Product Design using Value Engineering

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Lecture - 01
Introduction to Product Design and Development

Namaskar Friends! Welcome to session 1 of our course on Product Design using Value Engineering. As you are well aware about the contents of this course, the course basically focus on the concepts of value engineering as applied to product design. As you may be knowing and we have already done a course on product design and development. We have seen that what are the various steps involved in the process of product design. How an idea can be converted into a tangible product? We have seen that how the idea is scrutinized at various levels before it turns out to be a successful product.

Wherever, we talk about a product, the first thing that comes to our mind is the function that why this product is being developed, why this product is being used. We are using a camera which is recording this session; why this camera is being used, what is the function of this camera. I am using a mic, what is the function of this mic? We are using pens, pencils, we are using laptop, and we are using so many different products. Why these products have been developed? What is the basic knowledge required to develop these products that is the basic concept that we will try to develop in the next ten hours of discussion.

Our target will be to focus on an important aspect that helps us to analyze the functions of a product because when we talk of a product, we basically focus on four important aspects. We focus on the marketing aspects, we focus on the product characteristics, we focus on the economic aspects of the product, and we focus on the production aspects of the product. But basically, this particular course is focused on the functional aspects of the product.

Because once the function is satisfied then we can easily do the calculations that what will be the economic repercussions of this product; what will be the breakeven point for this product, when we will able to start making profit by selling this product. So, all economic decisions come later prior to that we have to finalize that what is the basic function for which, we are going to develop a product and value engineering is a concept

which helps us to analyze the functions of a product in a very systematic and logical manner.

We have already discussed the basic concept of value engineering in our course on Product Design and Development which was also a ten hour course. But later on when we have discuss the course on product design there were number of e-mails which were focused on the concept of value engineering.

So, there were maybe request to focus on value engineering, then there was a request to share the books to share the literature available on the concept of value engineering. Therefore, we decided that we must try to develop some content which is available to the designers; the product designers in particular. So, that they can apply this concept of value engineering during their product design process. So, this is one additional skill set that a product designer can develop. So, that the product that he or she is designing is also competitive from the cost point of view as well as from the functional operational as well as service point of view.

So, here we will try to develop our discussion related to the basic concept of value engineering. I am quite sure that there will be number of people who have registered for this course, who may not have undergone the course on product design and development. So, as the title of our course is product design using value engineering. So, there are two broad areas here. One is the product design, and other is value engineering. So, before starting the course, we will try to have a basic idea about what product design is all about. We will try to revise what we have covered from the product design point of view

And may be by third or fourth session, we will switch over to the concept of value engineering and then, try to understand the case studies related to value engineering where the concept has helped the designers to develop better products as compared to the competitors products or their own products. So, basically value engineering will help us to further redesign our products over a period of time, but why this redesigning is required? We must be able to answer this question also because ones a product is ready; for example, the camera which is recording the session is doing its function. Its function is to record movie.

So, it is doing its function, but still there will be researchers, there will be scientists, there will be engineers who will be working in their respective fields to further upgrade the

quality, the performance, the reliability, the durability of this camera. So, always there is a scope of improvement. All the time, we are trying to develop better and better products. So, therefore, there is a need to understand that why product design is important. Once, we understand that product design is important, then, we will try to understand, why value engineering must be used during the product design process. So, let us start our discussion. I think today is the first session.

So, therefore, I have taken a very long introduction about the title of the course that is product design using value engineering. So, value engineering concept, we will try to cover the introduction to value engineering; maybe once we are able to understand the process of product design number one and the second why product design is important.

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So, let us now go to the outline of the presentation. In this presentation, we will try to cover the product life cycle. We will see that why product development is important and when we should focus on our existing products, then we will see the new product design, why it is required, need of a new product design, product development process, new product development strategy, new product development process and successful product development that what are the factors that we must keep in mind for a successful product development.

So, here I must share with you that if you try to search on a media or on the social media or maybe on the various websites, you will find number of products which have failed.

But these products are not products by companies which are just starting to grow many companies which are well established have not been able to launch all the products which have been successful. So, even the well established companies which have a very stringent product design policy have failed in launching all the successful product. Not all; some of them would have been successful, some of them may have failed.

Similarly, let us take an example of a director who directs the movies. All the movies of a particular director may not be successful at the box office; some of the movies even fail. So, why? Because there are a number of governing parameters that affect the performance of a product in the market.

So, we will try to see that what factors we can keep in mind although these factors will also not be able to ascertain a success of the product. But will lead to may be at least, the break even or may avoid the risk of a loss in the product development, for the product when it is launched in the market. So, we are trying to mitigate, we are trying to reduce the risk by following a very systematic approach for the product development process.

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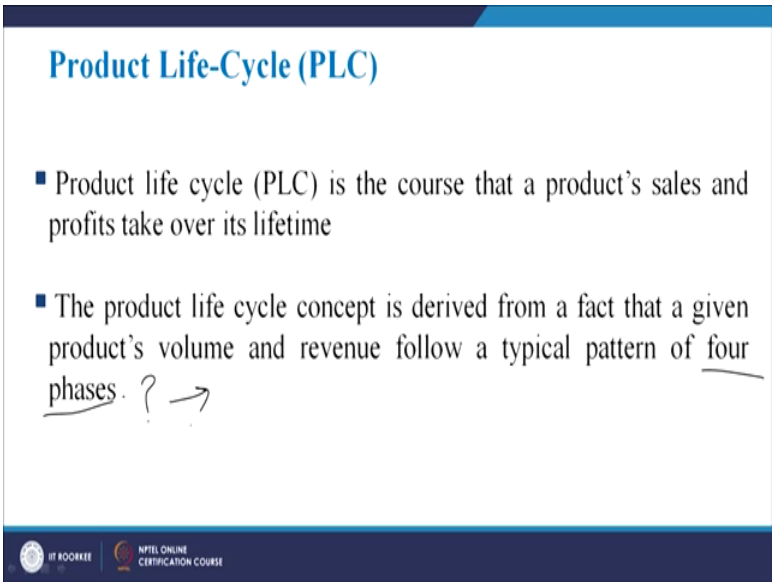

Now, first let us see, the product life cycle, what is the product life cycle. A product life cycle is a course that a product sales and profits take over its lifetimes. So, it is basically plotted on x and y axis; on x axis, we take the life cycle or the time and on y, we take the sales; on y axis, we plot the sales.

So, the product life cycle concept is derived from a fact that a given products volume and revenue follow a typical pattern of four phases. So, what are these four phases that we will try to see in the next slide where we will see that how the sales of a product normally varies over a period of time or over the life cycle of the product.

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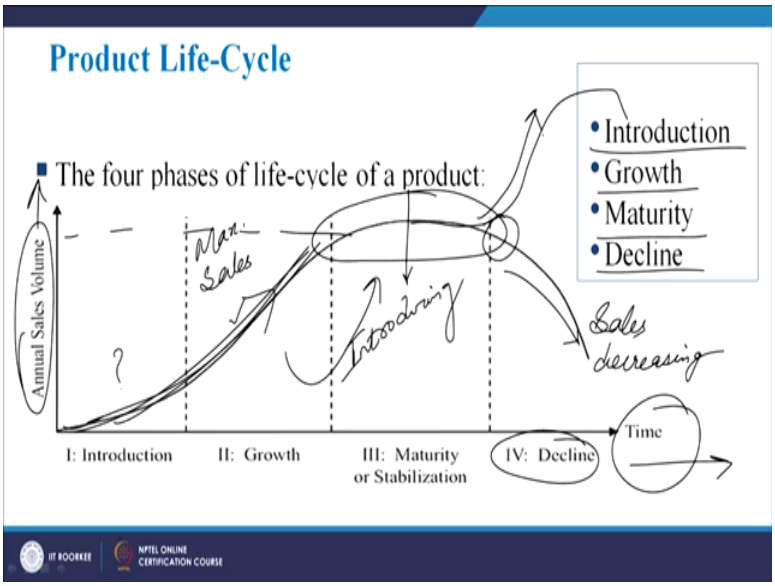

So, on your screen, you can see a typical product cycle. So, as was mentioned in the previous slide, we have an annual sales volume on the y axis and time on the x axis. So, we have time on x axis, annual sales volume on y axis. So, here we can see this is a stage where we have the maximum sales and after this period, there is a period of decline.

So, normally the sales are decreasing during the decline stage. So, there are four stages. The first one is the introduction stage, growth stage, maturity stage and decline stage. So, we are not bothered about the introduction as well as the growth stage because here, the sales are increasing; the sales are showing the increasing trend. So, you need not worry too much about this, but this is the phase where we must focus our energy, because the sales have become stagnant and now further the sales have started to reduce in the decline stage of the product life cycle.

So, here, we have to see that no company would like the sales to decline. So, what they will try to aim at? They will try to aim of introducing a new product at this stage. So, at introduction of the new product at this stage will further start a new life cycle for the product and the sales will further start to increase. So, that is the focus of each and every

company that every time when they feel that the sales of the product of which they are manufacturing or of which they are doing the business is stagnant. It gives an indication that the sales may go further down.

So, every company which is a progressive company will always be focusing lot of efforts for new product development. Also they will be focusing on that improvement in their existing products. This gives us an idea that if we are able to see that the new product development has become mandatory, it is necessary where our product sales have stagnated; the sales are not increasing as they were planned to be, there is a need to go for a new product development. So, therefore, we will go for a new product design.

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So, every organization has to design, develop and introduce new products, why? First reason is it is as a survival strategy, because if you do not introduce a new product, your sales have become stagnant; finally, the sales start to decline. So, you will become obsolete, the company will become obsolete or the product will become obsolete. There is a famous saying that if you do not obsolete your product, you may be obsoleted from the market. So, it is for the company to decide that when they need to launch an updated version of their existing product or they need to come up with a completely new product which will help them to establish as a maybe innovative company. So, always there is a need in the company to survive as well as to group.

So, these are the two important points which motivate the companies, which force the companies, which necessitates the company to go for new product development. So, always the companies are may be trying to come up with new and innovative products or the modified versions of their existing product. So, they, themselves try to obsolete their products, and they try to come up with the advanced versions of their existing products. I can take n number of examples, but, I will leave it for all of you to figure out for examples where the companies have deliberately phased out their existing products and have come up with new products, why?.

Because the maximum profits are derived; the maximum sales increase during the introduction and the growth phase of the product life cycle. So, it becomes mandatory for each and every organization as a survival strategy, as a growth story that they come up with new and new products.

So, product design is conceptualization of an idea. So, first thing is we must have hundreds and thousands of ideas because in one of the good books, I have read that the idea mortality rate is as high as more than 95 percent. So, if you generate 100 ideas maybe 95 or 98 ideas may not even be able to see the light of the day which means that hardly one or two ideas may get converted into a tangible product.

So, therefore, in product design process, our focus must be to come up with number of idea, because some of them may not be feasible, may not be technically feasible, may not by economically viable or sometimes may not be environmentally suitable. So, therefore, we need to come up with n number of ideas. Once we have a large pool of ideas, we can select that which idea can be taken further. So, we need to generate number of ideas about a product and then we have to transform these ideas, convert these ideas into the reality.

And what is going to be the reality? The reality is going to be the product which will be used by the customer. So, we need to have n number of ideas, then we have to transform those ideas into the product and that is the whole process of product design. So, converting the idea into the product is basically the overall summary of the product design process. To transform the idea into reality, a specification about the product is prepared. So, we need to make certain specifications. We will see with time in the course of our study that how we go from the idea to the conceptual design to the detailed

specifications and finally, to prototyping and then the test marketing and finally, the launch of the product in the market.

So, we will see, each and every step in due course of time, but first thing is to understand the two words that is product and the design of products. So, we know that we have number of ideas. Now we have to convert them the conversion process, we will study in detail these ideas into the tangible product. So, this is basically what we called as the product design.

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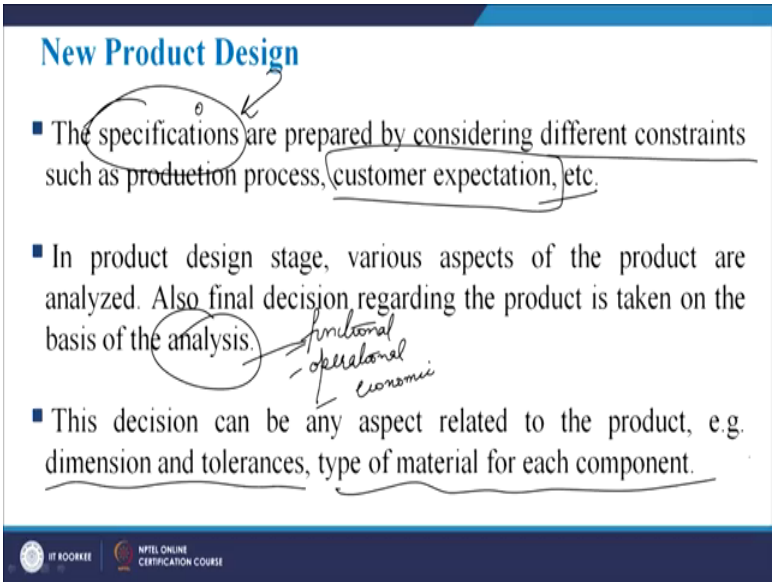

Now, the specifications are prepared by considering different constraints such as production process, customer expectations. So, basically every product will have certain specifications. For example if we buy a room heater, it will have its own specifications. If we go and want to buy a mobile phone, it will have its own specification.

Everybody maybe listening to this session on a computer system or on a laptop, it will have its own specifications each and every product will have its specification, and those specifications will depend upon the constraints as well as the customer expectation. So, every product will be developed based on certain customer expectations. So, each customer will have certain expectation from the product and accordingly, the product will be designed.

Now some of you may be wondering that each and every customer will have his own set of specifications, how a designer can satisfy each and every customer. Yes, that is true, it is absolutely true question. So, therefore, the term standardization comes into picture. The products will be made as per certain standards. For example, if we talk about a shirt a readymade shirt and a trouser will be available readymade; I am saying, it is not customized as per your dimensions.

So, if we talk about the readymade trouser, they will be within certain standardized sizes; the shirts will be available in certain standardized sizes. So, we have to fit our self into those standard sizes. So, that is the customer specifications or expectations are met with the concept of standard sizes in case of the clothes that we wear. So, basically the specifications will be developed based on the customer expectation.

In product design stage, various aspects of the product are analyzed. We will see: what are these various aspects also final decision regarding the product is taken on the basis of this analysis. So, this we will try to see what is this analysis; we will try to see the functional aspects here.

We can also try operational aspects of the products; we can see the economic aspects. So, all the aspects related to the product can be analyzed at the product design stage only. So, this decision can be any aspect related to the product. For example, the dimensions and tolerances type of material for each component there can be so many aspects. So, many facets of the product that have to be analyzed during the product design stage as I have already discussed. Many times we fail in analyzing these aspects properly, and which leads to the failure of the products.

And if you see after the product has failed when the postmortem of the product is done that why the product failed, we are able to find out that these are the aspects which were not analyzed during the product design stage and therefore, the product has not been able to perform satisfactorily in the market. So, therefore, whenever, we are coming up with the new product design, we must try to have a holistic view at all the aspects that may affect the performance of the product in the market.

So, our sole target must be that we launch the product which is able to bring delight on the faces of the customers and for that we have to do a very rigorous comprehensive exhaustive analysis of the product during the product design stage itself.

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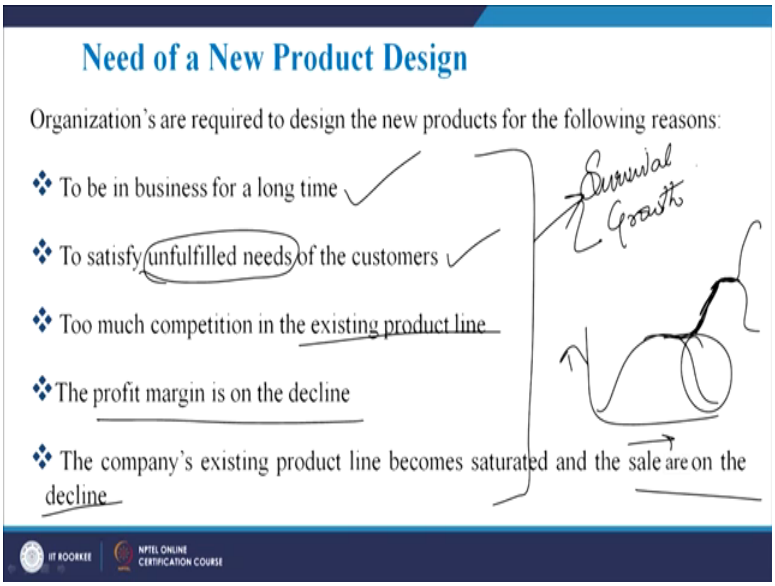

Now, summarizing what we have already covered; what is the need of a new product design, I have already highlighted the various aspects the growth as well as the survival strategy from the organizational point of view. If the organization want to prosper, they need to, it becomes mandatory for them with new and new products.

So, organizations are required to design the new products for the following reasons, to be in the business for a long time which is a survival strategy, to satisfy the unfulfilled need of the customers. Sometime, the company may be able to tap a specific requirement that this is something for which the customer does not have a product.

So, that is the unfulfilled need of the customer. So, if the companies able to tap that; obviously, it will come up with a new product; then too much competition in the existing product line. So, the profit margins are thin, whatever the company is producing there are number of competitors doing the same thing, there is no unique selling point of the product the companies producing. And therefore, they want to switch to a new product. So, they are not able to realize the kind of profits that they wish out of their business. So, therefore, the company may decide to go for a new product because in the existing product they are not able to get the due profits.

The profit margin is on the decline as we have seen in the product life cycle; the sales are reducing, the profits are declining. The company may decide to come up with a new product. The company's existing product line becomes saturated, and the sale is on the

decline, the sale is on the decline. As I have already told in the product life cycle when the sales are declining, we will definitely like to see a new product which again starts the new product life cycle like this. Again, there is an introduction of the new product here and then, there is a growth again, it will go to the maturity level and again we try to come up with new product.

So, we have seen if you summarize all these points again the summary can be in two words, first one is survival and the second one is growth of the organization. So, for survival and growth each and every company needs to come up with new and new products.

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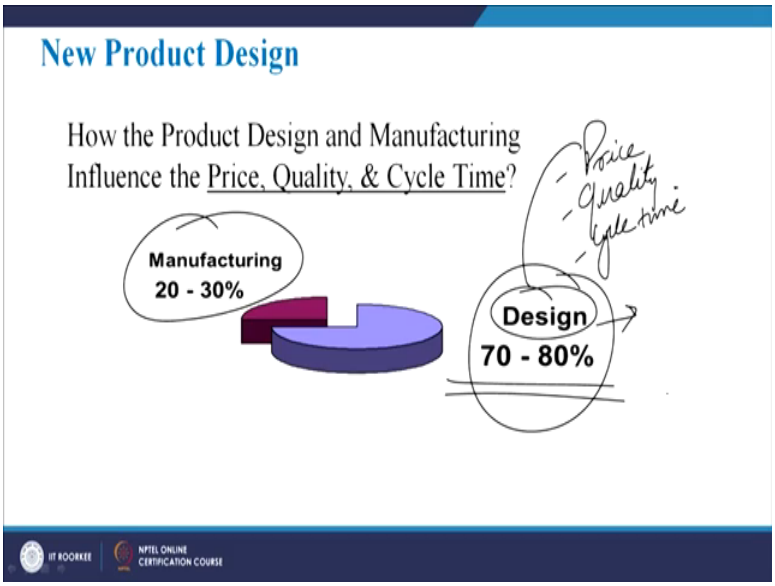

Now, what is the importance of the product design? How the product design and manufacturing influences the price quality and cycle time? You can see here manufacturing has an influence of 20 to 30 percent only, and the design has an influence of 70 to 80 percent.

So, you can see, the design influences the price of the product. It influences the quality of the product that we are producing, it influences the cycle time also. So, we can see that the design has maximum impact on the product design process or on the cost structure or the selling price of our product. So, the design is very important point that must be addressed. So, if we neglect the design process, we are locking 70 to 80 percent of the costs of the product.

So, design cannot be neglected, and we must be always try to improvise on our existing designs and simple examples, if you see around you, the kind of mouse that we use these days along with our laptops and desktops. How the design has come over the period of time? How the designs have changed over a period of time? That all of you can easily see the kind of screens of the laptops that we use the kind of overhead projectors that we are using the kind of phones that we are using. Always, you will see, there are so many design modifications happening every time, when a new product is launched in the market.

So, it is a very important aspect for every engineer to know that we have to continuously strive for improvement, continuously strive to improvise on whatever product, whatever process, whatever materials that we are using in our day to day life. So therefore, product design is very important as it influences we can see 70 to 80 percent of price quality as well as the cycle time. So, I was seeing the cameras are changing, the desktops are changing, the mouse is changing, the laptop design is changing even the lights design is changing, the air conditioner design is changing.

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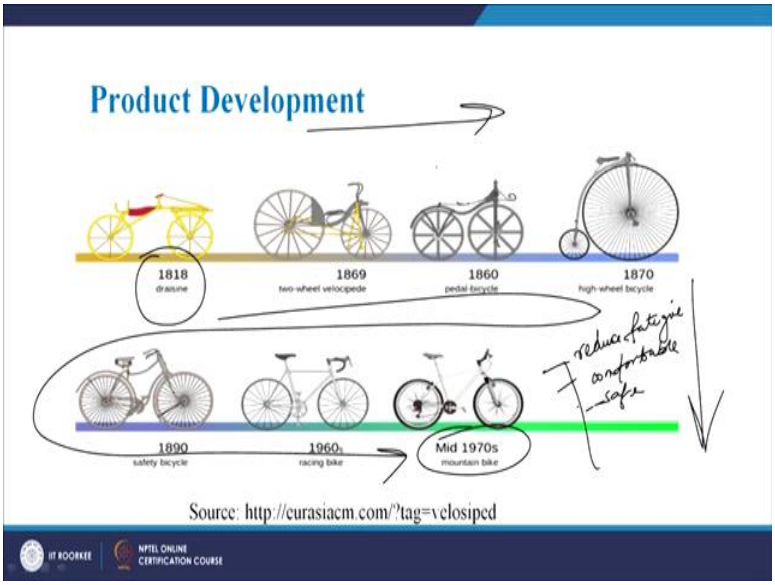

So, we see that products are changing and trying to satisfy unfulfilled needs of the customer. Therefore, we can see just one example, the design of a cycle in 1818s eighteen and the design of the cycle in mid 1970s. So, we can see that design iterations have taken place over a period of time. So, we cannot go into the intricacy of each and

every design that why the design was modified, but, we can see, that there is still a scope of improvement in the design of the bicycle. We can see some modifications at each stage have taken place from 1818 to 1970 and why this; what can be the factors, the factors can be we want to reduce the fatigue for the rider. We want to make the journey more comfortable, safe.

So, we can list down number of parameters which have been that design motivation for the designers who have tried to change the design, alter the design, modify the design, update the design of the existing bicycle to a new bicycle and that has led to the bicycles that we use in today's scenario. And maybe over the next 20 years, we may see many radical changes in the design of the bicycle.

So, it means that change is permanent. So, we have to keep on changing, we have to keep on updating, we have to keep on modifying. So, these are the reasons for new product failure. As I have already told if you search the social media; if you search the various website, you will be able to find out that number of products have failed, why they have failed.

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These are some of the reasons on your screen, overestimation of the market size means the company has forecasted that the sales will be high, but the product was not able to bring the delight expected out of the product by the customers and therefore, the product failed. Again the most important, poor design; the design was poor. So, our value

engineering aspects which will help us to add value to our product design, it will help us to add value to the whole process of converting the idea into the final product.

So, there are other parameters also like incorrect positioning the market segment identified for the product was not correct. The timing of launching the product in the market was not correct, the price was too high which will be addressed by our value engineering approach, ineffective promotion publicity was not done properly. The management influence sometimes the management had a negative influence on the product design and therefore, the product may have failed.

High development cost this will also be addressed in the value engineering approach we will focus on the cost structure of the product, then the competition was high which means the marketing aspects were not addressed properly the competition was not taken into account and therefore, the product failed. So, we will try to see that what are the functions of the product, and what are the functions being achieved by the competitor's product

Here, because of the competition the product has failed so; basically a customer is buying a product because it satisfies some function for the customer. Now we are also trying to satisfy the same function for the customer. So, if we are charging more money for satisfying the same function for the customer either, we should have a product which is adding value to the customer or it must be at a relatively lower price the function is getting satisfied for the customer, but he has to spend less money for achieving that function; obviously, the value of the product will be more.

So, we have to see that how to take advantage of this competition; what are the functions being offered by our competitor, how we can offer better functions at the relatively same cost or at a lower cost that is basic concept with which we will try to incorporate or in try to include into the product design process this is a basic concept with which the value engineering operates. So, I think the time for today is over. So, we will conclude here in today's session.

We have been able to address the basic aspects of product design the most important point is that why product design is important for an organization as a growth as well as survival strategy? We have been able to point out here that why the products usually fail, but if we use a proper process and try to mitigate the risk involved in the product design

process by doing or following a standard process of product design, by following or by using the concepts of customer delight by using the concepts of customer satisfaction customer feedback basically.

If you are able to address all the issues or all the functions that the customer want from the product at a reasonable cost, and this will provide a value to the customer and we will be able to come up with a with a successful product. So, therefore, we need to understand the concept of value of a product, how value engineering will help us to analyze our product from an entirely different perspective.

So, our focus is to learn the basics of value engineering and in our next session, we will focus on product characteristics. Try to see what are the features of a good product design, and then finally, we will switch our attention towards our main topic, that is the concept of value engineering as applied to the product design process.

Thank you.