

Operations Management
Dr. Inderdeep Singh
Department of Mechanical & Industrial Engineering
Indian Institute of Technology, Roorkee

Lecture – 06
Product Life-Cycle

[FL] Friends, welcome to lecture 6 in our course on Operations Management. As you are well aware in the first week we have already discussed about the basic fundamentals or basic philosophy of the subject that is operations management. We have seen that what is the requirement of managing our operations? We have also seen that what are the objectives and functions of operations management? We have seen the operations strategy.

So, basically what is the use of studying this subject we have seen in our week 1? We have tried to understand that various companies are producing different types of products, if you see the examples we have taken from laptop to maybe up hair pin. The degree of sophistication may vary, but the operations the conversion of raw materials into the final product will remain same.

So, the basic principle that is we have to add some value to a material or to a service in order to make it important in order to make it useful for the customers is the basic fundamental behind any value addition process or behind any process or service. You may see in hospital we have different types of services, in a car making industry we have different types of operations that are done. So, there is the service sector, there is a manufacturing sector and in both the operations have to be managed properly.

So, basically we have to see that if we are focusing on the manufacturing sector then what we should produce or we what we must produce? What means the product? We have to focus on the product. If our product is niche if our product has gotten innovation it will definitely capture the market. If the product is an improved version of an existing product definitely the product is going to be successful in the market, if there is a need for that product.

So, once we know that how we have to manage our operations? What are the various strategies to manage the operations? We have to start from stage one of operations, that is

we need to understand that what we must make or what must our product be. If we are sure that what our product is going to be what we are going to make? Then the next stage is how much? Should a first answer that every engineer has to look for is what the company should make? What should be the new product? What should be the improvised version of the existing product? So, what first answer has to be what the second answer has to be how much?

How much means once we know that we are entering into a very very specific domain of the customers, our customers are not going to be a common man. For example, a company decides to start making aeroplanes or aircrafts, every individual will not be buying a aircraft only few selected companies will be buying the aircraft.

Now, depending upon the customer that decision has to be made that how much should be our quantity of production? That is we need to forecast that how much we have to make? So, these are preplanning decision before we venture into full scale manufacturing or production, we have to decide these things, that what we are going to make in how much quantity it will be required in the market.

And finally, we will go to the shop floor operations and try to manage those operations on the shop floor; maybe the capacity planning the time planning, the resources planning, the materials planning, all that will come at a subsequent stage. So, in time if we draw this all these operations or all these activities or all these jobs, first thing will be every company has to take a decision that what they must produce? And these days there is lot of focus on innovation, lot of focus on creativity each and every company is looking for definite products for important products, which can capture the market and which is the need of the market.

And they are focusing their attention on development of new and new products. In improving the life or improving the efficiency or improving the performance of their existing products and that is the idea with which we have included the discussion on product design and development in our course on operations management, but I think I have been able to address the point that why product design and development is an important process. In the overall operations strategy of any organization and therefore, we are addressing this point at the very beginning of our discussion on product design and development that is week 2.

So, that the learners may try to appreciate or may appreciate the importance of product design and development in today's scenario. And I must also address here that the product design plays a very vital very important role in defining the overall success of an organization. For manufacturing the product there maybe standard processes or we can say standard procedures that may be adopted at a later stage, but what we are going to make and whether that product is required in the market or not that is going to define or definitely define the success of the organization.

And therefore, product design and development becomes very very important. So, in this we have seen maybe just 1 minute review of what we have already discussed. We have already discussed the basics of operations management, we have seen the scope functions objectives of operations management, we have seen the different types of production systems, we have seen the fundamental of operations strategy. So, our week one discussion is over only related to the introduction of the course on operations management.

Now, we are specifically focusing on individual domains of operations management and the first important domain is the product that the company has to manufacture. And in product design and development I must address here that this is a very wide subject. Product design and development is taught as a full-fledged course in many universities and institutes.

So, you can see that it can be a 42 lecture course in which different aspects of product designer covered in the class. I must also tell you here that we have already recorded or we have already run one course on product design and development under the moocs scheme in the last 2 last semesters. And there was a lot of interest lot of enthusiasm among the learner regarding that course. And I am hopeful that the course maybe re run in the sub sequent semesters and if you feel that it is an important course you definitely can get certified with that course.

So, in that course that was a 10 hour course and there were 20 sessions of half an hour each, but in this overall course of operations management we cannot be we can say, we cannot give that much time to this particular topic. So, here we have tried to include basic you can say tools that can be used that are important from knowledge point of view for every engineer.

So, we are not going to cover the product design and development in totality, but we are definitely going to learn some important tools which a product designer must know or an operations manager must know, during the course of his service or during his you can say working, he must be acquainted with this tools or he must be aware of these tools.

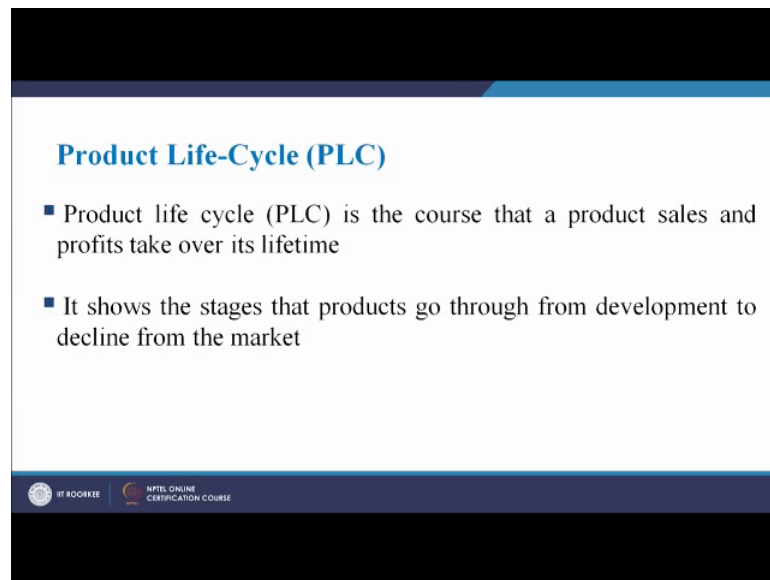
So, we will be covering 5 different sessions in product design and development. The first session will focus today on the product life cycle, the second will be on value engineering a very important tool for product designers, then third will be designed for x we will be away cover design for manufacturing design for assembly we the specific examples and then we will see the ergonomics of product design and finally, we will see once our design is ready how we can make a prototype quickly with the concept of rapid prototyping.

So, basically 5 important tools we will be discussing here. First important we can say information is related to the product life cycle. So, our first session today will focus on product life cycle, I must say here that we have covered; I think lot of introductory part in today's session.

So, I will be slightly you can say quick in the discussion part may not go in to the detail of each and every point that is there on the slide, but I will try to address the importance of product life cycle in the overall scenario of operations management and for details I think you can refer different books literature internet YouTube there are number of lectures, or number of you can say videos or number of E notes number of E books available, in which you can find the discussion related to the product life cycle.

So, quickly we will start our discussion regarding the product life cycle.

(Refer Slide Time: 10:43)



Product Life-Cycle (PLC)

- Product life cycle (PLC) is the course that a product sales and profits take over its lifetime
- It shows the stages that products go through from development to decline from the market

IIT ROORKEE NPTEL ONLINE CERTIFICATION COURSE

So, product life cycle is the course that a product sales and profits take over its lifetime. So, if we plot the product life cycle on x axis it will be time as it is showing that the PLC depicts the course that the product sales first thing is sales another things is another important point is profit.

So, we will see how the sales and profits will vary over a period of time and that will represent our product life cycle. It shows the stages that the products go through from development to decline from the market. Now any product you take may be I may take the example of my pen.

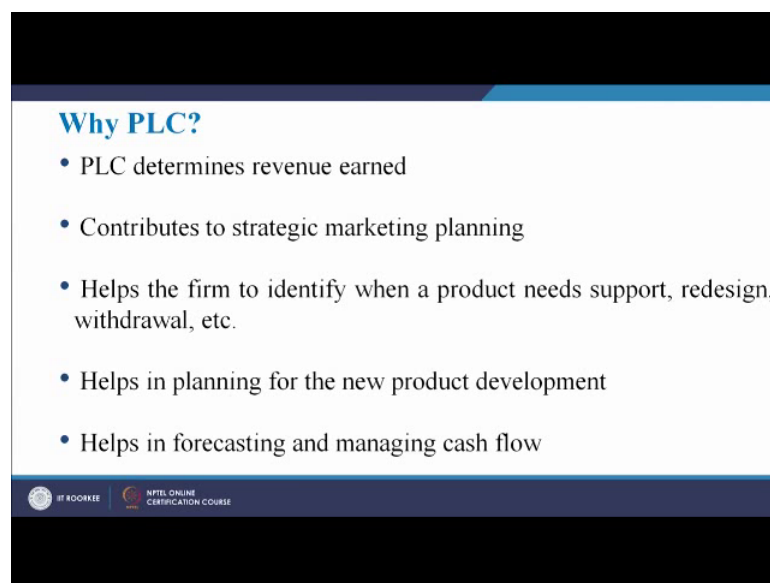
Now, this particular pen may have been you can say manufactured using the raw materials since it is a plastic product different plastic processing techniques may have been used to make this pen; so from conceptualization to prod rapid to prototyping, to development of manufacturing of the product, to the sales in the market and finally, the decline of the sales that will overall represent the product life cycle.

So, for example, the human beings also have a life cycle similarly every product has got the life cycle. So, the life cycle of the product is represented for the company in terms of the sales or the profits that the company make over a period of time. So, we will see what are the various stages of the product life cycle, before going to the stages let us see that what is the importance or why an engineer should have any information related to the product life cycle.

Now, product life cycle determines the revenue earned because it is giving us the sales. Now once we know the volume of sales or the number of products sold we can multiply it with the profit for product and very easily we can calculate the revenue earned from the product life cycle.

So, if we have a product life cycle for a product we can determine the revenue earned at this revenue earned is also important, because once our earnings start to decline we need to think, that whether we should continue with the same product or we should come up with the improvised version of this product or we should completely eliminate this product from our product segment and come up with a new product completely new product. So, that decisions have to be made based on the revenues earned. Similarly product life cycle also contributes to the strategic marketing planning.

(Refer Slide Time: 13:33)



Why PLC?

- PLC determines revenue earned
- Contributes to strategic marketing planning
- Helps the firm to identify when a product needs support, redesign, withdrawal, etc.
- Helps in planning for the new product development
- Helps in forecasting and managing cash flow

IT ROORKEE | NPTEL ONLINE CERTIFICATION COURSE

Now, strategic marketing planning depicts that once we know that this is going to be the product life cycle, we can make our planning accordingly. What type of plans we need to make? Once the product is in the growth stage we will see the different stages I am just taking an example; once the product is in the growth stage we need to emphasize aggressive marketing proactive marketing. So, that more and more customers join our product segment or just join our may buy our product or may join the people or the group of people who are using our product.

So, once the product is in the growth stage maximum profits are derived from the market and our focus is on more and more aggressive marketing. Once the product is in the decline stage, we know that there are competitors in the market. The competitors product is better than other products, we will see or we will say that, we must not put too much money into marketing or advertisements, because we know that our product is not able to compete with the competitors product rather we must put that money in research and development. So, that we can come up with the better product than the one we are that we are already selling in the market.

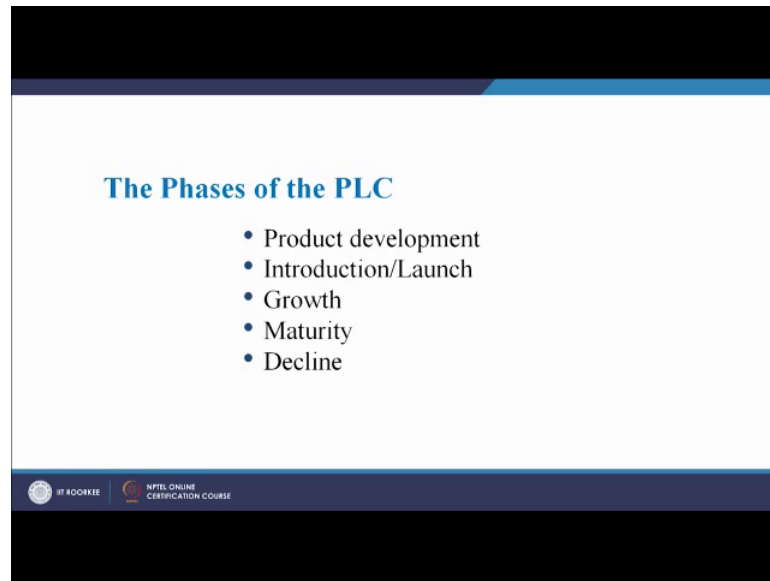
So, we have the product life cycle gives us an idea that how we should many manage our marketing efforts in order to derive maximum benefits out of the marketing efforts. Then the product life cycle also helps the companies to identify when a product needs support, redesign, withdrawal etcetera.

Now, since we know that this is going to be the product life cycle or these are the sales what is forecasted? For the sales like how the sales are going to vary over the next 6 months over the next one year? We can take decisions like, whether we should invest in redesigning the products, whether we focus on the withdrawal of the product from the market as I have already highlighted in the previous point.

So, such type of decisions are taken based on the product life cycle also it helps in planning for the new product development, which I have already highlighted as well as it helps in forecasting and managing the cash flow. So, we can see that if we have an understanding about the product life cycle very easily we can take decisions which are beneficial to the organization. And therefore, information related to product life cycle must be there with each and every engineer working for the organization.

Now, we will try to see the different phases of the product life cycle on your screen you can see the product development is the first stage we have to first develop the product, using innovation creativity and then sketching it conceptualizing it and then making a prototype and finally, testing the prototype and then seeing the in service conditions of the products. Finally, we come up with the tested product that this is the product which can now be launched into the market. So, from the product development once the product is ready we come to the introduction or the launch stage.

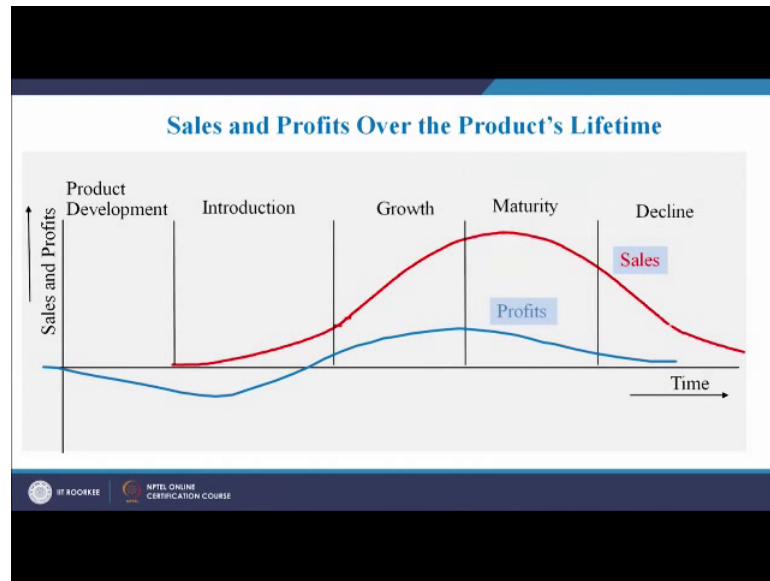
(Refer Slide Time: 17:03)



Then growth; the growth of the sales, the growth of the revenue, the growth of the profits that we are going to make from the product, finally there is a maturity stage in with the growth stops the market share is maximum at the growth at the maturity stage and once we spent some time or the product spent sometime in the maturity stage there are competitive products in the market at this stage. And finally, the sales start to decline and similarly or consequently the profits also start to decline.

So, we will try to see this with the help of a diagram and try to understand that how the sales vary over a period of time and how the profits vary over a period of time? So, here on your screen you can see the variation of sales and profits over the products lifetime.

(Refer Slide Time: 18:00)



So, we see x axis as I have already explained is time and these are the sales and profits on the y axis. So, we see the profits are depicted by the blue line and the sales are depicted by the red line. So, in the product development stage or the phase we do not have any sales, because we are in the process of development and the profits are also negative.

Because we are spending money in research and development and prototyping and testing so there is no profit at this stage, but once the product is launched in the market or it is introduced in the market, the sales start to increase. As well as the profits also start to increase and finally, we reach a stage where the profits are in the positive segment or in the positive domain.

So, we if we focus on individual variation from sales point of view let us see from introduction stage the sales start to increase, but in the growth stage we see there is a steep increase in the sales. And finally, at the maturity stage the sales become more or less stagnant and then in the decline stage the sales start to decrease.

And similarly if you see the profits the profits in the growth stage we see are increasing maximum at the maturity stage and finally, towards the decline stage the profits start to decrease. So, this is the basic variation of sales over a period of time and this type of diagram number of such diagrams you will see which will depict the product life cycle over a period of time.

Now, we will try to understand the importance of each one of these stages very quickly. So, that we are able if we have a product life cycle for a product in front of us in the form of a figure or a data. We must be able to deduce some information which can help us to take our decisions regarding the success of an organization.

(Refer Slide Time: 20:26)



So, first stage is the product development stage. New ideas are there if I must say that ideas we can say develop number of idea, because idea mortality rate is very high we may generate 100 ideas, but only 2 maybe culminating in to or 2 maybe developing into a tangible product.

So, the importance of idea generation is very very important. So, we in product development stage, we have to generate lot of ideas, then we do the market survey that whether the product is required in the market can it be produced at a profit? Because no company wants to make a product just for making a loss, product development and refinement, test marketing, analysis of test marketing results preparation of launch, publicity, and marketing campaign.

So, in product development we can have other stages also other technical stages also, but here we are just coming up with the basic idea that in product development what we do? We have some idea we develop it into tangible product we see, whether it is just do the test marketing we see, whether it is going to be successful in the market or not and then finally, we plan that how to launch in which part of the country we have to launch in

which way we have to launch, whether we have to go for a television marketing or television advertisements or we have to go in the print media. So, all that is covered in the product development then the next stage is very very important that is the introduction or the launch stage.

Now, we have taken all decisions related to the product we have a product with us now the product is introduced in the market. Now introduction of the product in the market is done in this stage.

(Refer Slide Time: 22:14)



Phase II: Introduction/Launch

- Introduction of the product into the market
- It may be new product or old product to the new market
- Demand is low
- High cost/low sales
- Advertisement and promotion
- Monitor initial sales

IT FOORKEE | NPTEL ONLINE CERTIFICATION COURSE

It may be a new product or old product to the new market now old product to the new market, maybe we are selling ice cream of specific brand maybe in one part of the country. So, we are introducing in to the other part of the country. So, it is a old product, but the market is new. In introduction stage if you see the sales are increasing it means that initially the demand is low.

So, in the introduction stage demand is low, but as the word of mouth, spreads, that this is a good product the sales will definitely increase in the growth stage, high cost low sales. So, sales are low the product is costly advertisement and promotion is required as we have seen that PLC product life cycle helps us to take certain decisions related to the aggressive marketing strategy.

We have to monitor the initial sales in this case why, because in the introduction stage we see that the sales are less we have to see that how we can increase these sales and what are the teething troubles? What is the problem areas asocial associated with the product? That we need to iron out in order to reach the product into the or in order to reach the maximum growth at the growth stage so, in the initial stage there are challenges teething troubles are there that we need to look at.

(Refer Slide Time: 23:41)

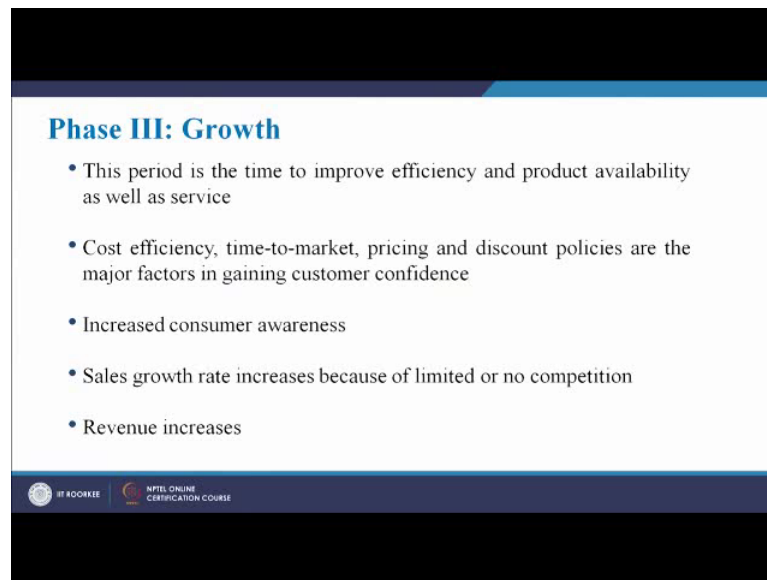


Now, this is summary of the introduction phase sales are low as clear from the diagram costs high per customer, because in in a heist to launch the product quickly we sometimes do not optimise the cost. So, get cost optimization is done at a later stage and that we will cover in our next lecture on value engineering. That initially once we have developed or designed the products, why there are unnecessary cost in their products and how we can overcome those cost at a later stages of the product life cycle.

So, the cost initially are high per customer profits are negative as we have seen in the diagram, initially, the growth profits, become positive in the growth stage only and marketing objectives are create product awareness and product trials.

Now, in the growth stage this period is the time to improve the efficiency and product availability as well as service.

(Refer Slide Time: 24:39)



Phase III: Growth

- This period is the time to improve efficiency and product availability as well as service
- Cost efficiency, time-to-market, pricing and discount policies are the major factors in gaining customer confidence
- Increased consumer awareness
- Sales growth rate increases because of limited or no competition
- Revenue increases

IT ROORKEE | NPTEL ONLINE CERTIFICATION COURSE

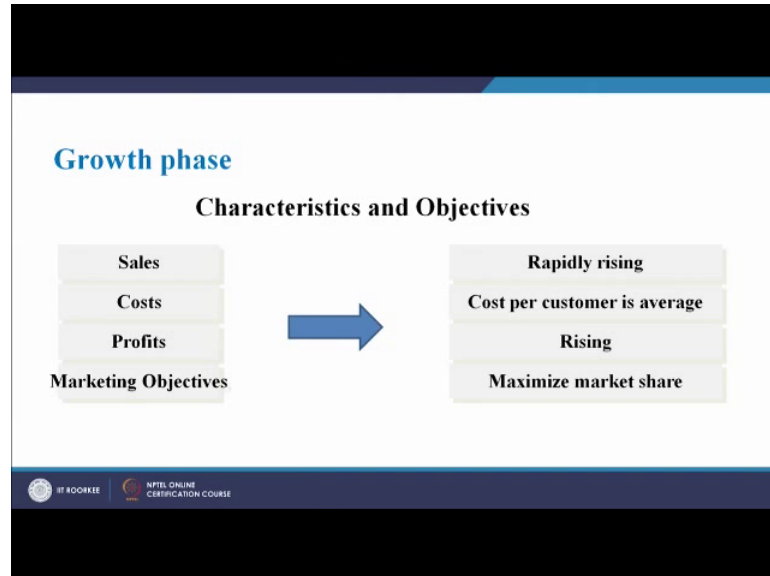
So, 3 points are here efficiency, availability and service. So, we have to ensure that if a customer goes to the market our product must be available on the shelf. The efficiency of operations also must be good, because we have seen that the cost is higher in the introduction stage. So, we have to keep a close tab on the cost of the product and how we can manage the cost? So, that the product is competitive in the market. So, we have to improve is improve the efficiency. Then the availability I have already highlighted as well as the service should be good, cost efficiency, time-to-market, pricing and discount policies are the major factors in gaining the customer confidence.

So, we have to focus on these points also. We have to focus on cost efficiency, time to market, price it should be competitive pricing, and the discount policies. Of 4 points further are added to the efficiency availability and service, increased customer awareness through marketing sales growth rate increases, because of limited or no competition. So, initially once our product is new it has been introduced in the market people have come to know about this product.

So, in the growth stage there is not much competition if it is a monopolistic type of market. So, the product will definitely have a growth trajectory and it will and the growths the sales will increase at a rapid rate revenue also increases. So, that is not to mention that because when the sales are increasing the revenue earned will also increase.

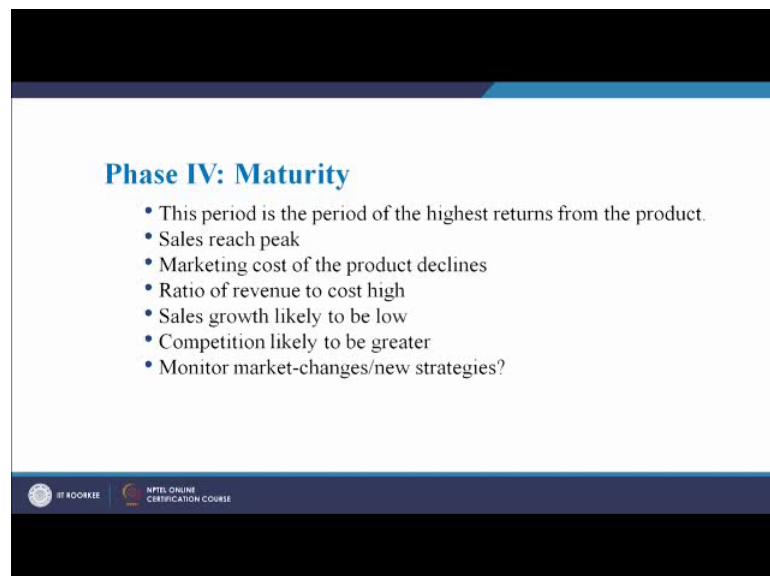
So, growth phase these are the we can say characteristics and objectives sales are rapidly increasing cost per customer is average.

(Refer Slide Time: 26:31)



Because we have focused on cost efficiency profits are increasing, marketing objectives are maximize the market share by improving the customer awareness.

(Refer Slide Time: 26:42)



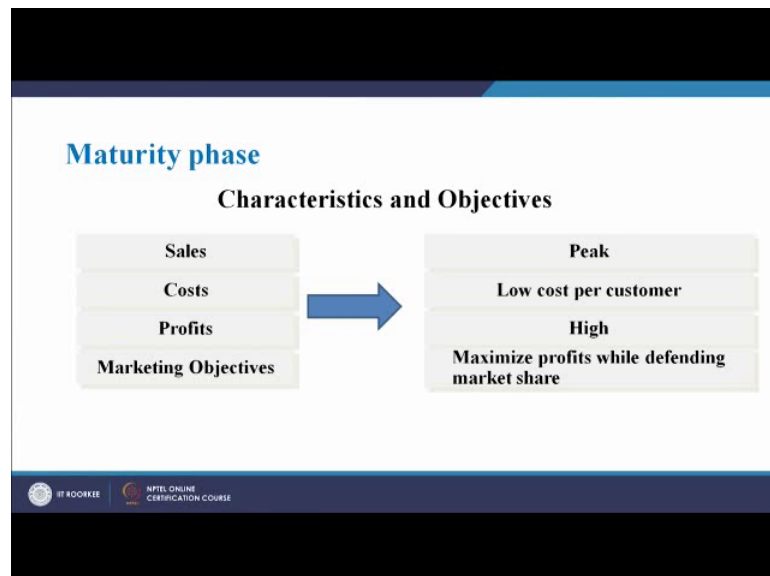
Now, the maturity stage slightly red zone in maturity stage highest returns from the products are actualized, this period is the period of highest returns from the product sales are at it is peak, marketing cost of the product declines, because in the introduction and

the growth stage we have done aggressive marketing, for improving the or for increasing the customer awareness, but at the maturity stage we know that the competition has set in now there are other products also available therefore, we do not focus too much on the marketing ratio of revenue to cost is high sales growth are likely to be low.

Now, growth stages we have seen the sales are rapidly increasing, but at the maturity stage the sales become more or less stagnant. And competition is likely to be greater in the maturity stage and we have to monitor the market changes and we have to adopt the new strategies in order to be we can say; successful in the market or in at least in order to sustain in the market. There is a famous saying that if you do not obsolete your product you will be obsolete it from the market.

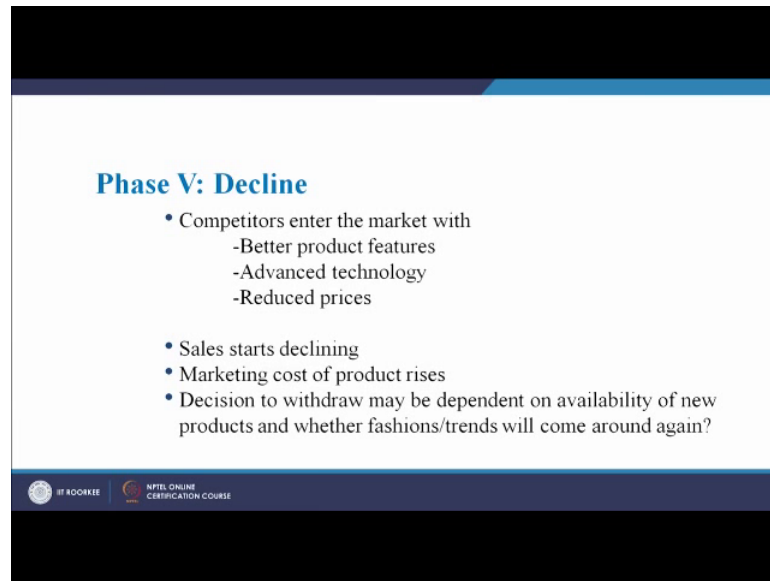
So, that decision we have to take that we deliberately or intentionally should make our product obsolete and develop a strategy in which we come up with a new product, which again enters into the growth stage after the introduction. So, every company wants to be in the growth stage only. So, the maturity phase these are the characteristics sales are at their Peak, Costs, low per customer, profits are high, because the sales are highest marketing objectives are maximize the profits while defending the market share.

(Refer Slide Time: 28:26)



So, we have to put efforts to sustain in the market.

(Refer Slide Time: 28:50)



Phase V: Decline

- Competitors enter the market with
 - Better product features
 - Advanced technology
 - Reduced prices
- Sales starts declining
- Marketing cost of product rises
- Decision to withdraw may be dependent on availability of new products and whether fashions/trends will come around again?

IT ROORKEE | NPTEL ONLINE CERTIFICATION COURSE

Finally, the decline stage the competitors enter the market with better product features, advanced technology, reduced prices. So, lot of competition is there. So, we have to see that how to manage the product sometimes there is such a technology shift such a change in the technology that our product may automatically become obsolete. So, the sale starts to decline marketing cost of the product rises, because now we are only spending the money on marketing, but we are not getting the returns out of the marketing and ever are the marketing efforts that we are putting.

Now, we have to take a decision to withdraw it may be dependent on the availability of new products and whether the fashion trends will come around again. So, if it is specific to a specific segment of industry, but in many cases we have to take a judicious decision that whether to continue with the product or we should focus on some other product or some other market segment, where we can again be in the growth stage of the product life cycle, where the profits are also increasing and the company is making profit.

So, with this we come to the end of today's session that is session number 6 in our course on operations management and we have started the week 2 discussion in which our focus will be on product design and development. Today's session was focused on product life cycle and in next session our focus will be on value engineering.

Thank you.