with a project at international level, so you should select a location from where you can easily serve your market, right. Availability of infrastructure at that particular location and

infrastructure include several things like you know utilities and you have got roads, you have got telecom and you have got other infrastructure, right.

Then comes labor situation government policies. I have already talked about government policies and other factors like climate conditions, general living conditions. For example, software business you have got cities like Bangalore, Pune isn't it? Why because of climate conditions, right. General living conditions of that particular city or of that particular area, right. For example, different facilities related to hospitals, education isn't it, proximity to ancillary units because you are not making all the products of your product, right. You would be getting a raw materials, semi-finished materials. So, there would be different ancillaries which would be giving their materials to you coping up with pollution, right. So, all such factors should also be considered while deciding location and site decisions, machineries and equipment. Whatever you are doing in terms of machinery and equipment should be done carefully. Structures and civil works.

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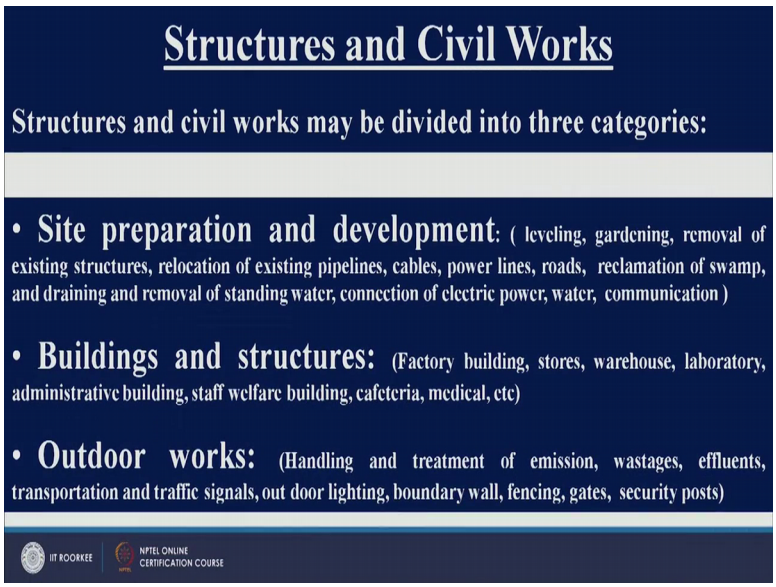

So, when you talk about structures and civil works, you can divide them into three parts. You have got site preparation and development. Very important point is site preparation. It is not simple to start construction of a plant at particular site. You need to prepare that site very carefully and there are several things you should take into account for site preparation, right. For example, levelling of the land which you have received from let say government you have bought from some other party, right. So, you have to do

leveling, you have to go for gardening, the removal of existing structures. There might be some unauthorized structures at that particular site. So, you need to remove them and it is difficult several times in our country, right.

So, the fellow you know unauthorized does not hold that land which you have brought. He might go in court of law, right. So, though he is wrong, but again it will take a lot of time. So, you need to look at issues like removal of existing structures, relocation of existing pipelines. It is possible that from that mainland, several pipelines let say either gas pipeline or some oil pipeline or water pipe line passing through that particular piece of land on which you want to construct your plant. So, relocation of those pipelines, cables, power lines, roads, you need to prepare roads also, reclamation of swamp and draining and removal of standing water. So, you need to clean that particular site, land, right.

Connection of electric power takes lot of time, water communication and so on. So, site preparation is a used task. It is not that once you get site from government or from some other source, you start you know construction sites, right. So, buildings and structures you need to come up with different types of layouts, different types of designs for factory, building and the buildings are not only related to manufacture something. You need to come up with several other buildings also. For example, stores, warehouse, laboratory, administrative building, right; very important building, right because most of the decision would be taken by peoples in administrative block, right. It is like PMO, right. We have discussed project management office administrative block staff welfare building. If your plant is a big one, then you might let say a school in the plant, you may have hospital in the plant, you may have let say swimming pool in that plant, you may have residential quarters, you may have some sports facilities, right. So, you need to come up with all those buildings and other structures, then outdoor works handling and treatment of emission which is very important.

If you are coming up with let say chemical plant, right so you need to get clearance from different departments, right. So, how you are disposing off wastages coming out of your plant, how you are treating by products which are coming out of your plant, fencing gates, security posts, boundary walls, all these things you need to look at, right. In fact, we have talked about environmental aspects. So, as I said what are different affluents coming out of your plant, how you are disposing them off, how you are getting

environmental clearances from let say Ministry of Environment or local bodies or some other agencies, right. So, the next point is project charts and plant layout. So, in previous slides, we discussed about location of the plant. Now, we will discuss plant layout as what kind of plant you should come up with, right.

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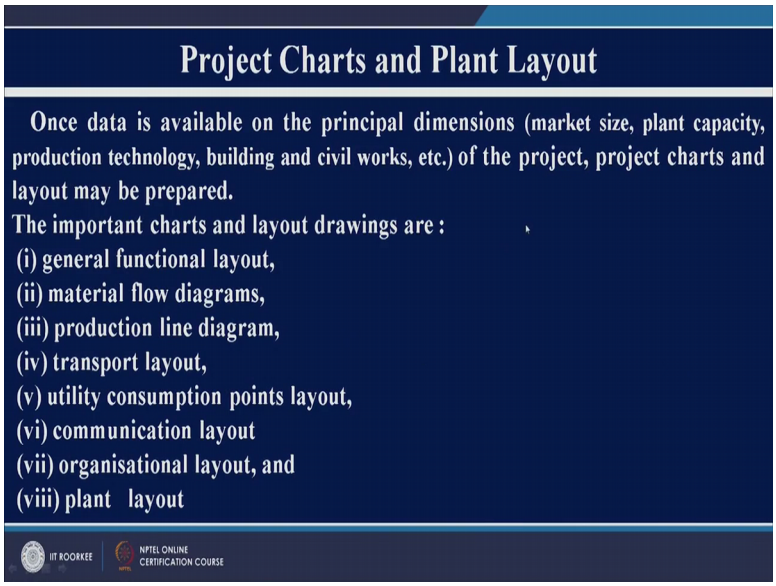

So, once you are done with issues like let say market size, plant capacity, production, technology, building and civil works, now you should take care of project charts and plant layout, right. So, there are couple of important chats and layout drawings. So, you should first come up with general functional layout. When I say general functional layout, I mean what are different functions which are performing in that particular plant. Let say you have got machine shop, you have got foundry shop, you have got assembly, you have fitting and so on, right. Different functions are to be performed, then how material is flowing, right. So, you should come up with material flow diagram. So, as far as possible, you should design a layout in such a way that backtracking of material is not happening much, right.

When I say backtracking means let us say the material is going from machine 1 to machine 2 to machine 3. Then, it should not go to machine 1 once again, right. So, backtracking should be minimized. So, your plant layout should be such that right under different types of plant layout, you have got you know product type layout, you have got process type layout, isn't it. Then, you have got production line diagram, transport layout,

how material will move within plant. Again they should not be backtracking of vehicles which are carrying your semi-finished products within plants, utility consumption points layout because you will have let say oil station, where you will have a power station, where you will have water tanks isn't it. So, you need to come up with utility consumption points layout, communication layout organizational layout. Yeah this is something which we have already discussed when we were discussing different types of organization structure, right.

So, organizational layout and then, plant layout, right. So, this is all about project charts and plant layout. So, the important considerations in preparing plant layout are as I said smooth flow of goods from one point to another point, proper utilization of space, scope for expansion. Whenever you come up with a layout, try to keep expansion scope. You should not use the available area in first goods itself, right. There should always be scope for expansion because if you are going for let say capacity expansion, what will you do, isn't it. So, your plan should be such that it should have scope for expansion, right.

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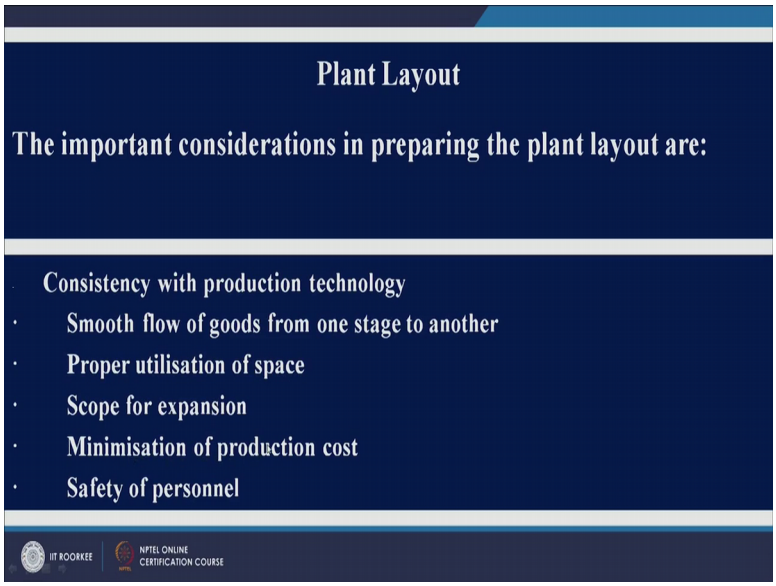

Minimization of production cost and minimization of transportation cost, minimization of handling cost, right. So, all those things you should be taken care of while plant layout designing, right and safety of personal workers who are working in that plant, schedule of project implementation. Now, once you are done with all those things, you should prepare schedule, right. So, when we say schedule means what schedule of project

implementation, right. So, you should have start date and ending date, right. So, its start and ending date for different activities of the project, right.

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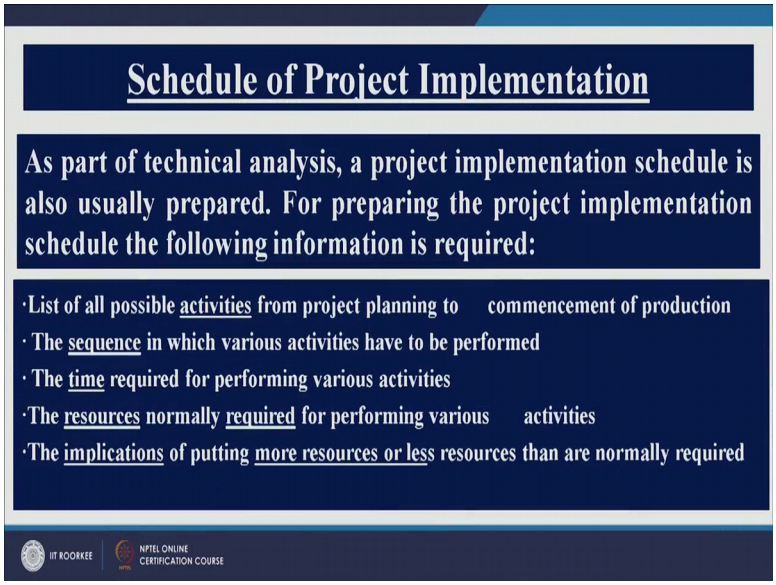

So, first of all list of all possible activities which would be there in that particular project which you have taken upright sequence in sequence, then how you are going to perform those activities because some of the activities can be performed parallelly, some of them in sequential manner, right. It depends on activity to activity, it depends on several other things, right. Suppose let say if you are doing two activities sequentially because of non-availability of resources right, but if resources are available, you can do in parallel manner also, right.

So, once you are done with listing of all the activities and you have decided what would be the sequence, then you should try to estimate what would be the time required for performing those particular activities, right and not only time, but you should also estimate how much resources are needed for a particular activity, right. So, these two are important points time estimate and the cost estimation, right. When I say cost, I am taking care of cost of resources which are being used for that particular activity, the implication of putting more resources or less resources than are normally required. So, what will happen if we put more resources on a particular activity? Its duration will come down, right. So, to what level we should add more and more resources to a particular

activity? So, those decisions are to be taken up carefully. The need for considering alternatives and there are alternative ways of transforming an idea into concrete project.

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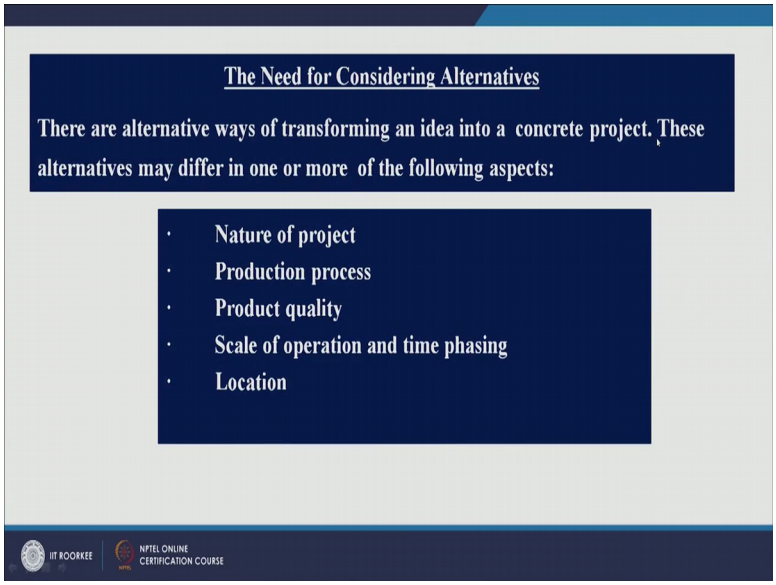

Now, these are alternatives in a different one or more of the following aspects, right. So, the nature of the project production process, product quality scale of operation and the final is location, right. So, these are couple of points which we have discussed in technical analysis. It is very important part of Project Management.

Now, we will move on to next topic which is very important and it is on Human Resource Management.

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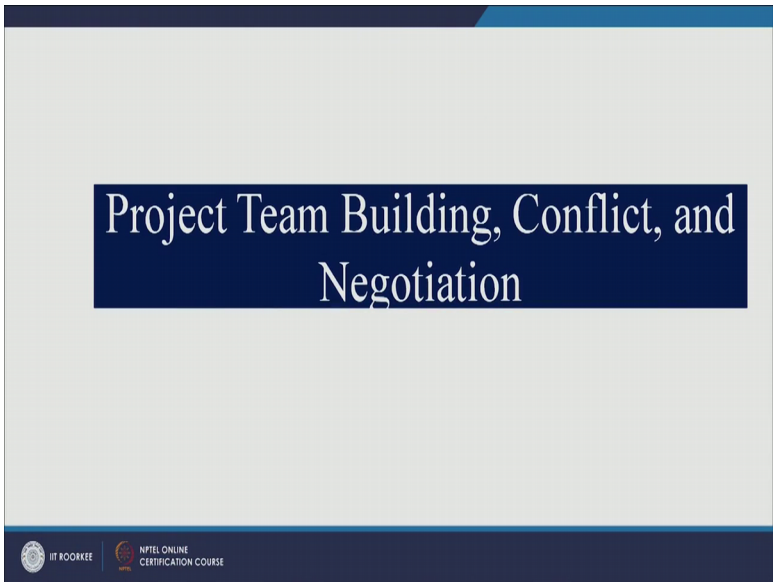

As I said we should study this subject into 10 different areas. One of them is Human Resource Management, right. So, the success of a project depends on how good your man power is, how good your human resources are in your organization because if you have got let say other resources, let say if you have got financial resources, if you have got material resources, if you have got machines and equipment resources, but if you do not have right human resource, you cannot do anything. So, the most important resource is human resource.

If you do not have finances for your project, but if your human resource is good, then they can arrange finances from somewhere, right. So, let say if you do not have machines or raw materials, if you have got good human resources, they can arrange, but if all other resources are there, but you do not have good human resource, then they will spoil everything. So, the most important resource is human resource and for a project, you will have a project team, right and in project team you will have different people. As I said it is very difficult to manage a project team, it is difficult to lead a project team because team members are from different educational background and they would be having different cultures, different traditions, different egos and so on, right. So, how you are managing talented pool of team members, it is a challenge, right.

So, let us look at couple of things related to Human Resource Management. First we will see what is project team building, then conflicts and then, negotiation, right. So, let us

start with this team building process. So, how to build a project team? So, if you want to build a project team, first of all you need to identify what kind of work you want to do in a project, for what purpose you need a team member. So, once you have the requirement, then search for necessary skills, right. So, identify a job. For a job in the project and then, look for a person for that job, right. So, there should be a fit between a job and a person, right otherwise it would be very difficult, right. So, identify necessary skills. If you are able to identify a right person, well and good, otherwise what you should do training, right. Isn't it?

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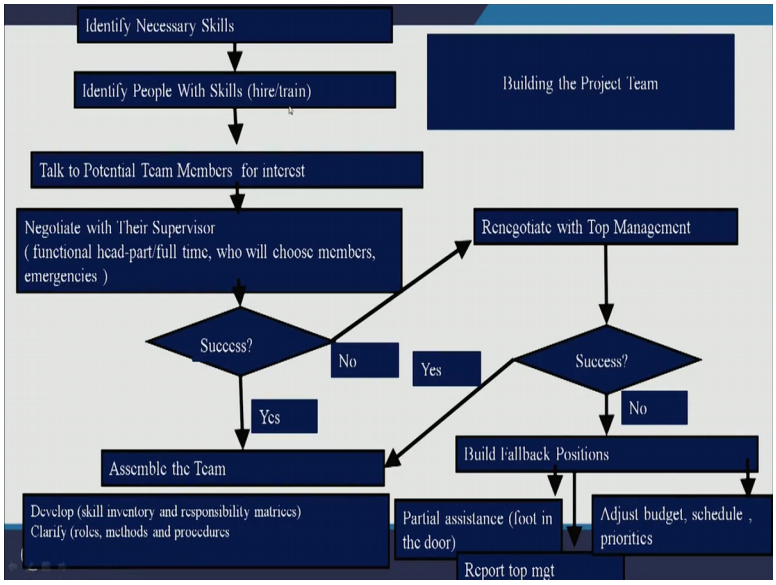

So, identify necessary skills and if you do not get it, let say if you want a person having let say you want a person having 100 marks right, but the fellow which you have has got 100 marks right, then you should need to try that fellow, right. So, that you get right skills in that fellow, right. So, for getting right person what you should do, you should talk to potential team members because as I said project is quite a heterogeneous entity, right. Heterogeneous in terms of different capabilities, different skill set, right. So, talk to potential team members and one interested to work for your project, negotiate with their supervisor. Let say in an organization you will have let say 10 functional departments, right and you are coming up with a new project. So, you need people from different functional departments for that particular project which you have taken up, right. So, what you should do is, you should try people who are working in different departments and talk to their functional managers as well, right.

So, negotiate with their supervisors, right because these are the people who would be giving their stuff for your project. So, talk to functional head, try to get good people for your project, but in real life, no functional manager would give you his best people for your project. Isn't it? Otherwise you will do the work of his own department, right. So, that is very important how you are getting right person for your projects. It is an art, right. You should talk to the functional head and talk to the concerned person. Isn't it? So, try to get that person for full project length right, for full period of the project. If you do not get, try to get it on part time basis, right. So, if you are not able to get him for let say entire one month, then get him for let say weekends, right. So, this is very important step i.e. negotiation with the supervisor, right to get right person for your project. If you get success in this process, then assemble the team, otherwise approach top management, right.

Now, if CEO of the company asks 10 functional managers to provide 20 people for your project, well and fine. Assemble the team. If not, then what? Then, you can take these options, right. There is something called build fallback positions, right. What is this? You can do couple of things, right. So, there is something called partial assistance, there is something called foot in the doorstep. You just ask for partial assistant of that particular expert which you need for your project and you just tell him that you just give this fellow for one day, right. Once you get him for one day, then ask for one more day. So, this is known as foot in the door approach, right. You just put your foot in the door and then, enter into house, right. So, take that fellow for few days and then, ask for extension, right. So, this is a good approach, right.

The second is report to top management. Once again you can report to top management to get that particular person for your project, otherwise what now since you want a resource person for your project and you are not able to get it by all the means. So, what now? Now, you can do only 2-3 things, right. Either you change schedule of the project because of non-availability of that particular person, right. So, change schedule, change priorities of the project, adjust budget, right. So, let say if you do not get a right person from within the organization, then get similar skilled person or similar person has got you know skills from external sources, right. So, in that case, you will have to adjust budget, you will have to pay more, right. So, this is nothing, but how you are building

project team, right. So, once team is ready, you can develop the team in terms of skill inventory and responsibility matrix.

So, you can come up with a matrix that this fellow has got these many skills and this fellow can do these many jobs, right. So, you can have a matrix, right. So, let say person A can do job B C D and so on, right. Person B can do jobs like U P Q R S T and so on, right. So, the matrix can be prepared, right and that should be of course clarity of roles and responsibilities in team. So, these two are not continuous processes, right. So, this is nothing, but building the project team. It is very important step because if you do not build project team, you cannot do project in time within budget and project will not deliver a required performance, right. So, it is very important step, team building.

Now, whenever you have got a project team, it should have certain characteristics.

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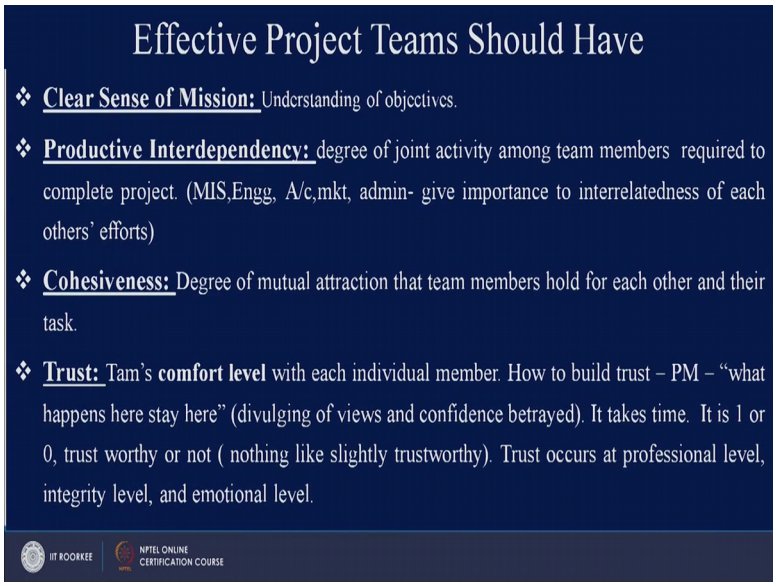

So, effective project team should have following characteristics. First of all, clear sense of mission. In other words, team member should understand what are the objectives of the project. So, the other points we will discuss later on. Let me stop here. As far as this particular session is concerned, in next session we will continue with other points related to team building, right.

Thank you very much.