Principles of Industrial Engineering
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Lecture 03
Introduction Functions and Tools

Hello, I welcome you all in this presentation related to the subject of Principles of Industrial Engineering. And in this presentation we will be talking about the different functions related with the industrial engineering and the various tools available with the industrial engineering for realizing the various goals and objectives which can be achieved with the help of industrial engineering.

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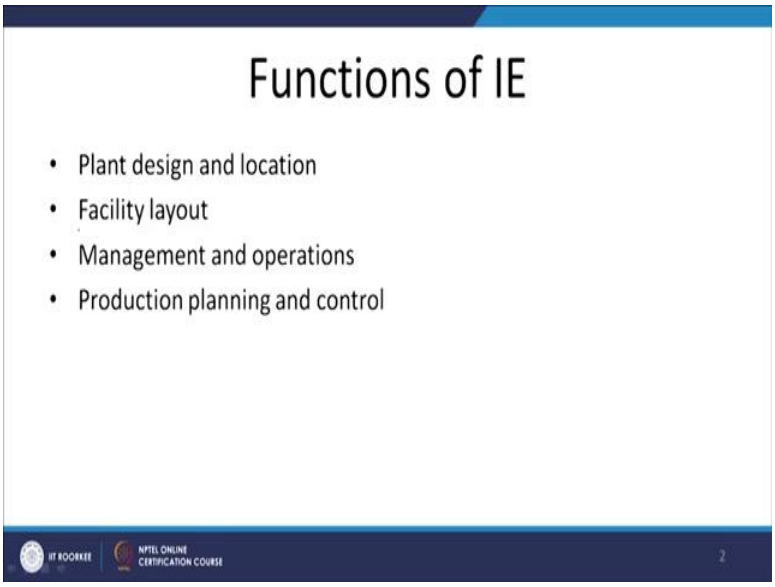

So, starting with the functions they are basically 4 functions associated with the Industrial Engineering which is related with like plan design, and that it is a location, then there is facility layout, management and operations and production planning and control. So, these are like the kind of 4 major functions associated with the industrial engineering. And we will be talking about the various things which are, which will be falling under these functions. And apart from these we will be talking about the various tools available with the industrial engineering.

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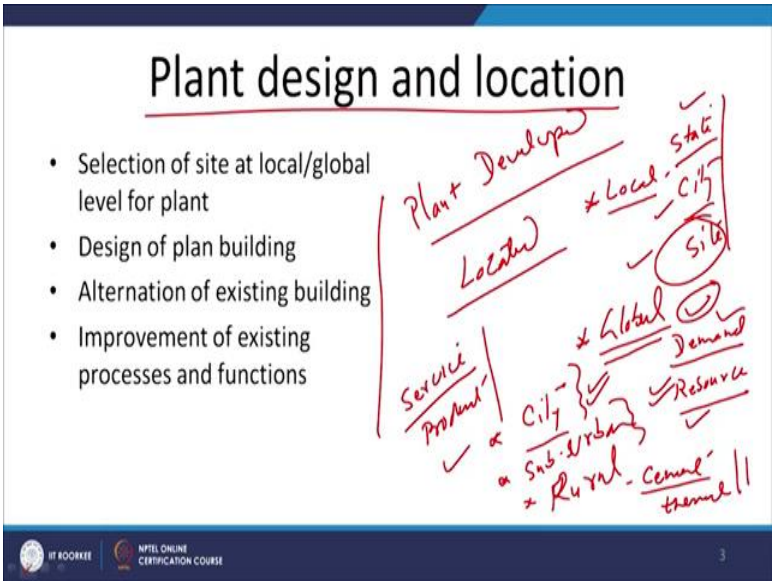

So, as far as the plant design and location is concerned, we need to see really if at all a plant is to be developed. Then the first thing is that where it should be located, the location of the plant maybe at two levels, the problem of location I will relate with the plant can be at the two levels; one is the local level like in which state it will be located or in a state in which city it will located or in a city at which site it will be located so, this is one aspect.

And another location related problem is the global one where we will try to identify the globally if the plant is to be located, which country will be more suitable. So, that you have the demand for the product or the services which will be offered and the kind of the resources which are available and their costs.

So, considering that demand and the availability of the resources needed for producing different things we need to see in which country will be more suitable for locating the plant and in a country, if the country has been identified, then which city, which state and which particular local site of that city or that particular area where plant can be located.

Another aspect is that like as per the nature of the service or of the product which is being manufactured by a particular organization, we need to see whether it should be close to the city, in the city, like it can be located in the city or it can be located in the sub urban area or it can be located in the rural areas so far away from the city.

So, as per the type of plants, like certain type of the plants are frequently located away from the city if they are causing pollution or like the cement plants or thermal power plants, so

they are typically located away from the city. So, the effect of the pollution being caused by these kind of the plants on the population is not much.

While if the if the, if there is no issue of that kind and it is required that the services and the products which are being offered by that by a particular company or by a particular industry, which should be close to the city and other kinds of resources which are needed for producing them will also be a near the city or in the suburban areas, then these will be located accordingly.

So, as per the need where the customers for a particular product or the service are there and what kind of resources, the kind of resources which are needed where they are located. So, as per that we try to locate, we try to identify the site for locating the plant.

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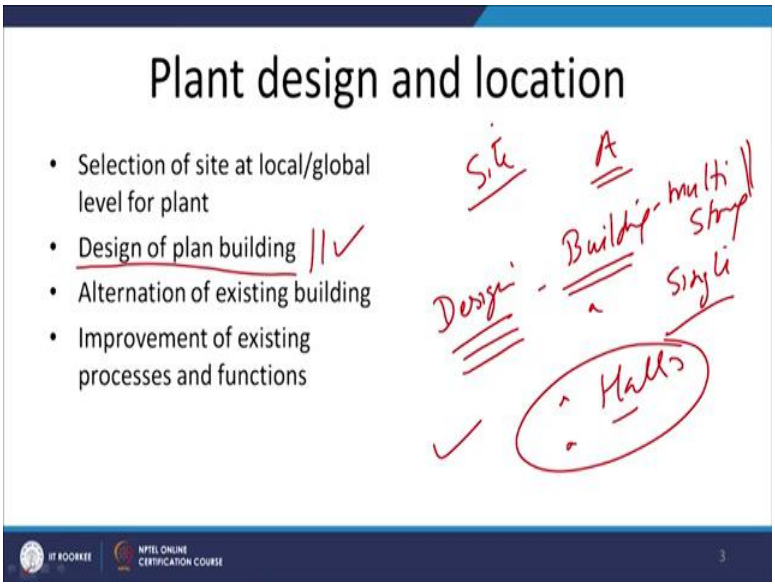

Another aspect related with this is the design of the plants. If just say site has been identified, if the A location has been identified to develop the plant, then what kind of the design a plant will have, like it can be the building which is a multi-storey kind or it can be single storey or it can be huge big halls.

So, depending upon the kind of the structure which is to be build up like some in some of the cases, huge halls running in hundreds of the meters length are installed, in some of the cases if the land is very costly, and the plant is to be located in the city or close to the city where the land is very costly.

So, the multi-storey and if The multi storey structure also suits to the plant or to the particular kind of the industry then it can be multi-storey or singular storey or it can be the huge halls running in hundreds of the meters in length can be developed. We will be talking in detail about like the kind of the buildings which are needed for the different kind of the industries.

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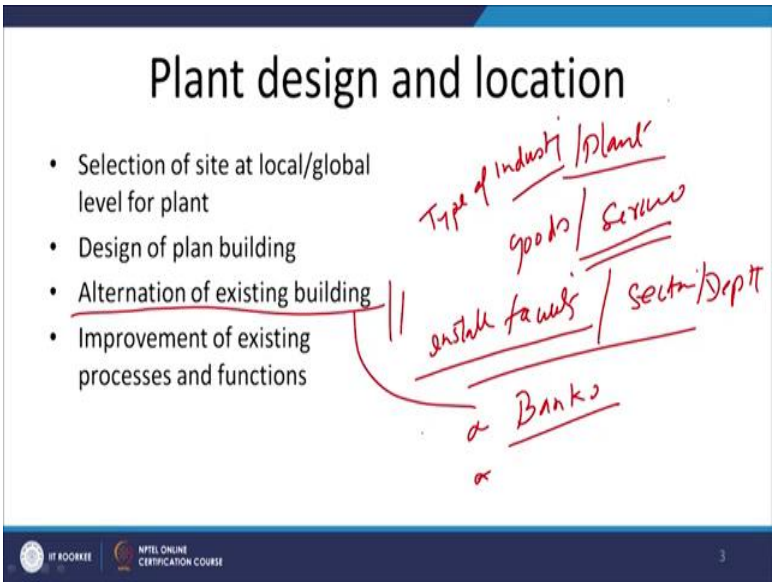

Then, we have the alteration in in the existing structure. So, as per the that kind of that type of the industry or the kind of the plant which is to be developed, depending upon the kind of the goods being manufactured or the kind of services being provided, it is possible that the existing structure may be modified so that it will be a able do install the facilities.

And then you can develop the different sections and departments accordingly so that it can start functioning effectively like we must have seen that the different buildings, minor modifications are carried out so that they are suitable for use as banks or like there the buildings can be modified suitability for making them as the eatery shops and likewise the different kind of the plants can be made or developed by modifying the existing structures.

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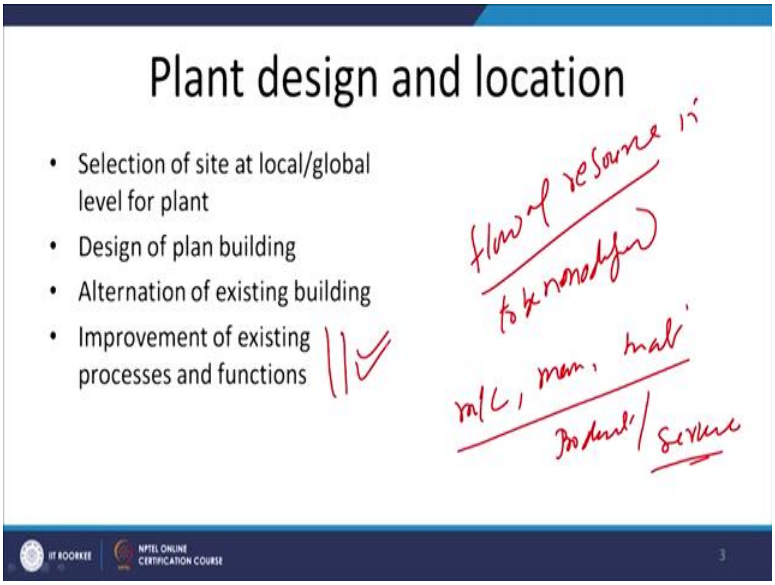

Likewise, the improvement in existing structures and existing processes and functions like if it is required, then the flow of the resources, if it is required that flow of resources is to be modified, need to be modified like the flow of machines or the man or the material need to be modified in course of the production or in course of the development of a particular service. Then sometimes if the minor modification in the processes or in the functions or in the existing infrastructure is needed, then that also can be can be realized under this kind of the function of the Industrial Engineering.

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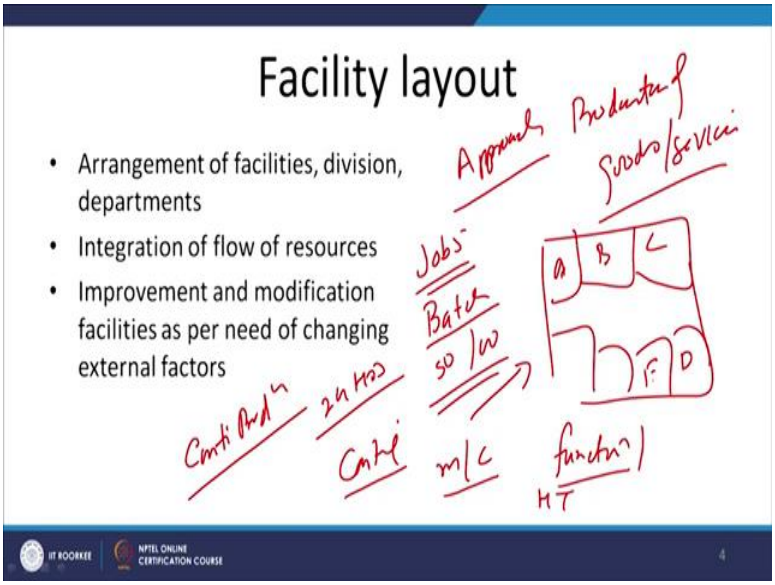

Then another is the facility layout. Like depending upon the kind of the approach being used for production of goods or services, we need to arrange the facilities in different ways. Like if

we are in the job shops, where variety of the jobs will be coming then we normally make a cluster of the different machines, where all types of the jobs whatever are coming, they can be done.

So, like A B C, D, E, all these types of the machines can be arranged suitably as per the space available and all these machines can be used suitability for production of the jobs also, where the different types of the customized jobs are being done. Then, then we have the batch production where like say batches of the 50 or 100 units need to be produced. Then also the systems or the facilities are arranged according to their functions.

So, this is called the like the facilities are arranged according to their functions and according to the kind of the job which is done by them like all costing relative jobs will be done, all machining related jobs will be done at another place, all heat treatment related jobs will be done at another place.

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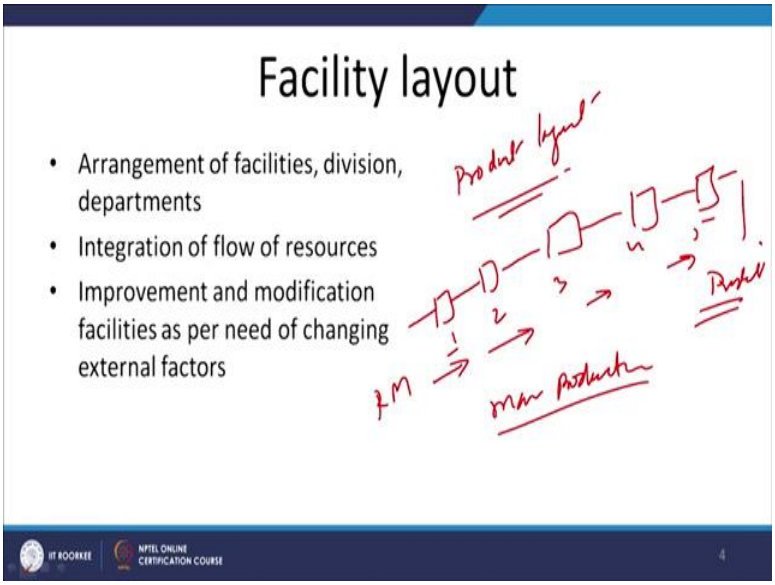

But if the kind of product which is being made is larger in quantity, much larger in quantity, where continuous production is needed, like the plants are running 24 hours and the same type of the unit is being produced continuously, then the facilities will be arranged differently that is called the kind of the product layout.

So, where the facilities or the machines are arranged in a particular sequence, where if the nature of the job or the service is such that things are the resources, resources will be moving in a particular line only for its completion, then the all the facilities which are needed will be arranged in sequence like the machine 1 then machine 2, 3, 4, 5.

So, all these, means the raw material will be passed, will be passed through all these machines in sequence and at the end we will be getting the product. So, this is, if the arrangement is of this kind, then this is called product layout and this is typically used for the mass production purpose and this is called product layout.

And if the facilities have been arranged as per their functions, then that is called the process layout which is used for the smaller volume of the productions small volume production of the goods and the services.

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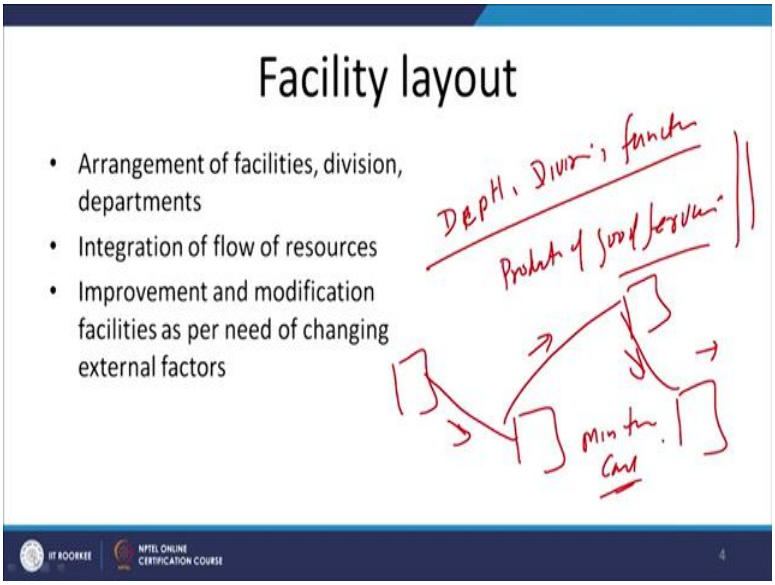

Then integration of flow of resources. How the different the different departments, different divisions and other different functions which are there in a plant, if their expertise resources are to be used for production of goods and services, then how they will be integrated with each other, so that there is a smooth flow of the raw material, a smooth flow of information or a smooth flow of the resources which is needed to produce the given product or the given service.

So, the different entities, different functions, different divisions and different departments having the different types of the expertise, they perform different types of the duties and if required to produce some goods or services as per the objective of the organization and all the need to be integrated.

So, that integrated in such a way that the flow of the resources through the different divisions, different functional groups is smooth and the job is done in the minimum possible time at a minimum cost. So, that is the idea about whatever the facilities have been installed, they are

properly integrated so that the flow of the resources is smooth for producing the goods and services.

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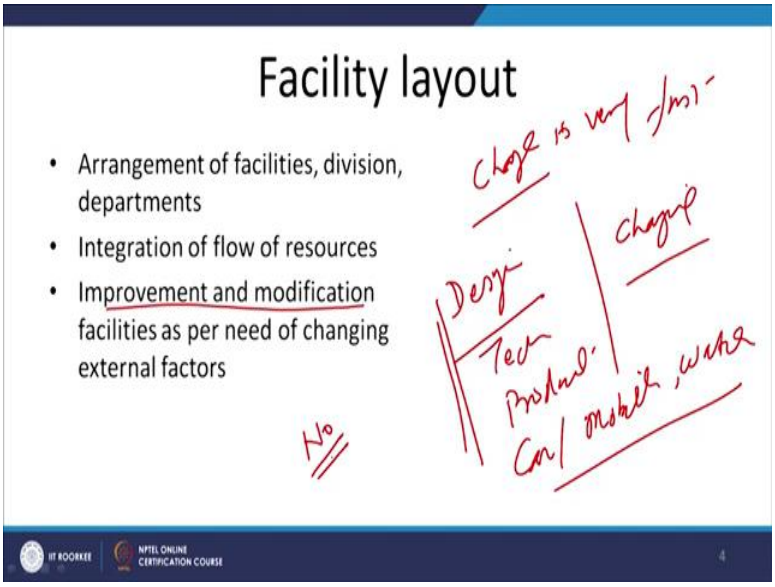

Then, there is the improvement and modification of the facilities as per the changing external factors. We know that nowadays that things change very fast, change is very fast, which means the given design, a given technology, given products with the different technologies and designs, they do not survive in the market for long, the taste and the kind of the trend or the kind of demand for the products and services are changing very fast.

And since, there is a huge competition in the market for same type of product, there are n number of the manufacturers, they are offering variety of designs, quality products at low cost, so the things are changing very fast. And every time we will see there is a new design for car, new design for mobile phones then their watches.

And likewise all kind of the consumer goods the design technology, things are changing very fast and that is why it is also required that since the nature of the demand is changing, not just in terms of the variety but also in numbers. So, the plants and organizations must be in position to accommodate those designs, those demands.

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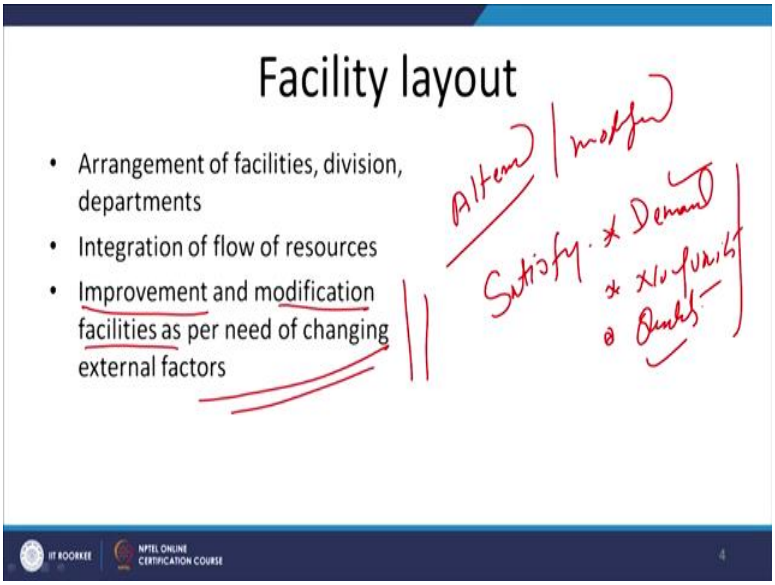

So, if required whatever the layout is there, it must be altered, modified, is the modification in plant or in organization must be implemented so that they can satisfy the changing demands for changing number of units, changing quality of the products, the kind of things that customers are looking for. And if this is not done, then the customers will be lost, the customers will be will be unsatisfied with the products and services and the customers will go away.

And the companies plants and organizations will not be able to survive that is why it is important that the improvement as well as the modification in existing facilities is done in such a way that they are able to satisfy the changing external factors with regard to demand and the quality so that they can remain competitive and their product can remain in the market to provide the record services to the customers.

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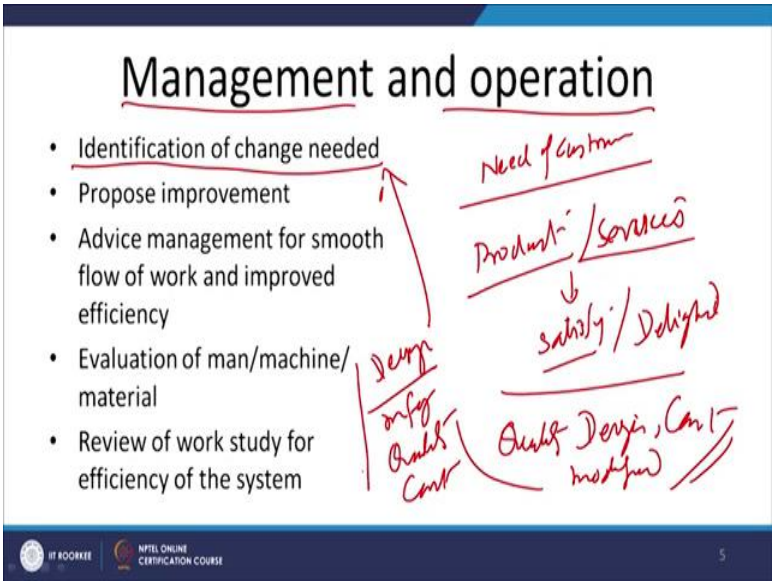

The third function related with the industrial engineering is the management and operations. Here, the management the line one major point is here as for the need of customers, as per the need of the customers it is required that whatever products being manufactured or the services being offered by the organizations they must satisfy the customers.

The customers must be delighted with the products and services, efforts are made for this purpose. Whatever is needed for the delightment and for satisfaction of the customers through the change in the product quality, design, cost, modifications, all that must be implemented. So, these things can be realized through the suitable alterations, modifications in the product, designs, manufacturing strategies, quality control, cost control.

And for that purpose the industrial engineering function under the management and operations will be identifying the kind of change that should be brought in. And after identification of the kind of change that should be brought in, this improvement is proposed, what kind of change should be brought in, proposal is made for improvement.

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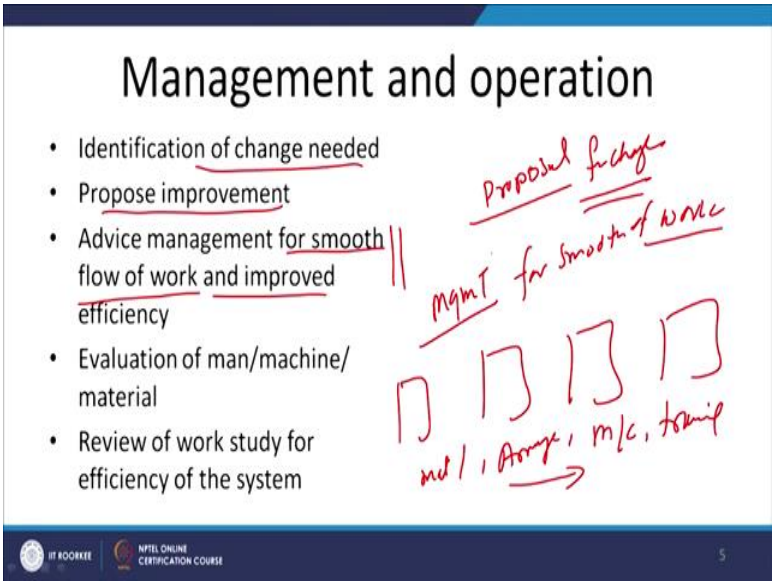

Proposal is made for, proposal for change is made so that improvement can be realized so that the customers can be satisfied, customers can be retained and rather the customer base is enhanced. At the same time this function also helps to advise the management for smooth flow of smooth flow of work and improved efficiency, which means the which kind of the changes should be brought in at the different stages of the manufacturing or production of the goods and services that is suggested under the management and operation function of the Industrial Engineering.

This maybe with regard to the kind of the, the materials should be procured, the kind of the arrangement should be made of the machines, the kind of the machines should be used, the kind of training to the workers should be given, all these things are done in such a way that the flow of the work, flow of the resources is smooth.

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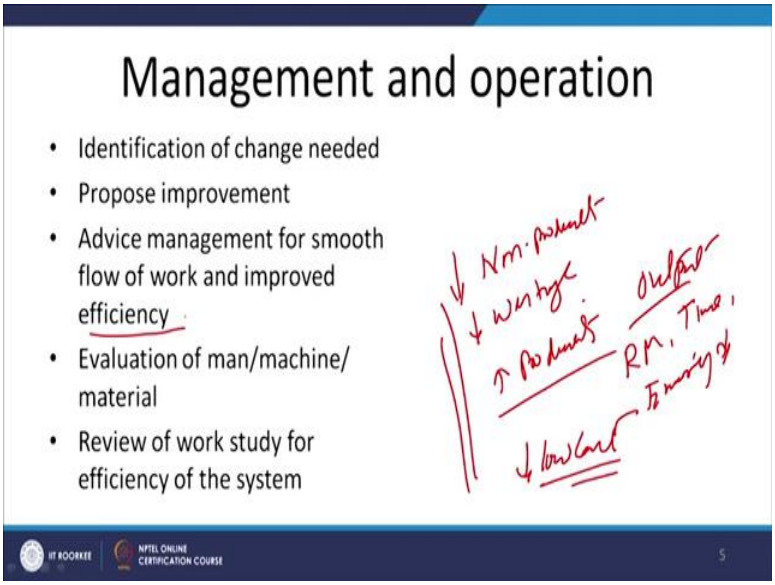

So that there is minimum non-productive activities, minimum wastage of resources in form of raw material, in form of time, in form of risk, in form of energy, et cetera, and the utilization is improved, so that productivity as a whole of the system can be enhanced. And once the productivity output is enhanced through the reduced or for a given volume of the input in form of the raw material, in form of the that time being invested by the workers and the machines, in form of the energy being consumed and if all these things are reduced, then the company or plant will be able to offer the quality products at low cost and that will help in improving the profitability efficiency of the organization as a whole.

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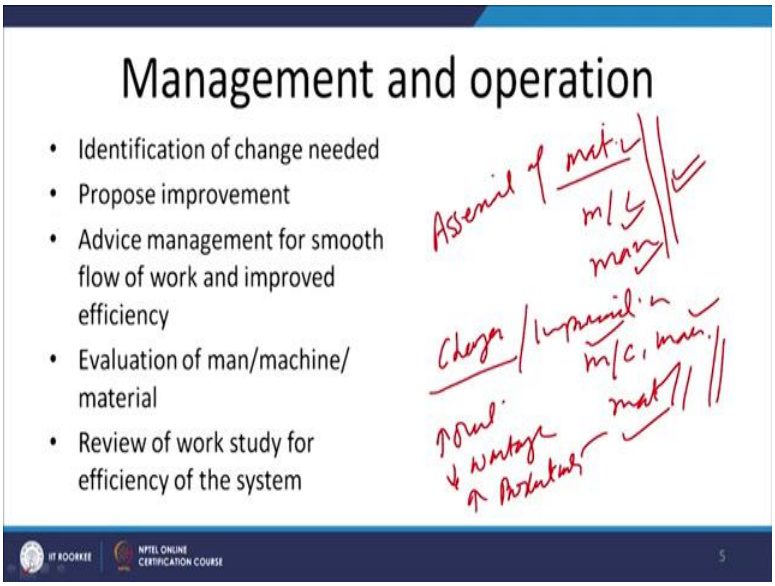

To identify the locations where the changes need to be made, it is important that proper assessment of the way by which material is being consumed, the kind of utilization of the machines exist and the kind of the manpower is being utilized. So, the assessment or evaluation of the material, machines and the manpower is important to see how efficiently and effectively these resources are being used to produce the goods and services.

And if required, then changes or improvement in these three aspects, machines, the kind of the expertise which is being used for of the manpower which is there for producing the goods and services and the kind of the material which is being used. So, these changes can be recommended with regard to the kind of the machines being used, the material being used or the manpower being used so that the output can be increased, the wastage can be reduced primarily with the goal of increasing the productivity.

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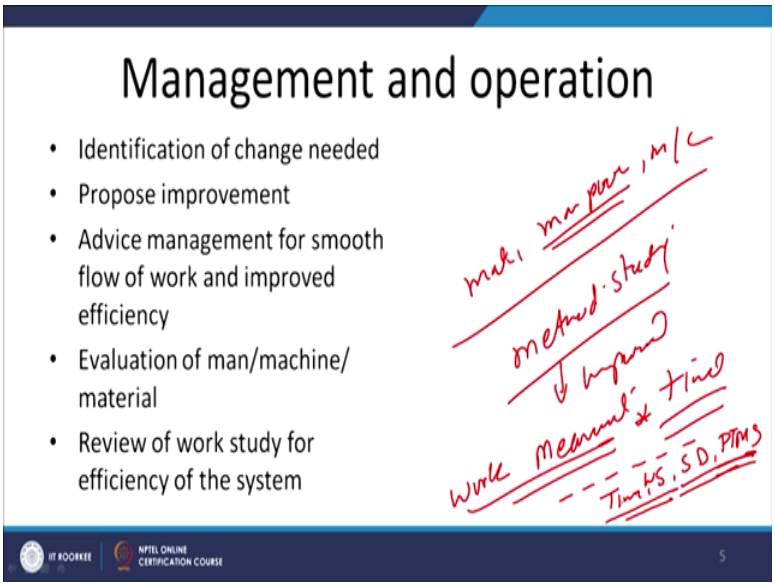

And then in this regard whether the man or the manpower or the machines, material, manpower or the machines these are being used effectively or not, various tools like work study is used to see if the things are working fine or efficiently or not. So, we conduct the method study to see if the currently the method being used by the man is not, and if required, then improvement in method can be brought in so that it takes, the man and machine takes less time.

It can also means there is another tool related to the work study that is the work measurement, which can be done to see if there is any non-productive element and the time of the non-productive element which is there which can be used to see how, what is the percentage of

the time which is being used effectively for production and what can be done to eliminate the ineffective time.

So, the work of measurement will help us to identify the time, which will be needed to complete a job following a certain fixed procedural steps, and this can be done using the techniques like that time, study, work sampling, standard data table method and PMTS – Predetermined Time Motion, Predetermined Time Motion Study method, PMTS method.

So, these two are the database methods and in these two methods means work sampling and time study that the study is actually conducted to see how efficiently the work is being done by the different machines and the manpower which is there to see, and if required then improvement maybe brought in.

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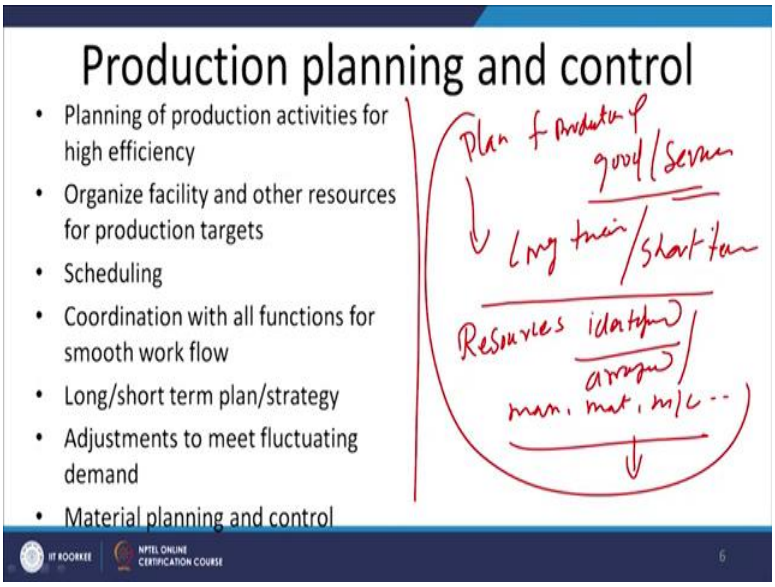

The next function or the fourth function related with the industrial engineering is the production planning and control. The idea behind is this primarily to see is this that what will be the plan for production of given goods and services. The plan maybe the long term or it may be short term. So, the plan is prepared and for making this plan effective whatever the resources needed, those are identified and resources are arranged in the required quantity.

These resources may be in form of man, material, machines or anything else which is required for smooth work, so that it can be produced, maximum volume can be produced with the minimum wastage of the resources. In this connection only the various important and finer things are there which are associated with the production planning and control.

But the main idea behind this is to develop a plan which may be short term or long term plan for production and are in identification and arrangement of the resources needed for production, that is the main idea. So, what we should do to make this available so that things are there whenever they are needed for production purpose and this these two things are realized with the help of these different points

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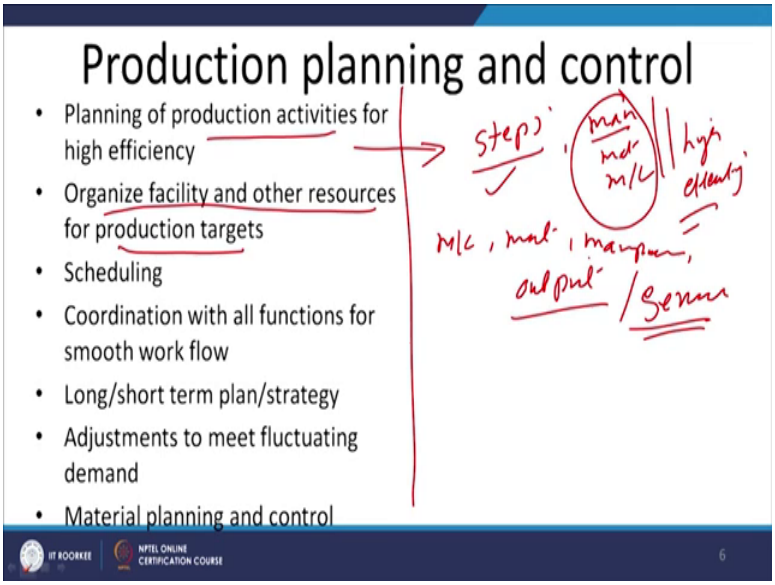

Like planning of the production activities, whatever the different steps are needed, those are identified, those steps in form of the like man, material and machines, which will be utilized in such a way, so various steps are identified and accordingly the resources are arranged so that all these can be used at a high efficiency for producing the maximum output with the minimum wastage.

Whatever has been planned based on that we need to organize the facilities and the resources. So, organize the facilities means, whatever machines we need, material we need, whatever manpower is needed, all that is arranged, facilities are arranged accordingly so that the target of producing the required output in form of products or in form of services can be realized.

So, the first is the kind of plan which planning of the production activities for higher efficiency, then organizing and arranging the various facilities and resources needed for realizing the set production targets. And then what kind of the schedule which will be followed.

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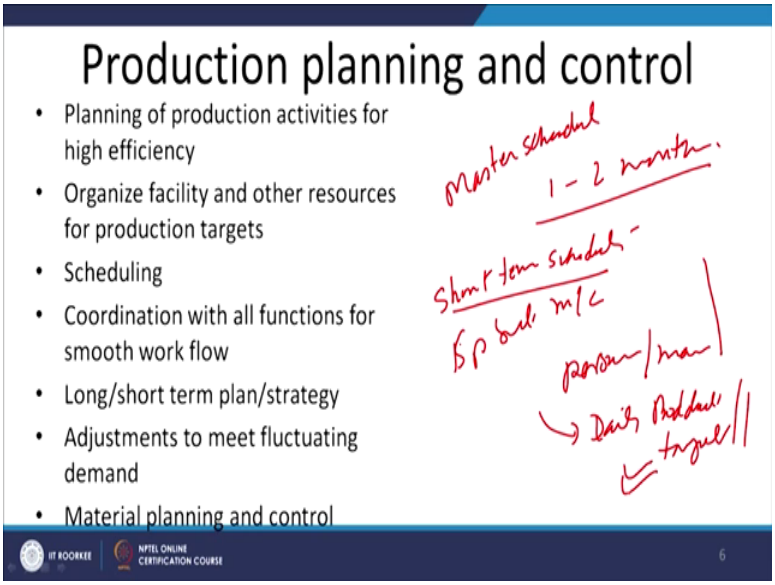

There is like master scheduling, like in coming one or two months what will be the different activities that will be done to realize the given production targets. And likewise, there is short term scheduling where we try to identify like the which specific set of the machines or the persons or the manpower will be utilized and how these will be engaged so that the daily production targets are realized in order to realize the major goal of producing the given volume as per the set target.

So, in the short term scheduling basically the kind, the way by which loading of the different machines and the manpower will be done for smooth flow of work, so that the daily production targets are realized in order to complete the goal of the set production and target which maybe weekly or monthly or given volume which is to be produced.

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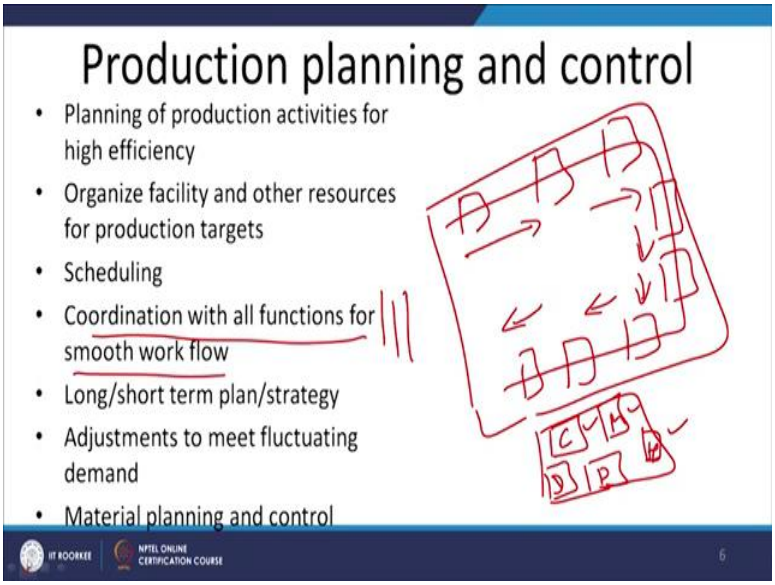

Then another important aspect related to the production planning control is about the coordination with all functions for smooth flow of work. Say, it is possible that depending upon the kind of the arrangement of the facility this may be like the product arrangement, where the facilities are arranged in the sequence in which our operations are to be done like this or the these may be arranged as per of functions.

So, we need to see what will be the as per the kind of product to be produced or kind of service to be produced, the flow of the resources can be different. So, we need to identify and we need to coordinate that all functions are ready to cooperate and to work on the given production targets so that there is a smooth flow of the work, like in case of the process layout, the facilities will be arranged as per the nature like all casting, all machining, all heat treatment, all painting, all dispatching kind of the work is done.

So, all these functions need to be taken into confidence so that once the production plan is launched, orders are dispatched for start of production, the things move smoothly through the different departments, different sections, different functional groups of the plants so that the flow of the work or flow of the raw material, flow of the resources through the different groups different functions is smooth in order to produce the set goal or in order to produce the set target in terms of the goods and services and for this purpose, coordination is very important so that the flow of the work is smooth.

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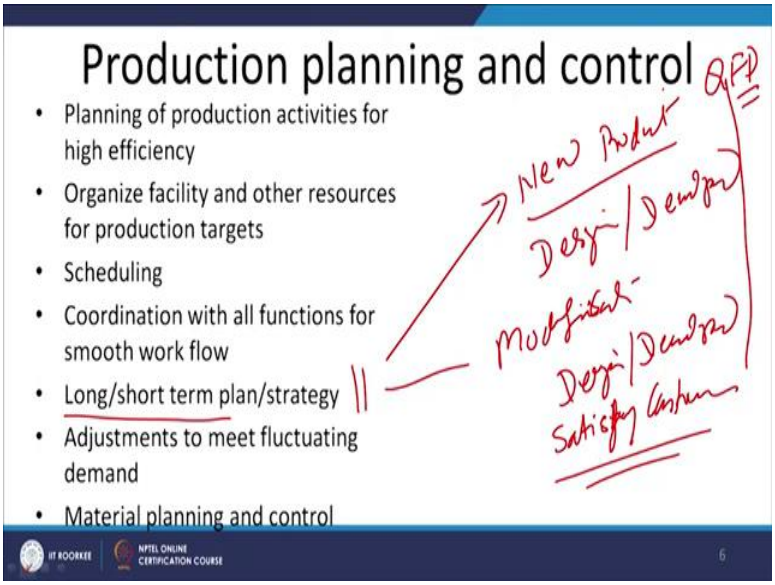

As I have said, long or short term production plan and is strategy is also made under this. So, it will be done like, if we have to come out with the new products. So, the product design and development group will be coming up with the newer products, or if the modification of the existing, modification of the existing products is needed based on the customer complaints. So, there also the design and development group R&D group of the organization will be working to modify the existing designs.

So, the industrial engineering tools like quality, function, deployment, can be used for this purpose where either development of the newer products is done is to be done or the modification of the existing product is to be done, so that they can come out with the units and products so which will we will to satisfy the customer. If these are not addressed, then the customers will become unhappy.

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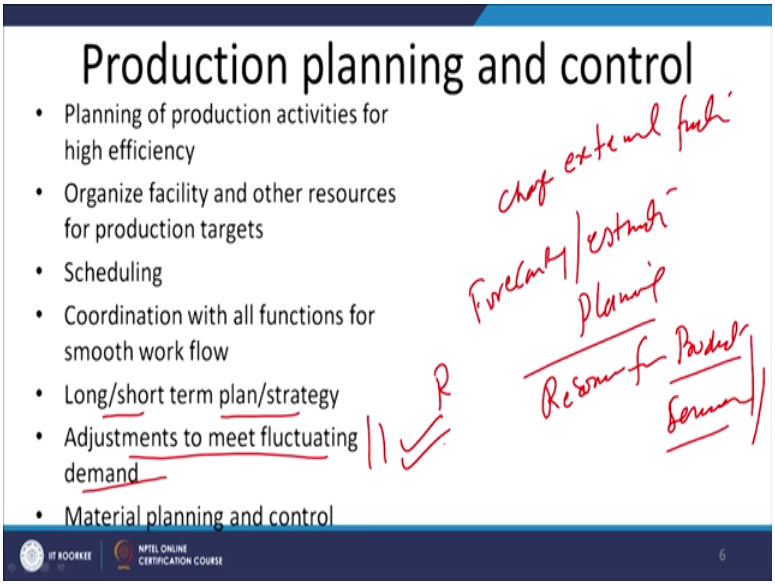

And likewise, the short term is strategies like the demand is changing very fast then how for the to meet the changing demands, what organizations should do, what is needed to arrange the resources so that the fluctuating demands, the changing product demands can be satisfied. So, both short and long term strategies can fall under this to deal with the changing external factors. Adjustment to meet the fluctuating demands.

This point is that unlike during the certain period the demand is very less, during the other periods, like in the festival seasons demand will be more for a particular kind of the goods and services, so the production planning and control function will help us in forecasting, estimating, planning, the resources needed for the products and the services to be produced, so that they can meet the demand as per the requirement.

And if the forecast is suggesting that demand will be less than accordingly, the arrangements can be done with regard to the resources so that surplus and unnecessary production of the inventories can be avoided. Then another point related with this is the material planning and control.

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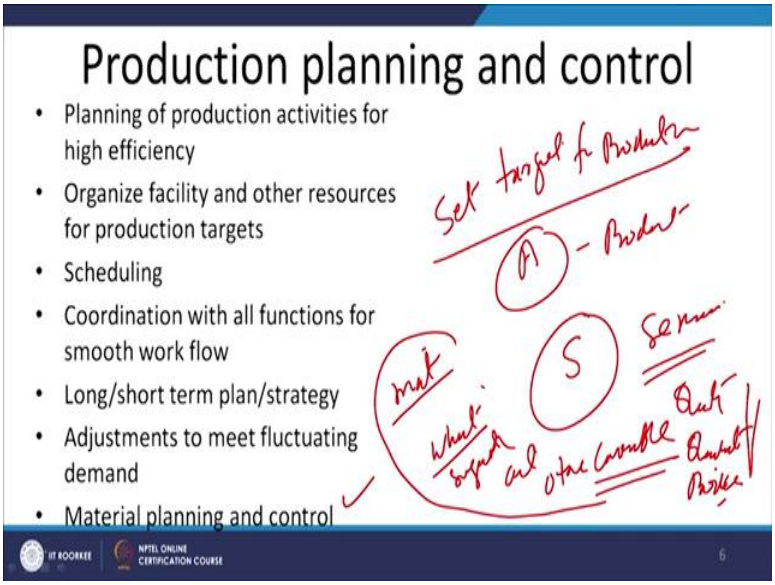

Like, if there is a set target for production of a product A or of the service S, these product A, product A and the service S will be needed, will be needing certain kind of the materials. The materials may be in form of the wheat, in form of sugar, in form of oil, in form of other consumable items to produce the service. So, all these need to be planned, what will be the quality, what will be the quantity, what will be the price at which it will be purchased.

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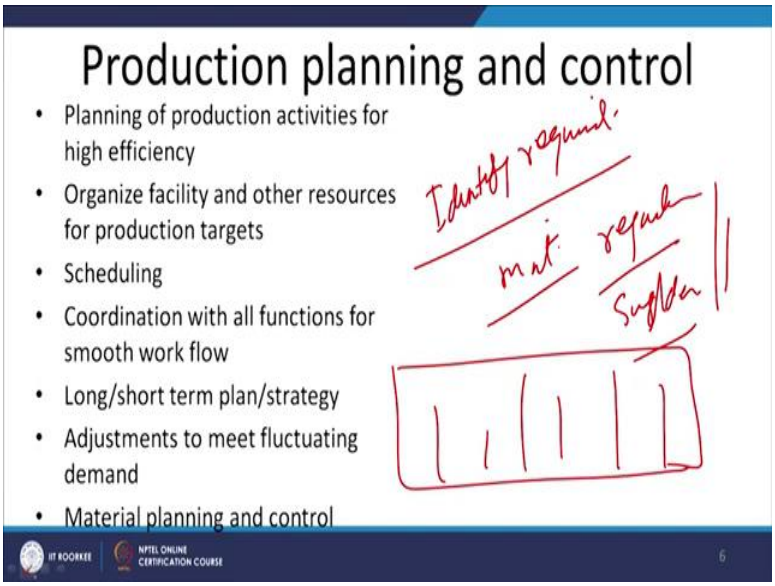

So, the material planning and control group or control function will be identifying the requirement for materials. And to arrange this material it will be whether the demand is regular or it is sudden or it is irregular only like it is possible that few items are needed with

the fluctuating demands like this, whole of the year. So, we try to estimate the demand for the whole year and then accordingly we prepare the plan for procurement.

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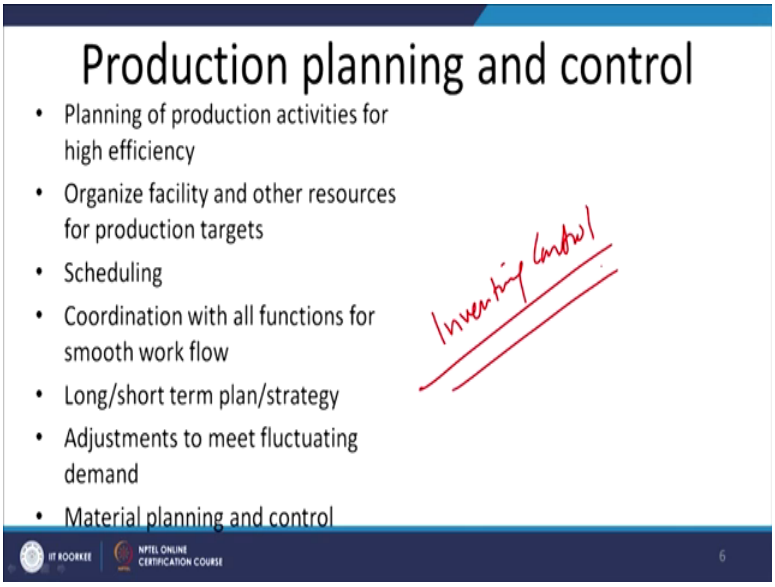

So, under this we will be having the inventory control. We would like to purchase the items in limited quantity in such a way that the things are always there, whenever they are needed, at the same time the investment in the inventory is minimum so that unnecessary capital investment can be reduced and the money can be used for more effective, for more effective purposes. So, inventory is one of the aspects related to the material planning and control, likewise there can be many other things.

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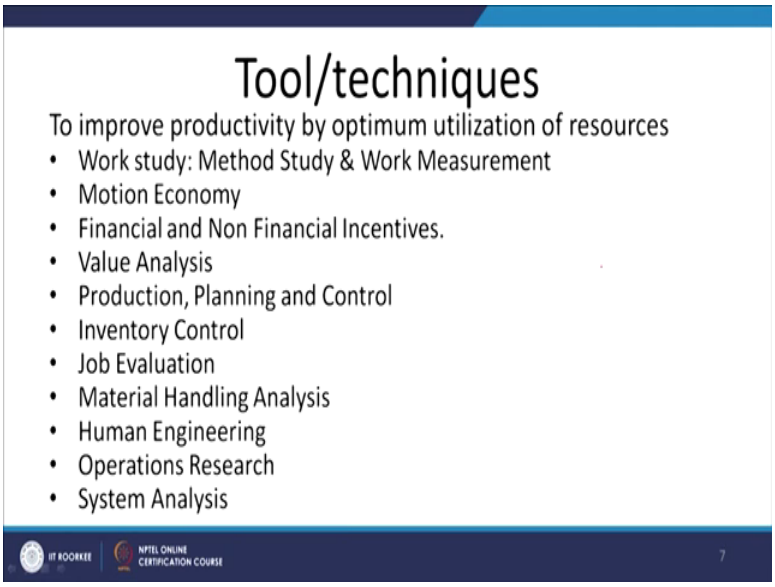

Now, here I will summarize this presentation. In this presentation basically, I have talked about the four types of the functions of the industrial engineering and these were the plant design and the location, the production planning control, facility layout and there was one more function. And in next presentation, I will be talking about the tools and techniques and the organization related features of the Industrial Engineering. Thank you for your attention.