

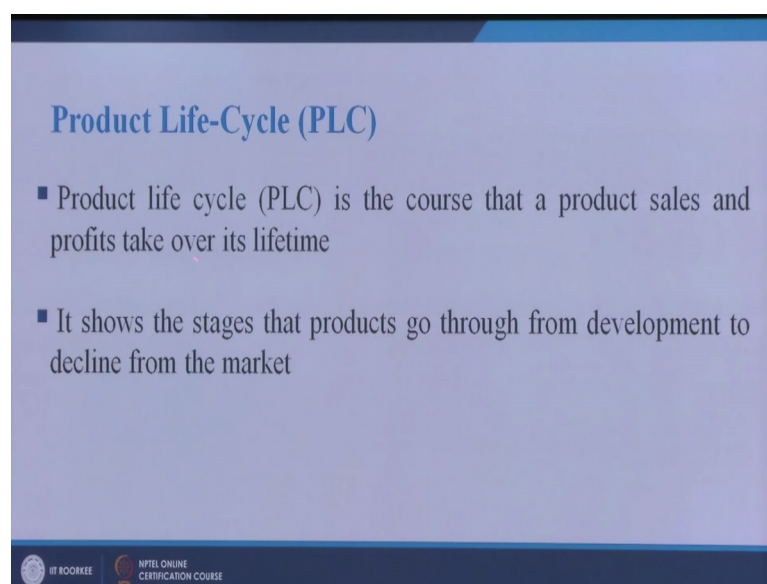
Product Design and Development
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Lecture - 02
Product Life-Cycle

[FL]. Welcome to the second lecture on our course on Product Design and Development. If you remember in the first lecture we have seen the introductory part of product design and development, today we are going to study or we are going to discuss a second important part that is the product life cycle. Why we are discussing the product life cycle? Because it has a strong bearing or strong influence on the product design and development, in the last lecture if you remember we have just finished with the diagram of product life cycle. So, we have not considered the various phases of the product life cycle.

But today we will discuss that what are the various stages or phases of the product life cycle and we will try to understand that how these phases influence the various strategies the various decisions of any organization which is involved in producing products for making profits. So, let us go one by one and quickly try to understand the basic philosophy the basic decision making process based on the product life cycle.

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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

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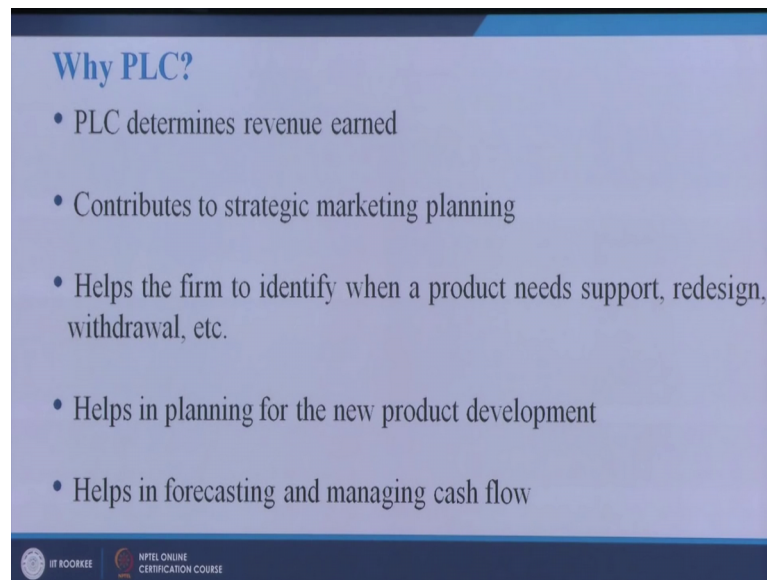
Now, let us see this slide was shown yesterday also, the product life cycle you can see is the course that a product sales and profits take over its lifetime. We will see with the help of a diagram that how the product sales vary with respect to time, and based on this time what are the various phases of product cycle or the product life cycle. So, we will try to understand that with the help of a diagram.

So, first point is, is the course or the trajectory that a product sales and the profits take over its lifetime. The second point is, it shows the stages that products go through from development to the decline from the market. So, we need to understand somebody may question that what do you understand by product life cycle, many a time student start answering from conceptualization of the idea then testing of the idea and then coming up with the concept design then detailed design of the products, all those things are not considered in the life cycle.

Life cycle is that the product is born, it is developed and then it declines or may be the sales of the product decline over a period of time. It attains a maturity level means a sales of the product attains a maturity level and finally, it declines or the sales or the profits related to the product decline. So, it is a starting phase is the development, many a times in many different books you will find that the even development stage is not considered in the product life cycle.

Basically they will show the introduction of the product into the market how the sales are effected during that stage, then the growth of the demand or the growth of the sale how the sales are influenced at that particular time finally, the maturity level and the decline. So, majorly it is the behaviour of the product when it has been lost in the market at the trajectory is drawn based on the data that is the sales data, or the revenue data or the profit data based on the product.

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So, let us quickly see that what are the various stages of or the various phases of product life cycle, but before going to that, let us see one important slide that why do we need to study the product life cycle; our course is on product design and development. So, why we need to understand the product life cycle? So, these are the few points which have been or you can say complied for this purpose.

Now, PLC or the product life cycle determines the revenue earned. So, suppose our revenue is declining over a period of time, what do we need to do? We need to have a relook at that product; we need to redesign that product so that the revenues may increase. No company wants to do business for loses. So, each company would like to make as much profit as possible, and that is only possible if you revenue that you are earning from the product increases over a period of time.

But suppose your PLC will help us that how much revenue we are earning, and suppose during the drawing the product life cycle we see that is the sales are declining the profits are going down, at that time we need to take a very hard decision to either shelf that product to leave to stop the production of that particular product or to come up with the relatively new or a redesigned or a innovative product to replace the old product for which the revenue is decreasing.

So, point number one is PLC determines the revenue earned in a way it helps us in decision making related to the product design. Second point contributes to strategic

marketing planning. So, we need to see that how the sales are for the last six months for the last one year, and it can help us to make our marketing plans, the advertisement policy that discounts all those decisions can be taking based on the product life cycle.

Next point: it helps to the firms or the companies or the organizations to identify when a product needs support redesign withdrawal etcetera. So, it completely helps the companies to make a product policy that at what particular time interval, they will withdraw the product from the market or they will launch a redesigned product in the market or they will support the product with some aggressive or proactive marketing policy like giving some discounts or giving some additional benefits to the customer. So, the product life cycle will help the company to identify all these things, related to the timing of reintroduction of the product, related to the withdrawal of the product related to the redesign of the product.

So, therefore, also product life cycle becomes important for this course on product design and development, because a redesigning part is coming into picture. I think I have told in the last class that there are two types of innovations, incremental innovation and breakthrough innovation. So, incremental innovations are always possible, when why that the product life cycle will be able to tell us that when do we need to redesign our product.

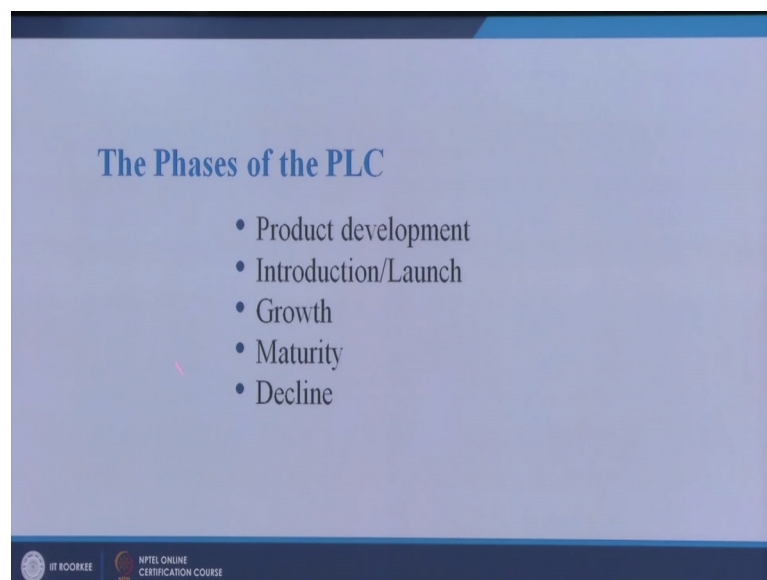
Next point on your screen the product life cycle helps in planning for the new product development. So, the timing as well as the policy related to the new product can easily be decided based on the product life cycle. And the last point see last point is helps in forecasting and managing the cash flow. How this will help you? Because suppose you have a product life cycle you know that initially the sales are maybe some number maybe x , after 6 months the sales are x plus Δx , after maybe 1 year or one and a half year the sales at x plus three Δx .

Now, when you know that how much is the demand in the market or how much is the sale in the market, you can make your policies procurement policies of the raw materials which are being used for making the product accordingly, and that will help you to manage your cash flow. So, it will help in forecasting also, it will help in managing the cash flow also. So, you can procure the materials you can hire the people accordingly

because you know that this is going to be the behaviour of the product when it is going to be launched in the market.

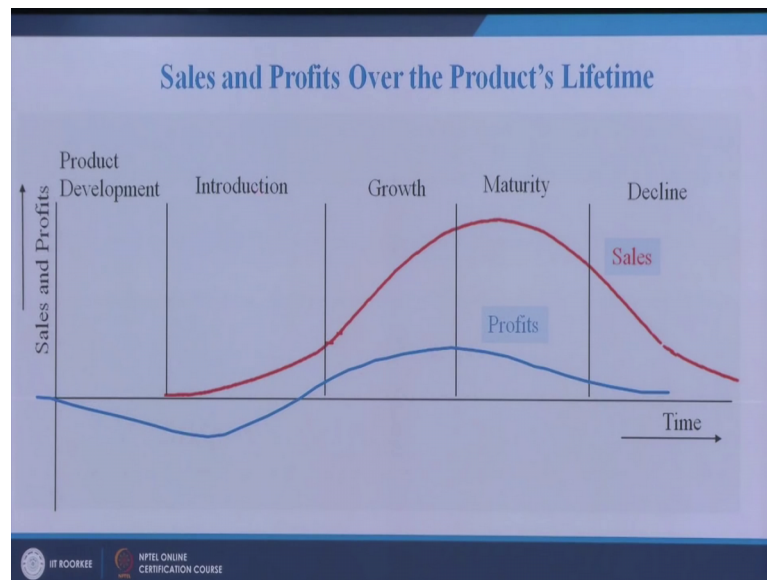
So, all these points and there can be additional points also that we may not be able to discuss because of the paucity of time, but these are the most important points which help us in decision making related to this topic or related to this you can say overall product life cycle of a product. Now in today's class our major focus is to understand that: what are the various stages of product life cycle, and what decisions we can take based on the various stages of this PLC.

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Now, the various phases these are the most common phases in all the different books you will find majorly these phases only. First is the product development usually in the beginning of product life cycle, then the introduction or launch of the product into the market, then you have growth maturity and the decline. So, you have four you majorly 5 phases, but in most common product life cycles you will see the 4 phases only or the four stages from introduction to the decline.

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So, let us see with the help of a diagram, on your screen you can see a more simplistic diagram for the product lifecycle. This is sales and profits on y axis and the time on the x axis, similar diagram I have shown in lecture number one also. So, you can see first phase is product development; second stage is introduction, growth, maturity and decline. So, you can see here red color graph I think it is clear on your screen is for sales and the blue color graph is for the profits. So, clearly evident that during the development of the product you do not make much profit therefore, you have a negative product negative graph for the profits.

But once the product is introduced into the market the profits start to increase. And you can see there is a area in which the profits are maximum this stages when the product has reached the maturity stage. So, at the maturity stage the profits are maximum. So, here we can see that introduction stage this product starts to grow, the sales of the product starts to grow and in the growth stage you see an incremental increase in the sales of the product and finally, in the decline stage the product dies down, the sales of the product completely dies down. So, we need to understand the importance of all these phases, phase number 1, 2, 3, 4 and 5 majorly we will focus on these four stages in this lecture because we are focusing on product life cycle.

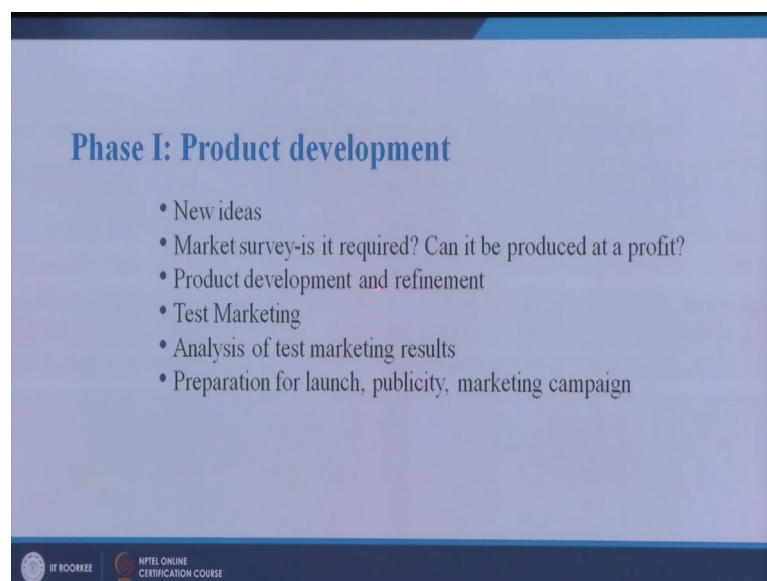
The product development part may be we will focus in the other lecture in which we will talk about the product development process in totality. So, today our focus will be on

introduction growth, maturity and decline. So, here you can see in the maturity stage the sales are maximum similarly the profits are also maximum. So, it is a kind of good feeling for the company when the product has achieved a maturity level, but it is a it sends a word of caution also because after the maturity. When your profits are maximum profits are maximum sales are also maximum the product sales decline as well as the profits as evident also declined.

So, our focus has to be in this area and we have to take decisions accordingly. So, that we do not go into this declining stage and we come up with the innovative or a new product or advanced version of the existing product, in order to maintain the supremacy in the market. So, let us see analyze each one of these stages one by one.

Now, first one is a product development stage we will just have overview of this stage what happens in the power development stage? There are new ideas market surveys are done.

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Product development and refinement test marketing is done analysis of the test marketing results and preparation for launch publicity and marketing campaign. So, more or less whatever product we have conceptualized we have done the initial design the detailed design the prototyping the testing, most of the things are already done.

Now in this stage we have maybe the market service the product development and refinement where the initial test marketing is done for example, many times you see with a magazine you get a very small sachet of hair gel or a hair oil or a hair shampoo and you just test it. So, that kind and then you can give your feedback online back to the company. So, that kind of test marketing is done in order to understand that how the customers are accepting this product in the market or how they are reacting to a new product in the market.

So, all that is done during the product development stage and you can see analysis of the test marketing result the example that I have given with a feedback that is received from the customers. Is analyzed during the test marketing results and finally, when you get good reviews for the product it is then asked it maybe it is then lost into the market and then the real test of the product starts as soon as it enters a completely new market.

So, this is product development stage and in one of our lectures in week number one only we will focus on the product development process, and we will see what are the important stages for designing a new product, and in that way will see that how a idea is conceptualized what are the problem areas related to the idea generation, then how the ideas are tested for various criteria, and then how the prototyping is done and finally, how the product is launched into the market.

So, all those answers we will try to find out during the product development process, and it will it is a long process and may I have told you that in many cases it may take maybe 6 years to 15 years for the complete product to be developed and launched in the market, but right now we are considering that the product or the prototype is already ready, and we are now launching going to launch it into the market, and then plot the sales of the product with respect to time in the product life cycle. And each stage is going to give us some input related to our decision making regarding the design of the product.

So, let us quickly see the second stage that is the introduction or launch. So, we already have the technology for producing the product, we have done the test marketing and finally, we are launching the product in the market.

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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

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Now, let us see what do we do in the introduction or in the introduction stage what are the factors to be taken care off or how to take a decision related to the product life cycle in launching of the product.

So, first thing is introduction of the product into the market, it is evident I have told you already, it may be a new product or an old product to the new market. So, sometimes there may be product for example, these days the economies have opened up there are multinational products entering into different countries.

So, may be you are taking example of India, we may not be using a particular brand of car or a particular model of a car. So, the companies already launched has already launched number of car models, but may there may be a new model which that company is bringing to India which was not being used here and, but that model was already existing in some other countries. So, when that is being launched that will fall under the old product the product is new to India, but it is a old product of the company and it is into the new market. So, Indian market is a new market for that product of the car.

So, sometimes a company may be coming up with a completely new product of the company has designed a prodigious fabricated model, tested and it is being launched. So, all situations different product life cycles will be there. If it is a new product the product life cycle will be drawn for that maybe some data will be required to draw the life cycle why because in this point it is important to understand that we are plotting the sales data.

So, there should be some input regarding the sales data. If you try to understand that if we are drawing a product life cycle for a specific product, which has been launched in 200 2015, so, January 2017 we have the data of sales of that product which was launched in January 2015. So, two year data is available with us.

So, based on the 2 year data we can draw a product life cycle that how the sales have varied for the last two years. Similarly the come same company is going to launch a similar type or a modified version of that product. So, they already have the data of 2 years that how the product has behaved in the market. So, all that data is useful to us when we are going to draw a product life cycle for a new product, and then we can as we have seen there was a word which is very important in products in production planning and control that is forecasting. So, we can make use of that forecast that how the product is going to behave based on the PLC of a similar product which has already been launched, and we have the actual sales data for that product.

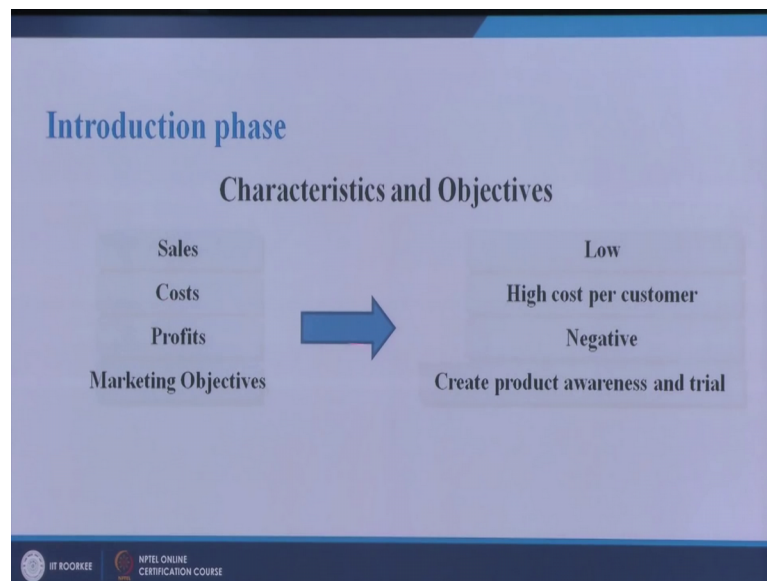
So, that will be helpful to us in our decision making related to managing our cash flow and other things. So, you can see we in the introduction stage we may be launching a new product and or an old product, but into a completely new market. So, in this case the demand is going to be low if you have seen the diagram let me go back to the diagram, you can see introduction stage the demand of the sales is low. So, this completely explains that the demand is low then the cost is high, high cost for any product if you see especially in electronics market when you have new products you have products like mobile phones, all of us have experienced this whenever a new mobile phone is launched the product cost is high, but over a period of time the cost is then stabilizes and even comes down.

So, during the introduction stage the cost is high sales are low sorry as it is clear. Advertisement and promotion is done very vigorously and then we the companies monitor the initial sales of the product, there may be teething troubles, there may be a software problem in the product there may be some service requirements in the very initial stage of the product.

So, all these are the characteristics of the introduction stage which we need to understand in a product lifecycle. So, once again I will read it for you. So, in the introduction stage introduction of a new product into the market, it may be a new product or a old product

to the new market I have tried to explain with the help of a car example then the demand is low in this period high costs are therefore, the product advertisement and promotion is foremost and most important part, and then the company usually monitors the initial sales of the product in order to take the decisions related to how vigorously they need to advertise and market the product in the market.

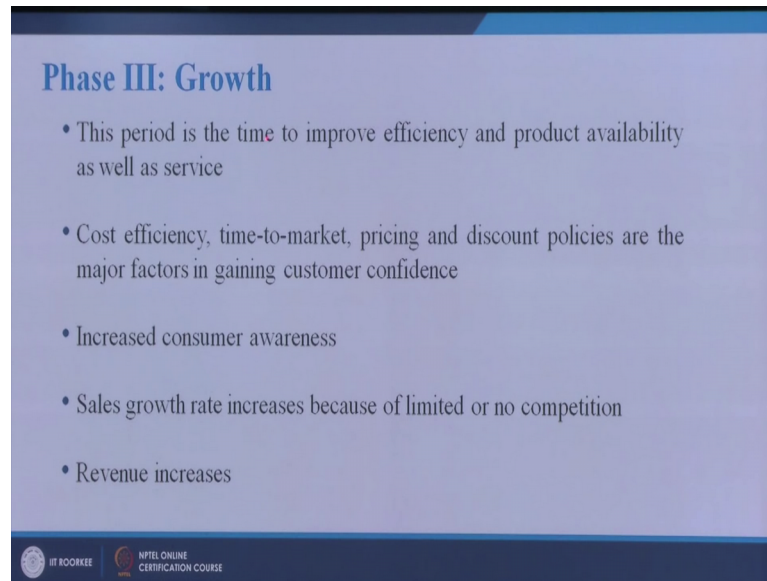
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And these are the summary of characteristics and objectives, you can see sales are low costs or high profits are negative as we have seen in the diagram, and then the marketing objectives are create product awareness and trial. So, we have seen stage number 1 that is product development, stage number 2 that is introduction and a launch.

Now, let us go to the third stage that is growth. Now usu if you remember the product life cycle, in the growth stage the sales increase and when the sales will increase automatically the profits will also increase. So, let us see what are the characteristics in this period.

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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

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This period is the time to improve the efficiency and product availability as well as service. So, when the sales are increasing it means there is demand in the market.

So, we need to ensure the product availability as well as the service that if there are some initial problems, there may be tackled and the product performs reliably because the product that is in the growth stage by word of mouth the auto marketing is also done, and many people may like to adopt this new product which has been launched in the market. The service also is important, availability of the product is also important and it is a time to improve the efficiency.

I am emphasizing on the time to improve the efficiency because we will be discussing in week 2, the value concept of value engineering or the value engineering principles as applied to product design. The at that point this thing will become all the more important that why do we need to improve the efficiency of the product during the growth stage, and there I will explain that it is important because the competition will start to set in, and here also we will see sales growth rate increases because of limited or no competition.

But as soon as the growth stage reaches its pinnacle value or the highest value, the computation steps to certain or it comes up with all the other companies also venture into the similar area and therefore, there is competition at the end of the growth stage. During the growth stage there is no competition and therefore, the sales increased unilaterally.

So, first thing is this is a period or this is the time to improve the efficiency and product availability as well as service. So, improve efficiency we will discuss during value engineering, cost efficiency, time to market pricing and discount policies are the major factors in gaining the customer confidence. So, all these four parameters the cost efficiency as compared to the competitors, time to market means suppose today I want to buy a motorbike.

There was a monopolistic type of your business environment few years back, if you want to buy a bike, you have to go just book the bike you may get it after 2 months, but that is not the scenario today a customer wants to the bike if he goes makes the payment through check or through transfer he wants the bike at the same moment only. So, the time to market has become very very important that the company should be able to satisfy the demand of the customer with there and then only, if he comes to the showroom and he wants to buy the bike the bike should be available there. So, that is the time to market has to be minimum.

Similarly, the pricing and discount policies of the company also play an important role during the growth stage. Suppose the company is not able to tap the increase in the sales volume, then or the demand that the product has created because of the success at the introduction stage, the growth will only come if the product is successful during the introduction stage.

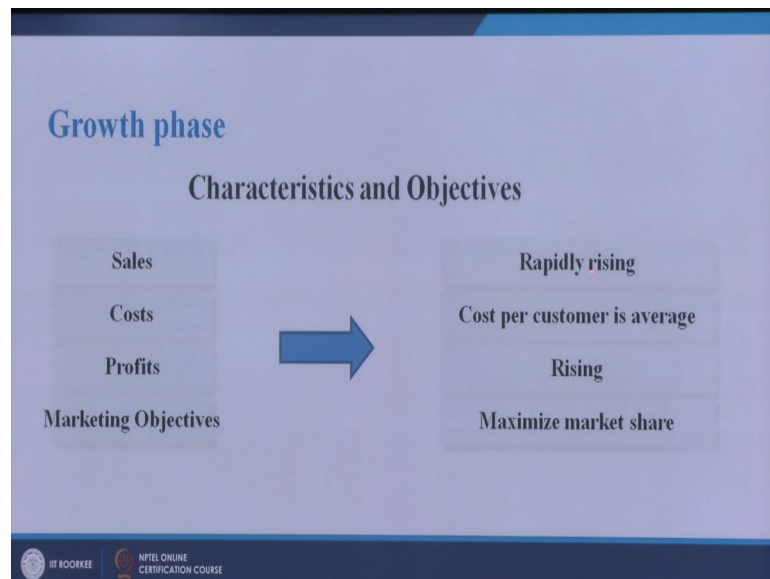
Now, suppose the product fails during the introduction stage, there are many problems related to the product. The product sales will never increase during the growth stage. So, all those things if the product has satisfied all the requirements the specifications and it has tested positive for the customers requirement only then we will go to the growth stage. And once we are in to the growth stage in order to maintain that increase in the growth, we need to satisfy the pricing and the discount policies. So, that that trajectory that the product sales have taken after the introduction stage, continues for a longer period of time.

So, the second point is very very clear these are the parameters or the factors or the criteria to be taken care of during the growth stage. Then the increased customer awareness we have to ensure that that is a marketing strategy, the sales growth rate increases because of limited or no competition which I have already told, that there is no

competition usually during the growth stage there is, but as soon as you reach the top point of the growth stage there may be some competition which may start to set in.

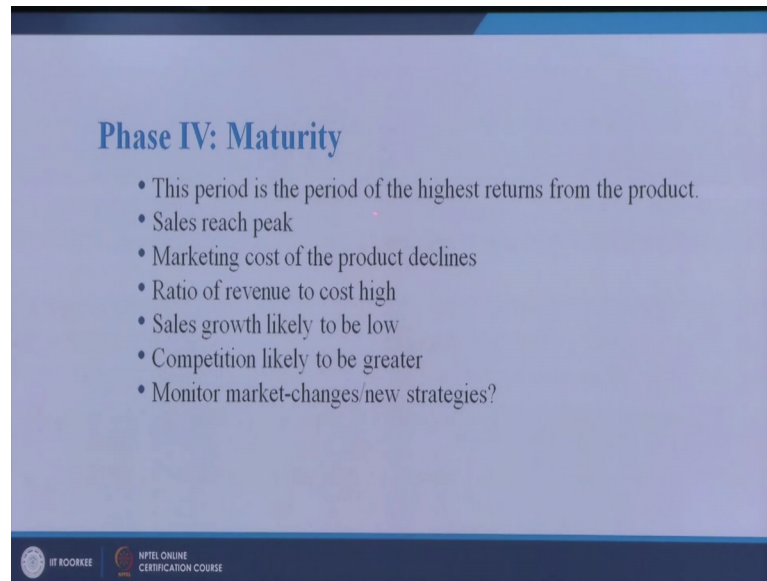
Then the revenue also increases. So, we have seen the profit graph also deliberately we have drawn the sales and the profit graph in order to justify the increase in the revenue. So, when the sales will increase, the revenue earned will also increase. So, most of the companies want their product to be always in the growth stage, because the revenue is high the cost that we the price that we can keep can be high because of the many because of the monopolistic nature ok.

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So, this is growth that is a phase 3. So, this is summary of growth phase sales you can see sales rapidly rising, cost per customer is average. So, the costs usually should come down during the growth stage as we will we are going to reinvent our pricing policies during this period, profits are rising, and marketing objective should be to maximize the market share by proper advertisements and by giving proper customer awareness.

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Phase IV: Maturity

- This period is the period of the highest returns from the product.
- Sales reach peak
- Marketing cost of the product declines
- Ratio of revenue to cost high
- Sales growth likely to be low
- Competition likely to be greater
- Monitor market-changes/new strategies?

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So, this is stage three and then the last fourth stage not the last stage is decline, the fourth stage is the maturity stage. In maturity this period is the period of the highest returns from the product because if you remember if you have seen the product life cycle with a little bit of interest, you will see the top portion is the highest sale and that comes during the maturity stage. So, the sales are highest therefore, the profits that we gain are also highest sales reach the peak; so highest sales at the maturity level.

Marketing cost of the product declines now the company customers have already got all the information related to the product. So, the company does not want to do too much of aggressive marketing, and they want to stick with increasing the efficiency of making the profit, increasing the effectiveness of converting the raw materials into the final product. So, they are not much bothered about the marketing because the marketing is already from the word of mouth at the maturity stage.

So, marketing cost of the product declines ratio of revenue to cost is high yes that is true, sales growth likely to be low because sales growth is merely constant only if the top you have reached to the top portion. So, your sales growth is likely to be low, competition likely to be greater as I have told you after the growth stage the competition in starts to set in, the competition increases during the maturity stage and the company needs to monitor the market changes, and you can see there is a question mark here they have to

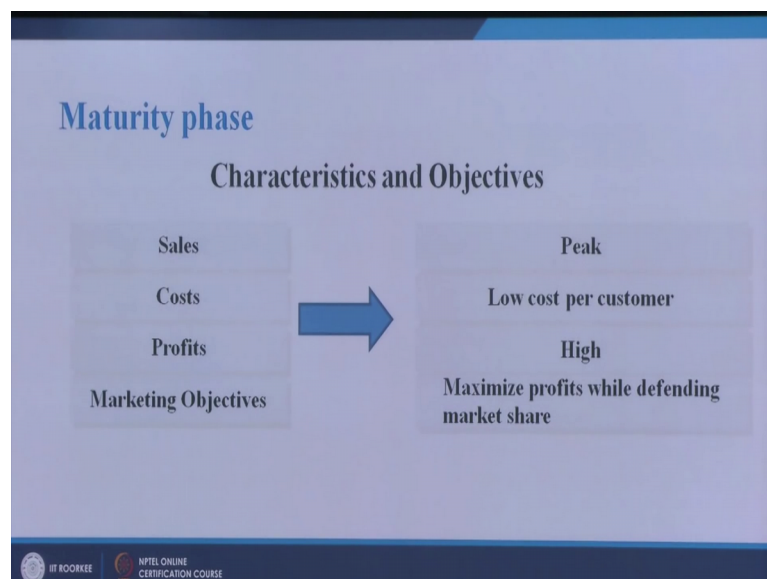
think of the new strategies why? Because the sales have reached the top point and for a period of time there is no increase further in the sales.

So, the company has to rethink their strategies now, they have to see that at what point of time they should withdraw the product from the market or at what point of time they should launch a new product into the market. So, that again they go into the growth stage and start making profit. So, although the profits are maximum here you can see the ratio of revenue to cost is high and the highest returns are there during this phase.

But because of the competition many a times the organizations or the companies will have to compromise on their profit component. They may have to come up like most of the times we see 1 plus 1 free or 2 plus 1 free or maximum up to 50 percent discount. So, what the companies are doing we are trying to compromise on their profit to keep their sales high. So, at that point we need to think very strategically that should we continue with the same product for which the sales have almost become stagnant or we should try to launch a new product or design a new product so that we are able to further push the sales of the product or further increase the revenue with the existing product by a little bit of redesigning or repackaging or rethinking.

So, we need to at that time develop our strategy accordingly. So, this is the most important phase and the new strategy development or the new product development is most important during this stage.

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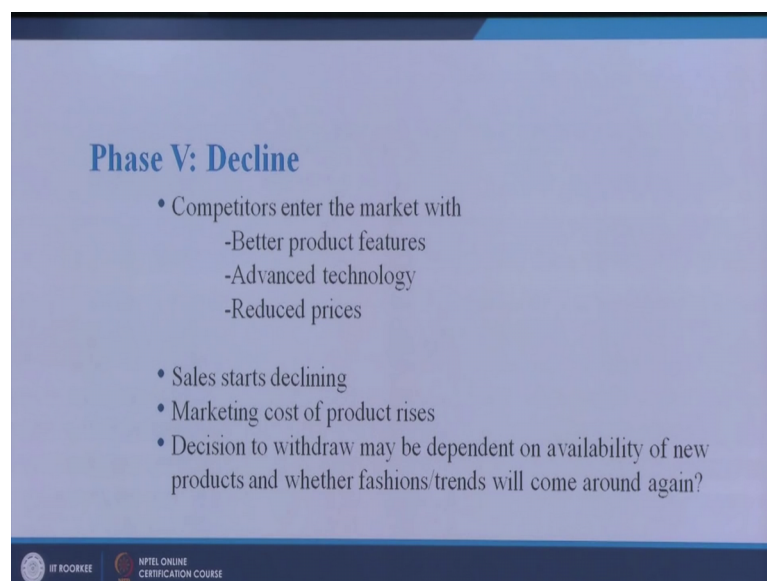


Then the summary of the maturity phase sales are at its peak, costs are low per customer, profits are high and marketing objectives. So, we maximize the profits while defending the market share. So, that is you can see marketing objective, we need to maximize the profits while defending the market share.

So, if you do not have proper pricing policies, if you do not have proper decision making related to the product, there may be chances that our market share may fall down, and it generally happens that we can see in the last stage that is decline stage. So, if we are not careful enough to plan our strategy according to the market environment, that sales are definitely going to go down. And if the sales are going to go down what else a star will also go down the profit curve will also start to go down.

So, in the decline stage the competitors enter the market with better product features what does that mean? The company has a better product design and therefore, we are talking of the features.

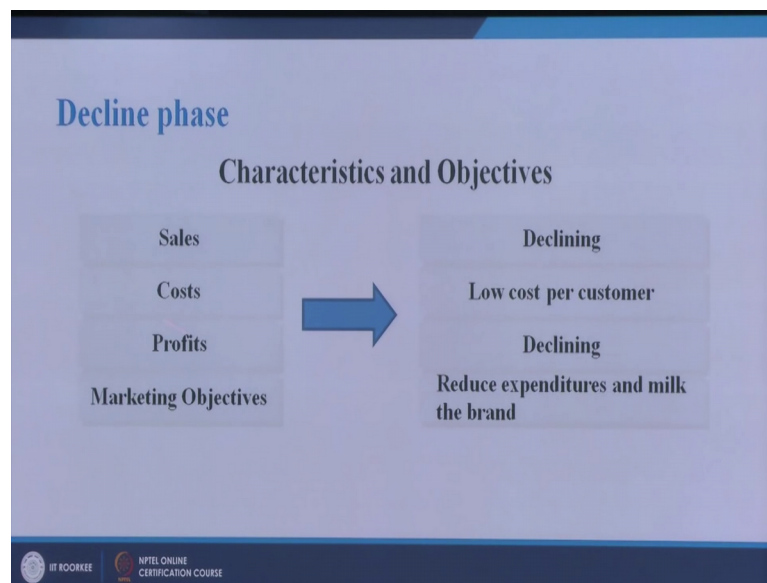
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So, our product is facing competition from the product of their competitors. So, they may have come up with the advanced technology, they may have come up with the reduced prices therefore, our the size of our product are now falling flat or are coming down. Sales start declining as I have already said marketing cost of product increases rises and decision to withdraw may be may be dependent on availability of new products and whether the fashion trends will come around again.

So, in case of in many cases we have we know that the fashions may come again or trends may come again. So, this may be related to one particular segment of industry, but in most of the cases if the product sales decline the company has to reject their product or redesign their product or reinvent their product in order to be competitive in the market. So, there are a number of strategies that the company has to adopt at various stages of the product life cycle.

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So, let us see now the decline phase sales declining costs low cost per customer, it was achievable in the maturity stage also, profits also starts to decline and marketing objectives are reduced the expenditure and milk the brand. So, maybe just they want to take advantage of the brand value and keep the product in the market, but the sales are not increasing. So, the sales are declining.

Last is the strategies based on the product life cycle. So, we have seen that there are four or five important stages in the product life cycle, and at each stage we can have different types of policies or strategies, but maybe since we are talking of a product that is our courses on product design and development therefore, we can see based on the product at the introduction stage, they usually companies offer the basic product during the growth stage.

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The slide is titled "Strategies based on Product Life-Cycle" in a blue serif font. Below the title, there are five main bullet points. The first is "Product", which has four sub-bullets: "-Introduction: Offer basic product", "-Growth: Offer product extension, service, warranty", "-Maturity: Diversify brands/models", and "-Decline: Phase out weak products". The other four main bullet points are "Price", "Distribution", "Advertising", and "Sales promotion". At the bottom left of the slide, there are two logos: "IIT ROORKEE" and "NPTEL ONLINE CERTIFICATION COURSE".

They offer the product extension service warranty, in the maturity stage they diversify the brands or the models may be redesigned reinvent the design, and during the decline stage they phase out the weak products maybe the whatever profits are not performing well can be phased out and whatever products are performing well they can be redesigned reinvented or certain incremental innovations can be used to that the product again into the wish list of the customers.

So, these are the four you can say stage wise strategies related to the product, similarly the marketing and advertisement people can take care of the other four criteria, that is the price the distribution, the advertisement or the advertising and the sales promotions. This may be the marketing policy of any organization, but related to the product these are the decisions which any engineer or engineering professional has to take in the company.

So, in today's class we have seen in detail the product life cycle what are the various stages of the product life cycle and what are the important decisions characteristics objectives at each stage of the product life cycle. Our focus in the next class would be the product development process and the selection of profitable products, and how or what criteria we should keep in mind when we are going to come up with the product ideas, and how those products success can be ensured by using the systematic planning as well as execution.

So, with this we come to an end of today's lecture. So, we will discuss maybe the product development process in our next lecture.

Thank you.