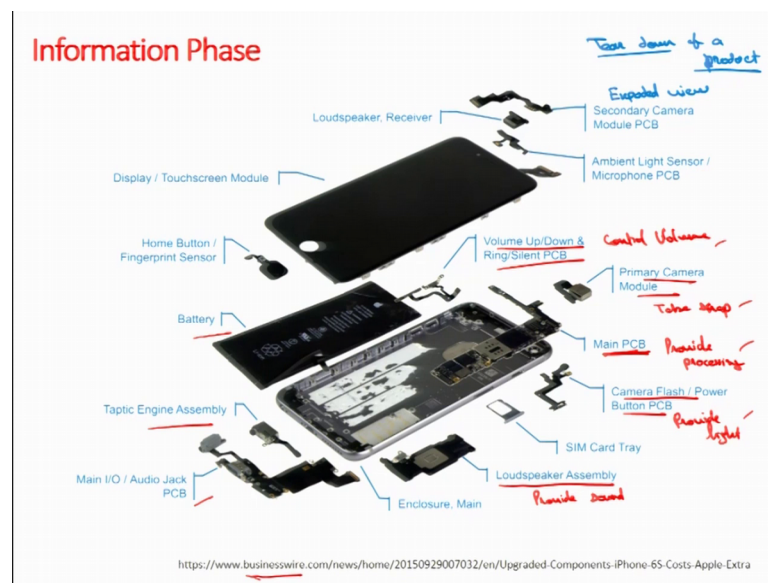


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Lecture – 11
Value Engineering Green Plan: methodology - Part 2

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In information phase as I said I need to have the bill of materials. For the bill of materials this is the picture that is taken from the reference here. This is the tear down of apple mobile; this is tear down of a product also in drawing it is known as exploded view.

So, what we can see different components of the apple mobile here. You can see we have loud speaker and receiver here, this is the top and this is the main body of the mobile, this is the outer cover of the mobile apple mobile, this is the battery; this battery is there and battery certain volume, ring up and down different components you can see here, camera, secondary camera module PCB, ambient light sensor, microphone, then primary camera module, main PCB main printed circuit board that has all the inner components of the processor all those things camera and flash, sim card tray, here the sim card is put then loudspeaker assembly ok, this loudspeaker assembly is there, then main close enclosure all these components you can see. In touch screen module display is there, display is a just the front portion here.

So, all these components are there. Now this is actually the component view point. Now we can have the function view point as well. Function view point is the volume button; volume up and down button is control volume ok.

Primary camera take snap. Main PCB by this we look at the mobile which is cellular phone with just see the front and the back cover. We cannot see where is this printed circuit board this is actually not the apple mobile, but a similar kind of a components would be here. We can just see the front and the back we cannot see the integrated circuits here, we cannot see the camera, we cannot see this loudspeaker assembly here ok, we cannot see this audio jack then engine assembly we cannot see the battery, but these are all required. So, the work function and the cell function, cell function is its colour golden colour, its body elegant look all those things these are cell functions ok. Work function is this is required this printed circuit board is required main PCB is required for which the function is to provide processing ok, processing the camera flash; camera flash or power button camera flash is provide light.

You might be wondering why I am writing only two words here. Control volume, take snap, provide processing, provide light, loudspeaker assembly is provide sound ok. So, why I am writing two word, I will come I will just come to the function phase and explain why these two words are very crispy and critical for the function phase. So, this is the tear down the information phase we can just see the different components here we can tear down the whole product in to components and see where is component send in the function phase we will try to identify the functions.

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Function Phase

- Specific purposes or Intended use of an item. *What is the product? What is it supposed to do? What else can it do?*
- Determine by considering the user's actual needs *Work or Sell*

1. Primary functions *The original intent for which a product, process, or service is made/acquired/performed. Work Sell*

2. Secondary — *Sell, or due to the current design*

Two words

Generate electricity *Verb + Noun* *Make connections*
Shoot bullets *Active* *Measurable* *Verb* *Connect people* *Noun* *Cellular phone*

Having a crisp information/definition/identification of the product/process/service *Two words* *ABRIDGEMENT*

So, next comes the major pillar in value engineering job plant and we are talking about value engineering green plant the function phase. In function phase we try to identify the specific purposes or intended use of an item. So, we ask certain questions what is the product? The answer could be it is a pen, it is a chair, it is a table, it is a mobile phone, it is a duster, it is a mobile cover what is it supposed to do? For chair and table we can it provide support, for pen we can say that it helps to make marks, for mobile it helps to make calls, for duster it helps to clean or wipe of the dust.

So, this is what they do. What else can it do can be the next question can it do. Now duster as I took the example of duster; duster is one just to wipe of the marks if I will talk about the blackboard duster the chalk duster that we have to remove the chalk from the blackboard. So, it removes the marks from the blackboard this is the basic function what else can it do can I use duster as a paper weight.

So, what is the other component duster the only the front portion of the duster that is having a cloth on it or a sponge material right that is used to wipe of the dust is completion of the primary function then, why do have why do we have this big size duster because we need to hold that. So, what else is the secondary functions we need to hold the duster as well, we need to duster should also have some weight ok, what if to hold that it has to have some weight it has the material has to be such that the normal force that applies if I hold the duster for instance this is the duster consider this as a

duster if I hold this what is the normal force or the average force that my hand apply it has to it has to bare that force can I make this back of a paper of this fifty Gsm paper can we make out of this ? No it would not hold. Can I make this of a cardboard? Yes that is possible. So, what else can it do? So, these are the questions those are asked to identify the function of the product.

So, when I talk about the green can I have something different is the distributor of plastic can I have some different material, can I have a cardboard that is compostable that is biodegradable because past plastic is non biodegradable those things would come in creativity phase and in evaluation phase in function phase we are just identifying the functions we will not thinking about something anything else. So, when will talk about the evaluation we will have criteria based upon the three areas that we discussed energy, material and pollution and in creativity phase we will come up with the ideas what are different ways to attain or full full the or make this product using some better or eco friendly measures?

So, these are the questions those are asked in function phase. So, function is that which make a product or process or project to work or sell ok. It is something that makes it work or sell. So, all the cost is for the function not for the product this is the basic idea on which value engineering is the worked upon. Customers are paying for the function, customers are paying for if I am gone a buy this jacket is a black colour jacket, I am I have given the money for the black colour also.

Because suppose if I wanted to just purchase black colour jacket only if I did not have that in the market; however, whatever the goods are stuff is or the material used the company is a steam whatever the needs are there I would not buy because my need is black colour this is making it sell ok. What is making it work? These buttons because jacket has to be closed ok. These buttons, this size specific my size that has to be there work or sell functions. So, now, determine by considering user actual needs; determine by considering the users actual needs.

So, these functions can be divided into two major forms that is primary functions and secondary functions. Primary functions are those values as we which are required to make a product work or sell as I said the original intent or the purpose for which a product or process is made. So, this is the original intent for which the product, process,

service or service is made or procured if service is there we need to have the performance for that or perform. So, these functions as I said could be work or sell.

Secondary functions are those which have no or very little value, but are just due to the current design of the product. Secondary functions can be this sell function sometimes or this can be due to the current design. The functions are mentioned in two words as I did in this last slide, two words abridgement is suggested by miles only the shorter the sentences the more clear it is this is a general set the shorter the sentence is the more clear it is two words can define the whole product.

If I say I need to have a product that is for using that I can make a call and receive call then I can also put write type an sms using alphabets or the letters those are provided there and you know big sentence is coming up. We can just say make connections ok; make connections or connect people because making calls receiving calls is connecting connect people two words are there, now there two words here; two words and saying make connection that is select between due two or connect people I believe better is the option connect people or connect friends whatever you call ok.

That two words, these two words should be a verb and a noun, verb plus noun in this case if you see this make is a verb connection is a noun this connect is a verb here, people is a noun. So, this is the basic function of a mobile phone of a cellular phone ok, but these functions can also be attained using land line phone, messages can also be made using emails the secondary functions which is this is the basic function that has to be done.

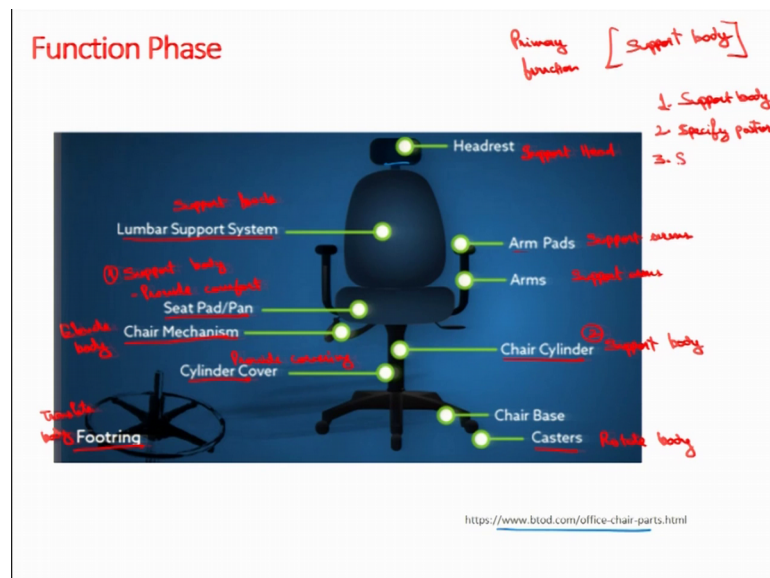
The secondary functions would define the further needs we need to make connections while we are on move when we are mobile, mobile means mobility is there we are moving because there is wireless connections only. So, this verb plus noun makes it a very crispy statement this is a two word statement only the complete statement is there in two words.

So, this verb plus noun. So, suggested by experts this verb has to be an active and noun has to be measurable and a measurable noun for instance other functions I can put some other functions here such as let me say generate electricity generate is an active verb the electricity is a measurable noun gene for instance. If I am gone a purchase Kanpur we have a amendment factories here we where one can buy a pistol.

So, the basic function of pistol is shoot bullets. So, what if one write kill people, kill animal shoot bullets is the basic function. So, because here shoot is an active verb, bullets is measurable noun. So, then if there is a some sensor that is just looking at some proximity sensor is there the function can be detect movement. So, this kinds of two words abridgement that this helps in making I will write it down having a crispy information or definition or identification of the product, process or service.

So, defining it in a two words a verb and a noun is known as two words abridgement; this is two words abridgement. So, the advantages of two words abridgment I have mentioned that can be it focuses on function rather than on item, it encourages creativity, it freeze the mind for specific configurations ok.

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So, I have picked this picture from a reference here just to see this is a chair different components of the chair of the different parts of the chair had different function those are to be accomplished.

So, we have a headrest here, a headrest at the back this is an exact to chair this is have an we have arm pads here arms to support the arms or support the elbow we have chair cylinder that support the chair I will keep writing here a headrest is the function that this has to do is, this is blue colour I will pick something else here red this is to support head ok, then this has to arm pad has to support arms ok.

Then this arms which are on which the arm pads are there these are again to support arms. I am talking about the human arm this is the arm, this arm that is there on the white colour, this is the arm of the chair in red colour, but I am writing this is a human arm. Then a chair cylinder, chair cylinder has to support body human body support body, then this casters can help to rotate body ok.

Then these this is chair mechanism; chair mechanism can help to elevate the body, seat pad can provide comfort you know the seat pad is there seat pad can the basic functions of seat pad is to support body only, but because it is pad it is a cushion here the secondary function can be provide comfort, I will write the basic function as support body, then lumbar support system then this has to support body because support body can be further divided into support head arms and all those things this has to support back. So, cylinder cover is there this is function could be provide covering chair base chair base can again have the similar support body foot ring can rotate body translate body translate body.

So, the basic functions can be one is support. If you see here one function is repeated number of times support back is again support body support body is here number one support body is here as well rotate body support body. So, support body becomes the primary function of the this executive chair whether it is an executive chair of maybe of maybe 50000 rupees or it is a chair of rupees 500.

The basic function is to support body now provide comfort can be something that has an associative cost additional cost on it then chair mechanism that is here elevate the body all those things is can have different. So, these are secondary functions for an executive chair these are necessary, but secondary functions rotated body and elevate body. So, the functions can be divided into three major categories two words three major categories supposed. So, one thing is support body in which support head, support arms this can be part of that.

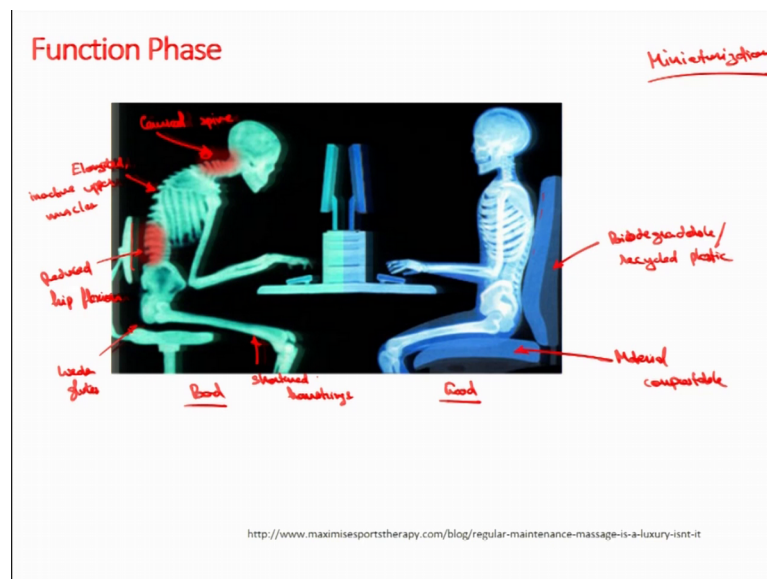
Number one is support body. Second can be provide or specify the postures; specify posture because this rotation lumbar support system this rotation of the body, elevation of the body these are all posters this is posture, this is posture, this is posture ok. So, these specify the posture. So, what is the other major function specific poster that back

poster, back support all those are part of it. Then other than poster we can also have positions poster is one thing position is something else.

So, we can have specify positions you know because we have casters here the chair base poster is like I am sitting like in a comfort way or I am rotating the this is my posture. Position is I can change my position of the chair as well for instance I am working on my office I am I have just have my laptop on this side I can change my position to work on the laptop I can just take off slide my chair using this casters also move by chairs.

Now these are I think you can identify your very much conversant how do we look at the product from function viewpoint. Now we will see not this specific chair we will take a case study on a foot operated pump, where we will see we will when we identify the function we will rank the functions as well ok. First we will see what are the primary functions for that the certain ways.

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So, before that because we are talking about the chair. So, you know this is a bad posture, this is a good posture.

So, in that posture what is there? So, this is what we need to work. You know this is a chair that is chair; this is also one of the chairs. So, in this case here, we have forward head cervical spine ok. Now we are talking about the agronomical design we have designed a chair, but we need to consider agronomics here. Then we have elongated or

inactive upper muscles elongated and inactive upper muscles, then here we have reduced hip flexion then again elongated and weak gluts here, hamstrings also shortened we have shortened hamstrings here.

So, these things can be considered while designing a chair. Now let us come to the green characteristics. This cushion material, material can be compostable this material in case of plastic we can have biodegradable, if not biodegradable recycled plastic or biodegradable material ok. So, other things also we can have this manufacture this chair in different functions in modules ok.

We will talk about the modularity or design for modularity. If we design anything in modules in place of replacing the whole product, we can just get the module or the specific component repaired and then get the product replace for instance if you have motorbike and you if your spark plug goes bad you just get the spark plug replaced because that is something that can be dismantled and can be replaced. In a similar way, we can think of the products this is known as miniaturization.

Where we will talk about the green manufacturing technologies miniaturizations is one of those that we will discuss for divide design the product in a way that different modules are there so, that the single product can be used in different ways and the maintenance is also easy. So, those aspects can be considered here.

So, while come with an examples of the chair that is, there is a; I do not remember the specific name of the body the people who have who did research on the trees and they have spaceship the trees in the way that it is directly ready to sit their shape in the form of chair only they have they spent 41 years in this research and I think with his one couple in US I will come up with the example when we come to the case studies the people who have really did remarkable or breakthrough research in green manufacturing.

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Function Analysis System Technique

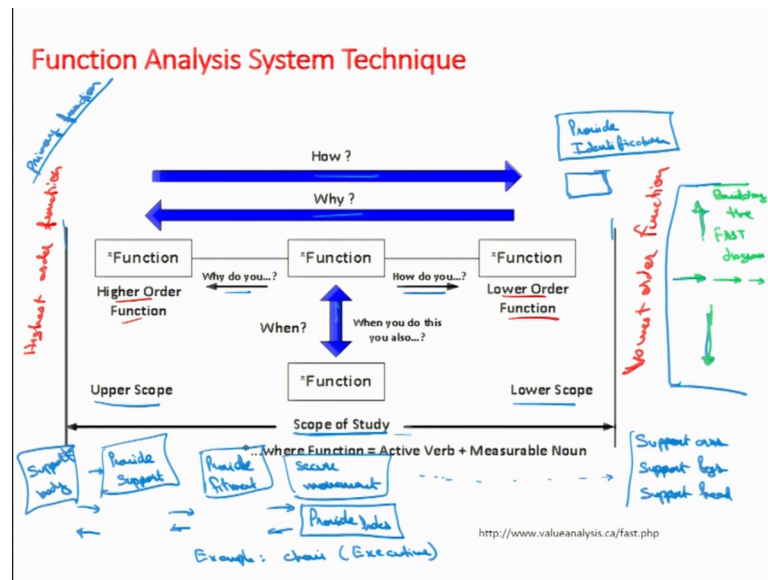
- The Function Analysis System Technique aids in thinking about the problem objectively.
- The organization of the functions into a function-logic.
- The FAST diagram can be used to verify if, and illustrate how, a proposed solution achieves the needs of the project.

Next is function analysis system technique which is also known as fast diagram. Function analysis system techniques aids in thinking about the problem objectively. The organisation of the functions into a function logic and the fast diagram can be used to verify it and illustrate how a proposed solution achieves the needs of the project. What is there we have different functions. For instance if we identify all the functions we have not we should be sure that we have not missed any function furniture for chair, I have not defined all the functions.

The certain functions for instance nuts and bolts are there, the rivets are there they are the small components which are large in number, but the specific functions they are provide joining, they are provide fitment, then secure the movement all those functions all this function need to identified, then we can put the functions in a organised way and we can find a critical path through which the product can be accomplished that, I will just discuss the fast diagram in technique.

I will just give an overview of what is fast diagram in this lecture. In the next lecture I will try to come up with a fast diagram of a pen of a pen that is the first is general pen and then we will talk about the multi objectives pen.

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So, fast diagram what it has we have how and why. This is the higher order function, this is the lower order function this is the highest order function here and this is the lowest order function ok. The highest order function or lowest order function we have here, in this direction from left to right we have how, we have how do we accomplish the higher order function. I can come with an example here, higher sort of function can be provide support body in for instance this can be support body.

How do we support the body? We need to provide actually we have not put those functions here we need to provide I cannot just provide support or provide support I can put. Provide support can be done by the leg or the back then how do we provide the support? We need to provide fitment. How do we provide the fitment? We need to secure movement. So, the point I am make a result to provide support the body I need to support the body right to provide support at the base the leg that I had ok.

This is provide support to provide this support I need to provide fitment this has to be fit with the base, base what do you call base that was called foot ring a chair base it has to be fit the chair base and the body support where the cushion was there. So, this fitment has to be there. How do we provide the fitment? We secure this movement secure the movement because this the cushion if we do not fix the cushion, the cushion can move if we do not fix this legs this is leg of my chair, if we I do not fix this can also move I have to fix it here I have to secure this movement this moment secure securing can be done by

using nuts and bolts rivets my maybe might be there, there some threads which are cut from this, this is fixed like this, this is secure moment this is how I am supporting body, how I am providing fitment, how I am securing the movement then why I am securing the movement because I need to provide fitment why I am providing fitment because I need to provide support why I am providing support because I need to support body. So, on finally, we have the lowest order function ok.

The lowest order function here maybe supports arms I am just considering this is not the final support arms or support legs etcetera etcetera I have just dividing into the support head I am just dividing into certain components here. So, this is the criteria to develop a fast diagram. So, this is the between these two lines the highest order function, lowest order function we have the scope of the study this is the scope of the study here.

So, this is the upper scope and this is the lower scope how and why are explained very well here. Now why do you how do you is also explained this specific line can be the critical path like these are the functions which are very much needed to be accomplished which are necessary functions. Primary function is support body this highest order function is actually the primary function ok. The basic function of the product. So, this is an example of a chair that I am taking here or an executive chair better to put. Now here we have a vertical line when.

When do we do this sometimes to secure movement for instances secure movement added to provide a nut and bolt their nuts which or the screws are there that need to fix my leg with my base fitment. So, for that to secure movement I need to provide holes for instance. So, when to provide holes when there is secure movement, I will say provide holes ok. Sometime these functions which are the well logic like these are stacked on each other and the last function or the few functions which are not very necessary can be eliminated. Some functions do not come do not fit in the whole scenario those can be put here.

For instance the chair is manufactured by a company which need to provide its companies mark here as well for that provide identification provide identification for instance the chair manufacturing company is Deepu Philip Amandeep Singh DPAS. So, DPAS has to be put here. So, provide identification I made the box first I will first write this is the function that does not fit here. So, these are the functions which are not part of

the basic function diagram or basic function network, here let us say, but those are separate, but those are sometimes necessary, sometimes they are not necessary that can be eliminated. So, this is the way we define value engineering fast diagram.

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Function Analysis System Technique

- Step 1:** Determine the highest-order function. ✓
- Step 2:** Identify the basic functions ✓
- Step 3:** Expand the FAST diagram. ✓
- Step 4:** Identify the supporting functions. ✓ when?
- Step 5:** Verify the FAST diagram.

Now, the steps to develop or build a fast diagram is determine the highest order function is the very first step, then identify the basic functions basic functionals of each component or each body like I said the basic function of the back support is to support body to support head is a basic function of the head support, then keep expanding the fast diagram like this when logic keep expanding in this direction; in this direction and from left to right because we have first identified the highest order function for this is the way value fast diagram propagates.

So, this is the I would say building the fast diagram from left to right from centre to top and from centre to bottom whenever required left to right is the major movement this is whenever required centre to bottom and centre to top. Then identifying the supporting functions which are there in the when logic like when, then verify the fast diagram verify the fast diagram means we see that whether there is some other way to make the fast diagram actually there is no specific way to make the fast diagram if I am working with my team members two or three persons are there we can develop the fast diagram for the same product in a little different manner than another team can do.

So, there is no specific or the you know. So, hard and fast rule that, this is the right fast diagram. So, best way is to write the name of the functions on the slips, paper slips and keep making the arrangements this is the organised way in this that way will have a critical path.

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Function Phase
– ranking of the functions

Paired Comparison Analysis

	Options A	Options B	Options C	Options D	Options E
Option A		A5	A4	A2	A0
Option B			C1	B1	E2
Option C				C2	C1
Option D					D1
Option E					

Scale of relative importance:

5	Major Difference
4	
3	
2	
1	
0	No Difference

Option Score:

Option	Score
A	11
B	4
C	3
D	1
E	2

Ranking or Re-ranking:
 1 1
 4 4
 2 2
 4 5
 3 3

FMT
 A → C → E → B → D ?

Now, to verify the fast diagram we can use the paired comparison analysis that is ranking of the functions. In ranking of the functions of functions those are ranked higher should be on the left side, this fast diagram actually the highest order function is the highest ranked function and lowest order functions is the lowest rank function in between the rank should be accordingly as we having the fast diagram if it does not come like that then we can considered to re-work on our fast diagram.

Now paired comparison what is paired comparison method? Paired comparison analysis is the technique that is around one and half centuries old technique which is used to pair or compare a few items. This method was used by some courts or judges to resolve the civil issues like the jury is there, the jury can have different opinions. So, that was used now this is used in engineering as well in management the fact really is of interest.

So, perhaps this was the way to resolve the dispute I suppose, but in value engineering what we do ; their options from A, B, C, D, E for instance these are the functions with different options for instance available. Now option A, B, C, D, E can be evaluated with respect to each other I can compare option A with option B here ok.

Now, this is the scale, this is the scale 0 means no difference of importance 5 means major difference of importance here I can have a little lesser difference like this is my major minor in between we can have certain 0 to 0 to 5 is a scale. For instance option A and option B which option is better if I say function A function B which function is better by what degree for instance support body and provide identification support body is the major function the difference from provide identification is very high.

So, I can say in that case suppose if A is support body I can say A 5 the major difference of importance is there. Similarly A can be compared with C A is higher than some function C by 4 points, A is higher than D by 2 points is higher than or A is equivalent to E there is no difference I can say. Similarly for function B I can say function B as B and C if I compare if C is having this is actually importance scale of relative importance I will say. If I say C is more important than B and by only 1 value where B is important than D by only 1 value and E is important than B by 2 value so on ok.

We will check whether the diagram is or whether the paired comparison correct or not. This should not be no close loop we will check that definitely. So, I can pick some values similarly some values finally, what happen we score we calculate the total score for A. So, total score for A can be in this line ok. So, total score for A is 5 plus 4 plus 2 plus 0 this is 11 total score for B let me say this is this is C 2 this is C 1 and this is D 1. So, total score for B here is B in this side and this side. So, total score of B is 1, total score for C is 1 plus 2, 1 plus 2 3, total score for D is 1, total score for E is 2. So, we can rank it accordingly.

So, accordingly we can say this is a rank 1; this is a rank 2, rank 3, rank 4 and 4 ok. B and D; B and D have no difference according to this calculation, but here we can see that B is better than D by a minor difference. So, B can be put again we can cinderling 1, 2, 3 we can put 3 and A can be put 5 a working. Now who works on this? It is the opinion of the experts different people like I said the different team members so, they work on this and they sometimes they come and sit and say this is the difference A can be more important than B by major difference for 5 can be put here.

So, that is the one way they also together or they can make the individual charts and the total numbers can be added and then make these then this is nothing can be made. Now whatever the ranking is made in the fast diagram also it should be rank like this only like

this is a highest order function, function A is rank to 1. So, this should be A and the lowest order function that a D is ranked 5 that is lowest order function after A we have C and after that we have E and after that we have B. It should go in this direction or maybe B and D could also come here as well. We do not know whether a supporting function or something like that.

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Function Phase
 – ranking of the functions

The paired comparison analysis to identify and rank the top motivators for a team. *that works on developing green products*

	A	B	C	D	E	F	G	H	I
A: Appreciation		A,3	A,3	A,1	A,3	A,2	A,2	A,3	A,2
B: Achievement			C,3	B,2	B,3	B,2	G,2	B,3	B,3
C: Work conditions				C,3	C,3	C,3	G,3	C,3	C,3
D: Power/Influence					D,3	D,2	G,3	D,2	I,1
E: Creativity						F,2	G,3	E,2	I,2
F: Interest							G,3	F,1	I,3
G: Financial benefits								G,3	G,3
H: Relationships									I,3
I: Self development									

*3 Major
2 Minor
1 No*

<https://citoolkit.com/articles/paired-comparison/>

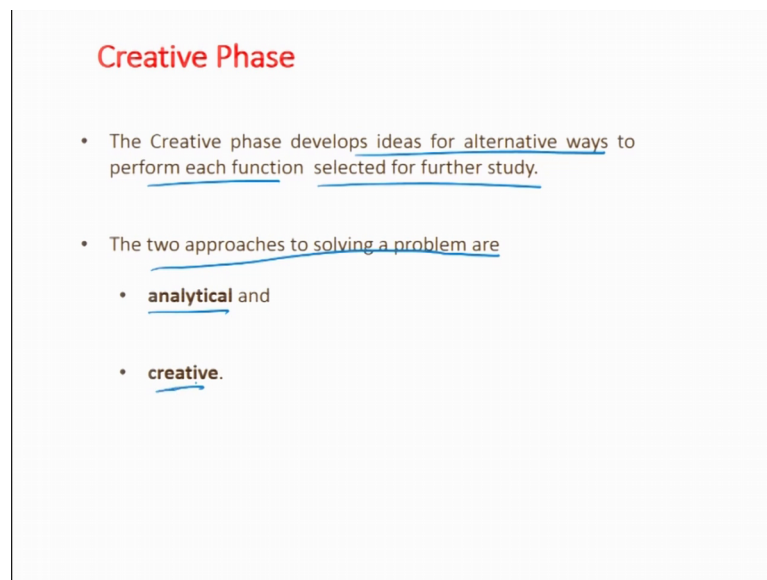
So, this is numerical evaluation I have one example here, the paired comparison analysis to identify and rank the top motivators for a team that works on developing green products. This is not made for this specific purpose that is putting here.

So, it is taken from this citoolkit, but the paired comparison what is the motivation, appreciation if you just appreciate to work on their project, some achievement, work conditions, power influence, creativity freedom to creativity, then interest whether it is a person interest, financial benefits are there whether you are would like to bring, relationships and get a have a good network here or self development. This is the points compared between A and B these are actually related in three scales three point scale 3, 2, 1 for major difference minor difference and this is no difference these are scaled put in this scale.

So, in this case we can see A is greater than B, C A is greater than C. Similarly the points are put here and these can be total to get the final rank. So, this is the task for you people try to see what is the rank or what is the order in which these criteria for the motivation

are there for the specific group there those have made this chart. This task has not to be submitted just diseases for self space and self study. So, next is creative phase in creative phase the functions, those are developed those are identified in the function phase are worked upon we group a few functions and try to find alternative for that.

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Creative Phase

- The Creative phase develops ideas for alternative ways to perform each function selected for further study.
- The two approaches to solving a problem are
 - analytical and
 - creative.

So, in creative phase we develop the ideas for the alternative ways to perform each functions that is selected for the further study. Two approaches to solving to solving a problem or analytical and creative in analytical way of solving with we just think of the problem is stated and a direct step by step approach though which solution is taken, while in creative phase we forgot about the basic facts we said forget about the basic facts or just come up with the ideas without considering whether we would be able to do that are not.

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Creative Phase

- Brainstorming. ✓ *Free wheeling*
- Gordon technique. ✓ *Abstract questions by the group leader Actual problem is not disclosed*
- Checklist. ✓ *Checklist*
- Morphological analysis. ✓ *Morphological analysis*
- Attribute listing. ✓ *Attribute listing*

A	1	2	3	4	5	6	7
B							
C							

Creativity or creative phase are discuss in detail I will take the in the separate lecture for this different techniques are there brainstorming, Gordon technique, checklist, morphological analysis, attribute listing. In brainstorming what we do? We use creative thinking we actually prohibit any criticism freewheeling is welcomed. So, one has to be spontaneous it is actually freewheeling I can say just come up with idea the group sit together and they have they have just come up with an idea.

Gordon technique, in Gordon technique closely related to brainstorming, but the principle difference is that no one except the group leader knows the exact nature of the problem under consideration exact problem is not opened, but abstract questions are asked ; exact questions by the group leader actual problem is not disclosed.

So, check listing is just making a long list and keep checking that whatever the people like what the people do not like and what are the ways to do what people suggest they should be the right way. So, this is the check listing ok. So, morphological analysis is just if I having I will discuss this in detail we make a table and we try to compare each option which has the options one two three options are there. We try to compare each option based upon different criterias ok.

Attribute listing is just listing of the attributes those are pertaining to our product or process that we are working upon. So, this is creativity phase in creative phase what we get we have number of ideas number of ideas and in valuation phase what we do first we

see what ideas are feasible ideas which are feasible those we bring into evaluation phase and then we try to evaluate that which idea are actually to be worked upon.

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Evaluation Phase

The Evaluation phase selects and refines the best ideas to develop into specific value improvement recommendations.

1. Eliminate Low-Potential Ideas
2. Ideas grouping
3. Select appropriate idea
4. List the Advantages and Disadvantages of Each Idea

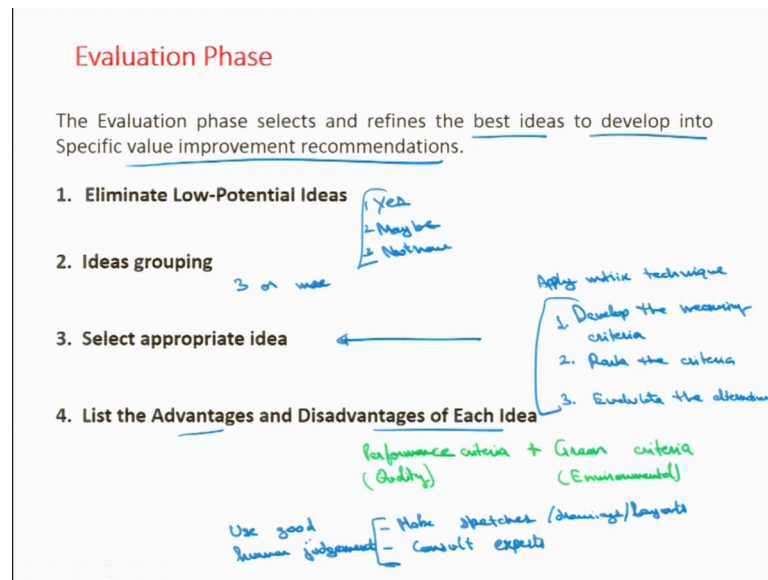
Handwritten notes on the slide:
Next to step 1: 1 Yes, 2 Maybe, 3 Not now
Next to step 2: 3 or more

So, we evolve in evolution phase we select or find the best ideas and to develop the specific value improvement recommendations.

So, we eliminate the low potential ideas here any idea that is low potential or that is not feasible those are eliminated here. So, that can be done in maybe yes idea can be eliminated or maybe or not now. Like none of the ideas are just thrown away. If any idea is not feasible at this point of time that might be something that is might implementable in the future. So, that is kept in record and not now approach is there. So, based upon these three 1, 2, 3 loc potential ideas are grouped. Grouped is a second part actually ideas grouping.

So, the remaining ideas which are feasible which are potential ideas are grouped into several like maybe three or more ideas three or more ideas are if possible that they might be grouped together. So, the categories and examinations to determine whether they could be modified or combined with each other those are taken into account. Then select appropriate idea then idea that has a champion idea in the study that will serve the basic purpose that is selected then this ideas so, the advantage of this idea are mentioned. So, we will see this where will see the case study of foot operated air pump that will make it more clear.

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So, next is a development phase once the evaluation of idea is there then we come to the development phase where we develop the ideas. So, in evaluation phase one has to have prior experience and stake holder has to have all the inputs we define the performance measure, weight and rank the measures I will put it here. We develop the measuring criteria ok. Number two we wait or we rank the criteria, then we evaluate the alternatives.

So, this is to select the appropriate idea. It is at this phase at this point when we develop the criteria, criteria to select a product and for a product the criteria can be cost of the product will put the cost at this cost not at the very first factor I will put the performance of the product is of maintenance like I said the product characteristics, basic function is of maintenance, then operational use, then cost these are all performance criteria.

In addition to that we can have the green criteria green criteria is material, energy, pollution or we can just pick whether the greenness is there or not based upon that we can conduct value engineering green plan it is in evaluation plan here we have the green criteria one is performance criteria, this is quality criteria, this is green criteria or I can even say environmental criteria. This all can be done by apply by applying matrix techniques apply a matrix technique in addition to this we can make sketches or drawings or layouts we have finally, evaluating what is the final element to select then

we can also consult experts; consult experts with all these we need to have good judgement use good human judgement.

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Development Phase

The Development phase determines the “best” alternative(s) for presentation to the decision maker.

- 1. Conduct a Life-Cycle Cost Analysis**
All costs are identified - New tools
- Additional materials
- New Process
- Changes in plant layout
[Prototyping
- Testing]
- 2. Determine the Most Beneficial Alternatives**
What are life-cycle savings?
Benefits > Costs?
Error and Risks?
- 3. Develop Implementation Plans:**
Make a report
Step-by-step plan
Who? - Personnel
when and how? - Schedule
what? - Document

After this they comes at development phase, development phase determines the best alternative. Because in evaluation criteria we select the idea appropriate I would better say not idea, but ideas the certain ideas are selected which go to the development phase and we then we find the best alternative here ok. So, that is presented to the decision maker, then we conduct the life cycle cost analysis for that to life cycle cost analysis ranks all the remaining at alternatives according to an estimate of their life cycle cost reduction, potential relative to the status quo all cost should be identified.

So, here all costs are identified like cost of implementing the idea as well the cost of implementing the idea, the cost of running the material, the future scope all those things, then new tools and fixtures additional materials, new tools, additional materials, then maybe new processes, then if it is there changes in plant layout, other cause that are not normally incurred by the originating activity but should be considered those might be that technical and economical evaluation proposals by the persons.

The prototype that was developed testing of the proposed change. So, I can put here other cost are prototyping, testing etcetera. So, this is a development final development after evaluation finally, we are actually now working as I said we are working in the actual conditions and prototyping and testing all these are happening then this counting

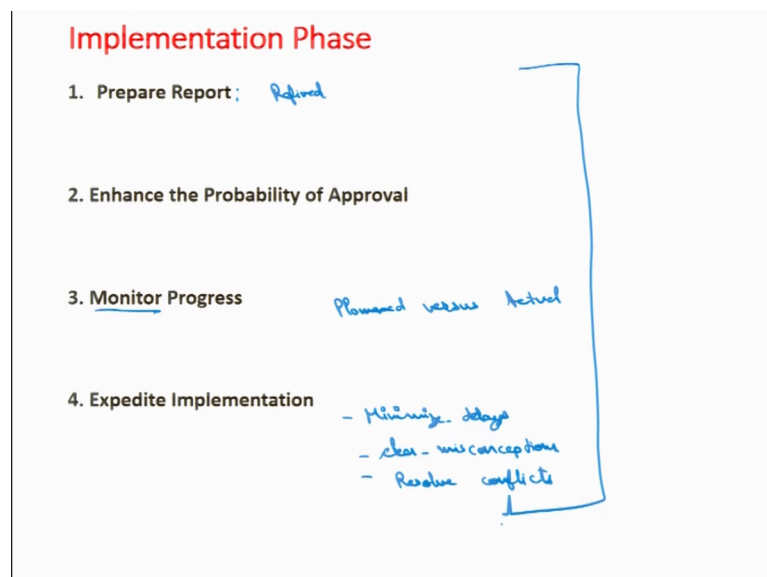
rate to be used the figure has to be the difference between the inflation rate and the assume time value of money all those discounts like we are talking about this profit here because and the length of the life cycle a whole life cycle, I have talked about this here.

So, we need to determine the most beneficial alternative most beneficial alternative in away the values in a team should consult the personal who has a knowledge about the items function and operation constraints dependability requirements. So, we can have certain questions what are life cycle savings and are benefits more than the costs question mark.

Along with this errors those could come for the better I should put errors and risks those are involved in implementing this. Now in this case like it is important to consider the risks because we are going to change something as well. So, implementation for develop implementation plans in this case we just make report step by step plan, then the implementation plan for each alternative or the specific best alternative that we select selected that should include the schedule of the required implementation steps as I said set step by step.

Then identify who will execute. Then again the questions who then how ; how is step by step plan then what is required, what is actually, what documents are required, how is the schedule or better put when and how; when and how who the personal this is the development phase.

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Now, the implementation phase prepare report comes here we have the report that came that came from the development phase and that report is actually refined, refined and actual conditions the oral presentation of the study results is more helpful to the person who responsible for making the decision.

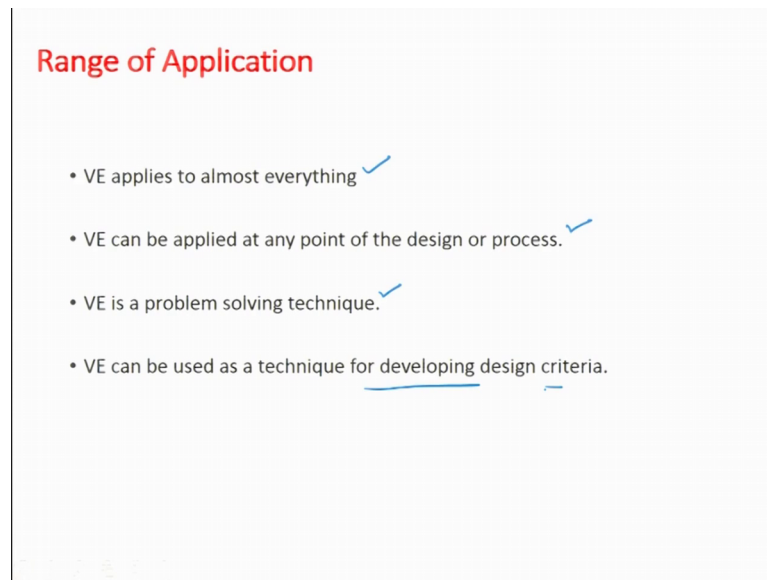
So, whoever the report is also is there, but that is to be refined while actual implementation if needed, then enhance the probability of the approval. So, approval of the proposal in causes change in the status quo because of this or other pressing product is a manager may be slow in making a decisions so we need to enhance the probability by like a properly presenting the report the monitor progress. These are general thing monitor progress like while we are implementing the actual or you say the planned versus actual implementation that has to be seen and monitored, then expedite the implementation this is a general thing expedite like minimise delays ok.

In presenting then the value engineering team should provide assistance clear misconception for their clear misconceptions you know what is happening here. We have made a report value engineering team in which five to seven people were there, they have made a report now they are trying to express their views or their ideas or their trying to present it to the whole manufacturing scenario whole manufacturing system. Now because people might have different view point while this is happening.

So, of they are resentment that I talked in the beginning in the information phase. So, misconceptions minimise delays all those things monitoring the progress these are very important while actually implementing the mail value engineering miss misconceptions are to be cleared up then if some problems are there we need to resolve conflicts these are general things. People who are working in the factories are to be made aware that green products are required that is in need of the present era.

So, that can bring a motivation. So, this might help to apply value engineering plan in a better way. So, this is how we develop the value engineering.

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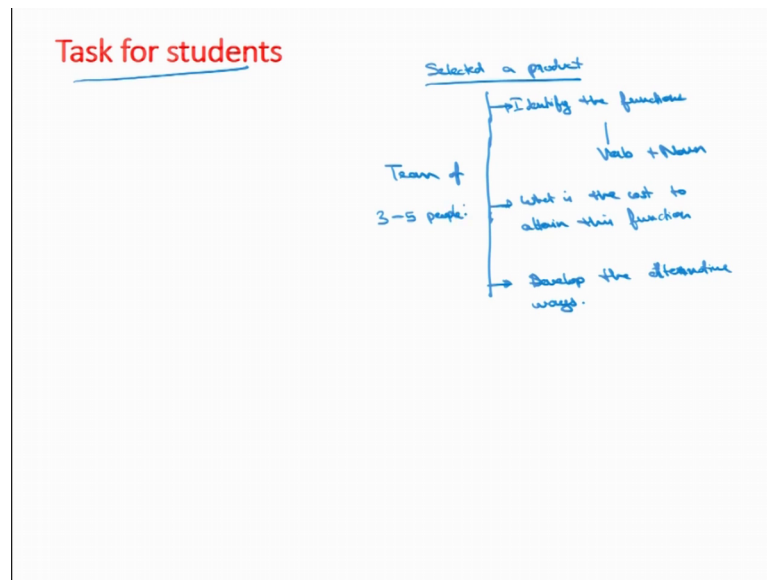
Range of Application

- VE applies to almost everything ✓
- VE can be applied at any point of the design or process. ✓
- VE is a problem solving technique. ✓
- VE can be used as a technique for developing design criteria.

Now, the range of application value engineering can apply almost to everything. So, value engineering can apply any point of designer process. It is a problem solving technique; value engineering can be used as a technique for developing, design criteria. So, this is value engineering. So, with this I have discussed a value engineering methodology, value engineering plan, value engineering job plan.

So, we will come up with an example we will at the next lecture we will discuss the fast diagramming and then will come up with an example or the case study on value engineering, then we will try to see value engineering green plan will try to pick the green criteria and see how does that work in value engineering. Then I might give a dedicated lecture on creativity techniques and also it is a term known as frugal innovation. Frugal is something that does not have a scientific background, but that does works. Frugal is some people call frugal as a green alternative greenway. So, we will discuss those things.

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So, in the end I have task for the students. You have already selected a product like I said in the last task you should select a product and try to see the different functions or different components of that product. Now you please try to as you know what are the functions you try to identify the functions or the product that you are chosen and use the two words verb plus noun for all the functions. I will tell you how to group the functions later when will talk about fast diagram or paired comparison method. So, then we can group and have creative techniques for that.

So, for all the functions try to see, what is the cost to attain this function. I am not talking about the specific component or specific part of the product this function support body what is the cost that is existing and if possible if possible please try to make a team of three to five people and try to develop the alternative ways. This has to be done in a team of three to five people. So, with this, this lecture is complete and we will meet in the next lecture where we will discuss more on value engineering green plant.

Thank you.