Tools & Techniques for Design Management

Prof. Koshy Varghese
Professor
Department of Civil Engineering
Indian Institute of Technology Madras

Indian Institute of Technology Madras (IITM)

CORE COMPETENCY:
- ENGINEERING EDUCATION & RESEARCH
- Ranked #1 in India for Engineering
- 8000 Students
- 500 Faculty
- Few hundred Spotted Deer & Monkeys
Our Department & Group

• Best Civil Eng Program in the India
• Conventional U.G. Program
• Graduate programs in all general areas of Civil Engineering
• Doctoral Program
• Extensive industry interaction

Graduate Programs – Our Group

Construction Tech. & Mgmt.

Civil – Elec - Mech

Infrastructural Engg. & Mgmt.

Building Tech. & Constrn. Mgmt.

Civil

Arch - Civil
Talk Outline

- What is Design
- Design in Construction
- Value Aspects
- Information Exchange Aspects

"GOOD DESIGN IS GOOD BUSINESS"
What is Design?

• Process of converting client requirements into technical specifications
• Design Theories

Design in Construction
Design Problems

Understanding value in design: Output value (D) in relation to first cost (A + design cost) and whole life cost (A+B or A+B+C) - Diagram based on an idea from Don Ward, Constructing Excellence & Anne King, BSRIA, data from Evans et al (1998), Hughes et al (2004), Ive (2006) and others
Design Process Standardization?

- Modern construction projects have challenging schedule requirements
- Design processes are generally unstructured
- Need for standardization of building design process
Study....

Design durations across four organisations

Graphical Comparison of the duration of design stages (Joe M. et al 2016)
Standardization Study

Brigade group – Hotels/real estate
Obj: Timely design and project delivery

Wipro – IT building
Obj: Landmark structure with operational efficiency

TRIL – Mixed use
Maximize return on investment

SPRE – Real estate
Obj: Meet planned budget

Value in Design
Types of Value of a Built Facility

- Others....
- Social
- Use
- Environmental
- Cultural
- Image


Tools to Capture Value

Quality Function Deployment
An approach to value delivery that integrates stakeholder judgement into the design process

**VALID Framework**

- Understand Values
- Define value
- Assess value proposition

**Design Quality Indicator**

*Source: Be Valuable, Saxon, R. (2005)*
Lean in Design Management

**Lean Project Delivery System**

1. Identify alternatives
2. Define factors
3. Define must have/want to have criteria for each factor
4. Describe the attributes of each alternative
5. Decide the advantages of each alternative
6. Decide the importance of each advantage
7. Evaluate cost data

**TFV theory**

**Value creation**

**Construction**

**Flow**

**Transformations**

**Design Space**

**Set-Based Design**

**Choosing by Advantages**
Target Value Design

Market/Benchmark Pricing

Establish Target Price (often lower than benchmark)

Owner's Budget

Maxim Profit

Project Objectives (functionality, quality, time, life cycle, and performance, etc.)

Target Cost

Establish Target Value (Target cost plus other project goals)

Evaluate Project Performance in Achieving Project Objectives

Design to Target Value

Evaluate Project Cost

TC setting and the TVD process (Source: Bozogi et al. 2013)

Value is Dynamic

![Image 1](image1.png)

![Image 2](image2.png)

![Image 3](image3.png)

![Image 4](image4.png)
Value is Subjective

Value to whom???
• User of the facility?
• Financing entity?
• Stakeholders of the project?

Value is a tradeoff between client-stakeholder benefits, sacrifices & resources. Collaboration & Iteration is needed for Convergence.

Design Iterations add Value?

Positive vs Negative Iterations?
Information Exchange in Design

- Multidisciplinary collaborative work
- More than a million parameters
- Iterative nature of design

HOW CAN IT BE MANAGED?

Information Exchange in Design

Information Dependency

Dependency Structure Matrix

Difficulty in defining design tasks
Manufacturing v/s Construction

- Repeatability
- Real Vs Virtual Prototype
- Complexity of requirements
- Static v/s dynamic
- Stakeholder involvement
- Measure of satisfaction

IIT/IIM/IISER Campus Design Study
IIT Palakkad

Area: 508.43 acres
Capacity: 20,000 students
Project duration: 20 years (3 phases)

- Six new IITs
- GFR, GoI rules
- Combined Quality cum Cost Based System (80:20)

1. Expression of interest
2. Pre-qualification of architects
3. Request for Proposal
4. Technical Evaluation
5. Financial Evaluation
Outcomes

- Early involvement of knowledgeable project experts
- Design- an iterative process
- Project Design Delivery Values and Architectural Design Values

Summary

Good Design is Good Business!
- Can we make it more of a science?

Defining & Delivering Value is Key
- But a Challenge
- Tools

Information Exchange & Collaboration
Enable better Delivery of Values
Tools
Thank You