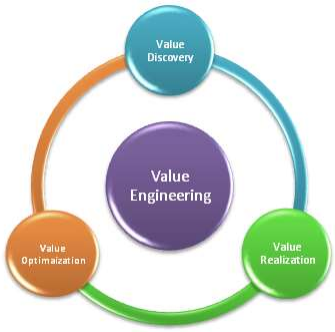
IPE 303
Product Design I

Value Engineering

R. M. SHAHBAB
Lecturer, Department of IPE, BUET
Email: sshahbab@ipe.buet.ac.bd



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Value Engineering

- Value engineering is an *organized study* of **functions** to satisfy the **user's need** with a **quality product** at the **lowest life cycle cost** through **applied creativity**.
- The value of a function is defined as the relationship of cost to performance.

$$Value^{max} = \frac{Performance^{max}}{Cost^{min}}$$

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Value Engineering

Value Engineering vs Value Analysis:

- ***Value engineering*** refers to the organized study conducted at the product design stage
- ***Value analysis*** refers to the organized study conducted when the product has already been launched, the functions are already being achieved, but with a view to analyze it from the cost point of view.

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Value Engineering

Reasons for poor value in an existing product:

- Lack of and/or poor coordination among designers
- Failure to network with customer – poor definition of needs and wants
- Incorrect assumptions based on poor information
- Design based on habitual thinking or mistaken beliefs
- Outdated or inappropriate design standards
- Fixation with previous design concepts

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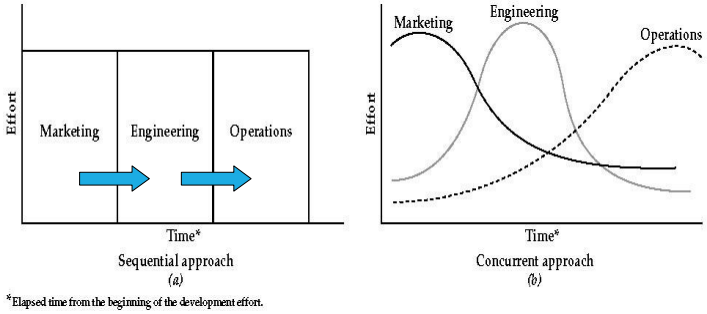
Value Engineering

- The design team has the greatest impact on the cost saving.
- In *traditional approach*, individual functional areas (engineering, operations, marketing) operate without consulting each other. This is the sequential or 'over the wall' approach. Often results in misalignment.
- *Concurrent approach* requires the various functional areas to cooperate and work together in the same time frame.



*Elapsed time from the beginning of the development effort.

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Value Engineering

Why Don't Different Functional Areas Cooperate

- They don't speak the same language.
- They have different performance measures.
- They tend to have different personality types, i.e., they don't think alike.
- They are defensive about their own turfs.
- They are in different physical locations.
- They "don't have time."

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Value Engineering: Functional Analysis

Functional Analysis Steps*:*

1. Function *identification*
2. Function *classification*
3. Select functions that offer opportunity to improve value.

   Two approaches are available:

   i. *Cost to function relationship*

   ii. *Functional Analysis System Technique* (*FAST*) diagram

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Value Engineering: Functional Analysis

1. Function *identification:*

- Product or project is evaluated by identifying the *function* in two words: Verb and Noun.
- Verb describes the specific action to achieve intended purpose.
- Noun defines the object onto which the action operates.
- Example: An eraser has the function – *Remove Pencil-marks*.

  Remove: Verb

  Pencil-marks: Noun

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Value Engineering: Functional Analysis

2. Function *classification*:

Primary function

- Basic function
- Cannot be compromised
- Example:
  - Boil water
  - Pour water safely

Secondary function

- Supporting function
- Can be modified or eliminated
- Example:
  - Indicate water-level
  - Filter water
  - Indicate power

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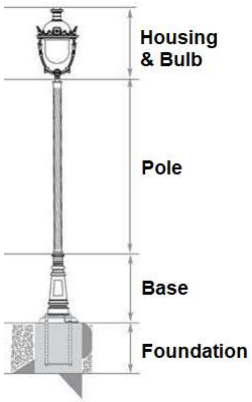
Value Engineering: Functional Analysis

Illustration: Function *identification* & *classification*

Component	Function	Primary	Secondary
Foundation	Transfer load	P	
	Resist load		S
Base	Support pole	P	
	Hold pole		S
Pole	Spread light	P	
	Hold housing		S
	Protect wire		S



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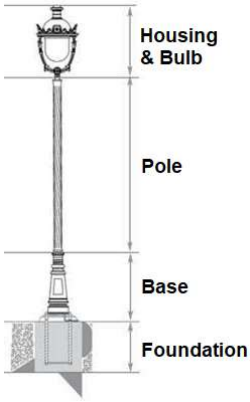
Value Engineering: Functional Analysis

Illustration: Function *identification* & *classification*

Component	Function	Primary	Secondary
Housing	Hold bulb	P	
	Diffuse light	P	
	Reflects light		S
Bulb	Produce light	P	
	Dissipates light		S



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Value Engineering: Functional Analysis

3.(i) *Cost to function relationship*: (for pencil) 

Component	Function	P	S	Cost	% (Cost/Total)
Lead	Make marks	P		0.50	10
Wood	Protect lead		S	1.00	20
Metal cap	Hold eraser		S	0.25	5
Eraser	Remove marks		S	0.75	15
Wood Shape	Provide grip		S	0.50	10
Printing	Display information		S	0.50	10

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Profit	1.50
Total	5.00

Objective: Select functions that offer opportunity to improve value

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Value Engineering: Functional Analysis

3.(ii) *FAST Diagram*:

- FAST diagrams are function-oriented, not time-oriented; *Verb-Noun* function to describe complex systems.
- FAST permits people with dissimilar technical background to effectively communicate and resolve issues that require multi-disciplined considerations
- FAST diagram offers a visual layout (tree diagram) of product's function
- Starts with the Primary Function, and builds to the right with supporting or Secondary Functions
- FAST diagram helps to understand Functions to be eliminated or improved, to deliver Primary Functions

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Value Engineering: Functional Analysis

3.(ii) *FAST Diagram*:

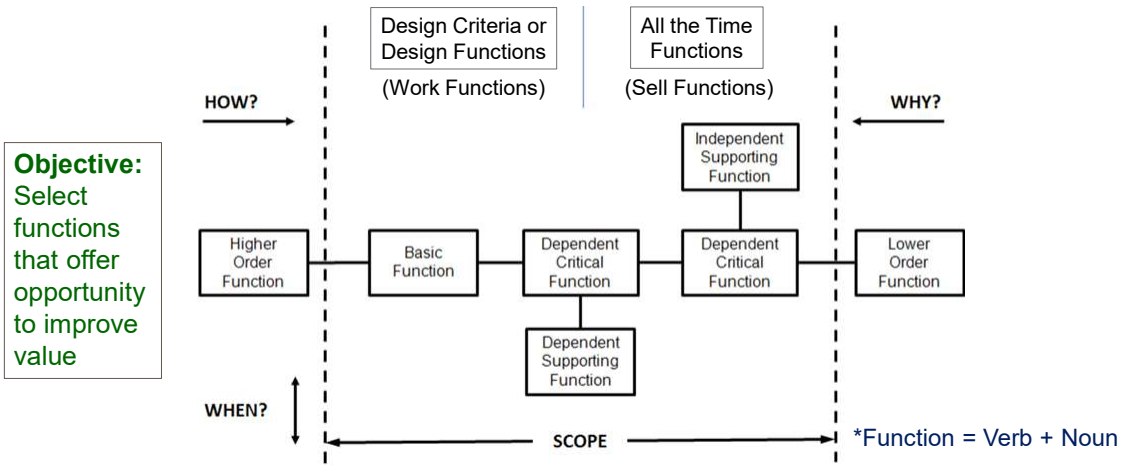

Figure: Common layout for FAST Diagram

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Value Engineering: Functional Analysis

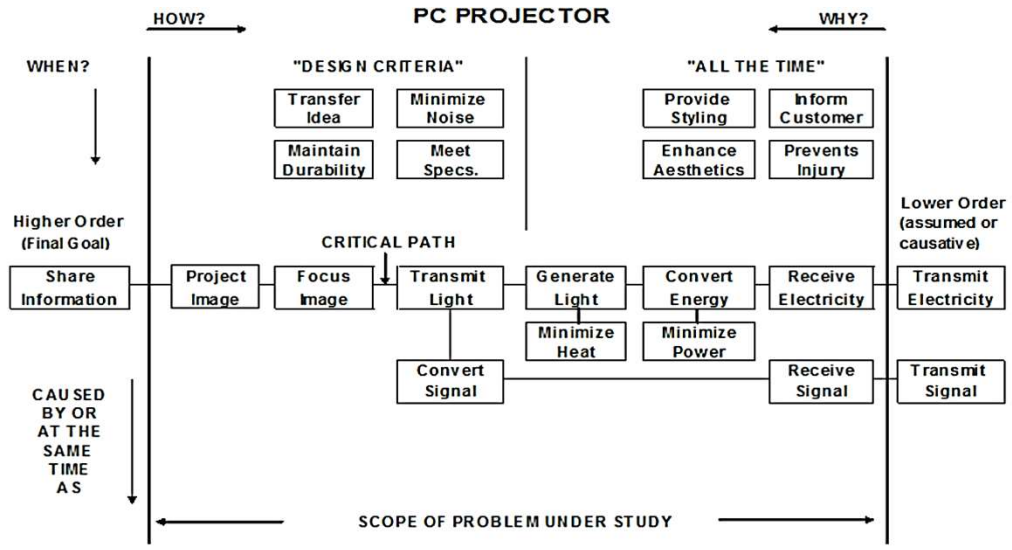

Figure: FAST Diagram for PC Projector

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