Industrial Engineering
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Module - 4
Lecture - 11
Facility Design Part-II

A warm welcome to all of you in this lecture on facility design, we already had a lecture on facility design that was called as facility design 1 in which we have seen that; it is very important to decide and appropriate an optimal location of the plant facilities. So, we have seen what do you mean by location, we have also seen what are the various factors that govern the selection of a appropriate location for setting up a plant or for setting up a facility.

We have seen, we have understood large number of a examples we have tried to explain the different types of factors like: internal factors, external factors that govern the selection of a appropriate location. Now, once we have decided that we are going to set up a facility in such and such area of the country. We have to decide that a within the area how our different elements of our facility of our manufacturing plant should be set of by elements I mean to say that where the machine should be there.

Where should be of particular shop say machining shop? Where should be paint shop? Where should be the maintenance plant? Where would be the employees be staying? Where would be the recreation facilities? So, initially we have to take a decision that; where we are going to locate the plant within a particular territory. So, once the territory is fixed once the city is fixed within the city a area has been identified as the site area.

Now, within the site area, how the different shops, different fields or different we can say elements will be allocated that we have to see. For example, I have already taken an example of a house a bird's eye view of the house, suppose there is no roof on the house from the top we are seeing. So, which suppose at one particular location we have kitchen then adjacent to kitchen we have the dining hall then may be the bed room we have a attached toilet and bathroom.

So, all these are the location of the various elements in the house or the various rooms in the house. Similarly, whenever we set up a plant or a facility may be a manufacturing

plant we have to set up the various shops may be the machine shop, the tool room, the assembly shop, the welding shop, the foundry all these different places we have to a locate certain area. And then they will be located how they should be located? What are the factors governing their appropriate location? And depending upon the kind of manufacturing that we want to do there will be different types of layouts that would be available to us.

So, we have already seen that there are certain particular factors like: the political factors, the legal factors, the economic factors, which have to be taken into a account when we decide on a particular location. Now, once the location has been decided we go on to set up the plant now why setting up the plant we take judicious decision about the location of the various shops or the various areas within the designated plant area

So, today we will see that what are the different types of layouts? That are used, in industry in the present day world, but before going to that in order to summarize and to carry forward our discussion related to facility design. I'll just summarize that how do we make a decision? Which factors play a pivotal role in deciding for a location, which is located in a city. Similarly, which factors are more important are or are predominant in the selection of a plant facility at a country site.

So, both these 2 areas can be used as a manufacturing plant facility, but which factors are favourable for one and which factors are favourable for the other that we are going to see know in the subsequently slides. So, let us start our discussion today with the requirements governing the choice of a plant in a city location.

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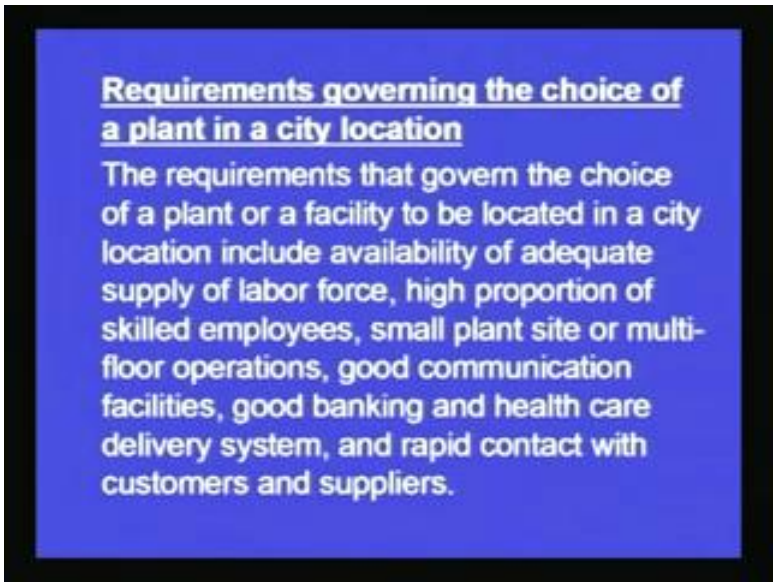

Now, what are the requirements? That governs the decision in favour of a city location or may be some times are not favourable for a country site. So, let us see first, I will go through this then I will break down into 2 3 different points, and then we will address those points in a little bit more detail. Now, let us see the requirements that govern the choice of a plant or a facility to be located in a city location include. So, located in a city location means the plant will be located in a city location.

So, what are the requirements that govern such kind of a decision these include availability of adequate supply of a labor force. So, labor force already we have identified that this the one of the most important criteria or factor for the location of the plant. So, availability of adequate supply of labor force high proportion of skilled employees. So, already I have told I have given an example in the first lecture also that skilled employees are required for any technologically oriented manufacturing facility or a service factor facility.

So, where our high technology is involved we required skill manpower to man that kind of technology. So, we have to see the adequate supply of the labor force is available then high proportion of the skilled employees are available small plant size or multi floor operations. So, this is also very important whenever, we have to take a decision to set up our facility in a city location. Why this is important because within a city the floor area is very costly very expensive.

So, multi story location means it should be able to adjust thus different offices at different stories on your screen you can also see small plant size or multi floor operations or multi story operations. So, if we see we are trying or we are planning to set up a manufacturing plant, which is having very heavy machinery can we think of setting up such a manufacturing plant in the middle of the city, I feel it is not possible because heavy machinery has to be installed on the ground floor only or on the base floor only. It cannot be taken to higher level of floors or higher stories.

So, whenever all the machinery has be set up on a single floor it would require a huge amount of area which may not be available in the city center or at the center or the heart of the city. Therefore, those kind of industries or those kind of plants which require substantially smaller size areas and in which multistory or multi floor operations can be augmented can be used for selection in a particular city area. So, wherever these kind of criteria are there these kind of requirements are there like, we require small amount of space multi floor operations are possible.

So, those kind of industry or those kind of plants or those kind of service providing facilities can be set up in the middle of the city. Now, what is the other point? We have seen till now, 2 3 different points we have seen on your screen you can see availability of adequate supply of labor force high proportion of skilled employees. We have already governed small plant site means area required is less or multi floor operations are possible, good communication facilities are available.

So, we have seen that many companies which are doing business process BPR companies we can say bpo companies, bpo, operations though are those are setting up in areas where the communication facilities are very good. Good banking and health care delivery system that is also very important like banks etcetera are available. But these are subsequent things primary things is the availability of the labor force and the area for carrying out the operations good banking and health care delivery system will also help a company to make a decision in favour of a city location and rapid contact with the customers and supplier.

So, when we are located in a city we have very good contact with the suppliers as well as our vendors or customers as well. So, these are all the requirement that will force the decision in the direction of location which will be located at the center of the city. So,

whenever we have to take a decision and whenever, we want to set up a plant we have to take a decision that whether it has to be in a country side or whether it has to be in a city. So, what are the factors which would govern our decision in favour of a city are there on your screen.

So, whenever we have to take a decision regarding the location in a city these are the requirements which would force our decisions So, once again to summarize I will just read out availability of adequate supply of labor force, high proportion of skilled employees, small plant size or multi floor operations, good communication facilities, good banking and health care delivery system, and rapid contact with customers and suppliers.

So, whenever these kind of requirements are there these will require the decision maker to make a decision in favour of a city location. Now, similarly there would be certain requirements governing the choice in favour of a country side location.

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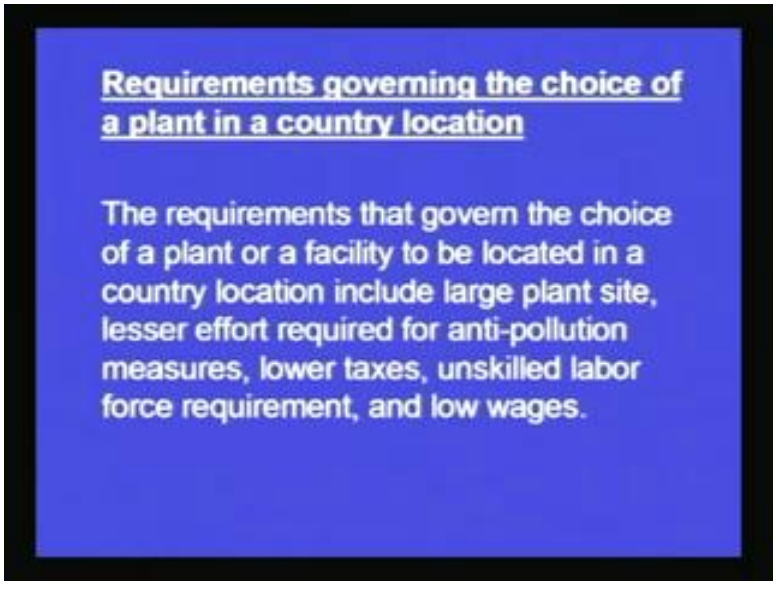

Let us, go through now those points. So, the requirements governing the choice of a plant in a country location may be outside city the requirements that govern the choice of a plants or facility to be located in a country location include. Now, let us see what are the factors, which will govern the decision in the country locating in the favour of the country location I should say these are large plant site. So, the area required is huge. So, wherever the area required is huge we will see let us, place the plant in the country side

only then lesser effort required for antipollution measures. So, may be the antipollution measures the requirements for antipollution measures maybe straightly less stringent in the countryside lower taxes. So, many particular state governments, many governments are in the favour of setting up plant country side location.

So, that it results in the societal upliftment of the people as well as less pollution in the already polluted areas. So, may be tax holidays are there lower taxes there the government wants to push forward the policy of putting the plants in the country side. So, they want to facilitate this process by providing tax holiday's etcetera. Then unskilled labor force requirement. So, wherever the labor force requirement is not that much me I mean to say is that labor is required, but skilled labor is not required.

So, in those cases we may choose country side location. Similarly wherever, we want to pay low wages in those cases also we would prefer a country side location. So, a country location would be preferred in all these circumstances. So, let us once again go through what are the requirements that is large plant site whenever, the plant site is very large the area required is large we may prefer country location lesser effort required for antipollution measures.

So, wherever we feel that we will not be able to meet the stringent guidelines of a city we may out for a country location. Similarly, if we want to save certain amount of taxes by setting up a plant in a country side, then it is also beneficial unskilled labor requirement is there that we do not require huge amount of skilled labor their also country side is more profitable. Then lower wages is would certainly reduce the total cost of the product and would lead the company in to making profit.

So, till now we have covered just two slides, but we have been able to figure out that what are the requirements that favour the location of a plant to be in the city. And what are the requirements that favour for a location of a plant to be in the country side. Now, let us come on to facilities layout design.

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Facilities lay out design refers to the arrangement of all equipment machinery and furnishings within a building envelope after considering the various objectives of the facility the lay out consist of production areas support areas and the personnel areas in the building So, what we have done till now is the decision making related to the location of the plant or facilities location we have decided that where the facilities should be located.

Now, once that location has been identified now within the location we have to setup all these different areas. As you can see facility lay out design refers to the arrangement of all the equipment where the equipment should be located? Where the machines have to be setup? Where the furnishings have to be done? Where the office area would be there? So, all these things within the building we have to place and when this placement has to be done there are number criteria, which has to be born in mind.

So, we have to take a judicious strategy and we have to follow a procedure for deciding the location of all these elements within the organization. So, once again just to summarize, I will read it for you facilities layout design refers to the arrangement of all equipment, machinery and furnishings within a building envelope after considering the various objectives of the facility. The layout consist of production areas, support areas and the personnel areas in the building. So, I think it makes it appropriately clear that what do we mean by facility layout design.

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The need for facilities layout design arises both in the process of designing a new layout and in redesigning the existing layout. So, already we may be having a layout, but because of certain miss management or we can say high cost of material handling within the shop floor or there may other reasons that may necessitated the relay out of a existing plant. And also sometimes, whenever we have developing a new facility we need to take a decision regarding the type of layout which we are going to follow in the manufacturing plant.

So, the need of for the facilities layout design arises both in the process of designing and layout and in redesigning an and an existing plant or existing layout. The need in the former case is obvious, but in the latter case it is because of many developments as well as many problems within the facility such as: I have already given you 2 3 examples that why do we need to redesign the layout, but now 1 by 1, we will see that what are these areas? What are these causes or what are these problems which lead to the redesigning of the layout, change in the product design is the first point on your screen.

So, whenever the product design changes the layout may have to be changed for example, if we have simple product type of layout assembly line is there a substantial change in the product design may lead to the complete overhauling of the assembly line may be we may need to redesign the assembly line all together. So, a change in the product is one of the factors that may lead to redesigning of the layout.

The second point is obsolescence of the existing facilities; we may install certain new facilities in our plant. So, if the new or the old facilities are obsolete or not in use, we may need to relocate those facilities, we may need to arrange for the space for new facilities and we may need to remove or all together send all those facilities which are not in use out of the plant. So, that is also an important point. So, when certain facilities become obsolete the layout might have to be change

So, the first plant is change in the product design, second is the obsolescence of the existing facilities, third point is change in demand. The change in demand is very important we have already had lectures on sales forecasting we have seen that how to forecast the demand different method we have seen. So, whenever there is a fluctuation in the demand. So, the demand is varying and suppose, the demand is too high and we have a layout to produce may be 500 components per week. And the demand is 1000 we may need to redesign the layout in order to meet the demand of 1000 components per week.

So, our existing layout is capable of producing only five hundred components, but we want to redesign it we need to redesign it in order to meet the demand of 1000 components per week. Then the frequent accident sometimes it may. So, happen that there are accidents because of certain layout problems in order to overcome that kind of scenario we may plan to redesign the layout. Then more scrap and reworks sometimes the layout is such that there is a lot of rework and scrap resulting out of that layout problem. Then we may think of redesigning the layout market shift introduction of new product etcetera.

So, all these important points guide us that we should now think of redesigning the layout these are the problem areas that are there in the industry and in order to overcome these problems we may think of redesigning our layout. So, two important points are there to note first point is that whenever we want to develop a new facility always we have to take a decision regarding the plant layout, but in an existing plant also there may be. So, different problems as: listen on your screen that may dictate or that may force us to redesign our layout in order to overcome all these problems.

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Now, objectives of facility layout design primary objectives of the typical facility layout include over all integration and effective use of man machine material and supporting services. Now, all these things are there in the enterprise, and it is our aim to make the most out of these. So, we want to make the maximum possible utilization of the man, the machine, the material as well as the supporting resources.

So, the primary objective is that overall integration and effective use of all these resources. Then minimization of material handling cost by suitably placing the facilities in the best possible way. So whenever, a manufacturing is being carried out the raw material enters the plant and then after processing on a number of different processes it goes out as the finish product. So, within the plant we want to minimize the material handling because material handling adds to the cost of the product.

So, we want to design the layout in such a way. So, that the material handling cost is minimized. So, first point is we want to integrate and we want to make the effective possible use of the resources within the manufacturing plant. And second thing is we want to minimize the overall material handling cost. Now, third is better supervision and control sometimes we want to design the plant in such way, so that all the people were working on the shop floor or under the direct supervision of the works manager or of an engineer.

So, where do we locate that engineer and works manager. So, that all the time he his having a eye on the people working around and if anybody is not doing the job properly he can directly call that person and ask about his problems and then he could be able to help him out. So, basically effective supervision and control is also very important and has to be taken into mind whenever we are designing a layout. So, this is also one of the objectives like we design the layout keeping this thing in mind that we should have very effective supervision and control system working, then employee's convenience, safety, improved morale and better working environment.

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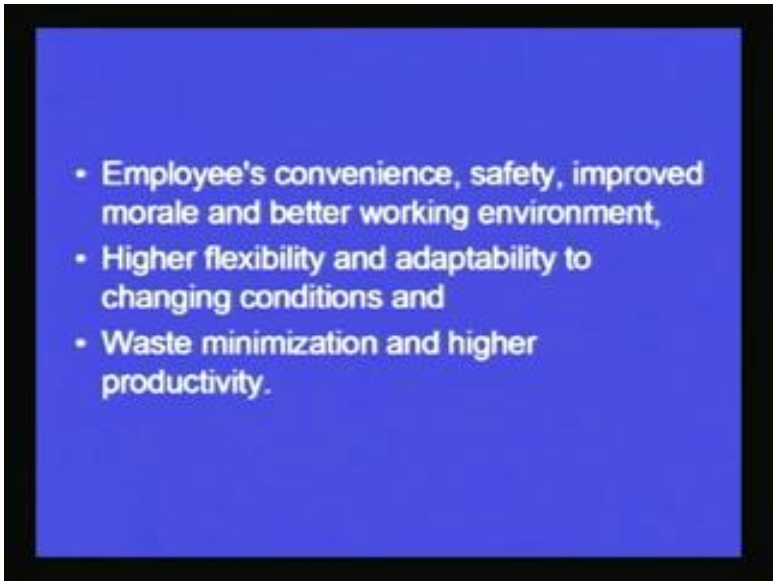

So, all these points also have to be born in mind whenever, we design a kind of a layout we have to see that the employee's conveniently working he has ample space to move around. He can move in x direction, y direction front back he should not be constrained otherwise his effectiveness may not be that much he may not be able to work efficiently.

So, appropriate floor area in which he can move should be provided then his safety also has to be a certain. When we are designing the layout, then improved morale. So, if he is working efficiently, his working effectively his morale would always be high and the working and environment should also be taken care of like the temperature should not be that high there should be adequate facility for cooling in the summer season and heating in the winter season.

So, appropriate environment should be provided to him. Even if the sunlight is not there adequate artificial lighting should be provided. So, that he is able to see what he is performing. So, layout whenever it is being designed should take care of the employee also an employee's convenience safety working environment should always be taken into account then higher flexibility and adaptability to changing conditions.

So, in our discussion we have seen that why do we want to relocate to a new facility or a new location, because sometimes we are... So, hard pressed for space that wherever, we have initially located our facility we do not have a space for expansion. So, whenever we design a layout we should design the layout in such way. So, that some space is always kept for expansion. So, whenever that expansion facility is available with us it is going to be helpful in the longer run.

So, our layout should be very flexible and it should be adaptable for further expansion also because changing conditions here I want to mean that sometimes we may have to expand our capacity which we have seen in the capacity planning also. So, waste minimization and higher productivity that is: the 1 of the catchwords for all the industry that waste should be minimum and the productivity should be highest. So, the layout should be such that our productivity is high and the rework or we can say the waste or the scrap should be minimum.

So, just to summarize we have seen that whenever, we design what are the objectives? 0 What are things? That we should keep in mind, so that the layout that we design is a most effective and most efficient layout.

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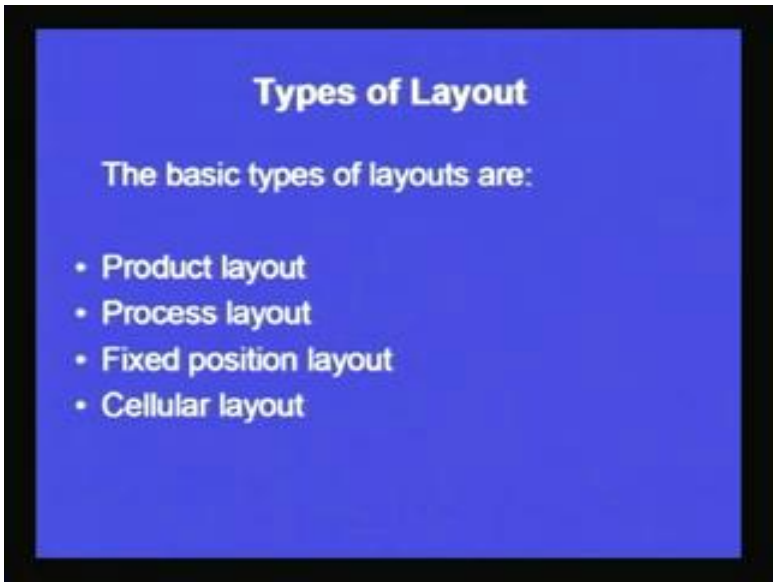

So, now let us come to the types of layout we have already decided that we have to keep in mind. So, many different factors when we design a layout, but there are certain standard types of layouts available which have already been designed and are being use in industry, in a lot many different kinds of scenario. So, different types of scenarios are there: what I mean to say here is that depending upon your objectives, depending upon your requirements, you can design your own type of a layout, but there are certain standard layouts which are being used in different types of scenario.

So, what are the types of layout? We will see 1 by 1, we will try to understand what type of layout is there? What is the basic principle of such a layout? And then we will see what are the advantages? And what are the disadvantages of that type layout. So, the type layout can be seen as on your screen are the product layout the basic types of layouts are: the product layout, process layout, fixed position layout and the cellular layout.

So, these are 4 different types of layouts which are used in a industry. And now 1 by 1 we will see that what is a product layout? What is the process layout? What is a fixed position layout? And what is a cellular layout?

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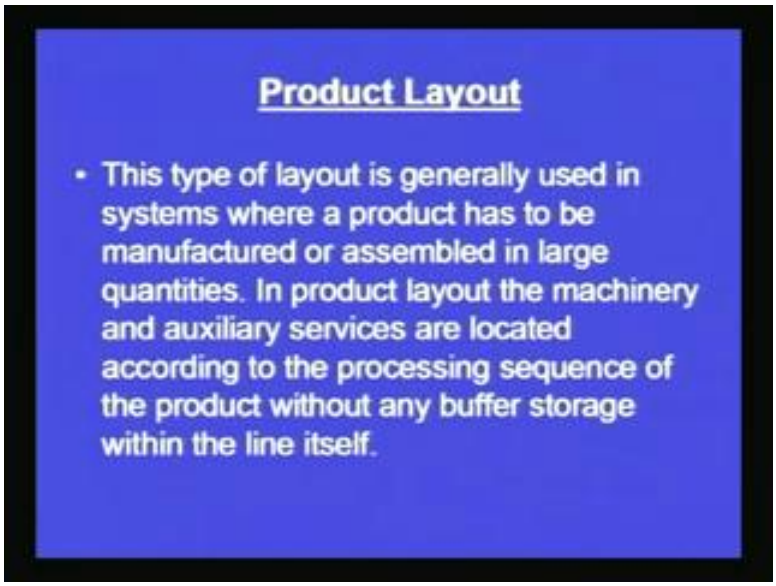

Now, coming on to product layout first, I will read it for you this type of layout is generally used in systems, where a product has to be manufactured or assembled in large quantities. So, the first point is from quantity point of view that if large quantity has to be produced we can go for a product type of layout. In product layout the machinery and auxiliary services are located according to the processing sequence of the product without any buffer storage within the line itself.

So, with in the processing sequence all the machines, all the assembly points are installed. So, you can say that all the machine in the product layout all the machine and auxiliary services are located according to the processing sequence. So, processing sequence means now suppose I take an example of a particular product it requires process A then process B, process C and process D. Now, how this process processing point ABC and D would be located.

So, the of raw material comes it would get processed on process A then it would go to process B then it would go to process C and then it would go to process D and finally, it will come out as a finished product. So, in the processing sequence the layout is made and all the processing units or processing points are in a line. Now, let us understand with the help of simple diagram on your screen.

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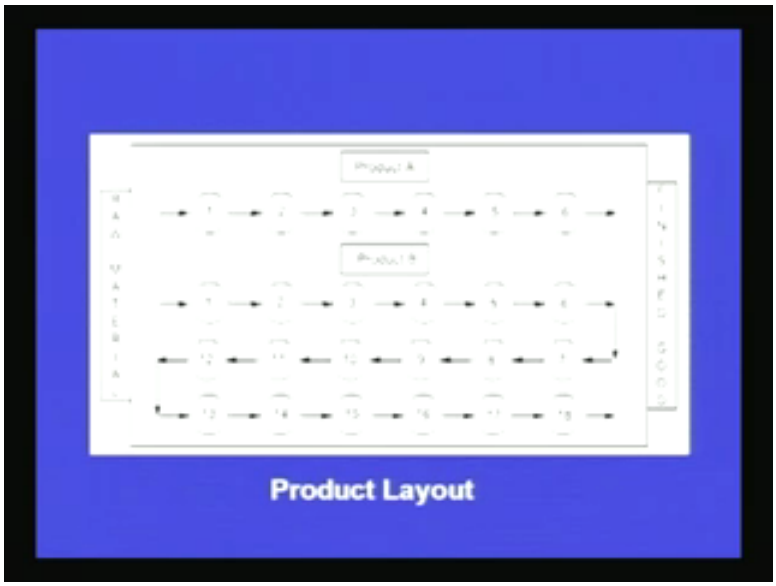

Suppose, this is a floor area this rectangular place this floor area and within the floor area there are. So, many machines machine number 1, 2 3, 4, 5, 6 or we can say these are processing units 1,2 3, 4, 5, 6. On your left hand side this is a raw material and this is the finished good.

So, the raw material is entering from this side and the finished goods are coming or the finished product is coming from this side. Now, for product A these are the processing sequences means this is the processing sequence and this is being followed. So, the raw material first it goes to the processing unit 1 then 2, 3, 4, 5, 6 and then the finished good comes out.

Similarly, for product b it raw material enters from here it goes to the processing at point number 1 or processing unit 1 then 2, 3, 4, 5, 6 then it comes to 7, 8, 9, 10, 11, 12, 13, 14. aAd then finally, it goes in its processing sequence and comes out from 18. So, what I mean to say here is that the raw material enters from 1 side goes through the processing in a line and then it comes out from the other side.

So, this is a product type of layout, and this is majorly used in a large quantity manufacturing plant as well as in the assembly units from one side the assembly will start, and from other side the finished or the assembled component or the product would come out I should say the assembled product would come out in which the different

components have been assembled in the assembly operation. Now, let us see what are the advantages of these types of a layout?

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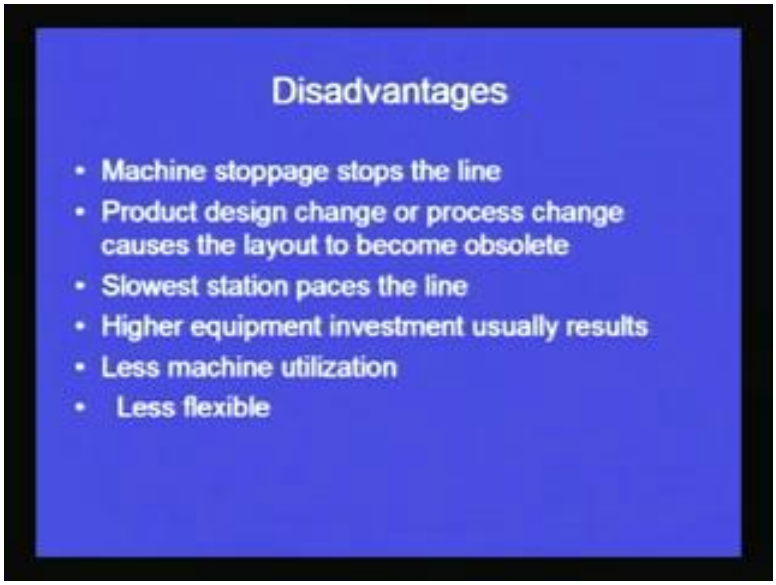

Now, it has advantages in terms of low material handling cost per unit. So, material handling is less, less work in process. So, there is no inventory in between work in process inventory is less. So, the work in process is less in case of a product layout then total production time per shift is short. So, the production time can also be reduced if we follow a product type of layout, low unit cost due to high volume. So, this type of layout is used for high volume. So, per unit cost is less.

Similarly, less skill is required for personnel because this is a assembly type of a operation or a sequence of operations are performed in a line. So, the skilled required is less smooth, simple, logical and direct flow a line flow is there, direct flow is there. So, it is very smooth operation very simple you can just walk down the line and see what are the operations has been performed and it is very logical also.

So, after 1 particular operation easily we know what is going to be the second operation then the third the operation and then fourth operation and after the final operation the product comes out in the finished form Then inspection can be reduced here which is quite obvious delays are reduced there are no delays, effective supervision and control. So, because a line manufacturing is taking place it is very easy to supervise and control

So, supervision is better because a person can be in charge of some 5 operation then an another can be in charge of another 5 operation.

So, the supervision can be very effectively done and the control can be exercise also we will be able to find out where the fault is taking place in a very lucid and clear manner. In spite of having, so many advantages a there are certain limitations are the disadvantages of the product type of layout. Now, what are these disadvantages? Now these disadvantages are: in term of machine stoppage stops the line. Now, there is a line or assembly line in which the processing is being done in a processing sequence. Once any machine stops the whole line will stop the operation.

So, that is 1 of the biggest disadvantage then product design change or process change causes the layout to become absolute. So, particular processing sequence has been designed for a particular product. Now, suppose if the product changes. So, a change in the product or a change in a particular process in the line would result in making the complete line absolute. So, a complete overhauling or designing of the layout would then be required which is one of the biggest limitations of this type of layout. Slowest station paces the line.

So, this is the third point on your screen slowest station paces the line. So, the speed of the line would be governed by the slowest machine in the line. So, in order to improve this speed either we have to replace that machine by an another fast machine or we have to expand our capacity by installing another machine. So, that consequent operation or we can see 2 machines can be operating simultaneously in order to speed up the line.

So, that those are certain things or certain remedies that I have told, but the limitation is that the slowest station or the slowest machine or the slowest processing unit will dictate the speed of the line or it paces the line. Then highest equipment investment usually results. So, the equipment investment is higher. Sometimes there may duplication of machines also because in the line the processing sequence is being followed. The product will not comeback if the same operation after certain operation is required. So, we have to install another machine of that type only.

So, may be certain times we have to go for higher investment in case of product type of layout. Then less machine utilization, because slowest machine would dictate the pace of the line some machines may be idle for that period time. So, machine utilization percent

is less in case of product type of layout then it is less flexible already I have told that if the product changes are the process changes or the product is redesign the flexibility is less we may have to redesign the complete line resulting into the huge capital investment. So, although there are certain advantages related to the product type of layout, but there are certain limitations as well.

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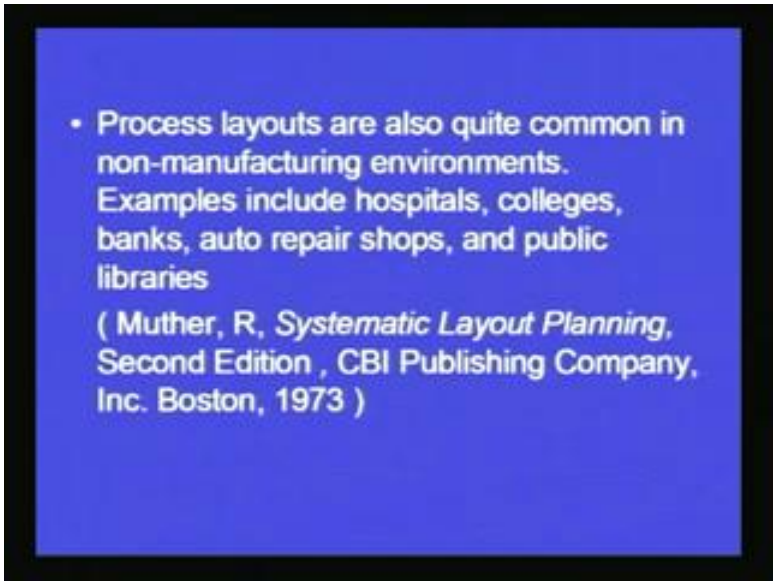

So, now coming on to the second type of the layout which is the process layout which is different from the product type of layout we would like to understand that what is the process type of layout? What are the advantages and disadvantages associated with the process type of layout? In a process layout also referred to as a job shop layout. So, this is also called as job shop layout similar machines and services are located together, so all the services and machine which are similar.

Similar in terms of may be their operations say all the lathe machines or all the drilling machines or all the milling machines in a machine shop if all the milling machines are located at particular place we will say it is a process of layout. So, in a process layout similar machines and services are located together. Therefore in a process type of layout all drills are located in one area of the layout and all milling machines located another area. So, this already I have told a manufacturing example of a process layout is a machine shop.

So, a process layout can be seen in the of machine shop may be big machine shop is there and we have different areas specified for different types of machining operations. So, it is not only in the machine shop or in the manufacturing industry only that we see a process of layout it can be seen in some other sectors as well. So, process layouts are also quite common in non manufacturing environments which I have already stated. Examples include hospitals, colleges, banks, auto repair shops and public libraries So, in these type of sectors also we see a process type of layout. So, how does a process type of layout look like?

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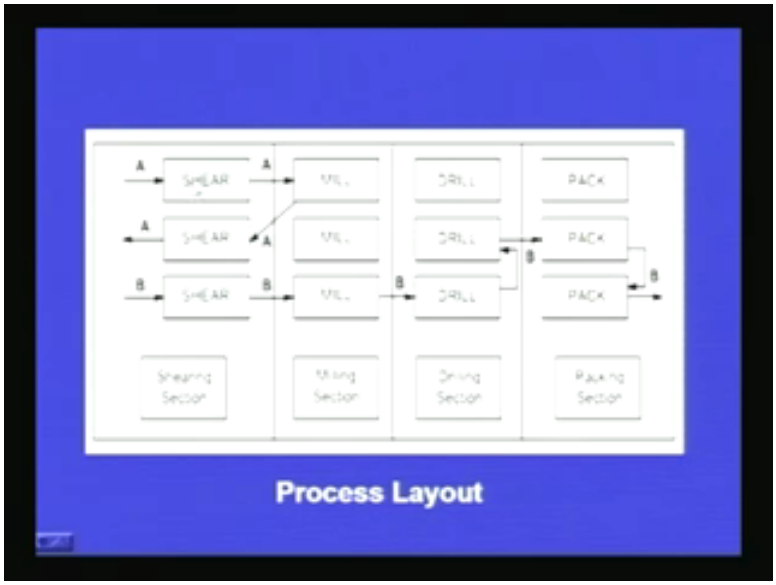

Let us go through of very simple diagram showing a process type of layout. So, you see shear, shear and shear mill, mill, mill, milling section, shearing section, drill, drill, drill, drilling section, pack, pack, pack, packing section. So, we have different sections similar types of machines placed in similar or specified area. So, this is the area which has been specified for setting up of shearing machines. This is the area which has been specified for setting up of milling machines and subsequently for drilling as well as for packing.

So, packing area is different from the drilling section. So, now suppose the product A require the shearing operation it comes from here shearing is done then milling is done again shearing is done again shearing and it goes out, and any product B. So, this A may not require the drilling or packing. So, product a comes shearing, milling, shearing and goes back then may be there may be another product that is B.

The product B first it goes through shearing operation then it goes through the milling operation then it goes through the drilling operation and then may be it may go out or it may again go to drilling again packing and then coming this like and may go out. So, basically we need to understand here is that the machines are the sections are not aligned according to their processing sequence or according to the processing sequence of the product. But these are aligned according to the similarity in the type of machines in that section.

If, we remember if you remember in kind of product layout we have seen that all the processing units are aligned or are put one after other in the form a line and a particular processing sequence is being followed, but here no processing sequence is followed. We have different sections dedicated for different types of operations and the different products would come in and they would go to their respective sections wherever, the processing is required. And finally, they will come out. Same thing is shown in the diagram also A and B 2 different types of products are there Product A require different type of operations, product B require different types of operations. So, a B let with the arrow you can see the path it is following and then it comes out. So, this is the process type of layout. So, what are the salient advantages and disadvantages of this type of a layout? Let us try to understand.

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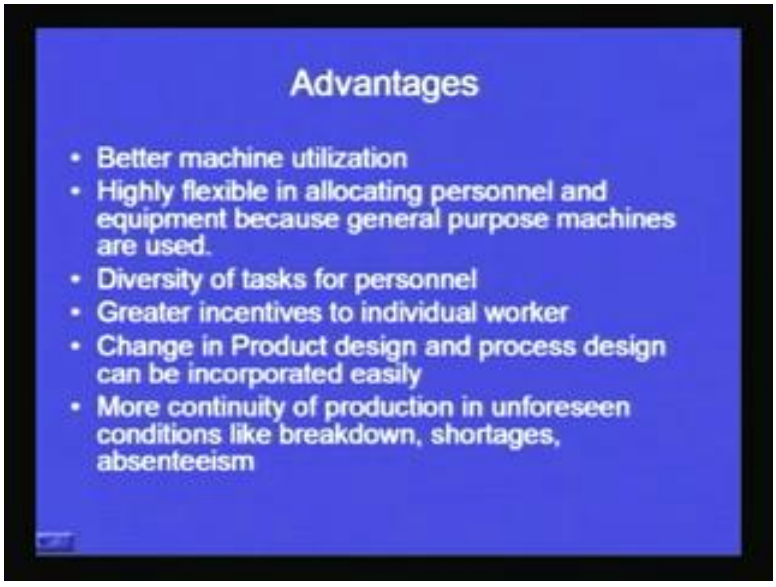

So, the advantages are better machine utilization. So, the machine utilization is better in case of process type of layout, highly flexible in allocating personnel and equipment because, general purpose machines are used. So, there are no dedicated machines like the product type of layout. So, general purposes machines are there, general sections are there, like: drilling section, milling section, shearing section, painting section, packaging section.

And general purpose machines make this type of layout as a very flexible type of layout. So, this is highly flexible in allocating personnel and equipment because general purpose machines are used then diversity of task for personnel. So, a personnel is not particularly working on a particular product, within the section he may have to process different types of products. So, the monotony may not be there. So, diversity of task for personnel, which would lead to high level morale among the employee's, greater incentives to individual worker.

So, individual workers are better rewarded in case of process type of layout. Change in product design and process design can be incorporated easily which was difficult in product type of layout So, whenever product design is there it can be very easily incorporated which can be attributed to the flexibility which is available with this type of a layout. So, the whenever a product design changes it is not to difficult to incorporate in this type of a layout. More over whenever, a process changes that also can be easily incorporated

More continuity of production in is unforeseen conditions like: breakdown, shortages, absenteeism. So, more continuity of production is unforeseen conditions like: breakdown, shortages, absenteeism. So, maybe I am trying to break it down into 2 3 different points. So, more continuity of production is unforeseen. So, in case of unforeseen conditions like: breakdown, shortages, absenteeism the continuity will not break we will have more continuity.

For example, if I compare this important point with the product type of layout. If there are breakdown we have seen in product layout single machines stops. The whole manufacturing process will stop, but here that is not the case in unforeseen circumstances like breakdowns shortages of material or mass absenteeism the process is not going to stop. Even if some employees are coming they can come and they can be in their section

and do some work because their work is not directly related to the subsequent other sections.

So, once again I will read it for you more continuity production in unforeseen conditions like: breakdown, shortages and absenteeism. So, these conditions will not have and direct effect on the productivity or the continuity of operations.

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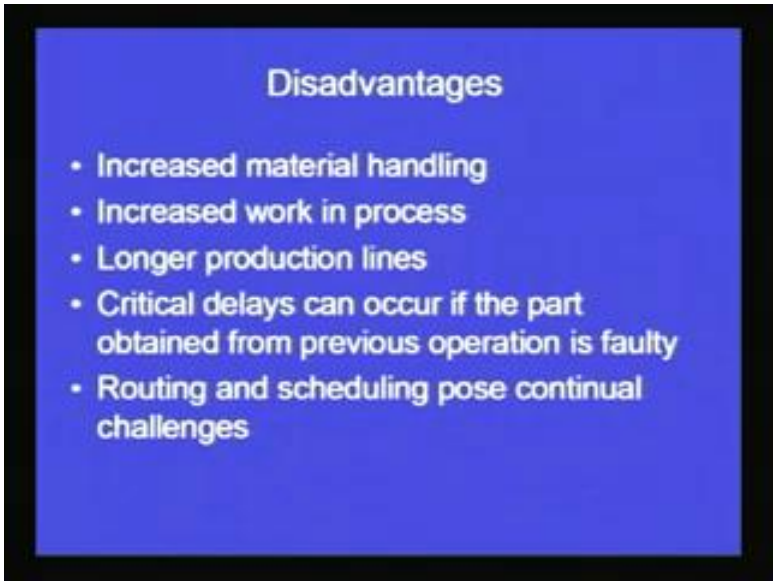

Now, let us come on to the disadvantages or the limitations of the process type of the layout. Increased material handling yes because, the material has to be taken from 1 section to the other section and from the other section to another section. So, the material will be taken from 1 shop to other shop to other shops. So, the material handling will be more. Increased work in process yes work in process would be more, longer production lines.

So, production lines are longer as to compared to product type of layout Critical delays can occur, if the part obtain from previous operation is faulty. So, suppose a product goes from 1 section to the section and most of the product is faulty or most of the component that have been assembled into are faulty. Then may be some delays that may take place Routing and scheduling pose continual changes or continual challenges. So, continuously we have to change the schedules and this type of problems is avoided easily avoidable in a product type of layouts.

So, the scheduling becomes complex and continuously we may have to change our schedules depending upon the dynamic scenario that existing in the organization of in the different section of the plant. So, routing and scheduling problems are there material handling is more work in process is increased longer production lines. So, these are some of the limitations of process type of layout. So, we have already seen that there are certain advantages associated with process type of layout, but these are the certain limitations also. Now, we come on to a special type of layout, that is called as the fixed position layout.

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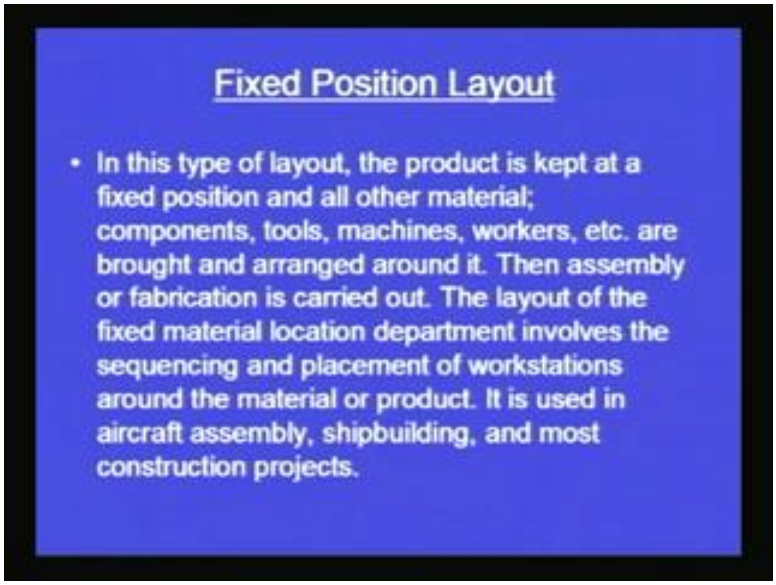

In this type of layout the product is kept at a fixed position and all other material which is this material like components tools machines workers etcetera are brought and arranged around it. So, the material or the product and which the processing is required is not moving it is stationary, and whatever processing has to be done on that product the related machines equipment manpower is brought on to that point, and finally the operations are carried out.

So, I will again read it for you in this type layout the product is kept at a fixed position and all other material component, tools, machines, workers are brought and arranged around it. Then assembly or fabrication carried out. So, whatever operations have to been done, they are done at that particular that we can call as the fixed position also. The

layout of the fixed material location department involves the sequencing and placement of workstation around the material or product.

So, layout of the fixed material location department, so fixed material location department will allocate or sequence the operations around the product only it is use now, where it is used? We have product let us, try to understand at that this way we have very huge and large product which cannot be move from 1 place to another. So, we are locating it centrally at a particular place where all the other machines equipment can be brought manpower can be brought and they can do the operations or the assembly operations on that product at fixed position only. It is used in aircraft assembly like very big aircraft cannot be move from 1 processing station another processing station.

So, the aircraft will be stationary all assembly operations will be done there only or in shipbuilding very and bulky product and most construction projects. So, wherever a big building has to be created or has to be fabricated or developed I should say. So, there we are not taking the building from 1 place to another place the building is being developed at a particular place and all the other equipment machines are going to that particular location. So, that basically is the fixed position type of layout. Now, we will see that what are the salient advantages of this type of a layout and what are the disadvantages or limitations of this layout.

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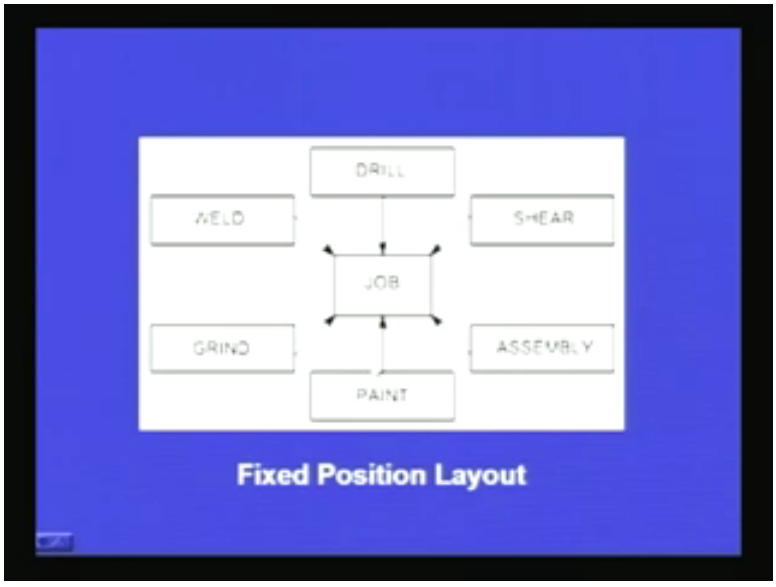

So, on your screen you can see a typical fixed position layout. So, this is the job on the center this is the job. So, the job can be aircraft assembly or this can be a ship or this can be a construction project. So, all the operations like: drilling, welding, grinding, painting, assembly, shearing all these operations will be done on the job which is located centrally at a fixed position and therefore, the name fixed position layout. So, all the operations assembly and painting is being done at one particular position only.

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Now, what are the advantages of this type of a layout? Material movement is reduced. So, the work in process also reduce material is not being transfer from one place to another it is fixed at 1 point only, promotes pride and quality, because an individual can complete the whole job. So, the morale of the employees would be high because they see that whatever, they are manufacturing in front of them. In front of their eyes they see the product developing from scratch into a final product.

So, things get assembled on top of the product and finally, we get a complete product. So, a sense of pride is being felt by the workers or the employees highly flexible can accommodate changes in product design, product mix and production volume So, the flexibility is 1 of the most important points here. So, whenever the product design changes not much change is required, similarly whenever the product mix changes instead of making a big ship we want to make a small ship with certain other design guidelines. It is very simple to accommodate in this type of a layout more over when the

volume changes again it is not going to have too much of a influence on the fixed position type of layout.

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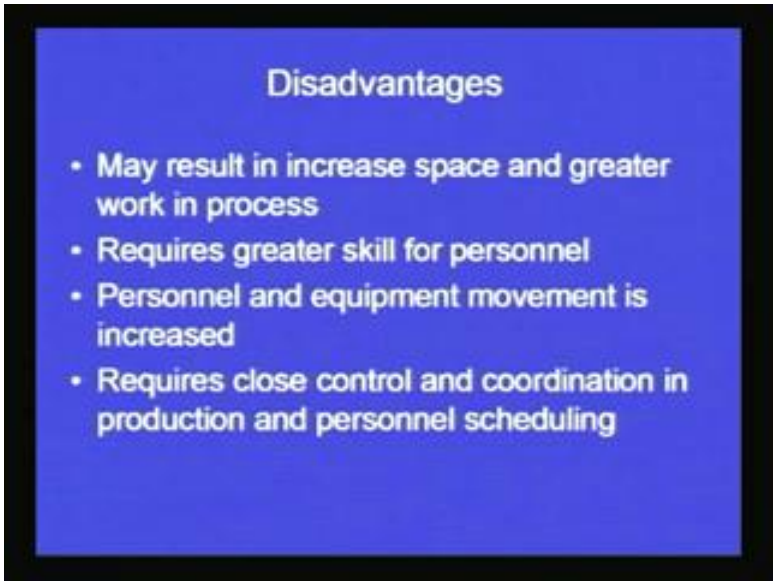

So, these are some other salient advantages of fixed position layout coming on the limitations we can see may result in increase space and greater work in process. Some times may be work in process may be more although as the product which is getting manufactured is not moving from one place to another, but sometimes the tools and the equipments on the machine which are operating on the particular product or the particular construction project or we can say aircraft or a shipbuilding industry or shipbuilding project.

Work in process sometime may be more, but the product is not moving from 1 place to another place that is 1 of the advantage then requires greater skill of personnel that is obvious whenever, such of project has to be under taker the skill requires are required is very high. Personnel and equipment movement is increase yes, when the raw material or the product which we are manufacturing is not moving from one place to another. We have to take the machines, the equipment, the manpower have to move to that particular location in order the carry forward the operations.

So, their movement is increased requires close control and coordination in production and personnel scheduling. So, a more involved coordination is required a more involved control mechanism has to be set in place in case of a fixed position type of layout. So, in

today’s lecture we have seen that; what are the requirements of setting up a plant in a country site or countryside? What are the requirements of setting of plant in a city? Then we have seen the objectives of the layout design that what factors? Or what are the requirements that have to be born in mind whenever, we design a layout.

Then we have seen what different types of layouts are? In which we have seen: the product type of layout, the process type of layout and the fixed position layout. In each 1 of these we have seen that what is the basic principle? Also we have covered what are the salient advantages and limitations of these types of layouts? Now, in the next lecture will focus on the cellular type of layout, as well as we will see the layout selection problem.

Thank you.