Product Design using Value Engineering

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Lecture - 17
Value Engineering Tools and Techniques - II

Namaskar Friends! Welcome to session 17, of our course on Product Design using Value Engineering. As you are aware that we are in the 4th week of discussion, and this is our 10 hour course of 4 week duration. So, in the last week, our target is to remember, to memorize, to maybe find out or establish some rules of thumb or maybe some rules which can remember, which we can remember throughout our lives whenever we are trying to solve any issue, problem or a challenge.

We have different types of problems all around. These problems may be related to product design, these may be related to the process that we are using, these may be related to the material that we are using or employing for developing our product. If we keep all these points, all these rules, all these guidelines, all these suggestions in mind, we will be able to come up with a better product, better process, and better material.

So, the point is that there are certain standard set of rules, standard set of tools and techniques which if we apply during the process of our product design, we will be able to come up with a product which will not only be functionally applicable, but will also be competitive from the cost point of view. And here we are trying to understand some of the techniques which can be used for value engineering purpose.

So, as you are aware in the previous session, we have seen some of the techniques. And we have tried to classify all the techniques based on the techniques which are focused on behavioral aspects of value engineering, the techniques which are applicable from the technical point of view, and the techniques which are related to the functional cost evaluation of the product.

So, here we are trying to see that what are the various techniques, and some of these techniques should always be ingrained in our thought process whenever we are trying to develop a new product. So, carrying forward the discussion of the previous session that is session number 16, we will try to understand some of the techniques because of the

time constraint, we have two sessions dedicated to value engineering tools and techniques.

In the previous session, we have seen a broad classification of the techniques given by two different books and today, we are trying to understand some of these techniques. In previous class also we have tried to understand the basic aspects of some of the techniques which are used for value engineering and analysis. So, let us quickly, run through the presentation and see some of the techniques which can help us to design products which are going to be successful in the market.

So, one of the techniques is, identify and overcome the roadblocks. So, what happens usually? There are different types of roadblocks. So, these can be technical in nature, these can behavioral in nature, these can be a resistance to change, sometimes we feel that if we change, there is a risk of losing the customer base. So, that risk of change is also one of the roadblocks.

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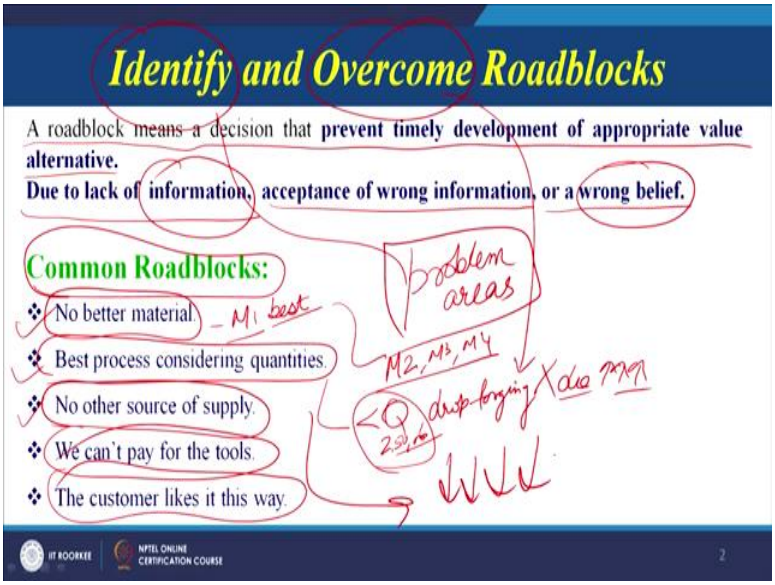

So, first and foremost what we must try to do? We must try to identify these roadblocks. And then what we have to do? We have to overcome these roadblocks, if we want to be successful. This is very true in our personal lives also. We have to identify that where we are lacking, where we are not able to do the work properly or where we are not being able to perform effectively efficiently, where our performance is lacking. First thing is

the identification. Once we are able to identify the problem areas, then, comes the problem of consolidation.

So, first thing is that identification of the problem areas, and once, we know that these are the areas then we can try it the next stage to overcome; overcome through different techniques. May be if I am not working out, I may feel that I must start working out, it will further improve my performance that is from the behavioral aspect

Similarly, some of the common roadblocks we have tried to list here which are most common in the industry. So, what do you mean by a roadblock? As I have already taken an example; a roadblock means that decision that prevent timely development of appropriate value alternative. So, there is a hindrance, there is a problem, which is not allowing the ideas to be converted into valuable products or the value enhancement of the product is not being possible, because of certain issues challenges or maybe problems which we can in totality call as the roadblocks. So, due to lack of information, acceptance of wrong information or a wrong belief.

So, you can see, the information is very important and wrong beliefs are equally important. So, we have to shed away, we have to get away from the wrong information and from the wrong beliefs. So, once, we are getting away from these wrong information and wrong belief, if you see in our previous session in our previous discussion, during the week number 3 we have taken so many case studies in which we have tried to highlight the very first step of any value engineering problem solving approach.

What we try to do? We first of all try to get all the possible and relevant information related to the problem and that information has to be correct, our source of information has to be a purely truthful source of information. So, if there is a source lack of information; obviously, we will not be able to come up with a good product. And if you remember in the previous session, we have taken a case study that current is conducted only through copper that was a designer's perspective, but a value engineer suggested why the current cannot be conducted through steel. So, the information was not correct with the designer that current can also be conducted through steel.

So, we have to focus on the right information, because wrong information and wrong beliefs may force us or may create certain roadblocks in our path of developing truly valuable products which are fully functional, and at the same time are competitive in

terms of cost. So, some of the common roadblocks that can be identifies that there is no better material available. So, whatever material, suppose M 1 we are using that is the best this is a common roadblock, there can be other material library M 2, M 3, M 4 different types of materials which may be available and may perform better as compared to material M 1 for a specific application. But normally, we have a belief that for this particular application M 1 is best.

Second is best process considering the quantities? If you remember one of the case studies we have taken that below a particular quantity we should not use drop forging operation. If you remember that case study, we should not do drop forging below a particular quantity I think that was 2,50,000. So, if the quantity is less than that we must not go for drop forging operation. Why? Because the die cost will be very high.

Similar case study, this case study we have seen in one of our previous discussions. So, that is not true because of the latest advancements, there are may be possible modifications in the drop forging process which can help us to even use this process for lesser quantities, than recommended. So, the processes can also be alternative processes.

Processes can be materials can also a better materials as compared to the current materials, then, sometimes one other roadblock and with no other source of supply. So, this is from the material procurement point of view. Many times, we stick to one vendor only because considering that there can be no other vendor who can supply as the desired quantity, desired quality of the raw material, but that is also not true it is a roadblock.

We cannot pay for the tools, is another roadblock. The customer likes it this way, this is another roadblock. So, if we keep on listing all these roadblocks, it is an endless list, and that is why we have to develop courses like product design using value engineering, that all these roadblocks can be overcome.

There is no better way of developing a product than focusing on a standard approach of product design and development without any bias, without any prejudice. Approach the problem with a completely blank attitude screen, without any prejudices in our attitude. So, if we follow that approach, we will be able to come up with products, which are really going to be innovative, creative, functional as well as cost effective.

So, the list can be endless. The summary of this point is that whatever roadblock comes to our mind in terms of application of value engineering or in terms of converting a innovative idea into the product we must find out ways to overcome that roadblock because yes, the solution is always possible.

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Then, there are standard approaches like second technique for today. Use industry specialists to extend specialized knowledge. So, we should not shy away for asking the specialized knowledge or expert advice for when we are developing our product or for our product development. So, we can say that getting an acceptable degree of value, acceptable degree of value that we want to include in our product means accomplishing functions.

So, our product must accomplish the function as well as the competition does. So, we have to see that whatever competition we have in the market, who are our competitors, what are the products they are offering, what are the functions they are providing to the customer, what is the cost they are charging. So, that is basically our target.

So, we have to get an acceptable degree of value. So, value is definitely related to function and cost. So, to get a good grade of value further specialized knowledge is required. So, there is a requirement of specialized knowledge in the concerned area; so, whatever product. Suppose, we are trying to develop a key ring or a keychain. So, whatever people or the people who have already in this field have designed maybe large

number of key chains or key rings, we must take into account their advice, wherever possible.

So, there is an example taken here; example is a general physician can give medicine to cure all types of problems or ailments. So, general physician is all right maybe at the beginning if you have a cold or a cough you can go to a general physician, and ask for a medicine. But nowadays, the word specialist has come into picture.

For every disease specialized doctors are available in the hospitals to diagnose the patients of their domain. Suppose, somebody has a toothache, he will go to a dentist. If somebody is having a vision problem he will go to an ophthalmologist. So, there are people if you have a skin issue, you will go to a dermatologist. So, you have different types of doctors, specialist for different types of problems or the health issues,

So, therefore, the point here is that in value engineering also depending upon the segment suppose you are trying to offer a service you are trying to develop a app, there also you will find the specialists who have done work in that direction, and we must not shy or we must not feel afraid or apprehensive before approaching them. We must approach the experts and take their expert opinion.

So, in case of value engineering techniques, the involvement of industry specialists is appreciable, during the brainstorming stage of creativity. We have already taken one session on creative thinking and in one of the previous sessions maybe this last week, we have taken the complete step by step procedure of brainstorming also. So, we have seen that a group of individuals sit together and follow a certain protocol to develop creative ideas. So, we must make use of these special during the brainstorming stage of our product development.

Why we should make use of the specialist? Because these industry specialists are continuously working on advancing knowledge on each technology. So, they are the people who know the latest technology or the latest technological advancements in that particular area or the area in which you want to develop your product. It can range from communication devices, to may be laptops or to other electronic gadgets like LED screens or development of a camera which is recording this session. So, we can say that there are specialists who have advanced knowledge of a particular area, and as a value engineer, we must take such specialists into our team for development of the products.

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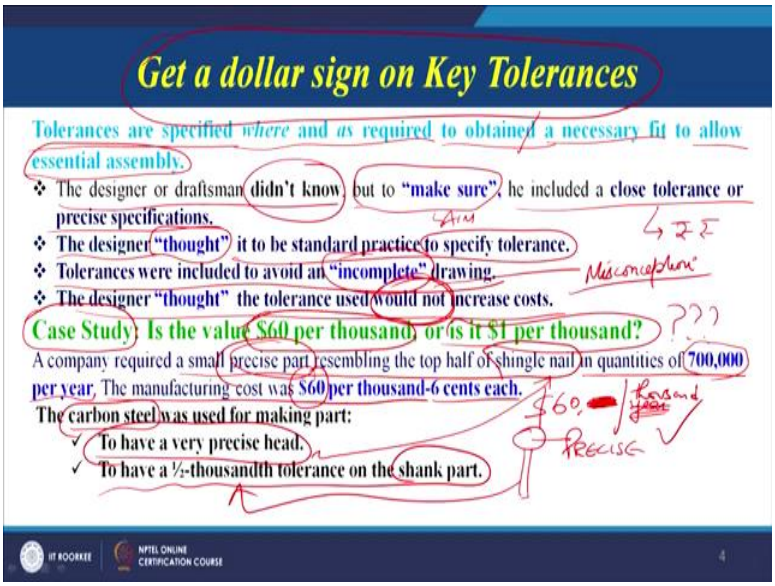

Next idea or next technique for value engineering is get a dollar sign on key tolerances. Many times, we specify tolerances or surface finish requirements just out of our interest or we can say design teaching. Whatever we have been taught; that for this product the surface finish must be very good.

Now, that very good is sometimes ambiguous. What is very good? So, something very good may be very good for me, but not very good for you. So, that very good sometimes create a kind of a confusion or ambiguity, and that sometimes or many times add cost to our component. So, wherever, there is such ambiguity we must try to eliminate that ambiguity.

How, we will be able to do that? That is mentioned on the screen. Get a dollar sign on key tolerances. So, whatever tolerance or surface finish requirements, we are specifying for our product, we must directly correlate them that how much will be the cost or what will be the cost implications of supplying or applying these tolerance is on our product. So, tolerances are specified where and as required to obtain a necessary fit to assemble to ensure the assembly.

So, all of us maybe knowing and if you are not knowing the definition for tolerances is given. Tolerances are specified where and as required, to obtain a necessary fit to allow essential assembly. So, for assembly operation when we have to assemble two parts together, we have to provide a tolerance, so that easily we can assemble them.

Now, that tolerance normally may add to the cost of the component. So, if we can see that designer or a draftsman did not know, so without knowing he included a closed tolerance or a precise specifications. Why? Only to make sure. Why did he specify that? Only to make sure. So, the target was or the aim was only to ensure that the two parts fit together.

So, he was not knowing that what kind of tolerance must be given. So, without knowledge as it was in the previous point also, the wrong information is going to be very dangerous for any value engineering endeavor. So, we have to be very informed, so that we make judicious and informed decisions when we are try developing or trying to develop our product.

So, the designer or draftsman did not know, but to make sure he included a closed tolerance or precise specification, and this close tolerance is definitely going to add a lot of value or a lot of money into the product. I must not say value, it is going to add too much of money into the cost structure of the component or the part.

The designer thought, here also the clarity is not there, he is just thinking, it to be standard practice to specify the tolerance. So, designer also thought that it is a standard practice to specify the tolerances. Tolerances were included to avoid incomplete drawing. Sometimes we add tolerances because, we are making engineering drawing and sometimes the people from the shop floor may say, the tolerances are not given. So, in order to just make the or in an order to show that this drawing is complete sometimes we specify the tolerances which otherwise may not be required.

So, the designer thought the tolerance used would not increase cost, would not. So, this is you can say misconception that if we apply or if we use the tight tolerances it will have no bearing on the cost it will not affect the cost, that is not true. So, let us see this case stud very simple case study, I will quickly read it for you. Is the value dollar 60 per thousand, this is the cost of some part which we are going to just see; is the value dollar 60 per thousand or is it dollar 1 per thousand?

So, for a particular part which in this case studies are nail should we really pay dollar 60 per thousand or the same function can be achieved by the nail at dollar 1 per thousand? So, this is a very important question as it is given here. A company required a small precise part resembling the top half of a shingle nail. So, this is a small precise part, there

is a part resembling, it resembles the top half of a single nail in quantities of 700,000 per year.

So, the quantities are also men also mentioned 700,000 per year. The manufacturing cost was dollar 60 per thousand that is 6 cents each. This is the no problem statement. The cost is dollar 60,000 per a per thousand, dollar 60,000 per thousand of this part. So, we can say and the quantities required are 700,000 per year.

Now, the carbon steel was used for making the part of the material is specified to have a very precise head. So, since it is going to look like a , so the nail has a head and a shank portion, and to have a half of thousandth tolerance on the shank part. So, there are two parts one is the head part, another one is the shank part. So, head part has to be very precise and a shank also a very tight tolerance to have half thousandth tolerance on the shank part.

So, this is the overall summary of the case study. 7,00,000 parts per year required, dollar 60,000 per thousand parts is the cost. So, we have to see dollar 60 not dollar 60,000, dollar 60 per thousand sorry this is not correct. The cost is dollar 60, dollar 60 per thousand it is correct now, dollar 60 per thousand. But this function can be achieved by dollar 1 per thousand also which is written though, this can be done dollar 1 per thousand of this part.

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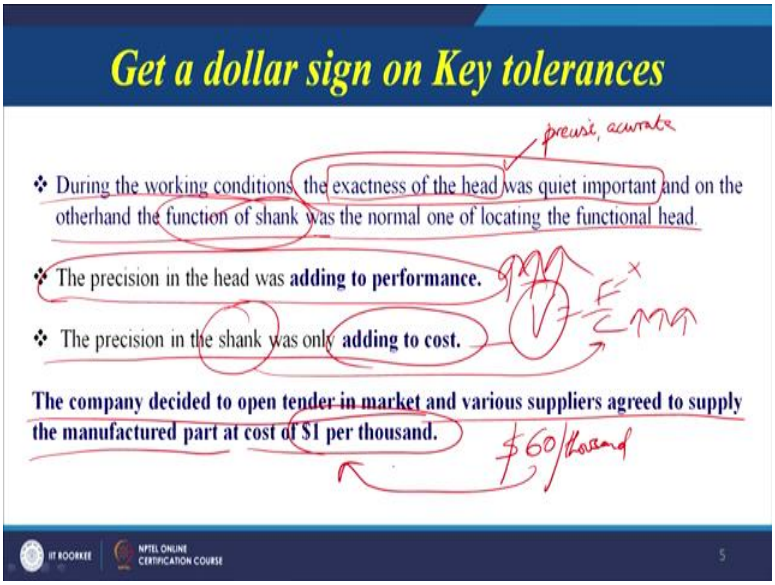

Value= Function/Cost

So, I think the problem is clear now. Now, once the value engineers attack this problem. During the working conditions the exactness of the head was quite important. So, when this part is going to be used exactness of the head, that is precision of the head, accuracy of the head is very important. And on the other hand function of the shank, the other part shank was normal one of locating the functional head which means the head portion, is required to be very precise it is required to be accurate, and with probable good tolerances. Whereas, the shank part is not all that important because its function is just to support the head or locating the functional head.

So, the precision in the head was adding to the performance means adding to the value, the precision in the shank was only, adding to the cost. So, a V, value is equal to function by cost. So, the shank whatever precision, we are providing on the shank is increasing the cost only, and is not adding anything to the function which means the value is decreasing because of providing tight tolerances on the shank part. But on the head part, yes, we really require to have a tight tolerance, because we are really bothered about the exactness of the head.

So, the company decided to open tender in market, and various suppliers agreed to supply the manufactured part at dollar 1 per thousand. So, we can see from dollar 60 per thousand parts, the cost reduced to dollar 1 per thousand parts, only by the change in the tolerance values that we were giving on the head, and on the shank. So, we can see that whatever quality characteristic, whatever we can say tolerance that we are giving on the part we must be very careful that it is definitely going to add some cost to our product. So, we must be very judicious in the quality characteristics that we are imposing on our product.

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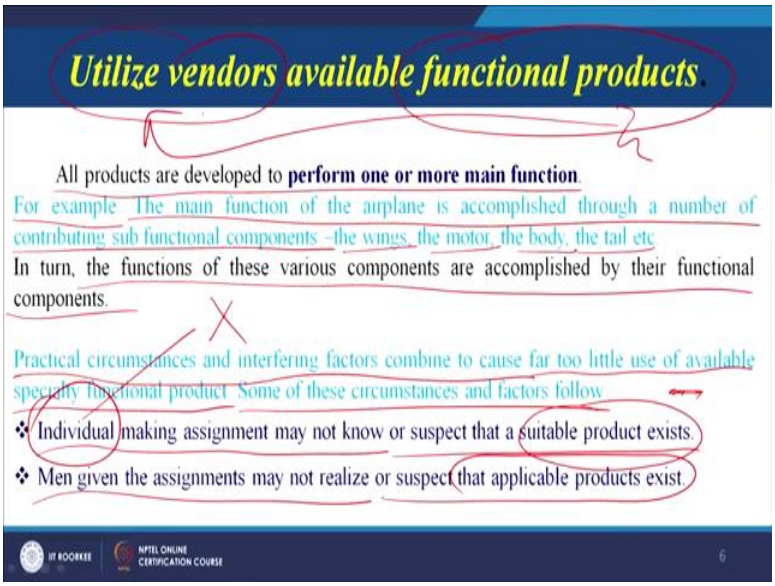

Now, utilize vendors available functional products. So, from our vendors some of the functional products may be available. So, we must make use of these, we must take advantage of the functional products which can be supplied by our vendors. So, all products are developed to perform one or the more main function.

For example, the main function of the airplane is accomplished through a number of contributing sub-functional components, the wings, the motor, the body, the tail extra. So, what do we mean to say; that a bigger component, a bigger part, for example, the camera which is recording this session so many sub parts are or sub assemblies are there.

So, the main function of the airplane is accomplished by the components or sub components or the sub-assemblies. In turn, the functions of these components are accomplished by their functional component. So, we can say block by block by block by a block we make a big product, and each and every block is satisfying one or the other functional requirements. So, that is the basic summary.

So, we can say that it is not our responsibility that we will develop each block ourselves. So, this means that wherever vendors have certain functional products which must make advantage or take advantage of these vendors. So, practical circumstances and interfering factors combine to cause far too little use of available specialty functional products. Some of these circumstances and factors are follow.

So, sometimes we are not able to take advantage of this. So, individual making assignment may not know or suspect that a suitable product will exists. So, the individual or the person is not aware that there is a suitable product that is existing which can solve our problem. So, that again, this is lack of information.

So, as I have already told that whenever we are attacking any problem or any product from the value engineering perspective, the most important thing is information. Here also the individual making assignment may not know or suspect that a suitable product exists. Men given the assignment may not realize or suspect that applicable product exists. So, a group of men or a team also sometimes may be unaware or ignorant of the existence of the functional products which easily can be bought from our vendors.

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So, we can also see that these are some of the roadblocks here, why we are not able to utilize the vendors functional products. Do-it-ourselves forces are strong, do-it-ourselves and in almost every phase of human activity. Most of the time we say yes, our company can do this why not to make it ourselves, why should we buy it from a vendor, who will ensure the quality of the vendors, product. So, so many issues are there.

So, do it ourselves forces also sometimes restrict, our thinking or restrict our openness to accept the vendors products. The boss assigned the work to me, he expects me to do it. So, maybe a behavioral aspect, the boss has assigned over to you, you have to do it and you may not explore the alternatives that such a product is already existing.

A normal human characteristics is the tendency to place too much confidence in what we, and too little confidence in what is done by others. So, sometimes we have that behavioral mindset that whatever, our company will do that will be the best, we cannot depend too much on other companies or we have an element of doubt regarding the performance or parts or components manufactured by the other companies, but that is not true. In today's scenario, there are common standard quality characteristics, quality tests which can be used to ensure the quality of the parts being supplied by the vendors.

The above mentioned myths, so we have seen, so many myths are there are going to increase the manufacturing cost of the product. So, if we are not going to make use of the functional products whichever vendors can supply; once we start or take a decision to do it ourselves the cost may be higher. Why?

Because our vendors may have optimized all the processes, optimized the material usage, optimized the manpower allocation. So, whatever they are making they may have already optimized everything, and we may take a while to get to that level of optimization. So, in the beginning and I am assured that our part or component that we decide to make ourselves is going to be costlier than what we can buy from a specialized vendor.

So, because the sub-functional part of a component can easily be outsourced from the experienced vendors, again you see experienced people who have already optimized at minimum cost instead of starting the separate assembly lines to manufacture each sub part of the product ourselves. So, we should make advantage of what the others have already established, what the others are already producing with high quality at minimum cost. So, we must make advantage of the functional products which can be delivered to us at our doorsteps by the vendors.

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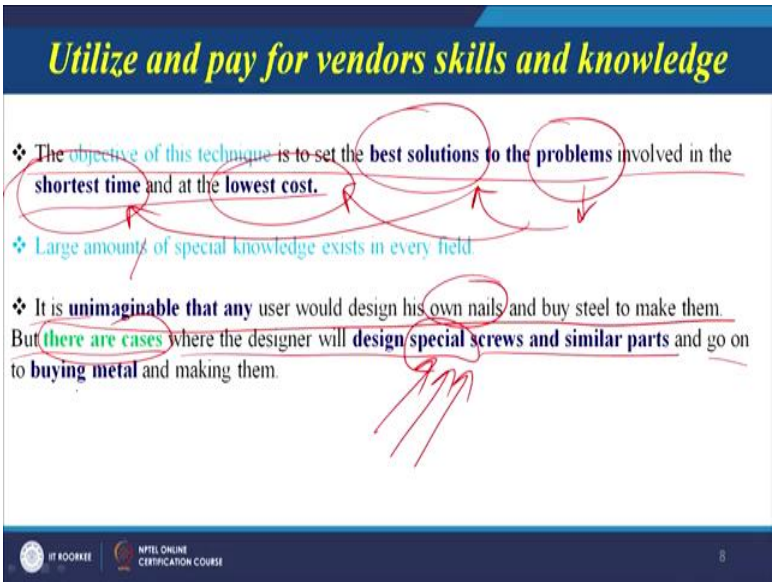

Then, the next point is important, utilize and pay for the vendors skills and knowledge. So, there is lot of knowledge existing all around us, and as we have already seen that we must take consultants who have the specialized knowledge. So, here also we must utilize and pay for vendors the skill and knowledge.

The objective of this technique is to set, the best solutions to the problems involved in the shortest time and lowest cost. So, best solutions in shortest time and at lowest cost. To what? To the problems. So, we have problems at hand, we must try to provide the best solutions, in shortest time and in lowest cost. Large amount of special knowledge exists in every field. So, there are vendors as it is, I think, carry forward of our previous point. So, wherever vendors are available they are experts in their domain, we must make advantage of their expertise.

It is unimaginable that any user would design his own nails and buy steel to make them. So, already when people have optimized everything, they are manufacturing nails and are making in mass production, why should for a smaller quantity, we must design our own nails, and buy steel, and then start manufacturing. We should buy the nails as are available or standard parts as are available from the market.

But there are cases, that is agreed; there may be cases, where a designer will design special wherever some special requirements are there, we made design special screws and similar part and go on to buying a metal and making them. In very rare of rarest

cases we must try to develop our own part because of some specialized requirement, otherwise all standard tools equipment, we must use, when we are designing our product.

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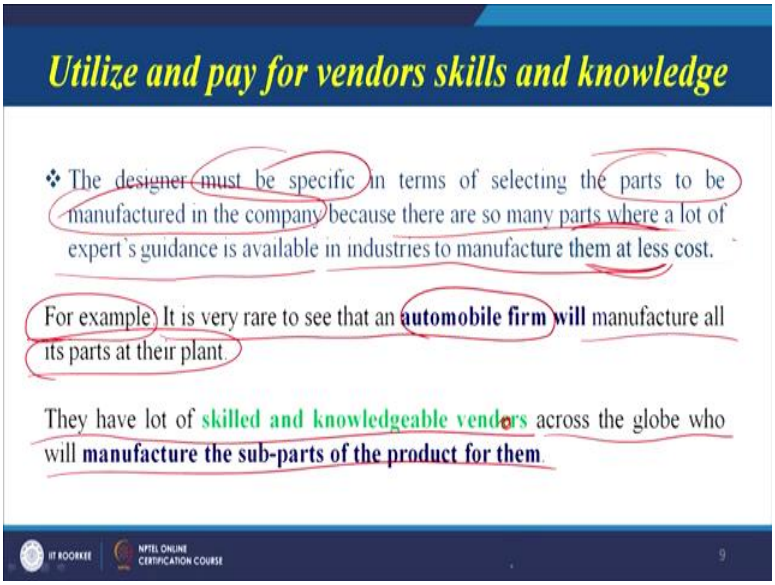

Utilize and pay for vendor skill and knowledge, this is again in continuation to our previous point only. The designer must be specific in terms of selecting the parts to be manufactured in the company. So, that is very important must be specific, regarding what? Parts to be manufactured in the company because there are so many parts where a lot of expert's guidance is available in industries to manufacture them at less cost.

So, whenever, the designer is specifying that we have to make this part in our premises only, we must look for vendors who have already specialized in that particular part and who are manufacturing it at a lower cost. So, we must take that cost advantage which has been established by the vendor.

For example, this is a very good example. It is very rare to see that an automobile firm, automobile company will manufacture all its part at their plant. So, you will see different you can take an example of different manufacturing companies or a automobile manufacturing company, there are many big giants even in India who are manufacturing automobiles starting from cars to trucks. So, they may not be making each and every part of the truck or a car by themselves, but what they are doing.

They have lot of skilled and knowledgeable vendors, across the globe who will manufacture the sub parts of the product for them. So, they also have their sister concerns or ancillary units or OEM, through which they will buy the parts, and then they will use these parts to assemble the automobile.

So, that is a very important point that as a value engineer as, one of the techniques we must always remember that we must not try to emphasize too much on parts where already people have expertise, because we can buy that part why to reinvent the wheel. So, when existing part already people have the expertise, they can make it at low cost and it is satisfying our functional requirements, we must go get the part from the vendors.

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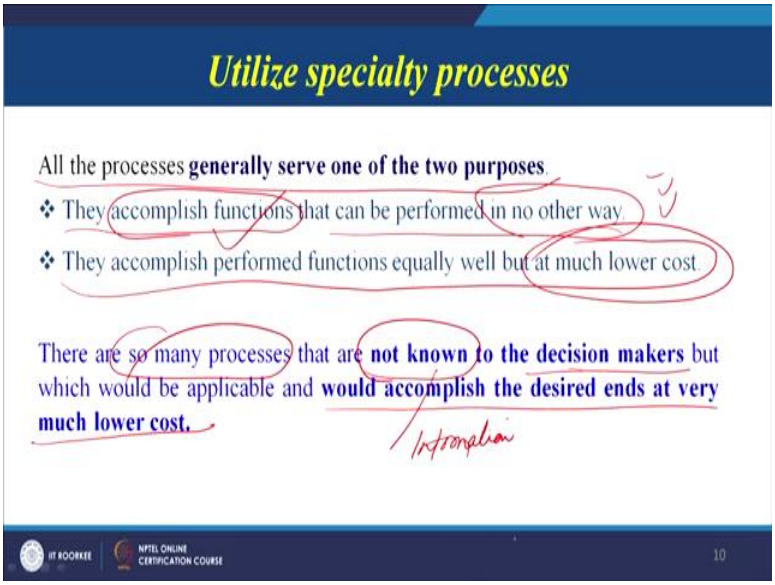

Utilized specialty processes; so very quickly I think time is already over. So, quickly we will go through the last two points. So, all the processes generally serve two purposes. They accomplish the functions that can be performed in no other way. So, each process will help you to develop something which is not possible by any other way. They accomplished performed function equally well at a much lower cost. So, you can see that for processes also accomplishing the functions and a lower cost is equally important.

So, there are so many processes that are not known to the decision makers. So, again not known means, lack of information. So, information is the key word when we are doing value engineering. So, there are so many processes that are not known to the decision

makers, but which would be applicable and would accomplish the desired ends at much lower cost. So, since the information is not there, we are following the processes which are costlier. So, similarly for processes also, they are each and every process will satisfy a particular function, and maybe we will try to accomplish the function or try to accomplish the function at the lower cost. So, what let us take an example.

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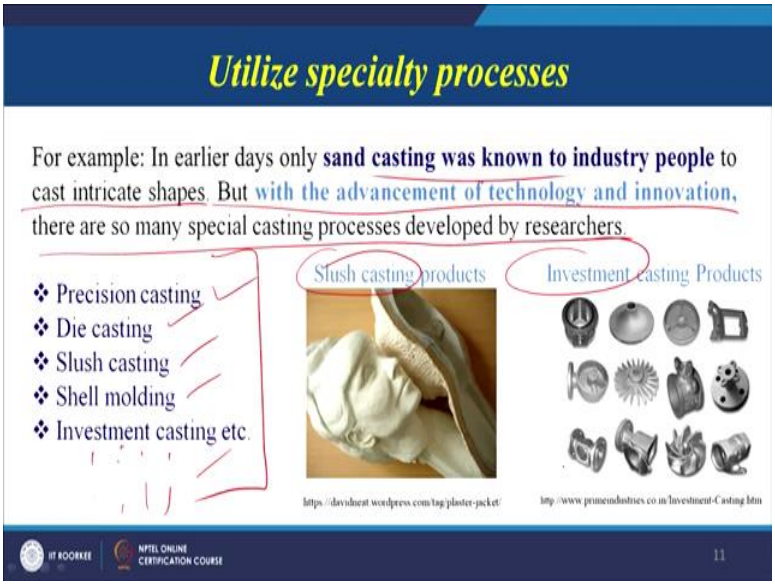

For example, in earlier days only sand casting was known to the industry people to cast the intricate shapes. But with, the advancement of technology and innovation there are so many special casting processes developed by researchers. Like precision casting, die casting, slush casting, shell molding casting, investment casting, so many casting process and even this list is endless there can be other casting processes also.

So, we can say these are some examples of slush casting, investment casting, we can see so many intricate parts or complex parts can be made by these processes. But due to lack of information, we only know that casting can be done in sand mold only. So, just that is restricting our innovation and creativity. So, if we know regarding the advanced casting processes also, we can definitely come up with better products, intricate products, complex products, products with very good surface finish. So, we must make use of the specialty processes wherever possible.

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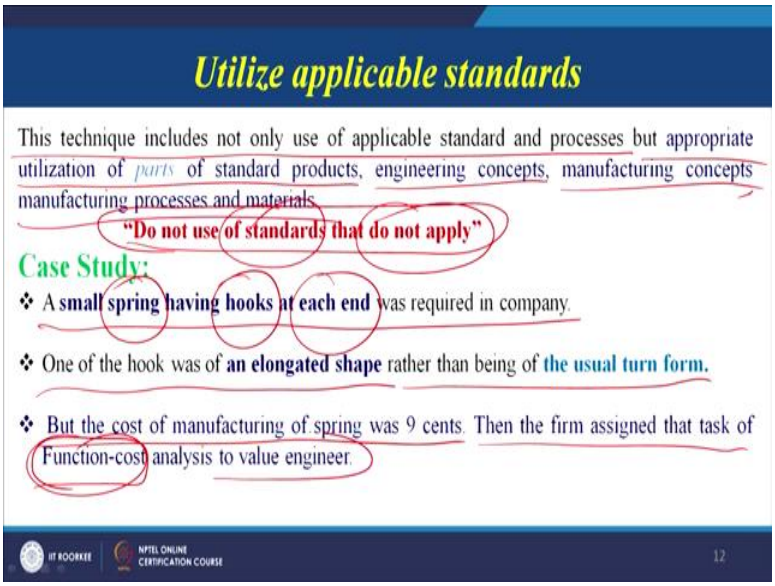

Then very important point that is utilize the applicable standards, wherever possible. So, this technique includes not only, use of applicable standards and processes, but appropriate utilization of parts of standard products, engineering concepts, manufacturing concepts, manufacturing processes and materials.

So, wherever some like manufacturing processes, there are standard manufacturing processes for making specific tools or specific parts. So, we must make use of those standards wherever possible. There are standard material steel has got so many grades. So, we must select the appropriate grade, for example, of food grade steel. So, we must know that for food grade making a tank where we want to store our food grains what is the grade of steel that we must use.

So, accordingly, if we want to use steel for making our stainless steel plates we must know that what is the standard steel grade that must be used for making utensils or plates that can be used in kitchen or for mess for where children can have their food. So, that is an important point. So, materials, processes, whatever standard guidelines of designs are there we must follow those guidelines. So, do not use of standards, that do not apply. So, we should not use standards which do not apply. So, whatever standards are applicable we must follow those standards.

So, let us say a quick case study. A small spring having hooks at each end was required in company. So, you can see it is a spring, it must have hooks at each end. One of the

hook was an elongated shape rather than being the usual turn form. So, we will see with the help of a diagram in the next slide. But the cost of manufacturing of a spring was 9 cents, so this spring was 9 cents. Then the form assigned that task or function cost analysis which we have already seen to a value engineer.

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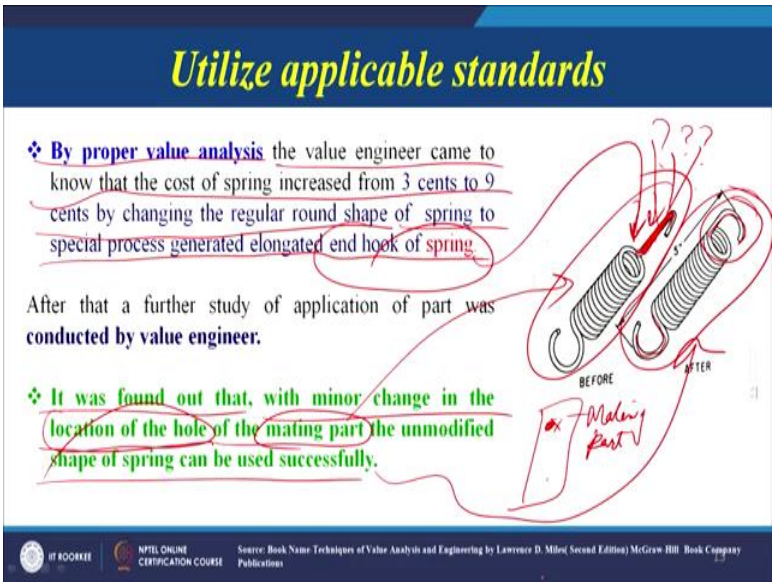

So, we can see the diagram I think, it will make it more clear. So, this is one spring, this is a standard spring. So, here we can see this is the elongated part which is a specialized requirement otherwise, there is a standard part, this is a standard spring. By proper value analysis, the value engineer came to know that the cost of spring increase from 3 cents to 9 cents by changing the regular round shape. This is a regular round shape of spring to a special purpose generated, elongated and hook of special process generated elongated. So, This is process generated, elongated, hook of spring. So, this is the end of spring specially required. After that a further study of application of part was conducted by the value engineer.

Now, as a value engineer, we would definitely like to question, what is the requirement of this elongated part It was found out that with minor change in the location of the hole of the mating part. So, wherever this spring has to be used, so there may be a mating part where there may be two holes, so the location of the hole. So, if we change the location of the hole, the unmodified shape of spring can be used successfully which means this spring can also be used if we change the location of the hole slightly in them, suppose

this is the mating part where this spring has to be attached. So, just by changing a little modification in the mating part, we were able to save 6 cents per spring. So, this is the way where we can see that whatever standards are there, this is a standard spring, this is a specialized spring. So, if there is no specialized requirement, we must follow the standards wherever possible. And this is the last slide for today, I think the lecture has been a longer one than expected.

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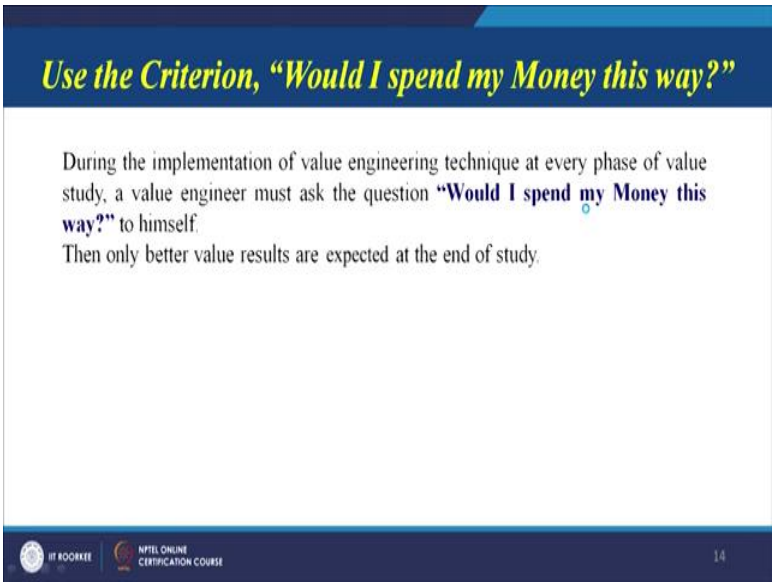

So, use the criterion. Would I spend my money this way? Very important point. And in the yesterday's session that is session number 16, also I emphasized on this point that would I spend my money this way. So, if we start spending the company's money as we would spend our own money, we would definitely save lot of money or lot of cost for our company. So, during the implementation of value engineering technique at every phase of value study, the value engineer must ask the question, would I spend my money this way to himself, then only better value results are expected at the end of the study.

So, therefore, we must follow a simple principle that we would, we must try to solve the problem as we would like to solve it for us. We must try to spend the company's money as we would like to spend our own money. So, if we start spending the company's money as if it is going from my own pocket, definitely, we will come up with solutions which will be better than the existing solutions that are being followed. So, with this we

come to the end of session number 17. We will carry forward our discussion related to some more case studies which hamper the application of value engineering in industry.

Thank you.