Adapting Flexibility in Decision-Making in Building Design Management

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Master Thesis

TU Delft
The story begins...

research project

before
Design Projects

hypothesis
observation

do
findings

after
Recommendations

evaluation tool
Influence-Information ‘paradox’

- Information
  - Limited available information about problem, goals, consequences of alternatives and preferences.

- Influence of decisions
  - Program – building form -- structural design -- element choice – energy -- installation

Source: Wamelink et al. (2007)
Increasing level of information

1. Identification of Problem & Goal (ex post evaluation)
2. Identification of Requirements
3. Identification of solution space
4. Estimate performance of design (ex ante evaluation)

Source: Wamelink et al. (2007)
Problem identification; Post Occupancy Evaluation

1. POE, Strategic briefing

2. Briefing process, format and content

3. Space solver, ADR and UDR

4. Cost models, Checklists, BSM..
Identification of requirements; Participation of users

1. POE, Strategic briefing

2. Briefing process, format and content

3. Space solver, ADR and UDR

4. Cost models, Checklists, BSM..
Identifying solution space; Urban Decision Room

1. POE, Strategic briefing
2. Briefing process, format and content
3. Space solver, ADR and UDR
4. Cost models, Checklists, BSM..

Source: van Loon and Bronkhorst (2005)
Ex ante evaluation; SVINSK Cost Model

1. POE, Strategic briefing
2. Briefing process, format and content
3. Space solver, ADR and UDR
4. Cost models, Checklists, BSM..

Source: Jong (2005)
Adopting flexibility in decision-making

- Alternatives are developed, evaluated & selected;
  - Early commitment to a single alternative
    - Chosen alternative (or point) is reversed
    - Point-based design
  - Delay commitment to a single alternative
    - Set of alternatives are kept alive
    - Set-based design
Project 1; Designing a Museum

Three sketch-alternatives are made and one is chosen to be further developed
Project 1; Designing a Museum

Chosen sketch-design is further developed into preliminary design
Project 2; Designing a HighRise

Three sketch-alternatives are further developed into preliminary design, choice is made for vertical walk.
Project 2: Designing a High Rise

Final Design
Observed difference in process

A. Selecting an alternative
   - concept vs. real options

B. Design iteration
   - sequential vs. parallel

C. Involvement of other actors
   - development vs. analysis

D. Information-exchange
   - risk of rework vs. risk of starvation
Selecting an alternative

**POINT-BASED**

**CONCEPT**

- Decision 1 (concept)
- No information available about influence of decision 1 to following decisions (2, 3, 4)

**SET-BASED**

**REAL OPTION**

- Decision 1 (concept)
- Information is available about influence of decision 1 to following decisions (2, 3, 4)

Source modified: Malak et al. (2007)
Design iteration

**POINT-BASED**

- Selecting an alternative
- Design iteration
- Involvement of others
- Information exchange

**SET-BASED**

- Scheme design
- Concept design
- Detailed design

**ALTERNATIVES ARE DEVELOPED AFTER ONE ANOTHER**

**ALTERNATIVES ARE DEVELOPED IN PARALLEL**

Source modified: Hopfe et al. (2006)
Involvement of other actors

Source: Poppendieck (2006)
Information-exchange

Source: Terwiesch et al. (2002)
Hypothesis

• ‘Delaying commitment to a single alternative could be very beneficial for the end-result!’

• Let’s measure it...
Methodology

- Vertical axe; determinants
- Horizontal axe; project value dimensions

**Evaluation Matrix**
Case 1
Point-based

Case 1
Set-based

Case 2
Point-based

Case 2
Set-based

Case 3
Point-based

Case 4
Set-based

Cross case study
Case 1: Computer Building (Geneva, Switzerland)

Case 2: Hospital Building (California, U.S.A.)

Case 3: Community College (Amsterdam)

Case 4: Feasibility Study (Amsterdam)

Case studies
Case studies

Case 1:
Computer Building (Geneva, Switzerland)

Case 1; Explicit comparing made cost-reducing optimization possible

Case 2:
Hospital Building (California, U.S.A.)

Case 3:
Community College (Amsterdam)

Case 4; Transparent and clear arguments for choosing of architect

Case 4:
Feasibility Study (Amsterdam)
Case 2: Hospital Building (San Francisco, U.S.A)

- High seismic area
- Select Structural system
- Control inter-story drift

Design task:

Source: Parrish et al. (2008)
Selecting an alternative

- Predictable influence
  - Base-isolation is difficult to construct & Moment-frame clash with architectural features

- ‘Hidden’ influence
  - Due to hidden value, viscous damping wall appeared to be superior in the remainder of the process.

Case 2: Hospital Building
(San Francisco, U.S.A)
Case 2: Hospital Building (San Francisco, U.S.A)

Design iteration

- Point-based design
  - Irreversible decision, due to timely & costly rework

- Set-based design
  - Keeping alternatives alive lead to increasing development costs
Design task:

- Multifunctional program
  - Educational space
    - 14,000 m² GFA
  - Commercial space
    - 3,000 m² GFA
  - Parking space
    - 3,700 m² GFA

- Design to be constructed
  - < € 1,450 / m²

Point-based Case 3: Community College (Amsterdam, Netherlands)
Point-based Case 3: Community College  
(Amsterdam, Netherlands)

Selecting an alternative

- Predictable construction costs during early stage of design;

Garage below groundwater level

Too many angles in facade  
East-façade close to viaduct

Source: Hamfelt (2008)
Point-based Case 3: Community College
(Amsterdam, Netherlands)

Selecting an alternative

- 'Hidden' value
  - Decision made about orientation, however unknown value.

Source: Hamfelt (2008)
Involvement of others

Costly and timely iteration;

- Supervisor of urban development in A’dam North;
  - Denial of façade design, which was worked out into preliminary design.
- General contractor;
  - Expensive to construct building
- User parking space was involved later on
SWOT analysis: Point-based design

**Strength**

- constrain development costs through selection of most promising solution
- no complex analysis/critique activity

**Weakness**

- Most promising solution may prove unfeasible in the remainder of the process, leading to costly rework
- Latent value remains hidden

**Opportunities**

- Decisions can be improved due to increasing level of information during early stage of design.

**Threats**

- Timely and costly rework may lead to irreversible decision
- Negative attitude by other stakeholders may obstruct implementation of chosen design
SWOT analysis: Set-based design

**Strength**

- Integrated analysis leads to clear arguments about chosen alternative
- Optimization is possible, due to unveiling of hidden value

**Weakness**

- Increasing development costs, due to parallel development of alternatives
- Integrated analysis/critique is timely and costly

**Opportunities**

- Enhance collaborative design approach
- Explicit analysis can increase learning process

**Threats**

- Failing to make decision at last possible moment
- Unable to involve all stakeholders at the project outset
• Added value research;
  – operationalized difference between point-based & set-based design

• Further research;
  – Explorative research:
    • in finding additional differences in process
  – Testing research;
    • Hypothesis 1: Delay commitment to a single alternative helps clients better define in what they need!
    • Hypothesis 2: Delay commitment to a single alternative helps better control stakeholders influence in projects!

• Both explorative & testing research through real time case studies!
Thank you for your attention

Any questions
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