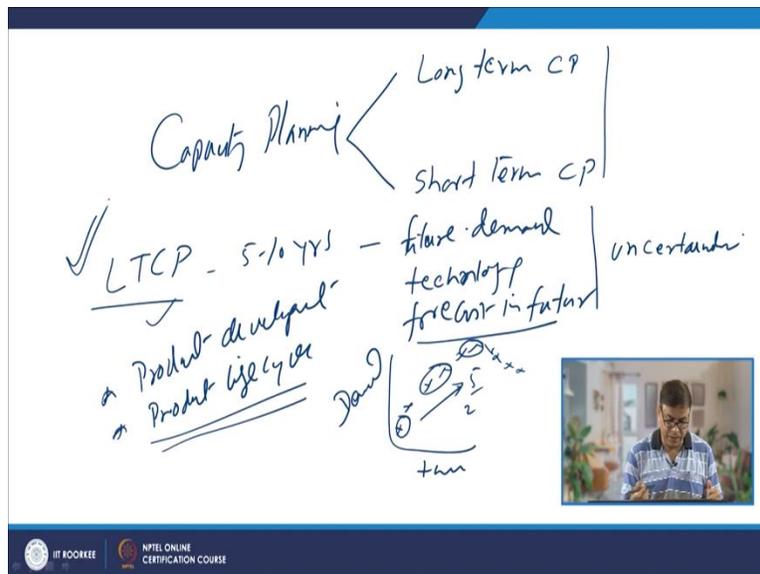


Principles of Industrial Engineering
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Lecture 30
Production Planning and Control:
Capacity Planning and Scheduling

Hello, I welcome you all in this presentation related with the subject Principles of Industrial Engineering and you know under the production planning and control, we are talking about the capacity planning. And you have seen in the previous presentation that the capacity planning is such a way that it can meet the demand of the customers, but the forecasting the demand of customers on long term basis is difficult because of the various uncertainties. And therefore, it makes the long term capacity planning job more difficult. So what are the main issues related with the capacity planning.

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As I have said, capacity planning is of the two types means as per as the processes or the strategies for the capacity planning. That is the long term capacity planning or short term capacity strategy. So, both these strategies are different but specially the long term capacity planning which is like say for 5 to 10 years ahead.

This becomes very difficult, because the future demand, the technological development which will be there and one more thing which is there in that the forecast in future means for such a long term is difficult. So there is uncertainty in all three factors that kind of technology which will prevail after 5 to 10 years or the kind of the demand which will be there or the kind of the forecasting for that long period is difficult. So because of these uncertainties, the long term strategy is really very difficult but still some of the methods are there and these long term strategy is further influenced by the kind of a the product development.

Considering how fast the technology is changing or the customers demand are changing. And another thing is the product life cycle, product life cycle. We know that whenever the new product is introduced, then initially as a function of time the demand will be less, say in y axis its demand then demand will grow gradually then it will reach to the peak.

And then demand for the product is start decreasing. So this is the maturity stage this is the growth stage this is the introduction stage. So the different products, a product will be following the different stages of the demand or the volume which is expected to be produced to meet out the demand of customers.

So the product life cycle whether the product achieves the maturity in 5 years or in just two years and thereafter decline starts in that demand. Now what is because of the fast changing technologies, the newer feature and the newer technologies are coming up and that is leading to the short product lifecycle and which is making the long term capacity planning strategies more difficult.

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LTCP

- * Mix of Product - variety of products. (same m/c, manpower)
- * Utilize m/c, manpower ↑
- * ↑ Profit
- * Different product have diff stages of product lifecycle
- * ↓ risk of failure

Graph: P vs T. Curves for A, B, C, D. D is declining, A, B, C are increasing.

Small video inset: A man speaking.

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But is still there certain methods for dealing with the long term capacity planning, and one is the mix of product. A plant is used to produce the variety of products using same machinery, manpower and advantage of this is that if the demand for one type of product decreasing, then the demand for another product may be on the higher side.

So in that way the organization will be able to utilize the machines, manpower efficiently and the chances for obsolescence of the machinery and the manpower that will be very less. So utilization of the manpower and the machine is increased, that is one thing and if the company is suffering loss from one product then the profit may be offered by another product.

So the chances for survival of the company will be much better when the company the plant is used to manufacture a mix of products or product mix is used. So, it helps to increase the profit and as we have seen when we when the plant is being used for variety of products, so then the products may be in the different stages of their lifecycles, like few may be there in the introduction stage, few in growth stage, few in maturity and few may be the decline stage as far as the demand and time is concerned.

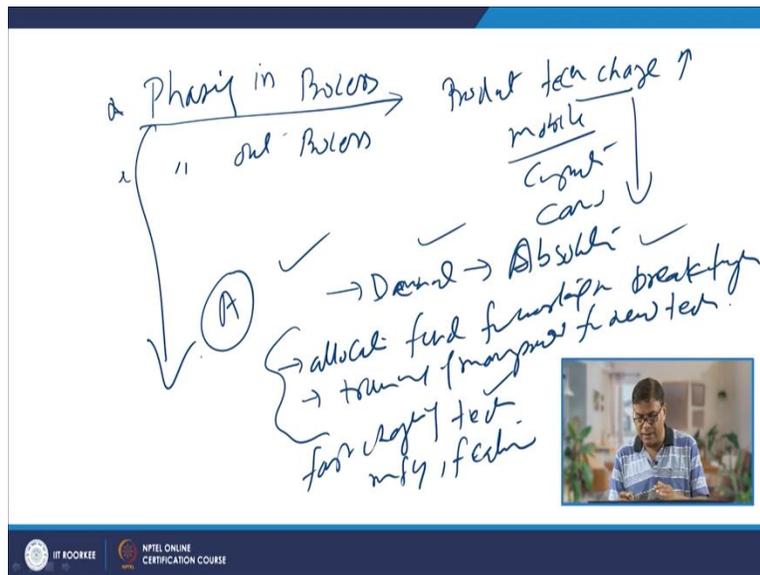
So it is possible that the product D is in decline stage so the company may start reducing the volume that is to be produced of the deep, while A, B and C may be on the increasing trend of

the demand. So the advantage in case of the product mix is that the different products have the different stages of product life cycles and advantage of this will be that the company may be able to effectively use the resources without going through the losses because of the product lifecycle related thing.

So intern it reduces the risk of failures of one type of particular product or there is a due to the decline in the demand for a particular type of product. So, as a whole the risk of failure is reduced when a mix of the product is produced. So these are, this is one way to deal with the long term capacity planning instead of manufacturing one type of the product the variety of the products can be produced using the same plant machinery and the manpower.

So it will help in continues utilization of the machinery and the manpower to produce the different things which intern will increase the profitability and reduce the risk of the failures.

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Then another strategy related with this is phasing in process and the third is basically the phasing out process. So, in phasing in process this is very interesting thing like in those products where technology is changing very fast technological change is extremely high like in the mobiles, computers and now what is even the cars. So in those cases where technological change is very fast in those cases when there is a fast change in the technology then there will be fast change in the demand as well. And there is a fast change for the possibility of the absolute facility. So to

deal with these things, like if the company is manufacturing A type of the product and very shortly if it loses the market that the demand will be reduce it the facility will become absolute.

So, to deal with those products, means the plants or organization manufacturing such kind of products where technological changes very fast, they need to be very proactive in the sense that they allocate some funds for working on breakthrough technologies. And the manpower training of the manpower for the newer technologies.

So this is about the proactive approach where the organizations will be working on developing the newer technologies and the training the manpower so that they can deal with these the fast changing technologies manufacturing procedures and the future requirements. So this is about the phasing end things are done in considering the possible changes in future through the allocation of the resource so that the company or the plant becomes ready to deal with those fast changing situations.

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The slide contains handwritten notes in blue ink on a white background. At the top, it says "Phase out Process". Below this, there are several lines of text: "M/C, Man power → tech.", "Profit / worth to continue", "absolute", "Capex, J&S gen.", and "relocated to the plant". On the left side, there is a section titled "Absolute facility" with a downward arrow pointing to "Low of fixed cost" and "manpower". A checkmark is next to "manpower". At the bottom right of the notes, there is a small video thumbnail showing a man in a blue and white striped shirt looking at a screen. The slide footer includes the IIT ROORKEE logo and the text "NPTEL ONLINE CERTIFICATION COURSE".

And then there is phase out process, there is a possibility that in some of the organizations that whatever machinery or the manpower is there technologically that is not worthwhile or profitable to use. So technically or from the profit point of view, it is not worth to continue because it has become absolute. So in this case, obviously we have to abandon the facility, and what will be leading to this? This will be leading to what like the loss of all fixed cost may be in form of

machines and the entire plant which has become absolute, which have become absolute. Then there will be the another problem that is of the manpower.

So, when the plant is abundant or plant is closed in that case, the manpower has to be taken care of through the either suitable compensation is given or the jobs are given or they are relocated in other plants. So there absorbed in other plants or they are accumulated in some other companies or the suitable compensation is given in the event of closer of the plant which has become absolute. So the, of course there will be loss of the fixed constants in terms of the machinery and the plant which has to be closed.

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Short term CP Process forecast up to 12M

Planning Capacity to meet demand

Plant Capacity \leftarrow m/c, manpower, space/infrastructure

Consideration of eff. capacity of plants

Demand \leftarrow

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But in this case, the efforts should be made that whatever manpower is there either there is compensated suitably or they are absorbed by relocating them in some other plants or other facilities.

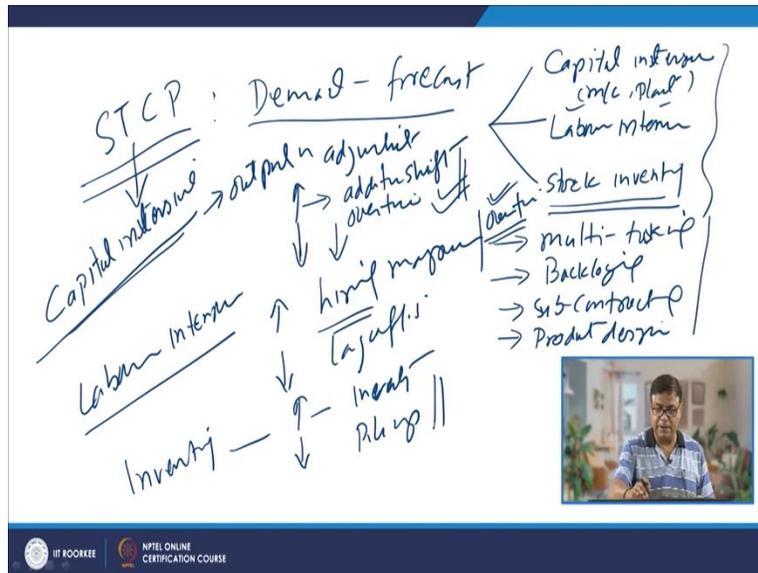
Then we have the short term capacity planning processes or the methods which are used. So this is normally for the shorter period based on the forecast like say for up to 12 months. The managers will be managers will be planning the capacity to meet the demand as identified through the forecast. So obviously this will be done through the consideration of the effective capacity of plant and the kind of the demand which is there. So if it is equal so nothing is to be done but if there is difference either on the higher side or the lower side like plant capacity lesser

than the demand or the demand is more than the or the plant capacity is more than the demand we need to deal with this difference effectively.

So in this case normally the plant capacity from the machinery and man from the machinery and the equipment wise that remains same unchanged. In short term capacity planning, considering the given machinery and the plant the plants are made to deal with the fluctuating demands. So what are those strategies where in considering the given plant facility how to deal with the fluctuations in the demand on the short term basis.

So for this there are certain methods which are used to deal with these situations and these include short term capacity planning. This short term capacity planning will depend upon the demand forecast. And how to deal with these demand forecast fluctuations as compare to the plant capacity that depends on the two or three types of the factors, like whether the plant is capital intensive, which means the demand can be achieve only through the use of the more machinery. So machines and the plant is crucial in this case to adjust the output.

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In another case, labor intensive, so in case of the labor intensive plants the demand adjustments are made through the adjustment in the manpower being deployed, either on the higher side or in the lower side. In third case where the stock or inventory number of case it is not possible to have the stock of the things being produced. But in the situation where stock can be produced, then in case of the increase demand the inventory can be used or in case of the less demand with respect to the given production capacity or effective capacity the inventory can be developed, so these are three approaches.

Apart from these three approaches, other factors are also there other methods are also there these may be in terms of like say training the manpower for the multi-tasking. That is one and the second is like backlogging, where few customers are asked to take the deliveries after the peak period.

Then subcontracting and then there is one more approach where product design is altered in minor way so that it requires less work to be done to enhance the production. So, starting with those case where short-term capacity planning strategies for the capital-intensive industries where output can be enhanced to the additional plant and machinery. So obviously for short term on short-term basis no major capital investment can be done.

In this case output is adjusted, of course considering the demand and the plant capacity output is adjusted means output can be increased or it can be decreased. So, when output is to be increased in that case the plant can be utilized for additional shifts or the plant is run for overtime so that more output can be realized from the plant. So that is what is done in case of the capital and the working hours are reduced if the plant is running in three shifts, then in case of the reduced demand plant can be operated and run in two shifts or in one shifts.

So that is what is done in the capital-intensive plants where output adjustment for increased demand is done through the additional running the plant in additional shifts or for longer hours. While the working hours or the number of shifts are reduced for reducing the demand. In case of the labor-intensive industry where output is increased through the hiring of the additional manpower or the output is reduced through the layoffs of the manpower.

Then in this case, hiring and then there is over time of the workers if not significant difference in the demand with respect to the plant effective plant capacity is there the minor adjustments can be done through the overtime. And then there is like those items if the plant is manufacturing certain kind of the items which can be stocked in inventory.

So in this case when the demand is high the additional demand can be met through the inventory and when the demand is less the inventory can be piled up or the inventory can be developed.

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Backlogging - few customer which agree for taking delivery after peak period

→ Employment Training - Different jobs are given to workers, multitasking

→ Subcontracting - Peak period using capacity of other plant - San plants, other

→ Product Design



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Then other factors like backlogging, in this case few customers which agree customers agreeing for taking delivery after peak period, so this is one thing. So this can be tried the consent of the customers can be taken to see if they can accept the delivery after the peak period. Second is the employment training, means they the different jobs are given, different jobs are given to workers. So that they are trained to do the different type of the jobs, so this is basically multitasking. So even if someone is absent the other persons can do this kind of the job.

And there is subcontracting like in case of the peak demand, additional capacity on short term basis can be developed in peak periods additional capacity can be developed by using the capacity of other plants which agree to produce the same parts as desired or same products as desired. So that is about the subcontracting, then here is the product design alteration.

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Product Design → No. of operations - Sequence
(
1. allow, high production rate process
2. combination of certain process
3. allow in ↓ bottleneck already
work content -
short



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You know for a given design of the product, like say product design for a given product design there will be certain number of operations which need to be done in certain sequence. And if the design is altered in such a way that it allows use of the high production rate processes, let us say one or design allows the combination of certain processes or it allows in reducing the design is modified in such a way that it permits in reducing the bottle neck at certain stations.

So all these things will be helping in producing more using the same resources, basically these will be reducing the work content work content with the modification of the product design. So here these are some of the strategies or the processes for dealing with the long term and the short term demand fluctuations, so that the capacity can be planed according. Now I will summarize this presentation, in this presentation basically I have talked about the different methods which are used to deal with the short term and long term capacity planning strategies. Thank you for your attention.