Product Design using Value Engineering

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Lecture - 06
Creative Thinking

Namaskar Friends! Today we are going to start the discussion for the second week of our course on Product Design using Value Engineering. So, as you are well aware in the first week, our target was to basically address the aspect of product design process, to learn about the various objectives or various strategies that the company need to adopt while they are coming with up a with a new products.

Why, in fact, they must come up with new product that we have tried to address and we have not discussed the strategies of product design process. Why? Because already we have a 10 hour course which is running for the third or the fourth time in MOOC scheme, the course title is product design and development.

So, we are focused on the product design process in that course. Here, our target is to relate the concept of value engineering with the product design process. And here you can see in the previous week our focus was primarily to introduce the value engineering concept. We have seen that what is the basic definition of value engineering? What are the application areas of value engineering?

Where value engineering can be applied? And in the last session, if you remember we have tried to compare or differentiate between value engineering and cost cutting. So, our target was that by the end of first week we must be able to introduce the basic aspect of value engineering and we have been successful in that.

In the last session, the comparison or difference between the two different approaches that is value engineering and cost cutting, we have seen that in value engineering our target is the basic design, we challenge the design of the product, we try to achieve the desired function reliably at the minimum possible cost.

So, we are more focused on design rather than manufacturing of the product. Whereas, in case of cost cutting, our target is more on the manufacturing of the product rather than on

the design of the product and we have also seen that when to apply the basic concept of value engineering

We have seen that the cost reduction potential reduces, decreases with the life cycle of the product or as the life cycle phases of the product passed by or the product development process passed by the cost reduction potential reduces.

So, we have lot of opportunities to focus on the cost of the product at the design stage only. So, our concepts of value engineering, the thinking process about the alternative designs, the thinking process related to the alternative materials, thinking process related to the alternative manufacturing processes route, strategies, techniques must be addressed at the very beginning of the design stage only and that will come from creativity.

We have to be creative in our design process, we have to be creative in the selection of materials, we have to be creative, I must say in all aspects of product design process. So, whenever creativity will be there, we will come up with designs which are innovative in nature, which have not been conceptualized earlier, which are good in terms of maybe the weight which are good in terms of appearance, which are good in terms of satisfying the functional requirements of the customer. So, that is our basic target.

So, today we are going to address again, the difference between cost cutting and value engineering and we will focus on an important aspect that is the creativity. So, what we have covered in the last session, we will try to take that discussion forward and on your screen you can see the difference between value engineering and cost cutting. So, on your screen on x axis, you can see that we have the time domain.

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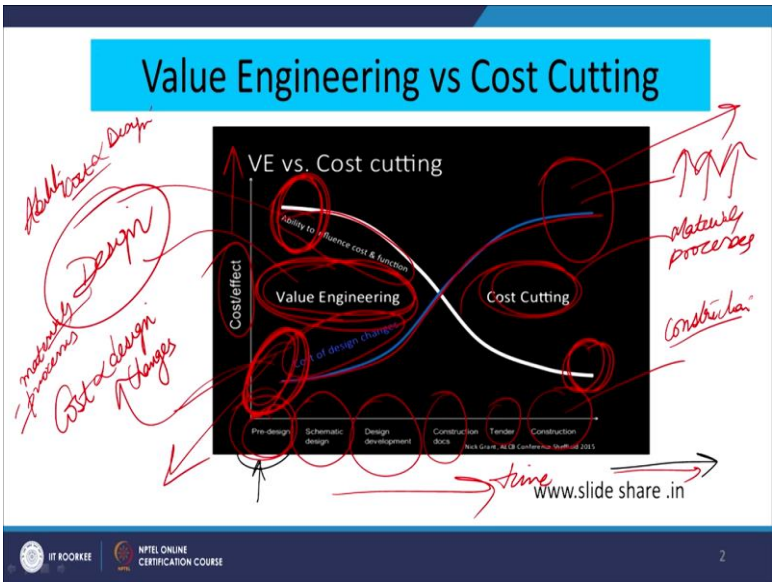

So, time domain you can see here, this is the time domain we have here. In time domain we have a pre design, if it is not clear I am reading it for you, this is a predesign. I will try to change the color of the pen, so that it becomes clear

So, we have a predesign here, then the schematic design here, design development, construction documents, tender, construction, so this is the time and this is we can see the cost to design changes. So, the cost linked with the design changes, and you can see the variation of this cost on y axis, and on y axis we have the cost, and on x axis we have the time domain

Now, if you try to understand it the variation. I am highlighting the variation, the variation clearly shows that the cost linked with the design changes is increasing with as the time passed by. So, if we want to bring a change, the example that I have already taken at the construction that is the last stage of making a building.

So, if we were focusing on the changes at the construction stage we can see, the cost is relatively higher. Whereas, if we want to bring about a change at this stage or the initial stage of our product design process or at the pre design stage, the cost to implement the change is considerably less. So, here the cost is more at the end of our life cycle or the product design phase and initially it is high. And the other curve, this is ability to influence the cost and function; that is ability to influence what, influence the cost as well as the design.

So, this ability is high in the beginning and this ability goes on reducing when you move with time at the last phase of your life cycle; that is the construction has already started and this example already I have taken. So, where we must focus on value engineering concepts? So, we can see that a value engineering, we will focus in the beginning only. Whereas, more focus on materials and processes, the way we are doing the construction that is cost cutting. So, cost cutting is more, we can say related to materials, processes. Whereas, value engineering, the more focus is on the design. So, when we are able to change the design.

Now, another important derivation that can be taken or another important analogy that can be drawn here is, that why value engineering is more important, because once you are designing the things at the design stage only, mostly, the materials processes will be selected. So, we are going to lock most of our cost at the design stage only and at that stage only we are applying the basic aspects of value engineering. So, therefore, value engineering gains much more significance as compared to the cost cutting approach.

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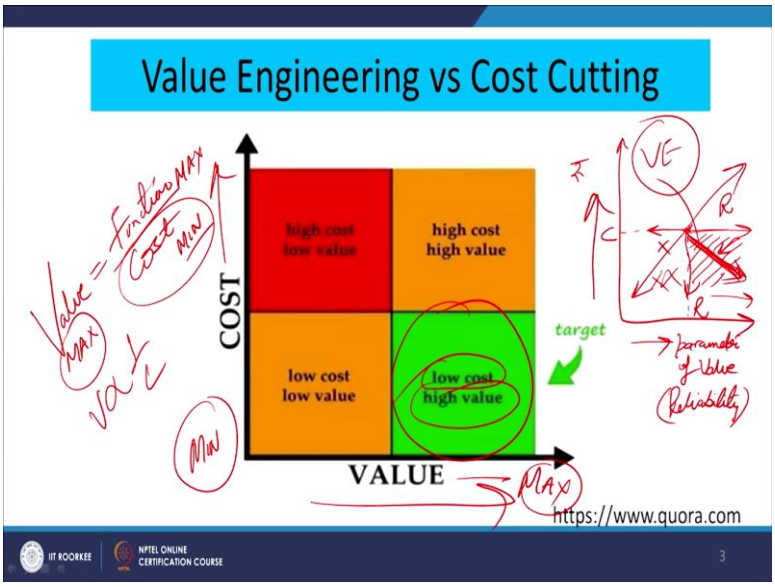

$Value^{max} = Function^{max}/Cost^{min}$

Now, here we can see to make the things slightly simpler on y axis again we have the cost and on x axis, we have the value. Now what is our target here? Our target here is

that our value must be. As if you can see in the previous session, we have said that value is normally or usually denoted by function by cost. So, our target is to maximize the value. How it can be maximized? By maximizing the function and minimizing the cost.

So, here we can see that value we have to maximize and cost we have to minimize. So, what is our target domain? Our target domain is this green color, where we have low cost and high value and here, we have high value and low cost, because value is we can say inversely proportional to the cost. So, if the cost is less, the value will be more; and same thing, if you remember in the previous session, we have seen benefits, we have to maximize, cost we have to minimize. So, benefits minus the cost will give us the value which we have to maximize, so that is the basic concept.

Another important diagram that we can see here is, that this can be any parameter of value, and on y axis we can again have the cost component. Now suppose the parameter of value, let us take an example suppose it is reliability. Now, how much reliability we must put into our system? So, suppose we have made a system reliable. This is the point where we have suppose this is the reliability in our system and for providing this much reliability in our system that is R we have to spend maybe cost C.

Now, what must be our target as a value engineer? What we must do as a value engineer? As a value engineer we will try to move this point, but in which direction. We cannot come in this direction, we do not want to reduce the reliability, we do not want to reduce the reliability by reducing the cost also, we do not want to move in this direction, reducing the cost for same reliability, but our target will be in this domain that we want to increase the reliability.

Reliability is increasing in this direction, and at the same time if the cost can be also be reduced. So, this can basically we can say target of the concept of value engineering that the reliability is increasing, it is increasing in x axis, it is increasing and the cost on y axis is also reducing. So, this can be our target area that the reliability is also increasing and the cost is also decreasing

So, cost we want to reduce, reliability suppose we want to improve. So, our target area as per the concept of value engineering is this particular area. So, we can see that if we work in this domain, somehow maybe in this domain cost is less reliability is increasing, so that is our target area.

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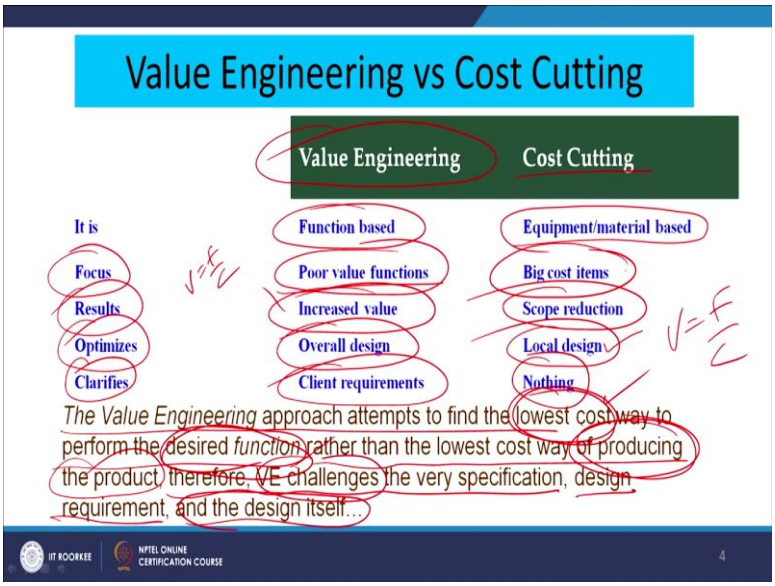

V=F/C

V= value of product

F= function of product

C= Cost of product

Now, this is the last slide related to or summarizes the discussion that we have been doing on differentiating between the value engineering and cost cutting. So, here we can see, what is value engineering? It is function based. Now I need not again emphasize on this because we have taken lot of example. Whereas, the cost cutting is majorly equipment and material based, already we have taken the example.

The focus of value engineering is on poor value functions. Whereas, when we focus on cost cutting, we will always focus on the big cost items. For example, suppose a company is going through a rough weather or a rough patch, the profits are dwindling, the market share is reducing. Obviously, the company would like to go for some stringent cost cutting measures and one of them can be that they will focus on where the money is being spent, which are the big fat cost items or costly items, they will try to reduce those costly items or expenditure on those costly items.

So, in focus, in value engineering is or again on functions; that is again we are focusing on the design, but here we are focusing on which are the big cost item. Now what are the results? Value engineering will lead to increase in the value of the product which is given by function by cost. Whereas, in cost cutting sometimes the scope of the product may reduce, because we have reduced some of the functions which may have been essential, but we want to reduce the cost of the product.

So, we had no other option, but to eliminate those functions or to change the material in order to bring about a low cost substitute of our existing product. So, the scope of the product may reduce on as an after effect of the cost cutting measures.

Now, it optimizes the overall design. As I have taken an example, the overall design is challenged in case of value engineering, a overall new or modified design comes out as a part of a deliverable of a value engineering process. Whereas, in case of cost cutting our focus is on the local design, so that is one thing.

For example, again I am bringing an example of this camera. So, if we say the tripod on which the camera is mounted. So, if we want to reduce the cost of this whole assembly, we may focus only on the tripod, and try to change the material, because there is not much weight that is coming on the tripod. So, if we change the material of the tripod our focus is local design only. We are not focusing on the overall design of this camera system, and value engineering clarifies the client requirement as we have already seen our focus is more on the customer requirements, what are the functions for which the customer is buying the product.

So, our focus area is, we try to clarify the customers requirement and in case of cost cutting there is no such clarification. We try to reduce the product and try to impress upon the customer that now we are offering a similar product at a lower cost, but the product may have compromised on certain aspects which is hidden or which is not known to the customer. So, that is one thing, because it does not clarify on anything, but in case of value engineering; obviously, we will clarify, we will not compromise on any of the customer requirements, we will try to satisfy each and every customer requirement by modification in the design of the product.

V=F/C

V= value of product

F= function of product

C= Cost of product

So, to summarize this point, the value engineering approach attempts to find very important, lowest cost way to perform the desired function very important; cost and function V is equal to F by C. So, the value engineering approach attempts to find the lowest cost way to perform the desired function, rather than the lowest cost way of producing the product.

So, we can see that cost cutting is more relative to manufacturing or construction. Whereas, value engineering is more focused on the satisfying the desired function by the customer reliably at the minimum possible cost. So, therefore, value engineering challenges the very specification design requirement and the design itself. So, in value engineering we will try to focus more on the design rather than on the process by which the product is going to be made, and that is why we must apply the concept of value engineering at the very beginning of the product design process.

Now, coming on to the second aspect that we want to address today that is the concept of creative thinking. Now we know that what is value engineering? It is function based approach. So, for each function we need to find out how that function can be satisfied. Satisfied means that suppose I am using a wristwatch, the basic function of the wristwatch is to show time.

Now, how this function can be achieved? And if you see there are hundreds of very good designs of the wristwatches which are available with us, but the basic function still remains the same; that is to show time. Now that how it can be achieved, how creatively we can create, we can innovate on our design, so that the customer feels attracted, the design is functionally satisfying, aesthetically pleasing and performance wise also is satisfying the durability and dependability aspects. So, functional, operational, durability, dependability and aesthetic aspects.

So, if we are able to focus on all these four aspects, our product design will be a successful product design. So, how this all can be achieved, there we need to use our creative juices, we need to use our creativity to come up with the design which is satisfying all these important criteria and how that is possible? That is possible if we focus systematically on the problem at hand.

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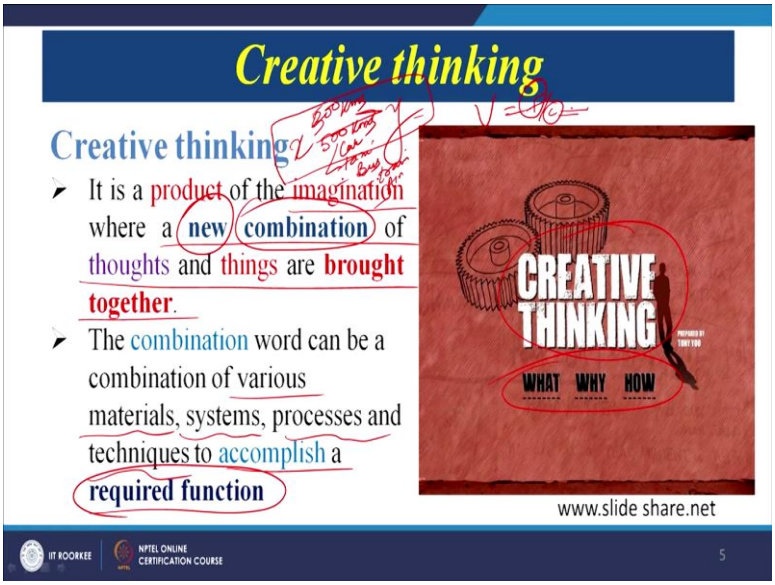

So, what is creative thinking? Creative thinking is, it is a product of the imagination. So, we have to think creatively, which means we have to imagine that how the product will look like, where a new combination of thoughts and things are brought together.

So, important point is the new combination, we have to create something out of an idea. So, we know that the watch has to show time. Now how the time can be shown to the person who is wearing the watch, there our creativity is coming into picture, whether it has to be digital, whether it has to be analog, whether the numbers have to be written or there can be diamond studded dots only. So, number of creative solutions may come to people. So, that has to be a new combination of thoughts and things that are brought together.

So, the combination word can be a combination of various materials. We can come up with various materials, systems, processes and techniques to accomplish a required function. So, why we need creativity? We need creativity to find out a way, mean mechanism of satisfying or achieving the desired function reliably.

Now, there can be five different ways of satisfying the desired function reliably, there can be 10 different ways by which the desired function can be satisfied reliably, but how to achieve those 5 or 10 different alternatives which can help us to choose the best alternative; that is what where the creativity is going to play a very dominant role.

So, normally in creative thinking what we do? We ask questions like what is to be done. Why is to be done? How we can do it? And then we can during our house stays, we are able to find out that there are n number of ways through which this function can be achieved. So, once we know that then, we will see which one is the best possible manner which is going to satisfy our requirement.

A very simple example we can take. Suppose we have to travel from point x to point y, very simple example. The distance is suppose 200 or maybe let us say 500 kilometres. Now you can see what are the alternatives possible? The distance is as clear 500 kilometres. So, somebody may say you can walk down, but then the time is a constraint. So, the normal means and mechanisms or the methods can be, you can go buy your own car, you can go buy a taxi, you can go buy a public roadways bus. If the train connections are there you can go by train, if the air connection is there you can go by plane. So, there are so many options.

Now, the function is, what is the function to move from point x to point y. Now this function has to be achieved, what are the alternatives available to us? All the alternatives are listed by own car, taxi, hired, maybe share taxi, bus, train, air all connection routes are possible. So, function has to be achieved.

Now, how we can relate the concept of value engineering here. As we know value is function by costs, so the cost component is also coming into picture, function is to travel from x to y. Now which alternative, we will choose will also depend upon the cost and there can be n number of other constraints also, the constraints can be time, availability of time, the constraint can be comfort. Suppose somebody is having a back problem, may not like to travel or by a road maybe the train is a better option in that case. So, depending upon the constraint the function has to be satisfied at a reasonable cost

So, here the modes of transport are very clearly known to all of us, but in many cases where the function will be the slightly technical in nature, in that case, this listing of the alternatives may not happen, so intuitively. So, we have to think of the alternatives and

how we will be able to achieve these alternatives through creative thinking process. So, value engineering is all about creativity. If we are able to generate n number of alternatives; obviously, we will be able to select the best alternative which will help us to design our product in a much better, as well as much you can say functionally satisfying and cost effective manner.

Now, what are the characteristics of creative people? I think I believe that everybody of us is creative in nature. Everyone has certain sense of creativity, but maybe from the theoretical point of view some important characteristics are mentioned of creative people and if we can change our attitudes and behaviour habits, and the way we think by focusing on these points; obviously, our creativity can be enhanced.

Although there are very philosophical aspects of creativity also, some people may believe that there is a group of individuals who are born creative, there can be another group of individual who become creative after acquiring a lot of knowledge.

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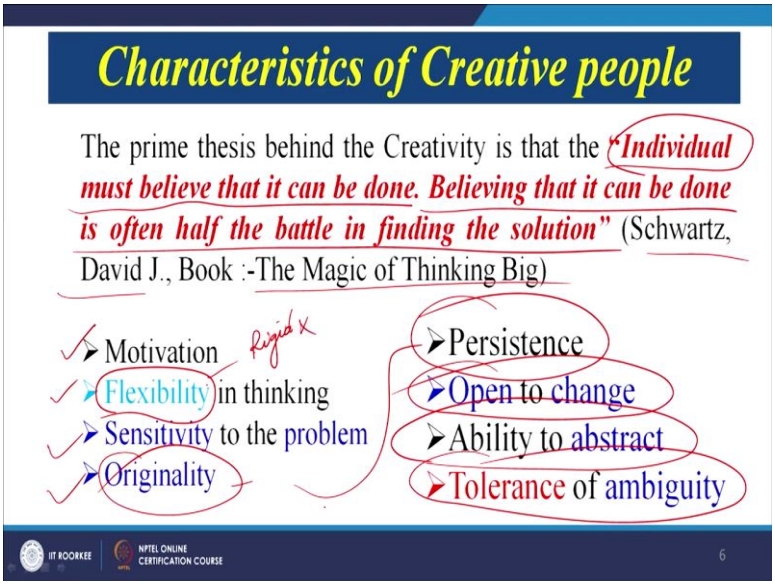

So, the prime thesis behind the creativity is that the individual must believe that it can be done. The individual must believe that it can be done, believing that it can be done is often half the battle in finding the solution. So, the line summarizes, I think the concept of creative thinking that first and foremost, we have to believe that it can be done.

So, if we believe it can be done, half the battle is already won. So, we can see this is from the book by David J; The Magic of Thinking Big. And what are the characteristics now, that is important, let us now look at the characteristics.

So, first one is motivation, we have to be highly motivated, flexibility in thinking. We should not be too rigid in thinking, if we are rigid, we have a very focused approach, we may not be able to create anything. So, we must be open to suggestions, we must be open to discussion and if we are flexible in our nature in our thought process; obviously, we can create, we can come up with creative solutions to the existing problem and in our case problems related to the product design process. We must be sensitive to the problem, we must relate ourselves to the problem; obviously, then only we will try to find out the solutions to the problem.

Originality, many a time whenever we are faced with a problem or with a theoretical problem, first thing is we try searching for what are the related problem, how we can very easily copy an existing problem just by changing or bringing about some cosmetic changes in the design or in the theory, so that our problem is solved.

So, the word originality is very important, we must start from scratch, we must not try to get some skeleton from somewhere, and then try to customize it as per our requirement. We must try to create our own skeleton based on which we will be original in our approach and our product or the design that we are creating will be a new or innovative design, rather than an incremental change in any existing design.

We must and this may not happen overnight, so we have to be persistent, continuously striving to come up with new and new ideas, new and new alternatives, as flexibility we must be open to change also. We must be receptive to new ideas, we must not be, we can say very stubborn in our approach, we must have the ability to abstract, we must try to understand the abstract approach and then try to bring it to the objectivity; then tolerance of ambiguity, so that is also very important.

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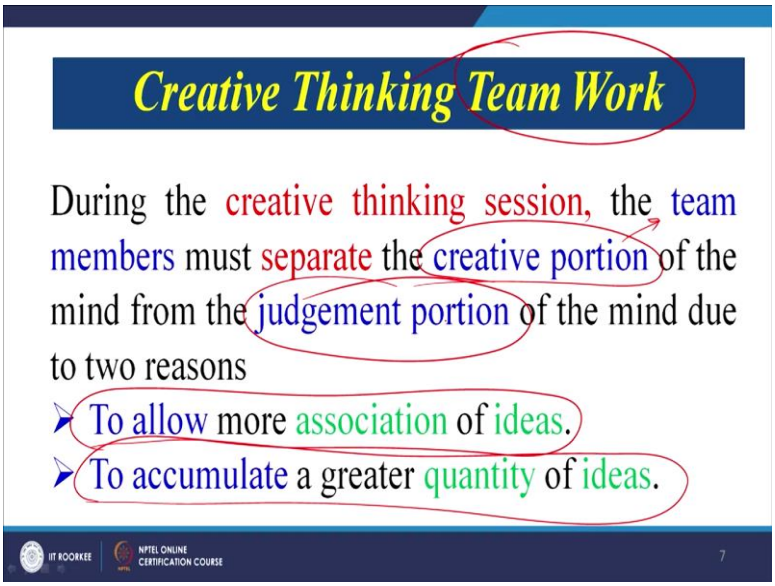

Now, creative thinking team work. So, this is another important point the teamwork, because when we are developing a product, it has to be a multi disciplinary approach, there have to be experts from different departments who will gel together to bring about a new product in the market. To name a few, we may have people from sales, marketing, then there will be a design team, people from the design, people from manufacturing, people from legal cell, people from intellectual property cell. So, there will be you can say team members from all different functions or domains or the verticals of the organization.

So, when you have people coming from different verticals of the organization the teamwork becomes the key. So, during the creative thinking session, the team members must separate the creative portion of the mind from the judgment portion. Two important point creative portion and the judgment portion, why, we must be creative, we must not be too judgmental, why? Because, if we are creative, we will be having more association with the ideas and secondly, to accumulate a great quantity of ideas.

So, if we are judgmental, suppose somebody is coming with the idea, and we start criticizing on that idea, that no this is not possible; obviously, the quantity of our ideas will be less. Now suppose we are generating 10 different ideas. We want to generate maybe 10 different ideas, and the very first idea given by person in the team is cracked down or screened down by the other person. So, we may not be able to bring into our

kitty a large number of ideas. So, therefore, we must be more focused on creativity generating n number of, large number of ideas during our teamwork, rather than being too judgmental in scrutinizing or screening the ideas. Now, suggestions to keep in mind during the creative sessions.

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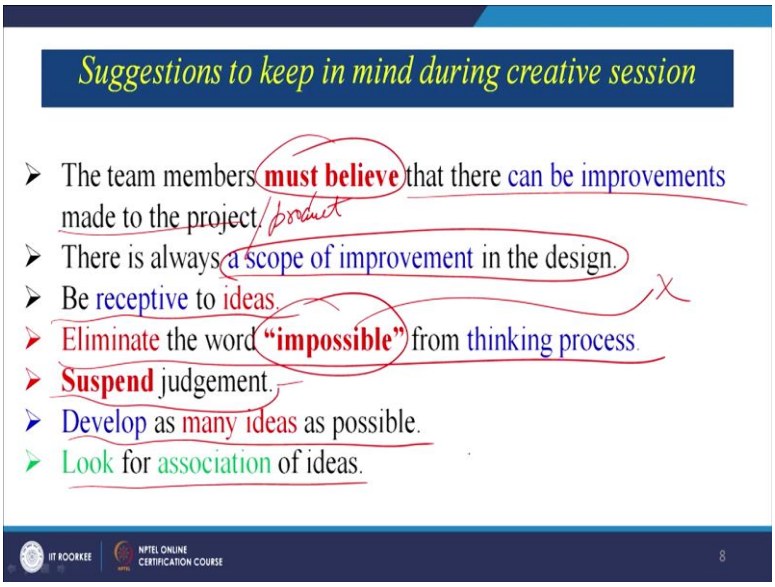

So, these are some of the points that when we are trying to create solutions for our problems, what are the things to be kept in mind? The team members must believe that there can be improvements that can be made to the project or the product. So, this is again coming back from the previous slide, we must believe, we can, and if we believe, we can certainly come up with a solution.

There is always a scope of improvement in the design. So, that we must all agree as a team that yes this design has still a scope of improvement. Sometimes, in the team there may be people who may have designed this product maybe 10 years back. So, these people also need to be taken into confidence that yes still, because of the technological advancements in terms of materials processes, maybe shapes and sizes of the products have changed over a period of time. So, there are chances of further improvising on our product design.

So, those people have to be taken into confidence and the team as a whole must agree that still there is a scope of improvement in the product design. Be receptive to ideas which has already come up in the previous slide also, eliminate the word impossible

from the thinking process. So, when we are thinking, we are creating, we are discussing, we are brainstorming, we must not encounter this word impossible and in normal discussion most of the time, we say that "impossible" also says that "I am possible".

So, we must focus on the important aspect that product design can be improved, all the team members agree it, yes it can be done they believe in their actions and therefore, must not let any negativity coming it into the discussion process. As we have seen suspend the judgment, we must not rule out any ideas during the creation phase, develop as many ideas. So, because if we will not be judgmental; obviously, we will have a long list of ideas that can be explored.

Look for association of ideas, maybe we can try to collapse certain ideas which look fairly similar type. Do not be afraid to experiment. So, we must be ready to take some risk, we must be ready to experiment, we must be able to make some calculated moves in order to be successful, encourage all team members to participate, there must not be dormant members in the team who are just there, just before the sake of being there, so each one of us must participate.

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Test your own views in form of questions. So, whatever we are proposing we must ourselves try to critically analyse through the questioning technique that whether, our idea is going to be successful or what are the lacuna or the problems or the issues or the challenges associated with the idea that I am proposing.

Help team members work through their ideas. Now a basic idea needs to be taken to its logical conclusion in the form of a tangible product. So, a person may not have the acquaintance or the knowledge or the skills to take that idea to the final stage. So, as a team we must help each other with the development of the idea into the tangible product. Record all the value engineering ideas.

So, whenever we are doing the idea generation process, we must systematically document, there are templates available in most of the reference books on value engineering, where we can systematically jot down, note down record all the ideas that are being generated during the creative sessions or the creativity sessions.

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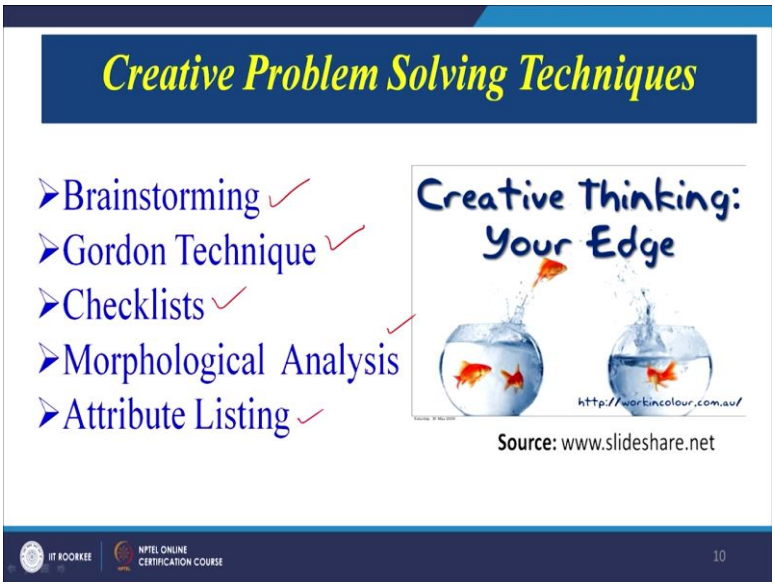

So, there are different creative problem solving techniques. We can go for Brainstorming, Gorden technique, then there are Checklists technique, Morphological analysis, Attribute listing. So, there can be different techniques that can be used for solving or for creating at least a large number of ideas. So, with this we can conclude that today's session.

We will try to see that if we can within the given time frame of 10 hours that we have dedicated for discussion on this important topic of product design using value engineering. We will try to see that if we can cover one or two techniques maybe in the next session. So, with this we come to the conclusion of today's session.

Thank you.