Product Design and Development
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Lecture - 06
Value Engineering Concepts

[FL] welcome to the second week of our course on product design and development, friends let us take a brief review of what we have covered in the week 1. If you remember we have covered all the basic aspects of product design and development in week 1.

We have seen what is the need of developing a new product, we have seen the life cycle of a product when it is launched in to the market, we have seen the various stages of product development, we have also seen the product analysis that what are the various characteristics that we need to cover, prior to that we have also covered that what should be the product policy of an organization, even we have covered the sort analysis that is strength weakness opportunities and threads and the discussion was focused more on the product design aspects of sort, otherwise what can be used in all different domains, but our focus if you remember was on product design that how is sort can be used for product design and in order to launch a successful product in the market.

We have built up a specific knowledge related to product design in our previous week linking the previous week with our discussion this week we will see that how the concept of value engineering as is clear on your slide are applicable to product design. Let me go back again to the last lecture that we had in which we have seen product analysis in product analysis if you remember there are 4 broad factors that are needed to be understood or that we need to understand in order to design a good profitable successful product.

If you remember we have seen first were the marketing aspects, second were the product characteristics, third if you remember the economic analysis in which we have seen the break even analysis, and the fourth were the production aspects. So, currently our discussion on value engineering is related to the second important factor that is the product characteristics. In product characteristics we have seen that there are functional

aspects, then durability and dependability we have seen the aesthetic aspects, all these things are required to be understood if we want to develop a successful product.

Let us see the functional aspects in product characteristics first thing is the functional aspect, if you see just free your mind and think that any product around you in your room or in your classroom or wherever you are listing to this particular discussion, see any product why that product has been bought either by you or by your parents or by the organization for example, you see a air conditioner where the air conditioner has been bought to cool the environment, what is the function, basic function of the air conditioner that is cooling the environment. Similarly why I am using this pointer or this slide changer it has got some function there for I am using it, similarly why I am wearing this jacket, it is January going on there is so much of cold all around and normal temperatures are low in order to protect my body I am using a jacket.

So, any product that you see around you we will have defiantly have a function and it will have a functional value and that function has to be provided by that product and who has to ensure that the function is being provided by the product or not. The product designer has to ensure that the product is designed in such a way that it satisfies it functional requirement or the functional property for which the product has been designed. I think it is clear to all of you that for any product to be successful it should be able to satisfy the intended function for which it is has been design that also satisfactorily and reliably, is the product is not able to satisfy it is intended function reliably definitely that product is not going to succeed in the market.

First and foremost when we analyze the characteristics of the product, we have to keep a focus on the functional aspects of the product and for those functional aspects only we have a concept called value engineering which is a function based technique and which helps us to ensure that the product performs it is desired function reliably, but simultaneously ensuring that this function is achieved at the minimum possible cost.

We will see that what is the concept of value engineering and how it is different from other commonly used techniques like cost cutting and the other techniques of saving money, in this case we will not compromise on the performance, reliability, quality, efficiency any of the parameters will not be compromised, but our focus will be to view the systematic approach to cut the cost or to reduce the cost satisfying all other

requirements as desired by the product or as desired by the, desired from the product, by the customer, our focus will be to ensure this particular aspect of the product.

Let us now see one by one slowly let us try to understand this week our focus primarily will be on the concepts as well as the successful case studies of value engineering, it has been applied word wide and there are so many success stories where the concept of value engineering has helped people to design the products, to launch the products, in such a way take they have been out rightly successful. We will see some of those case studies also, let us first try to understand in today's session we will just have an overview of the value engineering concepts, try to understand the basic philosophy of this technique and try to understand it with the help of some definitions and little bit of we can say historical aspects of value engineering. And we will also try to see that what are the advantage is that we can derive if you use the concepts of value engineering.

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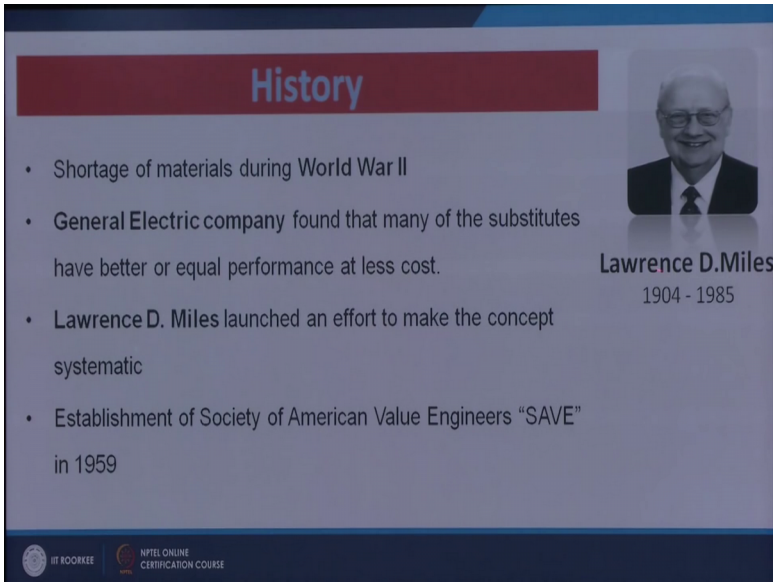

Let us go one by one, first see the history this is Lawrence D Miles, he is considered as the we can say the pioneer figure or the leading figure in the field of value engineering and how the value engineering concept evolved, it evolved due to the shortage of materials during the world war 2 and GE that is the General Electrical company found that many of the substitutes are better or equal performance at less cost. So, for any particular product what you need, you need the materials or the substitutes

Now, it happens it is so happened that after the world war 2 or in some time overlapping time during the world war 2 there was a shortage of materials, short a the designs of a particular we can say artillery gun or defense equipment were not available. So, what did the engineers do particularly may be at general electric this concept was develop that why not to use alternate materials, why not to modify the design, why not to change the process. 3 common things, 3 important things I have said first is design process and the materials or other order design materials and the process.

These 3 things if you change these are the substitute so, these led to better results, substitutes or better as compare to the original design, original materials and original processes. So, from there the concept evolved that there is always a scope of changing the product in context of it is design material or the process use to make that product and this is helpful for saving of cost. This was the basic you can say triggering point of launching the concept of value engineering the Lawrence D Miles launched an effort to make the concept systematic.

Earlier it was not you we can say systematic, the concept was more of philosophical thinking that if you change this things money will be saved, but then Lawrence D Miles took it as a challenge and then he try to systematize or put it in to systematic process step by step process so, that anybody any engineer can apply these concept and save the money for his or her organization. This is the concept finalized by Lawrence D Miles and this then it let to the establishment of Society of American Value Engineers SAVE, SAVE in 1959, to the all the concepts over than we can say put together and a society was established for propagating this concept among engineers and scientist, this is the brief history of value engineering.

Now whenever you have a new term on your platter you start thinking that this may be similar to this thing or how it is different from this thing or how it is different from what we already know for example, suppose we go and buy onions from the vegetable market, what is our philosophy, what is our procedure, we usually go to the market sometimes we go to 3 or 4 vendors ask for the prices and wherever we get the minimum price we buy the quantity that we want to buy; isn’t it, I think all of us do the same thing.

Now, it means we are doing value engineering, we have some target in our mind that what type of onions we want, what is the size of the onion, general quality of the onions

that we want to buy and then we see 3 alternatives moreover we are getting the cheapest alternative we are buying the onions from that vendor. So, everybody is doing value engineering is in his or her life, but the systematic analysis if we want to apply the same concept in any engineering solution for example, this camera which is recording this lecture if we want to analyze this concept or analyze this particular camera from the value engineering point of view what do we need to do.

It is not as easy as buying onions we need to systematically breakdown the various components in to the say individual component, then see what is the function of each and every component, than we have to see that can we combines some functions, can we eliminate some function, can we do some design modifications keeping the performance same the performance should not deteriorate performance should not die down that is our basic concept.

So, buying onions for same quality or same taste or same package or same look, usually by taking in to account get should be good looking also, not good looking as a person, but it should have a good packaging, it should not steal, it should not be you can say poor quality. Our quality same we are comparing 3 alternatives and whatever quality standard we have said we are picking it up, similarly for the camera design also we need to keep the performance is standard same, no change in the performance standard, but we have to redesign it in such a way, that the performance remaining same the cost comes down, that is the basic concept of value engineering. So, everybody is doing value engineering is in his or her life, but the systematic way of applying these concepts we are going to focus during this session.

Let us quickly a see what is not value engineering. Value engineering is not cost cutting many people say when you are saving money it is cost cutting, no it is entirely different of focus area is entirely different must right value, but in many case is the cost will increase in many case is when you apply the concept of value engineering the cost may increase, but the overall cost of that particular project would reduce may be when considering the life cycle cost of the project or the product. It is not cost cutting in many cases the cost may further escalate on applying value engineering, but the overall value of the product would certainly increase, it is different from cost cutting.

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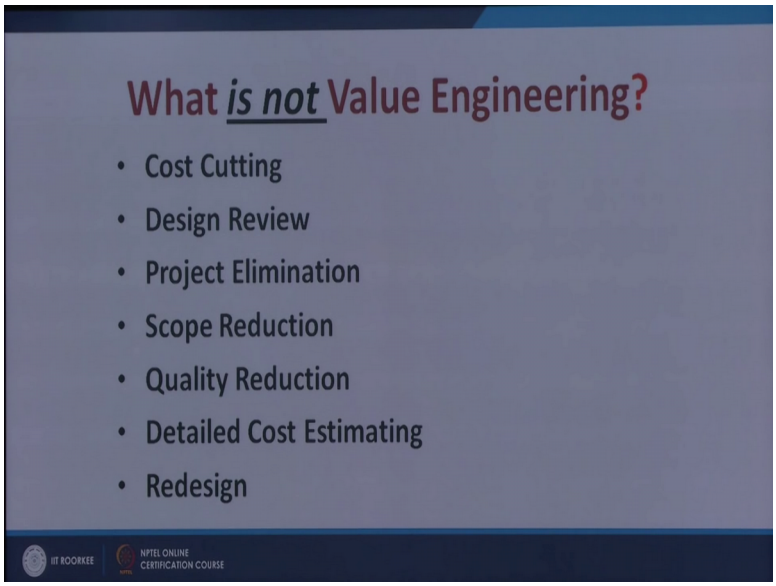

We will see in one of the subsequent lectures, but how exactly it is different from cost cutting, it is not design reviews some of the people you may say there is at design then few you can say persons will evaluate that designs based on the cost low it is not design review, it is a design process itself in this we will see the concepts of value engineering and we will design the product as per the value engineering guidelines.

There is no review or this is not a design review process from cost point of view it is not project elimination that if you have may be 3 or 4 different projects available, you will see which one is cheaper, select the cheapest project low it that is not project elimination, it is not scope reduction. Sometimes people will say that for this camera if you apply value engineering it may eliminate 1 or 2 parts, the overall scope of this camera will die down know, that we that is not the case almost or I should say even there we can we increase in the functional value of the product after the value engineering process. It will never lead to scope reduction, but I can say with confidence that the scope may further improve, that is one advantage of value engineering.

Quality reduction I think I have today only within last 7 to 10 minutes I have told I think 3 times that there has to be no compromise on the quality performance, reliability, serviceability, no compromise anywhere, only thing is using the fundamental aspects of science and engineering and using a commonsense we will aim to bring the cost of the

product down by our creativity innovation as well as the knowledge that engineers gather over a period of time.

There will be no compromise on anything that is quality reduction is not value engineering, detailed cost estimation is also not value engineering and redesign you can say slightly may be in call value engineering we may suggest some new designs, but is will not only the redesign process only. Redesign process may be your design the product without considering the cost aspect low in this case if even if we are redesigning we will take in to a account the cost aspect also therefore, value engineering is not the redesign process it is entirely different process. So, we can see this is this is this all these points have nothing to do with value engineering value engineering is a different aspect.

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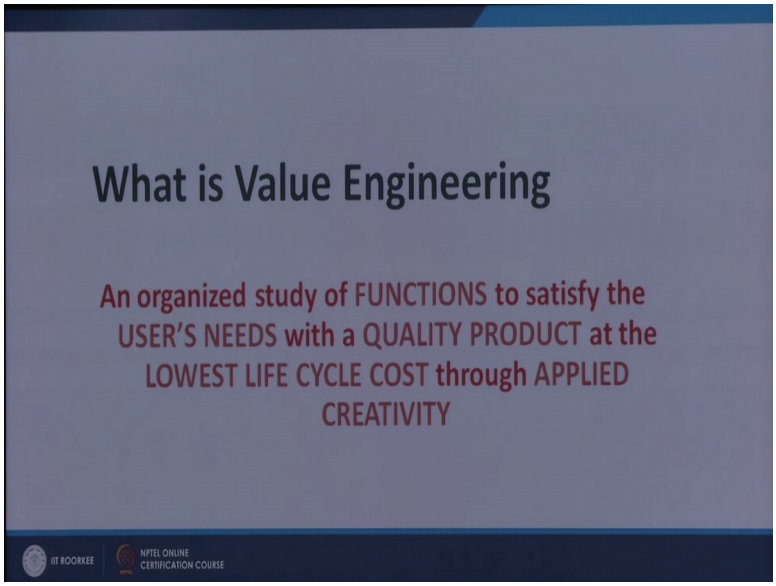

Now some of you may the wondering what is a value engineering why question mark is not put here because the answer is given may be on the same slide you can see what is value engineering an organized study. Let me first emphasize on an organized study, it is not philosophy, it is organized, it is systematic it is step by step, it is orderly, it has a sequence, it is a systematic or scientific study, an organized study of functions, I have already told with the help of example that each and every product that the customer buys has a function. So, you have to take in to the account that function, it is a organized study of the functions to satisfy the users need that we have seen why do we design products in

the last week we have seen that products are design to satisfy the fulfilled or the unfulfilled or the new needs of the customers.

The functions it is foxing on functions to satisfy the users need if with a quality product, quality cannot be compromised in this at the lowest life cycle cost through applied creativity. Let us see one by one there is a user need, for some functions which have to be satisfied ensuring the quality at the lowest life cycle cost and how it is possible by applied creativity. So, you can see I will not look at the explanation or the definition again let me just try to clear this definition to you because the next 2 definition I am just to going to read and move forward with our discussion basic definition out of this definition can be that we have to achieve the desired function now why desired because the user wants that function to be achieved.

It is the process of ensuring or it is to achieve the desired function reliably at the minimum possible cost reliably is a quality parameter or we can say it is to achieve the desired function at the defined level of quality, but at the minimum possible cost, that is what value engineering has to ensure. So, again it is emphasize that there has to be no compromise at all in the quality as well as the performance parameters.

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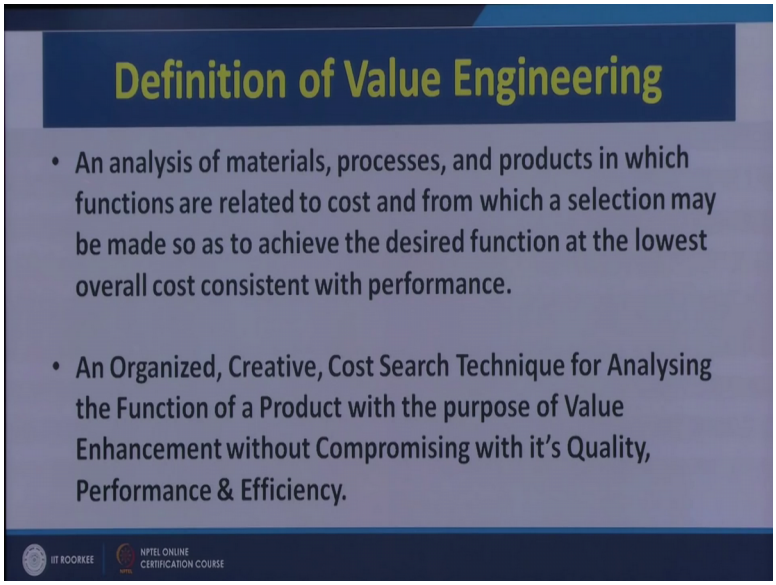

Let us now see the other definitions I will read this definition for you, value engineering is an analysis of materials, processes and products in which functions are related to cost as I have already told and from which a selection may be made so as to achieve the

desired function at the lowest overall cost consistent with the performance, again I am reading to achieve the desired function at the lowest overall cost consistent with the performance.

Let us see the second definition it is an organized, creative, cost search technique for analyzing the function of a product with the purpose of value enhancement without compromising with it is quality, performance and efficiency. So, I think the concept of value engineering is now absolutely clear to everybody that it is to ensure the desired function is achieved reliably at minimum possible cost.

Now, if you see mathematically how you can relate this relationship or how you can put this in to mathematics the value of the function is defined as a relationship of the cost to performance.

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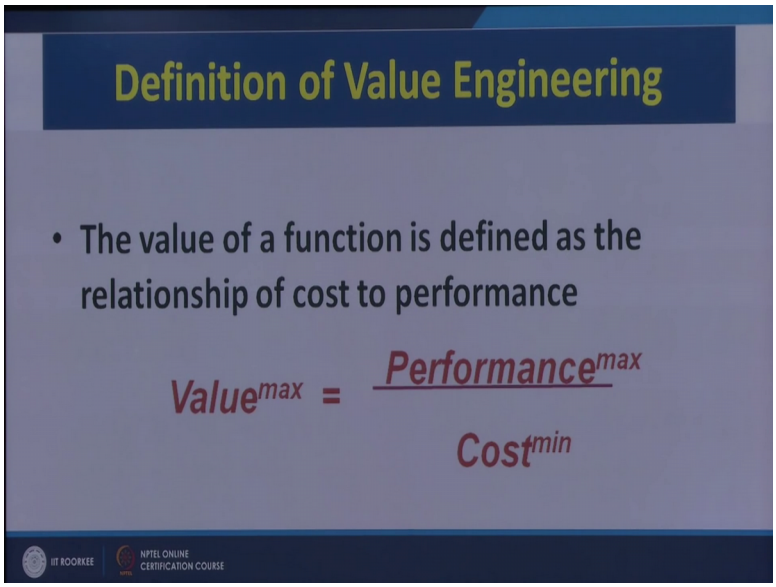

Now V max is equal to performance maximum divided by cost minimum let me emphasize you are in place of performance in many law books or in different type of literature you will get function also, it may be return as Value is equal to Function by Cost, V is equal to F by C.

This is a relationship between 3 things value of the product for example, this planter can have can be considered as a product order or the jacket can be considered as a product. So, value of the product is directly proportional to it is performance or the functional

value of that product and inversely proportional to cost. So, very easily I can say that this jacket can have a very good value if it pro provides me the (Refer Time: 22:22) for which I had bought this jacket and I have to pay less money for the buy this jacket or for acquiring this commodity or for acquiring this product.

It is directly proportional to the functional value inversely proportional to the money that I have to spend to acquire that product. So, value and as a value engineer what should be my target as a value engineer my target is to maximize this value maximize and minimize the cost that the customer has to spend, how it is possible providing the functional value high functional value for that product.

It is easier said than done it requires lot of search, it requires lot of innovation, it requires lot of creative thinking there only there after only you will be able to come up with ideas which will help you to redesign the product or which will help you to select the alternate material for that product or which may help you to suggest the alternate manufacturing process for that product, that your cost is minimized. This is a basic concept of value engineering and how it can be related mathematically how value can be related mathematically.

So, some of you may be wondering now if I think you have understood the basic concept of value engineering some of we may wondering that I am using a jacket how it can have poor value or why do we need to do value engineering. So, prior that I may emphasize on 3 words first one is value engineering. The number of books you will find value analysis and value management which is not a very common term, but value engineering and value analysis are used interchangeably and people are usually not able to understand the difference between the 2.

Value engineering are the concepts when they are applied at the product design stage, design stage means I have a idea that I have to manufacture may be a pointer which should be able to have duel functions that is it should be able to point on the at the screen and it should be able to change the slides also. If I apply all my value engineering concepts and a during the design stage of this pointer I am doing value engineering for this product.

Now, suppose this is already in my hand it means the product is already existing and I am using it or the other users are using it, now suppose I want to a apply the concepts of

value engineering on this then I will see what are the desired function and how I can achieve both the functions you reliably without compromising on the performance that at a lesser cost, then I have brought this product all right.

So, then it becomes value analysis the product is already there, the functions are already being achieved, but I further want to analyze it from the cost point of view. That is the point basic concept of value engineering and value analysis, now these point list out that why these product why do I analyze, why do I want to analyze this product for value or on another words we can say why should I do value analysis if already I have done value engineering during the design stage. These are the reasons that why products sometimes have poor value and therefore, the need to be analyzed for further improving there competitiveness in the market, because if you remember the product life cycle that we have covered in our last week there is a maturity stage and that maturity stage the market share of the product is more or less constant.

The company may would like to become more competitive by offering discounts to the customers, discount on the product to the customer now how the company will give discount if they are able to save some money in the cost that is adding up to make that product. So, at that point of time companies may want to do value analysis of the product, that the use now alternate materials or manufacture it through alternate process or they can redesign it slightly. So, that the overall cost of the product comes down at they pass on the benefits to the customer and try to get more market share during that maturity stage. Therefore, the value analysis is equally important as compare to value engineering which is applied at the beginning or at the design stage of the process.

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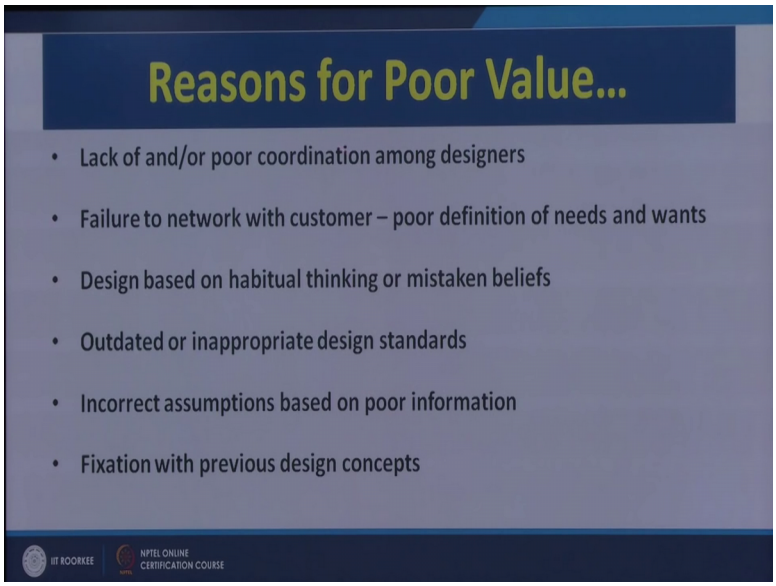

Let us quickly read this parameters what are the reasons for poor value in a product, first is lack of or poor coordination among the designers, avoidant if designers are not in harmony the product may have poor value, failure to network with customer poor definition of needs and wants we have not been able to find out the functions that the pro customer is desiring from the product. So, our marketing or our marketing aspects are not been addressed properly design based on have be actual thinking or mistaken beliefs usually change people do not want.

So, whatever is our design thinking we do not want to change which needs to poor value in the product outdated or inappropriate design standards clearly avoidant a company may be following the design standards for the last 20 years and many things may have changed over period of time therefore, if old things are used you may not be able to launch a product which has good value then incorrect assumptions based on poor information, information is not adequate fixation with previous design concepts.

So, whatever tools and techniques were used by the earlier designers in the company same things are continuing therefore, the poor value may creeping into the product, there can be other reasons also a during our discussion we will keep on identifying these reasons which lead to poor value and with case studies we will see that why this poor value has entered into the product and how using the concept of value engineering this poor value was eliminated or the parameters or the function leading to this poor value

were removed from the product that was redesign was better as compared to the previous product which was not value engineered properly. These are only some reasons which are responsible for poor value in the product there are other reasons also which I will address during the course of our discussion.

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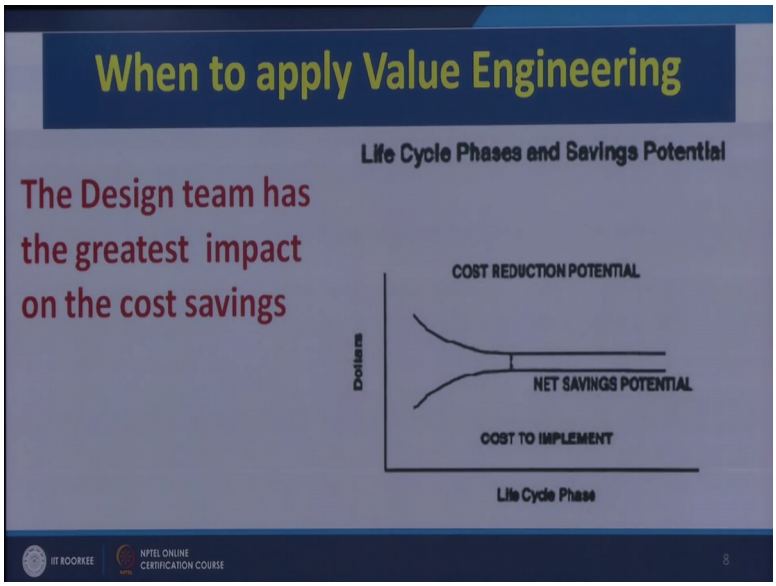

Now this is when to apply the value engineering concepts, this I will try to explain briefly, this is the cost in there the money this is the life cycle, if you see cost to implement the change is increasing and cost reduction potential is decreasing.

This is the gap here that is the net saving potential, cost to implement the change why it in increases because suppose I am designing a product my product design is on my screen, for example, if I am using a software CAD software I have designed the proud on my screen if slight modification is required immediately I will change the file and will not cost much, but suppose it has already been prototype some you can say models have already been made and test marketing is going on at that stage if I change what will happen the cost to implement will keep on changing and similarly the cost reduction potential will keep on reducing.

It is always avoidant that we should apply the concepts of value engineering and the very beginning stage only or at the design stage only. The design team has the greatest impact on the cost saving and if you remember in one of the previous class is we have seen that the cost is logged at the design stage 70 to 80 percent of the cost of the product is logged

or freezed or finalized at the design stage only, only 20 to 30 percent of the cost is may be controlled during the manufacturing stage. It is always important since this technique is related to the cost aspect of the product it is important to apply this technique at the design stage only.

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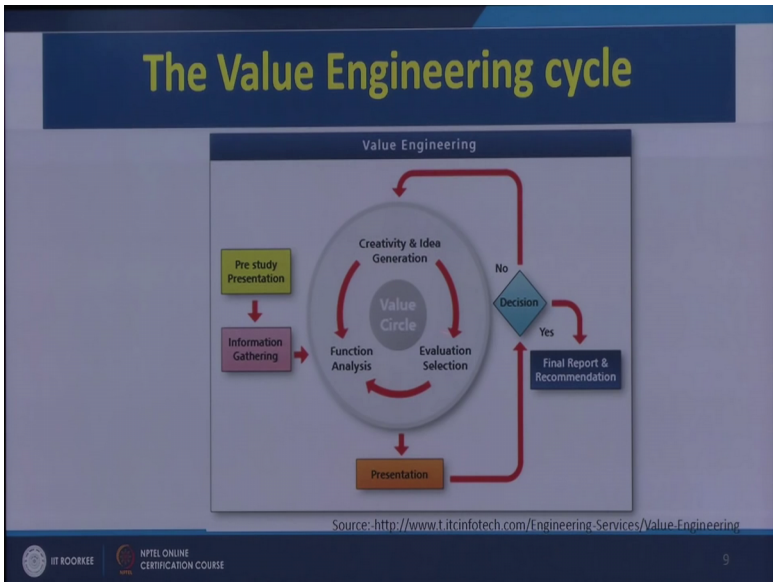

Now this is a typical value engineering cycle it is given if it at Google if you type value engineering cycle you will get this diagram. So, very quickly I will just go through this may be we will come to this again in the next lecture there is a Pre study Presentation, Information Gathering and then this is the main value engineering cycle. This is common to any engineering technique use you have to do a pre study, then you have to collect the information, but this is the main value engineering cycle that is creativity and idea generation, functional analysis, evaluation and selection in order to solve any problem these are the 3 things.

And then finally, there is a presentation if the solution is acceptable next stage final report not acceptable again it goes into the circle again you create, innovate, generate new and new ideas do the functional analysis with those ideas and finally, do the evaluation and selection.

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The application areas of value engineering construction projects ca is one area manufactured product manufacturing is going on any product which is being manufactured is a may be a computer screen or a computer CPU anything that is manufactured is can be, can use value engineering concept business systems on process is can also use service organizations like hospitals, airports, hotels all these industries can use that basic concepts of value engineering.

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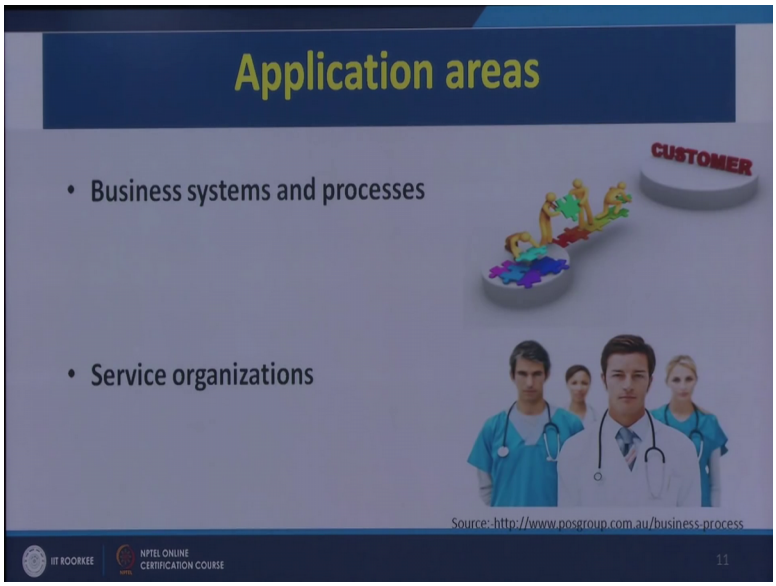

We can say that this is the applications application is not only limited to the tangible product it is limited to the service industry also, maybe I will stop here in for today's lecture we have seen today the basic concept of value engineering, the basic concept of function, we will discuss the functions again in the next section and try to relate it with the product design.

We have seen the basic concept of value engineering the definitions of value engineering and some mix or some miss information that value engineering is similar to cost cutting we have try to address that value engineering is not cost cutting or a design review process it is entirely different technique it is a systematic technique and which can be applied to different application areas that is it can be applied to design of new products it can be applied to service industry it can be applied to construction project.

It has got wide range of application and therefore, I personally feel that every engineer should at least have a basic working knowledge of value engineering and that is the target we are trying to achieve through this series of lectures. And over a period of may be next 2 hours on discussion on this course on product design and development our focus would be on value engineering application in product design process.

So, with this we come to the end of today's lecture in the next lecture we will see the next stage or application of value engineering into various aspects of engineering or product design.

Thank you.