DECIDING BETWEEN PREFABRICATION AND ON-SITE CONSTRUCTION: A CHOOSING-BY-ADVANTAGE APPROACH

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Agenda

➢ Background

➢ Method

➢ Prefabrication impact factors

➢ Prefabrication impact evaluation process

➢ Conclusion
Background

- Multiple Impacts of the prefabrication: cost, time, waste, safety, ergonomics

- Limited tools to evaluate impacts: Surveys (Quality), Design Structure Matrix (Environmental Impact), Cost-benefit –analysis (Cost), Case studies (Safety and Health)
  - No proper methods for multiple factors evaluation

Purpose

- Development of multifactor MCDM tools to evaluate impact of prefabrication

Tool components:

- Cost-benefit-analysis: Monetary factors evaluation
- Choosing-by-advantage: Non-monetary factors evaluation
Method

- Literature review and analysis
  - Impact of prefabrication
  - Measuring impact of prefabrication
  - Multi-criteria decision making
  - Cost-benefit analysis
  - Choosing-by advantage

- 15 prefabrication impact factors

- FGD: Aalto University and 17 leading Finnish construction companies

- Multi-criteria tool development for prefabrication impact evaluation

- FGD: Aalto University and 17 leading Finnish construction companies

- Conclusion
## Prefabrication impact factors

<table>
<thead>
<tr>
<th>Impact factors</th>
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</thead>
<tbody>
<tr>
<td>➢ Project schedule</td>
<td>➢ Quality</td>
</tr>
<tr>
<td>➢ Site deliveries and supplies</td>
<td>➢ Surrounding environment</td>
</tr>
<tr>
<td>➢ Waste and disposal</td>
<td>➢ Sub-trade activity on site</td>
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<tr>
<td>➢ Safety (worker and environment)</td>
<td>➢ Design costs</td>
</tr>
<tr>
<td>➢ Weather conditions</td>
<td>➢ Procurement</td>
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<tr>
<td>➢ Ergonomics</td>
<td>➢ Design flexibility</td>
</tr>
<tr>
<td>➢ Labour and material costs</td>
<td>➢ CM/GC coordination costs</td>
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<tr>
<td>➢ Maintenance</td>
<td>➢ Maintenance</td>
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Process of prefabrication impact evaluation

Choosing-by-advantage

1. Define prefabrication and its on-site alternative

2. Define impact factors

3. Categorise monetary and non-monetary factors

4. Cost-benefit-analysis

5. Define criteria for each non-monetary factor

6. Describe the attributes for each factor

7. Define advantage for each attribute

8. Decide importance of advantage

9. Perform cost-advantage-analysis

Evaluate direct costs

Analyze benefits between alternative and convert them to costs

Calculate total cost and define cost-benefit ratio
Importance of advantage difference vs cost benefit ratio

![Graph showing the comparison of various modules (Water pipe module, Modular bathroom, Bathroom pipe module, Prefabricated machine room, Corridor elements) against their cost-benefit ratio.]
Conclusion and contribution

- Novel MCDM tools based on ‘cost’ and ‘value’ prospective
- Combination of CBA with cost-benefit analysis is suitable approach
  - Evaluates based on the several impact factors
  - Lowers the uncertainty of assumptions
- Helps to neutralize the cost debate of implementing prefabrication
Thanks!