

Product Design using Value Engineering
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Lecture - 08
Type of Product Functions

Namaskar Friends! Welcome to session 8 of our course on Product Design Using Value Engineering. So, the last seven sessions, we have focused on the product development process. We have seen the various phases, stages of the product design process and then we shifted our attention towards the second aspect of this course, that is value engineering and in the previous sessions already we know; what is value engineering. We have seen the definitions of value engineering, and we have also tried to understand, the purpose of creativity in value engineering.

We have also tried to understand the value engineering job plan, that how we should go about solving the problem, using the value engineering or analysis. And as far as I remember, I have tried to explain the difference between the terms value engineering and value analysis, also. So, in today's session our target will be to focus on the word functions. If you remember in the previous sessions, we have already covered that value is a ratio of function to cost.

So, we need to understand the word function, because cost all of us know that whatever product we are using would have costed us something. We may have paid some price to acquire that product for example, I am using this coat; I have spent some money to buy this coat. We are using a camera to record this session, which means, the institute has spent some money to buy this camera or to create this facility, where a good quality session recording can be done.

So, the money that we are spending all of us know about it, but what function the camera is solving for us or what function the camera is achieving for us; that is something we need to understand. Also the coat, what is the function of this coat? Why this coat has been bought? I could have simply come here and recorded the session in the shirt also, but the coat maybe in the weather today, some amount of chill is there.

So, in order to protect from that cold environment a coat is protecting the body that is one thing, that is a function of the coat and second function can be that it is giving an esteem value, because we consider it as an official dress. So, both, it is satisfying some functional requirement of protecting the body from cold, also it is giving some esteem value related to the appearance, that it is giving to my personality.

So, therefore, whatever product we have, will have a combination of different functions, some of the functions may be the use functions that is protecting from cold and some of them can be the esteem functions related to the appearance. Now, esteem can also be related to the brand value sometimes.

So, if I am able to put a maybe a logo or a brooch here, showing you the company of this coat, the company which has manufactured this coat and that company is known for a well known company; obviously, it will add some esteem value to this product; that is a coat.

So, that is the basic concept that whenever, we talk about a product, we have to see that what is the right combination of the use and esteem functions in the product that the customer will feel happy about or the customer will be willing to pay, because the companies are making different types of products, which are to be bought by the customers or which is the requirement of the customer.

So, being or looking at the competition in the market each and every organization, each and every company wants that the customer must procure or buy or purchase their product only. So, if their product has a right combination of use and esteem value, use and esteem function; obviously, the customer would like to buy that product. So, in today's session, we will try to understand the different types of functions that a product can have, but before going to that let us now, understand the basic definition of a function. So, value engineering as is our topic, our main topic for this course is value engineering.

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Function

- Value engineering defines **Function** as that which makes a product work or sell. *Watch = See time*
- **Function** is certainly the end result or action desired by customer.
- Customer wants a **function** to be achieved reliably, efficiently and effectively by product or service.

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So, the value engineering defines function as that; it is that thing, which makes our product work or sell. So, we are buying different product. Suppose for example, I have bought this watch. So, what is the functions which makes a product work or sell? Why this watch has been bought by me? Why this has been sold; because I have bought it why I have bought it to satisfy the function.

So, the function is what, for which makes a product work or sell. So, we can see for my watch or the wristwatch, I may have bought it to see the time that is the basic function of the watch to show the time. I have bought it to see time, the basic purpose of the watch is to show time. So, function is certainly the end result or action desired by the customer.

So, action desired by the customer, as I am a customer of this wristwatch; what is the desired action from me, from this watch or what is the desired function? Desired function is that it must show the time accurately, a reliably without any failure. So, the action desired by the customer is basically, another definition of the function.

So, customer wants a function to be achieved as I have told you, I want from my watch that it must be able to show me the time reliably, efficiently and effectively. So, that is basic function or that is what the customer normally wants. So, a customer wants a function to be achieved reliably, efficiently and effectively so, from the product or the service.

For example, if I book online cab, what is my requirement? What is the function? The function may be to travel from one place to another place. So, the function the service provider is providing to me, it must be reliable. I have booked that cab, if the company says, the cab will arrive in seven minutes; it must come before seven minutes. It must be efficient, the time required for moving from one place to another place, the destination if the traffic is normal efficiently, I must reach there, and it must also be effective that it must also take the shortest route to reach there.

So, that minimum time, minimum energy is expended in moving from one place to another place. So, if a customer is looking for a product or a service he or she would definitely like to have that product or service that is most reliable, effective, efficient, productive, good performance and maybe there can be a number of other parameters also. So, if we have understood the basic meaning of the function then we can try to understand that what are the various types of functions? So, function essentially is a reason for which a person buys a product.

And you can now take examples of the products around you. All of you may be listening to this session on your desktop or a laptop or on your mobile phone, very simple question you can answer, why you are having that product? What is the function of that product on which you are listening to this session? So, there must be certain solid reason, certain logical reason for you to possess that product, and that is the basic function of that product.

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Function

Questions helps to achieve a function:

- What is the **purpose** of the product? ✓
- What does it **cost**? ✓
- What is its **worth**? ✓
- What **alternative** would do the **same job**? ✓
- Is it **exactly** what it does for the customer? ✓

Handwritten notes:
- A red circle around the word "Function" in the title.
- A red circle around the word "Function" in the list item "What alternative would do the same job?".
- A red circle around the word "Function" in the list item "Is it exactly what it does for the customer?".
- A red circle around the word "Function" in the list item "What alternative would do the same job?".
- A red circle around the word "Function" in the list item "Is it exactly what it does for the customer?".
- A red circle around the word "Function" in the list item "What alternative would do the same job?".
- A red circle around the word "Function" in the list item "Is it exactly what it does for the customer?".

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Now, the questions that help us to achieve a function or to understand, I must say achieve can have a synonym here, which understand the function of a product. Now, what is the purpose of the product that is going to help us to understand that what is the function? Why the product has been bought? What does it cost? So, that will have us a relationship between the purpose and the cost. What is its worth? That is another thing.

We must also look into that I am buying a product for satisfying some function; is it worth to have that product for example, I have taken an example of a wristwatch now if I want just to see the time I may not like to wear a wristwatch I can see the time from my mobile phone also. So, is it really worthy or is it worth taking decision that I must buy a wristwatch. So, that is the question that we have to answer related to the function, because the function of a wristwatch is to show time.

So, is it worth then what alternative would do the same job. I have already taken an example, I can see the time from a wall clock also, I can ask a time from my friend also, I can see the time in my mobile phone also, I can calculate the time using certain heuristic measures by maybe just taking estimate from the shadows of the trees. So, there can be n number of alternatives which can satisfy my function of knowing about the time at a particular duration of the day.

So, what alternative would do the same job and is it exactly what it does for the customer. So, these are the questions that will help us to understand the function of our

product. So, that is very important, if we know the function of the product; obviously, then the creativity will come into picture. We would like to create, we would like to innovate, and we will like to find out n number of ideas which can satisfy the same function.

So, the customer has a requirement, a customer has a need, the customer wants a product to satisfy some of his functions or some of his requirements and those requirements must be satisfied reliably, efficiently and effectively and once we know the function, customer is looking at, we are a part of our job is done, because once we know the requirement, we have our creative team, which can help us to satisfy that function in the most simplistic manner. Now, normally I have told that we have to identify the function.

Now, once we start defining the function, what is actually required out of the product, the problem is that, we may write paragraphs, we may write a lot of pages related to the function of the product, but that is not going to help us and it will going to lead to a lot of ambiguity in satisfying those functions. In order to overcome that ambiguity, we have to define the function or identify the function of a product in the most simplistic manners, in the brief manners and for that in the concept of value engineering. Normally, we define the function with the help of two words only and the two words are given on your screen.

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Function

- Project or product is **evaluated** by **identifying the function** in two words:-
Verb and Noun *V or N* *paragraphs* *function*
- **Verb:-** Describes the **specific action** to achieve **intended purpose**
- **Noun:-** Defines the **object** onto which the **action operates**
- **Example:-** An electrical cable has function of **Conducting Current**
Conduct:- verb *Current:- noun* *of wire cable = Conduct Current*

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You can see the project or the product is evaluated by identifying the function. So, we will evaluate a product, based on its function. So, we will try to identify the function, but we will try to identify it in two words only. So, we are not going to write paragraphs or sentences to identify the function. No, this is not required. What we will do? We will use only two words, we will use a verb and a noun combination to identify the function of the product.

Now, suppose in your room you are sitting, you can see around, you look around and try to identify some products, and try to write the definition or the identification of the function for which that product is being used. For example, if we can talk off this recording studio, we can see that there is a lighting arrangement.

So, if I say a light or light source, what is the function of this? We can say illuminate room, two words only, illuminate room. There is a wall clock in this room so, we can say what is the purpose of the wall clock? We can say only in two words, show time. So, similarly maybe if we say there is an air conditioner in this room so, what is the purpose of the air conditioner? Again with a verb and a noun definition we must be able to represent, to identify the function of the air conditioner as you can think over it that what can be the purpose of the air conditioner. If there is a fan, we can say the function is to circulate air.

So, there can be n number of products around you, which you can try to identify the function using two types of words only that is the verb and the noun. So, what is verb? The verb describes the specific action to achieve the intended purpose and what is noun? It defines the object on to which the action operates.

So, these are very generic definitions of the verb and noun, but you can see and understand that with the help of an example, an electrical cable has a function of conducting the current. So, we have electric wire which is being used for conducting the current. So, if we say what is the function of wire or cable? It is to conduct current. Now, what is conduct? You can see here, it is verb. What is current? It is noun.

So, conduct is verb, current is noun. Similarly, identify the function of a fan, circulate air. So, circulate is verb, air is noun. What is the purpose of a function of a shaft; to transmit torque. Now, transmit is what? It is verb and torque is noun. So, you can

identify the functions. Now, some of you may be wondering, why we need to identify the function only in two words.

So, I have already explained, that we must be very brief and precise in identifying the function, because if we start writing sentences related to the functional requirement of the product, we may not focus on the design which will satisfy the intended function. We may get confused with the design that we must do in order to satisfy the functional requirement of the product. So, therefore, once we are very crisp, show time. If we talk about a wall clock, basic function we have identified a show time, now that is the basic.

Now, you can think, you can imagine, you can find out ways through which you can satisfy this function. Sometimes the clock may not at all be required; you may be able to satisfy this function of showing the time without even using a wall clock. You will have to take your creativity, ingenuity to that level where you come up with a solution that without even using a wall clock, you are able to show the time to all the people sitting in the room.

You can just blast your imagination and try to find out a solution to, solution to what? Solution to the basic function of a wall clock that is in two words verb and noun and that is, show time. So, once we are able to identify the function in two words, we can think maybe from different perspectives of identifying these or off satisfying a function, which is being represented by these two words, that is show time.

This is just an example; you should look around you, you can have hundreds of different products and for each product you can write or identify the function using a verb and a noun and then just focus on those two words and try to look out for, try to create, try to innovate solutions, which can satisfy those two words, because those two words are representing the function for which the person or a customer is going to buy the product or the product is going to satisfy the needs and requirements of the customer. So, that is the basic definition of the word function and we identify the function as a verb and a noun.

Now, there can be different types of function. So, two things by now, we have covered, today. First is the basic definition of a function, the purpose for which the customer is going to buy the product and the second is that we identify the function of a product as a verb and a noun combination.

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The slide features a blue header with the title "Types of functions" in yellow. Below the header, the text "Functions may be defined as the purpose for which the product is made" is shown, with "designed" written in red above "made". A red circle highlights the section "Types of functions:" which is followed by a bulleted list: "❖ Primary Function", "❖ Secondary Function", and "❖ Tertiary Function". The slide footer includes the IIT ROORKEE logo, the text "NPTEL ONLINE CERTIFICATION COURSE", and the number "5".

Now, the third thing is the types of function. So, functions may be defined as the purpose for which the product is made or product is designed, that is the first thing and there are different types of functions. What are the types of functions? Primary functions; we will try to understand it with the help of examples, secondary functions and tertiary functions. So, these are three types of functions which a product normally will have.

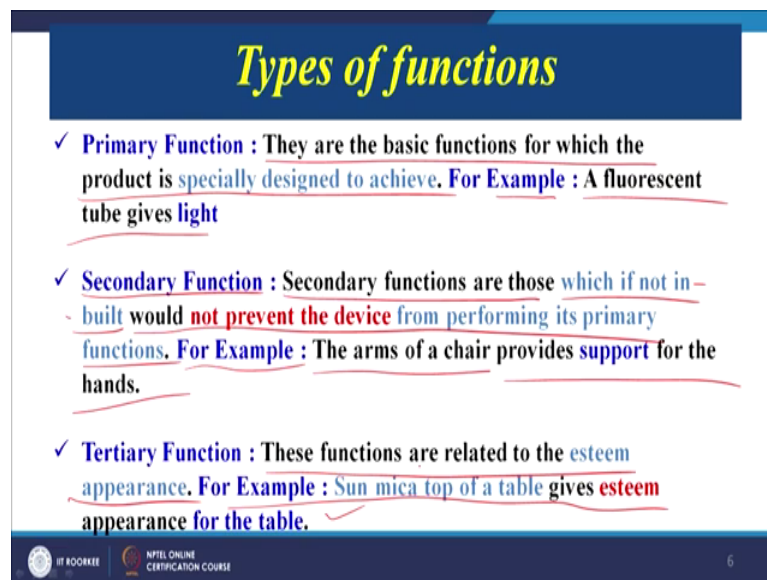
Now, suppose before going into the explanation, if I can give you an exercise that, to take out your mobile phone and try to note down what are the basic functions of the mobile phone? What are the secondary functions of the mobile phone? What are the tertiary functions of the mobile phone, I think 90 percent of the learners will be able to answer this query, for answer this question correctly, because you know that from the word primary, why have you bought this mobile phone.

So, the primary function may remain same, but in today's contest the things may change, because some of the mobile phones have a very distinctively precise and distinctively good quality camera. So, somebody may have selected that phone not only for making the calls, which may be the basic purpose or primary function of a mobile phone, but may have bought it, because of the camera, that making call is now, common for all the mobile phone.

It has to be satisfied, but he or she may have focused on one important aspect that is the camera quality of the mobile phone, but in general if you start working for the majority

of the people, you will be very easily able to identify, what is the primary function of a mobile phone. What is a secondary function of a mobile phone? What is the tertiary function of the mobile phone, but let us try to first understand the definition of these three then, we will take an example.

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Types of functions

- ✓ **Primary Function** : They are the basic functions for which the product is specially designed to achieve. For Example : A fluorescent tube gives light
- ✓ **Secondary Function** : Secondary functions are those which if not in-built would not prevent the device from performing its primary functions. For Example : The arms of a chair provides support for the hands.
- ✓ **Tertiary Function** : These functions are related to the esteem appearance. For Example : Sun mica top of a table gives esteem appearance for the table.

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Now, what is the primary function? Now, they are the basic functions for which the product is specially designed to achieve. Now, the product is designed to achieve the primary function only. What is the example, fluorescent tube gives light. So, if we are using a tubes here or light sources here. Their primary function is to produce light illuminate room, produce light, two words only verb and a noun.

So, that is the basic function for which these lights have been installed in this studio. What is the secondary function? Secondary functions are those which if not in built that they may not be, they may be present in the product, may not be present in the product. So, secondary functions are those which if not inbuilt, would not prevent the device from performing its primary function.

So, now, suppose there can be a secondary function of these light sources or the fluorescent lights that we use, but even if the secondary functions are not there, still it will perform its basic function for example, the camera which is recording this session, it is stationed, secured on top of a tripod. Now, what is the basic function of this camera?

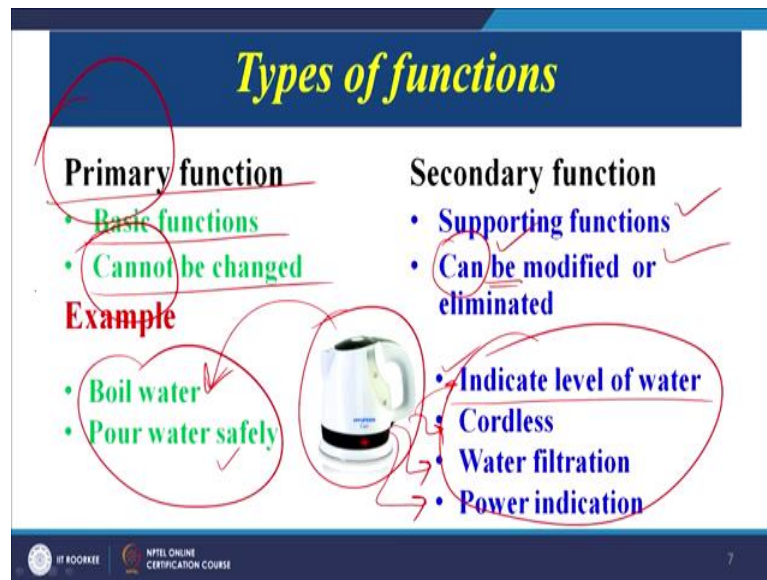
The basic function of this camera is to record the video, to record this session, but what is the function of the tripod? The tripod is supporting the camera, securing it at a fixed position. So, even if we do away with that tripod and a person is standing and holding the camera still the primary function of the camera will be satisfied, but the secondary function is being provided by the tripod that we do not require a person to stand there with a camera, the tripod is performing that secondary function.

So, we can say the secondary functions normally assist the product to perform its primary function. So, here we have taken one example here again, on your screen there is another example you can see, the arms of a chair provides support for the hands. So, if we have an arm chair the arms of the chair they are providing, even if the chair is without the arms, a person can sit on the chair. So, the primary function of the chair is to provide seat, provide seat verb and a noun.

So, provide seat is the basic function of a chair, but the armrest are making the sitting position more, arm rests are making the position more comfortable. So, these are the secondary functions. There can be other definitions of the secondary function also, but I think the learners may have by now understood the difference between the primary and the secondary functions.

Now, what are the tertiary functions? These functions are related to the esteem appearance of the product for example, Sun mica top on the table gives us esteem appearance. So, the tertiary functions may this is just one example maybe helping the primary and the secondary functions to become more evident, to become more presentable as the top on the table or the good surface finished top on the table. Now, very quickly we can see the type of functions this is an example of a cattle here.

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So, what is the basic function? Basic function is to boil water, pour water safely. What are the secondary functions; indicate the level of water. So, even if there is no indicator for pointing out at the level of water still the basic function of boiling the water can be achieved by this product. It can be cordless even if it is not cordless, it will be able to perform its basic function. Water filtration is a secondary function. Power indication is a secondary function; indicate the level of water is a secondary.


So, all these are combination or addition of secondary function, but the primary function is boil water and pours the water safely. So, again we go back and revise what we have covered in the previous slide, what are the primary functions, the primary functions are the basic functions which cannot be changed.

So, any product must satisfy the primary function, because primary function is the purpose for which the person has sought this product or the customer has bought that product. Similarly, the secondary function supporting, these are the supporting functions. These can be modified or eliminated primary functions cannot be changed or eliminated, secondary functions can be modified or eliminated.

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The slide is titled "Types of functions" in a yellow, italicized font on a dark blue background. Below the title, there are two columns of text. The left column is headed "Primary function" and lists three items: "Make phone calls", "Send text message", and "Portability", all in green text with red checkmarks. The right column is headed "Secondary functions" and lists six items: "Camera", "Take/play video", "Social networking", "Games", "Internet", and "Apps", all in blue text with red checkmarks. In the center, between the two columns, is a black smartphone. At the bottom of the slide, there are two logos: "IIT ROORKEE" on the left and "NPTEL ONLINE CERTIFICATION COURSE" on the right.

Types of functions

Primary function		Secondary functions
• Make phone calls ✓		• Camera ✓
• Send text message ✓		• Take/play video ✓
• Portability ✓		• Social networking ✓
		• Games ✓
		• Internet ✓
		• Apps ✓

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Now, again the primary function on mobile phone example we have taken. Primary functions can we make the phone calls, send text message, portability. Secondary functions can be camera, video, social networking, games, internet, various apps that we use. So, with this example I think every learner may have got an idea that what is the difference between the primary and the secondary functions for products. Now, again we can classify the functions based on their use and esteem value.

So, I will not spend much time on this, because already in the beginning of today's session, I have told the example of a coat, it is giving me both the use function protecting me from cold and the esteem function maybe giving a good look to the personality at least, this is what I feel after wearing the coat.

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Types of product functions

- ❖ **Use functions:** Use functions entail some action that customer wants to be performed and aesthetic functions please him or someone customer wants to have pleased.
- ❖ Refrigerator, automobile, dress, shoe pipe and flower etc. all requires use and aesthetic functions in varying ratios.

➤ Identify, clarify and name Functions
The process includes

- ❖ Identifying ✓
- ❖ Clarifying ✓
- ❖ Naming ✓

$$V_{max} = \frac{F_{max}}{C_{min}} (Use + Esteem)$$

Handwritten notes: 90% + 10%, 10% + 90%, (Use + Esteem)

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$$\text{Value}^{\max} = \text{Function}^{\max} (\text{Use Function} + \text{Esteem Function}) / \text{Cost}^{\min}$$

So, what is the use function? A use function entails some action this may be the function that the customer wants to be performed and aesthetic functions please him or someone, customer wants to have pleased. So, there are two; use function is basically the purpose or some action that the customer wants to be performed by the product and aesthetic is to please himself or the people who are looking at the product.

Now, we can say refrigerator there are different types of refrigerators in our houses these days different types, shapes, colors of automobiles, different types of dresses, shoe, pie, flowers, etcetera all requires use and aesthetic functions in varying ratio. So, basically if we again right that equation that we have to maximize the value, we have seen that it is a ratio of function to cost, cost we want to minimize. So, function here can be a combination of the use plus the esteem function, in the numerator we can have a combination.

So, here we see the use and the aesthetic functions in varying ratio. In some instances, we may have 90 percent use plus 10 percent esteem function On the contrary, we can have in other cases 90 percent esteem or the aesthetic function and only 10 percent of the use function. So, we have to be very clinical in order to find out that how much or what combination of the use and the esteem function, we have to put together in our product

design. So, identify, clarify and name the functions. So, the process includes identifying, clarifying and naming the function.

So, we will come to this topic when we will discuss the functional analysis or we will go through the various case studies related to the functional analysis. So, these are the various steps. So, how to identify already we know, we will identify it as a verb and a noun combination. Now, here we can see another example.

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Types of functions

➤ Quantify functions when practicable
This approach, in many cases, allows and promotes measurement of the appropriate cost for a specified function in more specific terms.

For example

Now the next question:

- ❖ Conduct current ✓
- ❖ Transmit torque ✓
- ❖ Enclose volume ✓

✓ How much current? ✓
✓ How much torque? ✓
✓ How much volume? ✓

Functional cost

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This approach in many cases allows and promotes measurement of the appropriate cost for a specified function in a more specific term. So, many times we may have to do a functional cost analysis. So, it is not only identifying the functions, clarifying the functions and defining the functions which is going to solve our purpose, there is a cost involved also as and when we keep on increasing the esteem or we can say, the aesthetic value of our product, the cost will also start to escalate simultaneously, your cost will also start increasing.

So, we have to take a judicious and a very logical call to decide that how much or what must be the combination of esteem and the use functions in order to justify the cost of the product. So, examples, we can see transmit or conduct current and close volume now, we have to quantify also. So, this is just quantification of the use functions how much current, how much torque, how much volume, similarly, how much aesthetics, how much surface finish, how much color combination. So, both from the use point of view

also we have to quantify, and from the aesthetic point of view we have to quantify how much.

Now, the esteem function again, just we are closing down the today's session all of you know what is a used function by now, that is a basic purpose for which the product has been designed, then the esteem function which is going to give a very pleasing look to the product.

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Types of functions

➤ **Esteem function**

- ❖ Provide appearance ✓
- ❖ Provide shape ✓
- ❖ Provide color ✓
- ❖ Reduce thickness ✓
- ❖ Reduce size ✓

• The realistic name that seems to apply to all esteem function is to please customer.

• Cost accepted in use functions in not more wisely used than cost in esteem functions area. Sometimes costs accepted in the esteem area brings the best return.

Handwritten notes: "use" next to "Reduce size", "reduce" next to "Reduce thickness", and "reduce" next to "Reduce size".

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So, what is the esteem function? It provides the appearance, shape, color, thickness, size. So, thickness and size is a combination eventually will depend upon the use of function also, but precisely appearance, shape and color, shape also some time is correlated with the used function also.

So, these are the things which will define the esteem value of the product, how it looks like, what is its shape, how what is the color of the product. So, there is an example that is coming to my mind, when a bridge we make a weird, we design a bridge to cross a river so, most of the bridges that we see around us will only have the use function that is to provide a passage to cross the river, but in many cases we will see that there will be esteem value also, there will be aesthetic value also or aesthetic function also of the bridge and what is that aesthetic function?.

There may be some shape, there may be some lighting arrangement, and there may be some additional good looks that have been provided to that bridge. So, that is what is the aesthetic or the esteem function of the bridge. The use function is to provide a passage between the two banks or the two sides of the river.

So, we here we can see the cost accepted is used function is not more wisely used than the cost in the esteem functions area. Sometimes, the cost accepted in the steam area brings the best return. So, this is a very debatable thing that how much cost must be associated with esteem function? How much cost must be associated with the used function?

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So, there are products which will only have use function. So, that we close down this session with this understanding that learners have got an idea about the different types of functions the products normally possess and how this is related to value engineering again I am writing the equation, because value is dependent upon the functions and the cost. So, once we know the functions that how to define the functions, how to identify the functions, how to relate the functions to the product; obviously, we can now focus on the value of the product.

So, we can see that only use function nails, mostly will be selected or bought for used function only, not for the esteem function. Similarly, the motor windings cable will be selected for the use function only and may not be having any esteem function. All the

functions are used functions only, but on the contrary, there will be product which only have the esteem function what is opposite of use function only will have the esteem function.

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So, what are these products maybe the jewelry items will have the esteem function, only similar the type in may have a little bit maybe 2 percent of the use function also, but the 98 percent maybe the esteem function only and especially the diamond studied type in will have 99 percent of the esteem function, only 1 percent of the use function only.

So, with this week we conclude that today's session that is session number 8 and I think in today's session we have been able to clearly indicate the different types of product functions that is a basic, secondary and tertiary and finally, we have been able to identify the use function, and the esteem function and most of the products that we see around us will have different variations of or with different combinations of the use and the esteem function and it is for the product designer to make a right choice, to make a judicious choice, to make an informed choice regarding the combination that he or she wishes to include in his or her product design.

In our next session, we will try to take our discussion to the next level. We have only right now focused on the functions, identification of functions, defining the function. We will try to analyze, the functions from a different perspective in our next session.

Thank you.