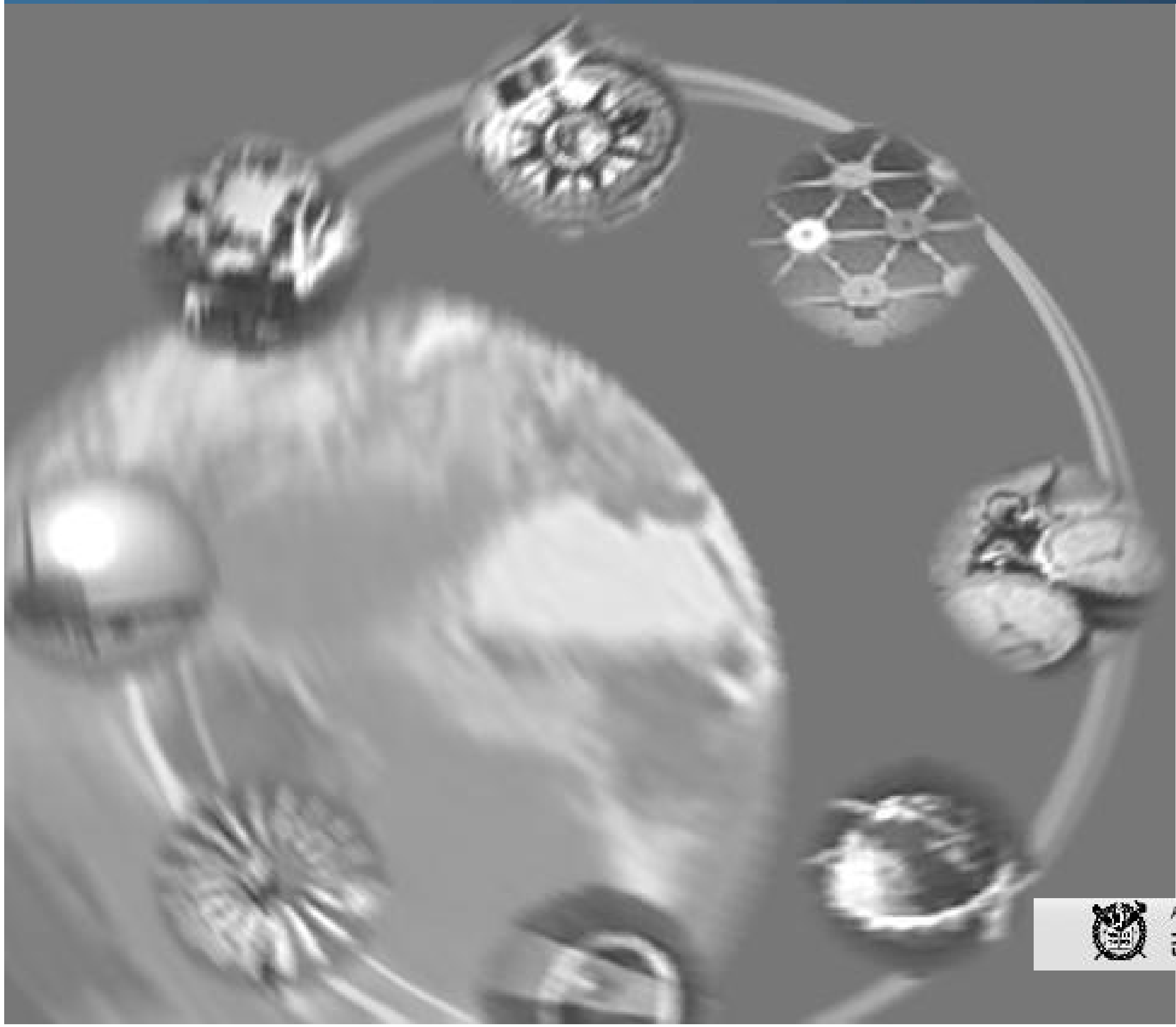
Value Engineering / Management, Life Cycle Costing

401.649 Cost Planning for Construction Projects

May 20th, 2009



Moonseo Park

Associate Professor, PhD

39동 433
Phone 880-5848, Fax 871-5518
E-mail: mspark@snu.ac.kr

Department of Architecture
College of Engineering
Seoul National University

서울대학교 건설기술연구실

과학기술부 국가지정연구실 National Research Lab.

History

- Formal Value Analysis first developed by Larry Miles working with GE in US in 1947
- Adopted by US Department of Defence in 1955
- Introduced to the U.S. Army Corp of Engineers and the U.S Navy Bureau of Yards and Docks in 1962 as VE became a mandatory requirement in the Army Services Procurement Regulations
- Adopted by agencies like NASA, Department of Transportation

Value Engineering

"Systematic, interdisciplinary examination of factors affecting the cost of a product with the aim of devising a means to achieve its specific purpose at a required standard of quality and reliability and at an acceptable cost"

Cooper and Slagmulkder, 1997

- A disciplined procedure directed towards the achievement of necessary functions for minimum cost.

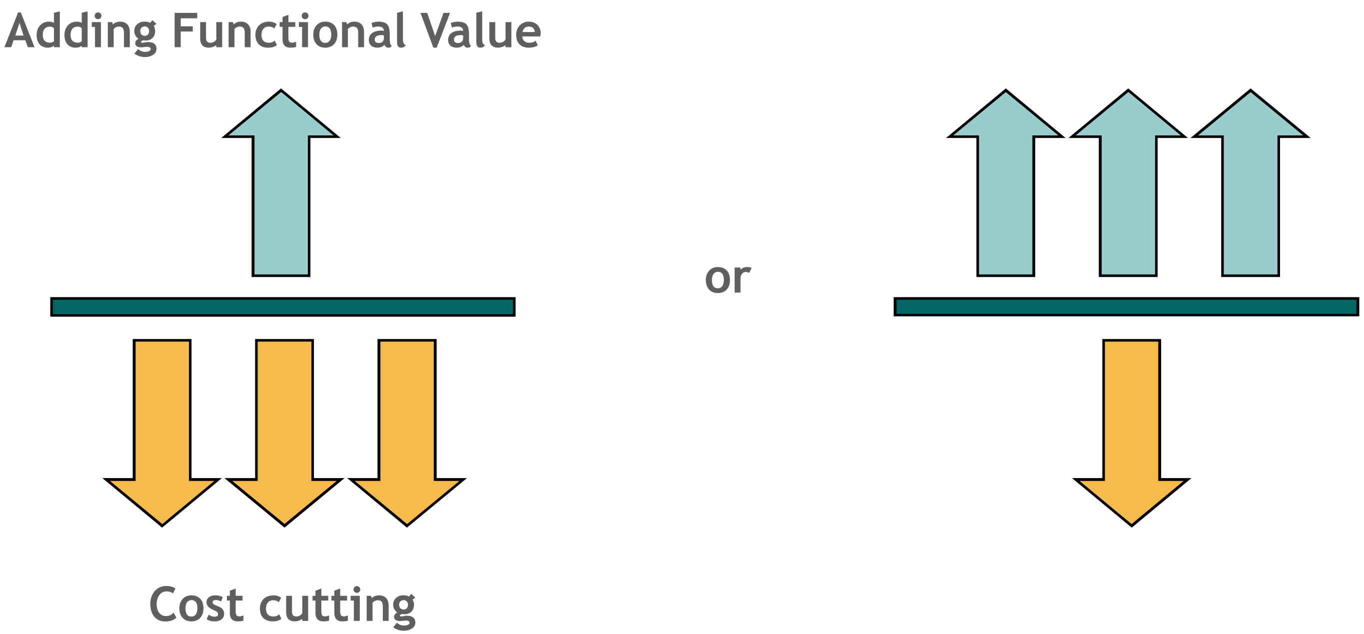
- VE is essentially retrospective and tends to take place during the detailed design stage in response to a projected cost overspend.

Core Concepts

The Value Engineering (VE) approach considers cost in relation to function, recognising that there is a three-way relationship between function, cost and value.

$$\text{Value} = \frac{\text{Function}}{\text{Cost}}$$

Cost cutting or adding value?: VE vs VM



No-one got rich from getting smaller

Value Management

- A service that maximises the functional value of a project

- by managing its development from concept to completion

- through the comparison and audit of all decisions against the value system initially determined by the client

Core Concepts

- Based on what things do rather than what they are, thereby stimulating understanding and innovation.

- Short, structured, facilitated workshops, involving the whole multi-disciplinary teams, thus enabling mutual learning by all

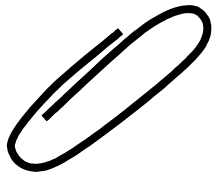
Core Concepts

- They result in proposals to add value for the Client, supported by the whole team

- Formal studies are underpinned throughout the project by Value Based Thinking

VM helps to solve problems

- Problems need not be negative.
- Problem is the gap between where we are and where we want to be.
- VM helps close that gap through a process of mutual learning.
- Through a structured facilitated process embracing the whole team.



Structure of VM

Workshop

7. Implementation - Do & review
6. Presentation - Build decisions to implement
5. Development - Demonstrate proposal viability
4. Evaluation - Selecting the best ideas
3. Speculation - How might we do it better?
2. Briefing & Function analysis - The issues + what things do
1. Preparation - Understanding the project, the objectives, the people

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VE vs. VM

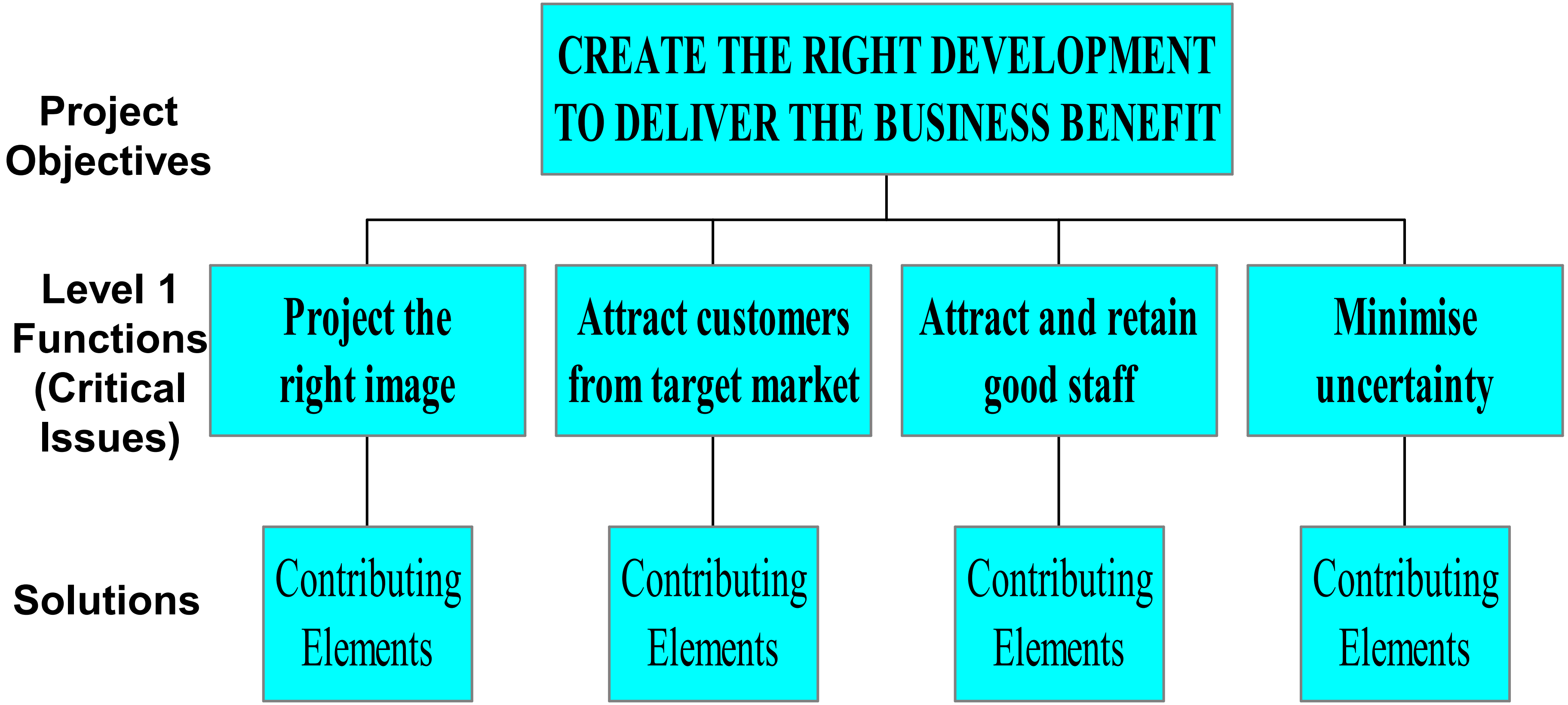
VE looks at ‘hard’ issues, while

VM addresses soft issues.

Step 1 - Preparation

- Convene strategic briefing meeting
- Establish information base
- Identify people involved
- Compile documents, cost plans, etc.
- Agree timetable and logistics

Step 2 - Briefing & Function Analysis



What is the relative importance of the Critical Issues?

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Think Functionally…

The classical approach to problem solving: element based

The function based approach

Wealth flows from innovation, not from perfecting the known

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Step 3 - Speculation

- Generate Ideas
  - Brainstorm for better ways of doing things
    - Reduce Costs
    - Increase Revenue
    - Address Issues and Observations
    - Reduce Risks
    - Other ideas to reflect Study Objectives
  - Defer evaluation

Hints for Generating Many Concepts

- Suspend judgment
- Generate a lot of ideas
- Infeasible ideas are welcome
- Use graphical and physical media
- Make analogies
- Wish and wonder
- Solve the conflict
- Use related stimuli
- Use unrelated stimuli
- Set quantitative goals
- Use the gallery method
- Trade ideas in a group

unrelated stimuli example

화장실

Step 4 - Evaluation

- Evaluate Ideas
  - Identify common Evaluation criteria
  - Score each idea against criteria
    - e.g. 1 – Must do it
      2 – Worth looking at
      3 – Consider in future
      4 - Reject
  - Select best ideas for further development (within the study)
  - Identify owners for each idea selected for development

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Step 5 - Development

- Develop proposals for value improvement
  - Advantages and disadvantages
  - Impact on Cost, Time and Quality

- Summarise on standard forms

Step 6 - Presentation

- Present proposals to decision making group
- Ownership, honesty and accountability
- Agree implementation plan

Project : XYZ

Item : External Facade System : Type of facade	**Originator :** Architect ABC

Original Concept :

Vision panel	...	2.10m	)	
			)	50 : 50 ratio
Spandrel panel...		2.10m	)	

Proposed Change :

Vision panel	...	1.75m	)	
			)	40 : 60 ratio
Spandrel panel...		2.45m	)	

VM Proposal Summary Sheet

SAMPLE

Advantages :

- Cost saving
- Ceiling line same as window line [original provision requires pelmet]

Disadvantages :

-

Cost Summary	$
Original	14,000,000
Proposed	13,140,000
Saving (-) / Extra (+)	-860,000

Rating		
1	Must do it	✓
2	Worth looking at	
3	Consider in future	
4	Reject	

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Step 7 - Implementation

- Track implementation
- Review Project Outcome
- Feedback for continuous improvement

Life-Cycle Costing

- Accurate cost measurement is one of the most important requirements of a successful VE program.
- Most cost records and estimates in the construction industry deal with capital cost.
- The life of facility will extend from 20 to 50 or more years.
- During this period the cost of maintaining and servicing the facility will equal or exceed the capital cost.

- LCC is the total cost of ownership of a product, structure, or system over its useful life.

- The five life-cycle phases of a system:
  - Conceptual design phase
  - Advanced development and detailed design phase
  - Production phase
  - Project termination and system operation and maintenance phase
  - System divestment phase

- The need to LCC arises because decisions made during the <u>early</u> stages of a project inevitably have an impact on future outlays.

How to help

- LCC is designed to help designers identify and evaluate the economic consequences of their decisions

	Air conditioners		Refrigerators		Televisions		Gas ranges	
Useful life:	10 years		15 years		12 years		15 years	
Cost element								
Acquisition	$204	(58.7%)	$295	(40.9%)	$400	(60.2%)	$211	(50.8%)
Operations	131	(37.8%)	392	(54.3%)	178	(26.8%)	159	(38.3%)
Service	4	(1.2%)	19	(2.6%)	79	(11.9%)	35	(8.5%)
Disposal	8	(2.3%)	16	(2.2%)	7	(1.1%)	10	(2.4%)
	$347	(100%)	$722	(100%)	$664	(100%)	$415	(100%)

When it is useful…

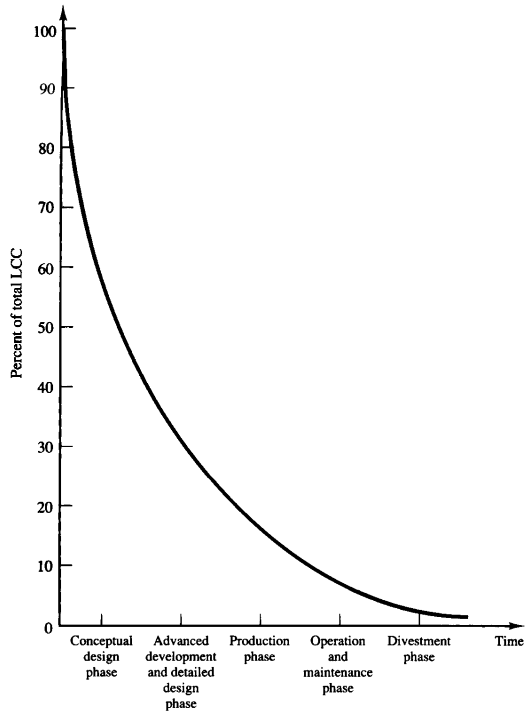
- The development and use of LCC models is particularly justified when a number of alternatives exist in the early stages of a project's life cycle and the selection of an alternative has a noticeable influence on the total life-cycle cost

Uncertainties in LCC Models

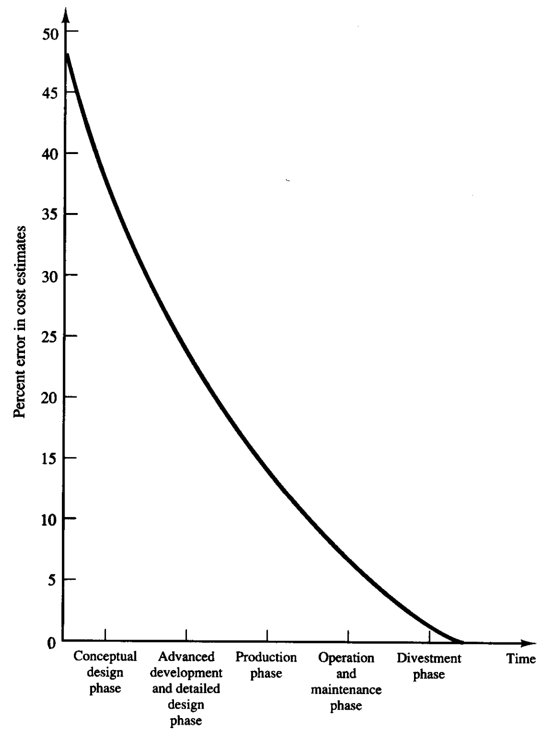
- In the conceptual design phase little is known about the system, the activities required to design and manufacture it, its mode of operation, and the maintenance philosophy to be employed - Highest degree of uncertainty in the LCC model.

- <u>Most critical decision are made when uncertainty is highest</u>

Effect of Decisions on life-cycle cost of a system



Cost estimate errors over time



Example of an LCC Model

	System life-cycle phase										
	Conceptual design		Advanced development and detailed design		Production		Project termination/ operation and maintenance		Divestment		
Quarter	Labor	Mat'l	Labor	Mat'l	Labor	Mat'l	Labor	Mat'l	Labor	Mat'l	Total
1	2										2
2	3										3
3	3										3
4	1		3								4
5			4	1							5
6			5	1	10	3					19
7			5	1	12	4					22
8			3	1	15	6					25
9					10	5	3	1			19
10					7	3	4	2			16
11							5	3			8
12							5	3			8
13							5	3			8
14							5	3	1		9
15							4	2	1		7
16							4	2			6
17							3	1	1		5
18											
	9	—	20	4	54	21	38	20	3	—	169

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