Product Design using Value Engineering

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Lecture - 04
Value Engineering (VE): History, Concept and Definitions

Namaskar Friends! Welcome to session 4 of our course on Product Design using Value Engineering. So, the previous three sessions, we are tried to address the need of product design. How to improvise or increase our profit and how the increase in the profit is related to our decisions related to the product design process as well as related to the cost estimation and profit maximization.

We have seen that we can increase the profit by three different approaches, three different strategies: Increasing the selling price, increasing the quantity of sales as well as volume of sales as well as reduction in the total cost. So, that was the target that we had in our last session so, we have discussed the concept of profit maximization.

So, by now we know that why new products are required, what are the cost elements in a product, how the profit can be maximized and how we can try to add worth to our product or how to increase the worth by price ratio for our product.

Now, today in session number 4 our target primarily is if you see the title of today's session it is value engineering. So, we will try to address the concept of value engineering as well as try to see the definitions of value engineering. So, our target is product design using value engineering. So, product design very basic steps, we have seen, now our main target is value engineering, and to habituate or to become habitual for considering the concepts of value engineering whenever we are designing a new product.

Some of these concepts, we always use in our day to day life, for example, we go and buy a jacket, for buying a jacket, we use the concept of value engineering, but we are not aware that we are using the concept of value engineering. We want to buy the best jacket which looks good on us that is we are focusing on the aesthetic aspects. If you are buying a jacket we are going to a place where it is lot of snow fall is expected, we would like to have a jacket which is warm.

So, another function in the jacket, we will look that jacket must be warm it must keep us warm in cold and chilly conditions. So, the functions the aesthetic functions the colour, the taste, the texture, the combination of colours in the jacket number of parameters are there. We will always look for the best combination of parameters, best combination of functions, but on the other hand we will like to make a smart decision. We would like to spend the minimum cost that we have to spend to buy that jacket.

We will try to look for coupons, we will try to look for sales, we will try to look for the best deals, we may try to, buy through the E commerce websites, we will try to get the best jacket or best combination of features, but at a relatively or we can say optimal cost or a lowest cost. Sometimes we may give a preference to a particular brand also. So, we would like to be associated with the particular brand. So, the branding is also important we would like to buy a jacket of a particular brand.

This is a collection of features, we would like to acquire in the form of a jacket, but at the minimum possible cost. So, that is the basic concept of value engineering and as a designer, we have to take these decisions at the design stage only. So, in advertently we are doing value engineering in our day to day life, but this is a strategic approach scientific approach where we try to put the things in perspective and try to solve the problem in a more logical and concise manner. Otherwise, all of us are doing value engineering in one or the other aspects of our life. Suppose, I have to travel from one place to another place, how I will decide?

There are all the three options available, the flight is also available, train is also available and the bus services are also available I have to take a call how should I go? There will be certain constraints that whether I want to spend how much money I want to spend what are the time constraint, whether it is a emergent situation or not. So, with these constraints we will chalk out that yes, it is a emergent situation. So, we the time is the most critical parameter.

So, with time we have two choices may be by train or by air what as what is the availability of the flight? What is the availability of the train? How quickly I can reach there that is my target. So, I am trying to focus on the alternatives, I am trying to focus on the cost, I am also trying to focus on the, you can say, the emergent situation also.

So, all these alternatives I am trying to decide which is also you can say basic concept of value engineering, that we try to focus on a large number of alternatives, and try to select the best alternative, which is solving my problem which is achieving the desired function, but at a relatively overall lower cost. So, that is the target with which we study the concept of value engineering. So, in the previous session if you remember we have closed our discussion on the third strategy to maximize our profit. So, third strategy was, what was the third strategy if you remember? It was reduction in the total cost of the product

So, again we can see this is a very good diagram which you can have on your screen.

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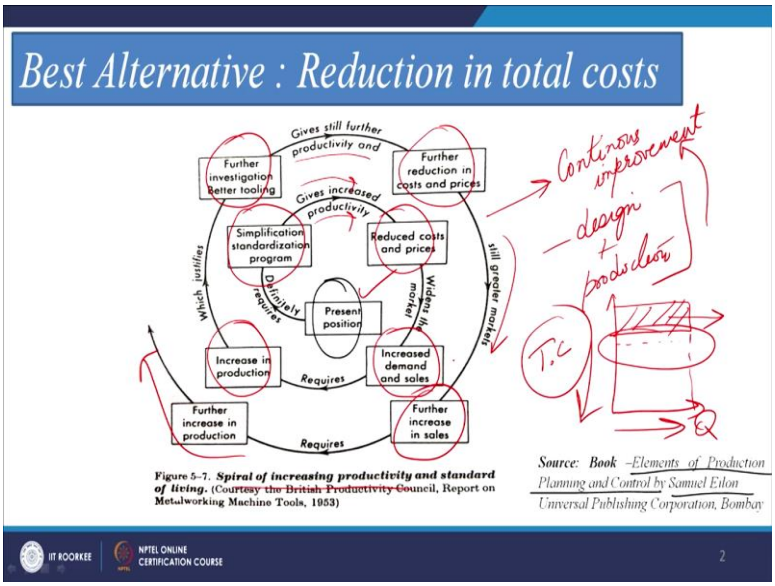

This is again from the same book, elements of production planning and control by Samuel Eilon. So, here we can, see this is our present position if you see this is the current position where we currently are. Now we require simplification standardization program. So, we are trying to redesign we are trying to select the standard parts and equipment for our product.

So, we are focusing on simplification, standardization, which will lead to increased productivity, when the productivity increases it will lead to reduction in the cost and the price. We have seen that when the total cost will come down it will increase the demand and the sales why? Because when the cost and prices have come down we are

negotiating or we are passing on some benefits to our customers in the form of a reduced sales price.

So, then, again the demand and sales will increase. When demands and sales will increase we have to produce more. So, it will increase the production when we are going to increase the production, it will justify that we should try to work, on our processes, on our procedures on our tools equipment so, that our productivity further increases.

So, it will give us still further productivity, more productivity further reduction in the cost and prices. So, again our cost and prices are coming down we are passing on some benefits to our customers again that the demand will further increase in the sales. So, still greater markets are achieved and finally, again increase in production, So, this spiral continues.

So, with which emphasises that there is a always a scope for continuous improvement. So, we can focus on the various aspects not only related to the design of the product plus also the production. So, in all the aspects, it is always possible to do certain improvements which will lead to increase in the sales as well as the demand in the market, which will further lead to the improvements.

So, this is a continuous process which will help us to further increase the product productivity as well as the sales of the product in the market. So, what does this mean? The two things that can summarize from here is that we have to focus on our design, we have to focus on our production. So, within production we have to focus on our procedures tools, equipment that we are following and that will help us an optimization of these parameters will help us to increase the sales and demand of our product.

So, this is a spiral of increasing productivity which is further leading to the increase in the demand as well as the sales volume and if we go to the previous session on x axis, we have taken the quantity. So, our increase in sales and sales volume is going to help us to increase the area of our profit rectangle which we have already covered in the previous session as well as it is leading to the reduction in the total cost also.

So, basically value engineering focus on the third important aspect that is the total cost. And we will see in our subsequent sessions that value engineering may not necessarily lead to reduction in cost sometimes, the cost of the changes that we are going to bring in

the design, in the manufacturing, in the materials of the product may lead to increase in the cost of the product also, but that increase will be offset by the increase or the increment in the value that we are adding by doing the necessary changes.

So, these changes in design processing and materials may lead to a significant amount of incremental improvement in the value of the product. So, that we have to see that even by spending more money, we are adding more value to the product, and we are getting benefits in terms of customer satisfaction in terms of increased demand in case of leading to further increase in the sales volume and overall improvement in the profit of our organisation or the profit that we are accruing from the product.

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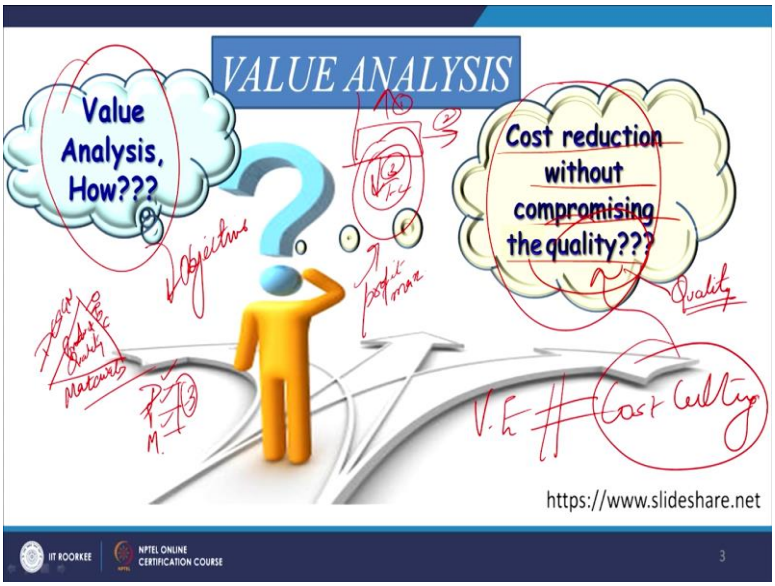

So, here we can see that value analysis basically is cost reduction without compromising the quality. You see it is very important why because most of the time you will have to answer a question that what is the difference between value engineering, vis a vis cost cutting. Some of us may be made to believe that value engineering is nothing, but cost cutting which it is not.

So, value engineering is not cost cutting. If you talk about cost cutting, cost cutting will never focus on this important word which we are calling as the quality. So, in cost cutting we may have to compromise the quality, performance, reliability, service life of the product whereas, in value engineering we will never compromise, but on the other

hand we will try to improve, to increase, to have a incremental change towards the positive size positive side on all these aspects related to quality.

So, we are not going to compromise on quality, but we are going to see that we are able to achieve that desired quality at a relatively lower price. So, that is the basic target with which we challenge a particular product design or with which we attack a product design and try to find out a better alternative of achieving the function which is not only satisfying the desired function, but is also achieving the function at a overall reasonable cost.

So, value analysis is something which is going to be our objective of discussion in the next sessions. So, this is the basic concept that for increasing the profit that first two options have bigger challenges as compared to the third option that is the reduction in the total cost. So, we are focusing now on the third alternative of profit maximization. We want to maximize our profit that we can do if we are able to target the total cost of the product.

Now, that can be because if you see there are always three sides of any product. So, one is the design of the product, another one is, we can see the processing of the product and the third one is, the materials that goes into the product. So, we can focus on the design, we can focus on the production, we can focus on the materials.

So, if we focus on these three aspects, the product quality can be taken into account. So, the quality will depend upon that design, the production as well as the materials that are going into the product. So, if we focus on these three important aspects and try to achieve a combination of these three parameters that are reasonable cost, we will definitely be able to serve the needs and requirements of the customer at a reasonable cost. So, let us now just go into the history of value engineering.

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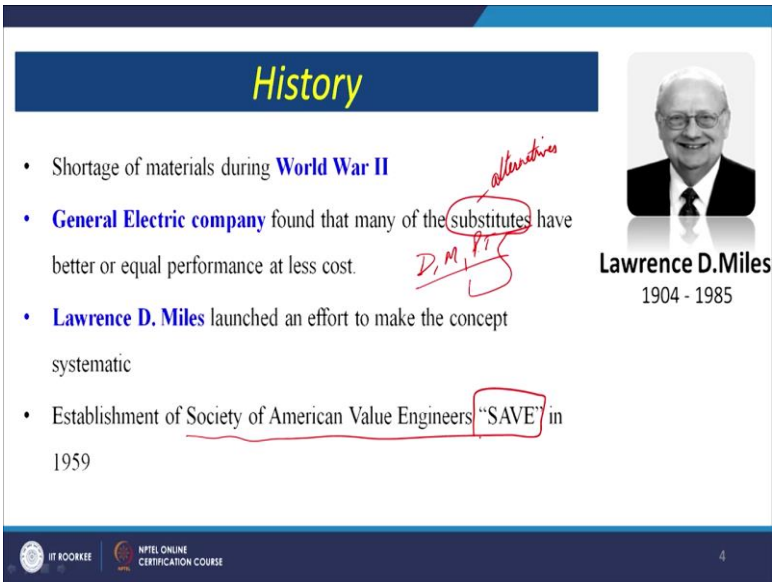

So, here we see Lawrence D Miles 1904 to 1985 who is considered as one of the exponents in the field of value engineering.

So, what is the historical perspective of value engineering? So, there was shortage of materials during the World War II. There was may be during the war, there were certain issues related to the design the materials, the processing of the various defence equipment. So, the various countries were not able to procure the designs or the materials that have gone into the manufacturing of certain defence equipment.

So, the journal electric company found that many of the substitutes have better or equal performance at less cost. So, basically the design, the material, the production technology for these defence equipment were not available readily because of the world war because of the alignment of the various countries in the different group. So, they were not able to get these three things. So, therefore, they thought general electric company found that now we have to go for the substitutes. When we are not having the actual designs, actual materials, actual production technology available you have to look for the substitute, in other terminologies we can call it as the alternatives also.

So, when they focus on the alternatives they found out that they are giving at least the equal performance as compared to the original equipment or the in original parts, but also in many cases, they are better than the parent material. So, why not to investigate and find out that this function can be achieved using an alternative material or a

alternative equipment also. So, for at that point of time the concept of value engineering originated.

So, Lawrence D Miles launched an effort to make the concept systematic; as I have already told that all of us are doing one form or the another form of value engineering in our day to day life, but then this concept has to be systematic, we have to attack the problem in a very systematic manner, we have to document the issues related to the problem and then we have to generate n number of ideas alternatives, and then we have to select the best alternative which is achieving the function at the minimum cost. So, there has to be a systematic approach of challenging the problem and that systematic approach was developed by mister Lawrence D Miles.

So, a society was set up or Society of American Value Engineers which is famously known as SAVE in 1959. So, the basic concept started during the World War II, why? Because I have already told, because there was lack of knowledge sharing based on design, equipment, materials, processing technologies and therefore, alternatives were looked into, and the alternatives gave better performance. Then, the approach was made systematic in the form of concepts of value engineering and the society for our American value engineers was established. Now, what do we mean by value engineering and what it tries to achieve in a globally competitive environment?

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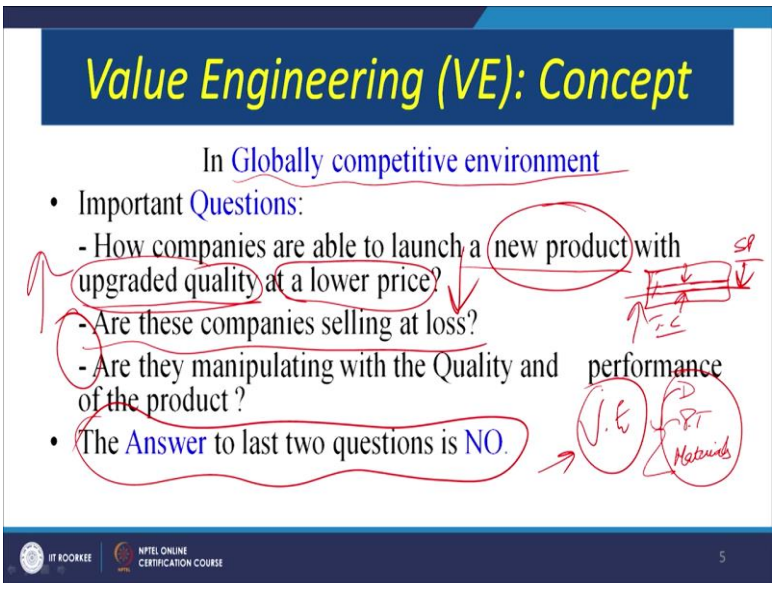

We know that internationally there is a competitive environment for various commodities all of us are using mobile phones we can take an example of a mobile phone. Suppose today I decide to buy a mobile phone, there are n number of mobile phones available which I can choose from. So, there is a competition.

So, each company has to establish, a worth to price ratio for their phone or for their product, that if the customer is selling out some amount of money from his or her pocket. He wants the best product out of that money and therefore, each company has to do this type of analysis that what is the worth, we are offering to the customer at the cost we are charging.

So, the important questions are that how the companies are able to launch a new product with upgraded quality at a lower price. Now you see, there is a new product we have already seen why new products are required. The new product is being launched the quality has increased, but the price has reduced how it is possible, is it possible?

So, we have to find the answer to this question, second is are these companies selling at loss? Which means that the quality has improved their total cost has also improved in order to achieve that higher quality. So, and the prices have come down. So, therefore, in the last session we have seen how the profit is being calculated and if you see the profit rectangle as we can see quality has improved, it means the total cost to achieve that quality has gone up, the selling price has come down as per our rectangle. So, it has come down. So, that a selling price is fixed here, total cost has already gone up.

So, are these companies selling at this loss? The second question; are they manipulating with the quality and performance of the product? It may so, happen that they are now manipulating with the quality to generate more profits. So, we have to find answers to these questions. The prices are coming down, the quality is going up, the functions are improving, the features are improving, but how the cost can come down or the selling price can come down so, that has to be taken into account.

So, the answer to the last two questions, the last two question means these two questions; are the companies selling at loss? No still they are making profit as well as, are they manipulating with the quality and performance of the product? Again the answer is no. So, the quality and performance remaining same they are still making profit, how it is possible that the prices are coming down with the enhancement and increase in the

quality of the product. So, the answer to the first question is the concept of value engineering.

So, they may be focusing on the design of the product, they may be focusing on the production technology of the product, they must be focusing on the materials that are being used for the making the product. So, once all these three are optimized, the quality is not compromised, the product has a better quality by optimizing these three important aspects related to the product quality, and the cost can come down.

So, how the companies are able to launch a new product with upgraded quality at lower price by using the concept of value engineering. Now what is this concept, how it can be implemented in the product design process that is the subject of our discussion in the subsequent sessions.

We will try to understand this concept that ones the concept was applied systematically, the product was analysed, certain features which were found to be redundant were removed, certain design modifications were done, and the product with same quality or even better quality was attainable, was manufacturable, was produced at a lower price. So, that is the target, we will try to understand with the help of certain case studies.

Now, there is another concept of coaching of champion's concept.

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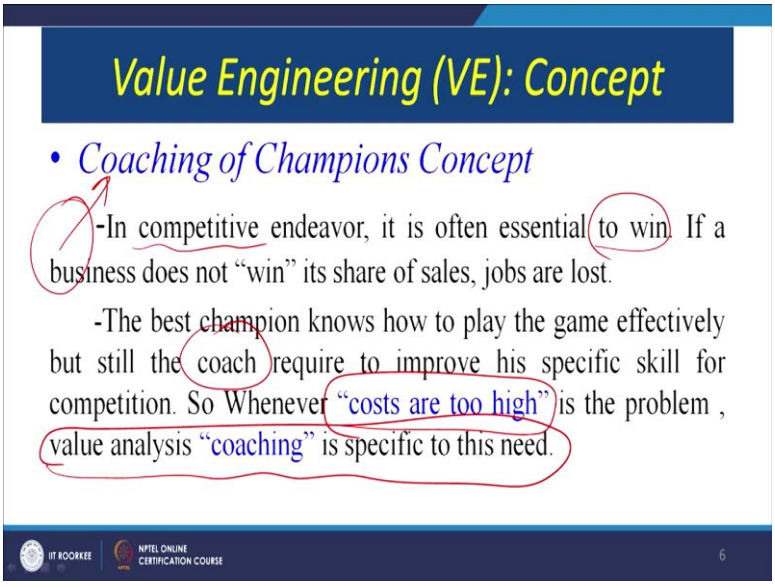

So, in a competitive endeavour it is often essential to win. So, all the time normally we have this in mind that when we are entering into the ground, we must come out as victorious only as the victors. So, in competitive environment or in competitive endeavour, it is often essential to win all of us want to win in previous session we have seen all companies want to make profit. So, if a business does not win its share of sales and jobs are lost. So, each and every company want to be in the profitable mode only.

So, the best champion knows how to play the game effectively, but, still the coach requires to improve his specific skill for competition. So, you definitely require a coach who can help the player to play in the best possible manner, and I will advice you that you can see suppose you take an example of a tennis player, just try to find out on Google that who is the coach of the tennis player.

You may be knowing the name of the tennis player, but still that tennis player who is the best tennis player in the world may also be having a coaching team for specific purposes. Somebody may be taking care of his diet, somebody may be taking care of his physical strength, somebody may be taking care of his skills that how to hit the ball. So, the person who is at the top of the world in a particular skill may also require coaching staff. So, the coach is required to improve the specific skills for competition.

So, whenever cost are too high, value analysis coaching is specific to this need. So, now, value analysis has come as a, we can say saviour, wherever, we feel that the costs are too high. So, wherever in a particular organisation we find out, this is not a cost effective solution to the problem that is at hand, we can use the concept of value analysis and try to systematically approach the problems systematically write the facts related to the problem and we will be able to find the best solution which is helping us to achieve our target, and the target is that we have to achieve the function at the minimum possible cost.

So, wherever the cost are too high coaching comes from the concepts of value analysis. Now, what is value engineering? We have seen in our previous sessions or in our discussion today also what is value engineering. So, it can be an organised study of the functions.

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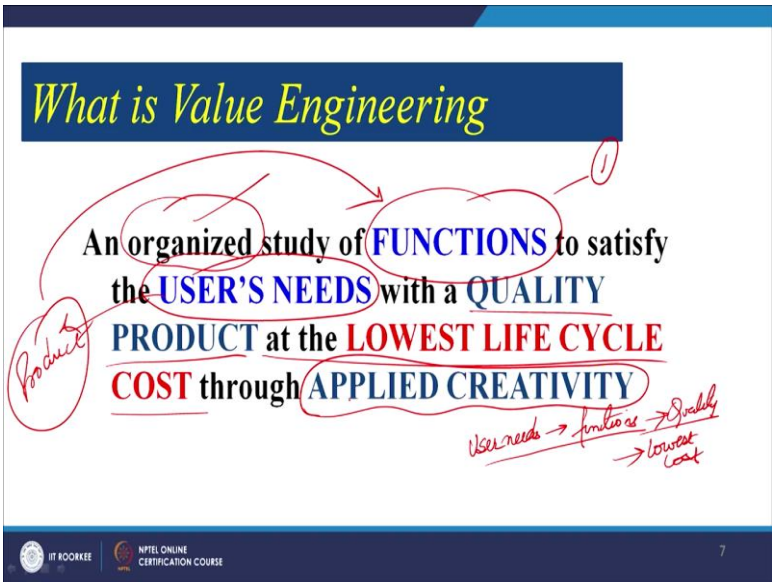

First thing we will be using quite often in our course functions; every product will have certain functions, this camera is recording this session it has got a specific function, I am using a pointer it is having certain function

So, I have a screen here, it has got a specific function each product has got certain function, we will see what is the basic definition of a function in our subsequent session. So, it is a study of the functions, we will try to see that why this camera is used, what is the other alternative to this camera, how this camera can be eliminated and the recording can still be done.

So, we will try to find out what is the meaning of the function. So, value engineering basically is the organised study. So, another important point that we must keep in mind is that it is a organised it is a systematic study of the functions to satisfy the users needs. So, the user is going to buy the product and the product is going to satisfy some functions. So, users need are also equally important. Now it has to satisfy the users need with a quality at the lowest life cycle cost.

So, there are two things here, if I write there are user needs which may translate into the functions we have to achieve this functions at a very high quality standard and we have to achieve this user needs translated into functions at a very high quality, at a lowest possible cost.

Now, how it is possible? For that we will require creativity, how creativity will come into picture? We have to generate may be hundreds of ideas related to satisfying the function for a product. We have to find out that why this product is required, what are the essential functions this product must satisfy, and once those functions we have identified we have to generate may be hundreds of ideas to satisfy that function.

And then that function it has to be satisfied at the lowest possible cost without compromising the quality which the customer is looking at. And that is only possible if we have a creative team working on the concept that is to satisfy the function at the lowest cost that is the basic definition of value engineering. So, what is value engineering? This is the basic concept. So, there can be number of definitions for value engineering.

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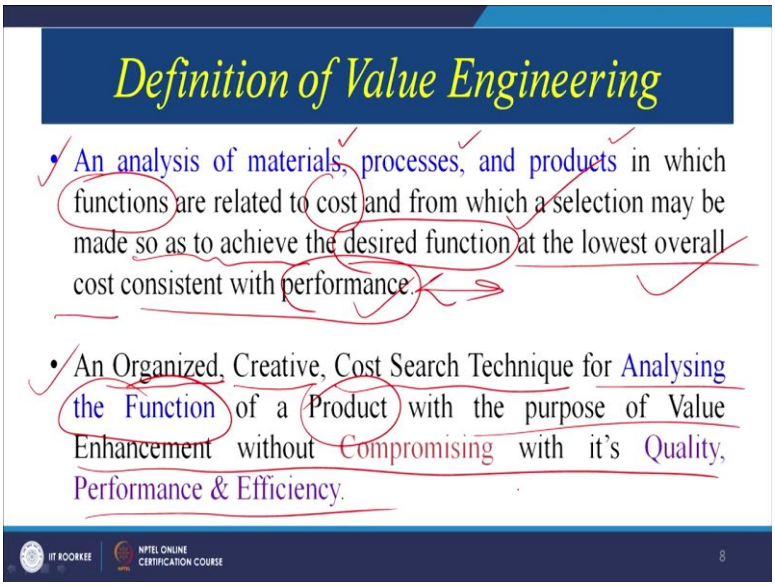

So, I will just read may be one or two of these. The first one I am reading for you, an analysis of materials I have already told, processes, products in which functions, again the word function is coming into picture are related to the cost, again the cost word is coming and from which a selection may be made so, as to achieve the desired function at the lowest overall cost, but consistent with the performance.

There has to be no compromise with the performance of the product, to we have to achieve that desired function at the lowest overall cost at the desired performance level without compromising on the quality of the product. So, again another definition we can

see, the core thought the basics will remain same, the idea will remain same, the words may be different.

So, second definition can be it is an organised again the word organised is coming previous slide we have also seen, creative again creativity is important cost search technique for analysing the function again the word function is coming of a product with the purpose of value enhancement without compromising with its quality performance and efficiency. So, again we have to achieve that desired function without compromising the quality, performance and efficiency.

The value of the function is defined as the relationship of cost to performance.

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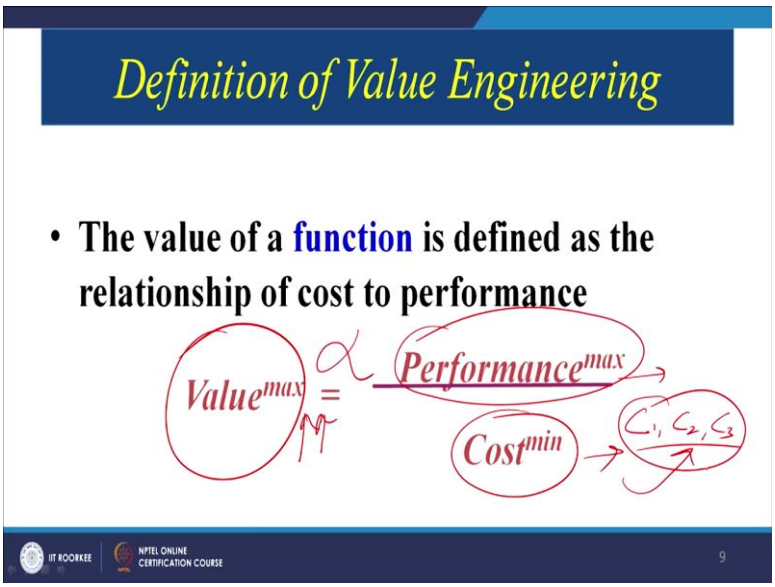

$Value^{max} = Performance^{max}/Cost^{min}$

So, this is basically the value function, we have to maximize the value. It is directly proportional to the performance of the product. Now if I am saying the camera is recording this session, the performance of the camera if it is recording perfectly or if it is recording without any failure, the quality of the videos very good, we will say the performance of the camera is good.

So, we have spend some money to buy this camera which means the value that we have achieved from this camera is good or the best. The cost also then comes into picture, cost comparison can be done if we have suppose camera 1, camera 2 camera 3. So, we will try to buy the camera which is giving us consistent performance, but out of the cost we will try to focus on that which one is the minimum cost.

So, basically value will be maximized when we are getting the desired function reliably at the minimum cost. So, that is the basic concept of value engineering.

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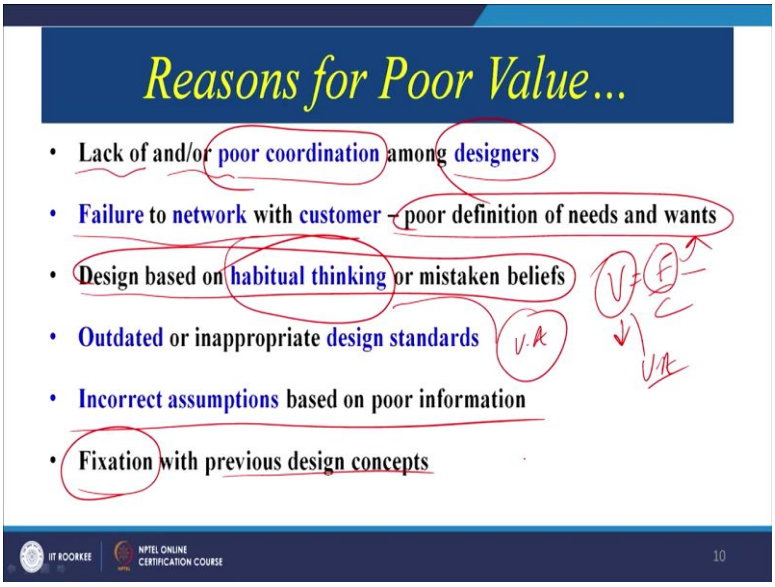

Now, what are the reasons for poor value, some of us may feel that this is a very standard approach of designing the products? So, whenever a product designer is designing a product, he will take care of all these parameters whatever I have said by now; that the cost must be low, the functions must be more, the performance must be good. So, all designers will always keep all this things in mind so, why do we need to do the value analysis?.

So, there are reasons when the poor value keeps in our product design; what are these reasons quickly, let us see, Sometimes there is lack of and or poor coordination among the designers. So, aircraft if you see, all the aircraft will not be designed by a single designer. So, there will be a team of designers designing the aircraft or the various components, various design elements of the aircraft wherever there is a big team of designer there may be poor coordination.

So, may be one designer has specified a particular material for a part, another designer has specified a different material for that part now they have these two parts have to be joined together. So, all of us know that when you are combining or joining two different materials, the joining strategy becomes slightly complicated, as compared to when the two materials are same. So, this is just one example lack of coordination among that designers may lead to poor value in the product, failure to network with the customer, poor definition of the needs and wants.

Value = Function/Cost

So, basically we see value is function by cost and functions are what? The user needs and wants. So, we are not able to identify what the customer actually wants. So, once the functions are not achieved the value automatically will be low and therefore, we need to do the value analysis of this product that why the value is low? We will find out, one of the reasons may be that we have not been able to seriously look into the actual needs and wants of the customer.

Similarly, design based on habitual thinking or mistaken belief. For example, habitual thinking always we say copper is the best conductor of electricity. So, where our electrical conductivity is required every designer will without bothering about how much conductivity is required we will propose the use of copper for electrical conductivity purposes. We may also look for alternatives, but habitual thinking is copper is best conductor so, let us go for it.

Those type of thinking has to be taken into account may lead to poor value. So, then therefore, value analysis is required. Sometimes outdated or inappropriate design standards. If you see the old buildings you will see the thickness of the walls. So, there was a standard that this must be the thickness of the wall. So, that was a design standard at that time today the standards may have changed, but many times when that designers have a may be a old school of thought they may be following or the we can say latest standards, they may not be following, may be following the old standards only which may lead to poor value in the product.

Similarly, incorrect assumptions based on poor information sometimes we are not updated with the latest technology available in the specific field. So, we are only using the old technology which may lead to poor value in the product. Similarly we have a

fixation with previous design concept. So, may be that design is in use for the last 70-80 years of we become fixated with that the this is only the best design procedure to design this product or this can be only the design which is possible for satisfying this function.

So, that kind of fixated thinking or we can say a very rigid thinking which is not flexible, which is not open to new ideas, which is not open to brain storming which is not open to questioning. So, those type of thinking may lead to products which may not have a very good value. So, therefore, these are the reasons which may lead to poor value in the product.

So, if our product has got inherent poor value we need to do the value analysis of that product and find out that how the value of the product can be improved. So, with this we conclude the today's session, in our next session we will carry forward our discussion in the field of value engineering we will try to take certain examples in the subsequent session, where the things related to the application of value engineering will become absolutely clear to all of you.

Thank you.