EXPLORING THE TYPES OF CONSTRUCTION COST MODELLING FOR INDUSTRIALISED BUILDING SYSTEM (IBS) PROJECTS IN MALAYSIA

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Introduction:

Construction cost is an important element that should be monitored at different phases of the building construction process.

Construction cost is a factual process designed to give a reliable estimation or prediction of its financial cost.

Cost estimating is ‘a fundamental activity which combine of a mechanical process and subjective expertise undertaken to assess and predict the total cost executing of construction works. It consists of application of appropriate methods of estimating to the measures finished quantities of appropriate building’.

The purpose of construction cost estimation is to provide information for construction decisions including areas in the procurement and pricing of construction, establishing contractual amount of payment, and controlling actual quantities.
Introduction

As the construction industry is encouraged to adopt innovation in its trade, it came to the industry players’ fore to review the prevalent method of cost estimation for cost planning and control of IBS projects.

Drawing from that, and appreciating the need to reform the construction industry’s practices, it was conceived that reviewing the existent construction cost modelling used in the preparation of cost planning and control for IBS projects would be most expedient and vital.

Its strength should be the ability to adhere and remain relevant to the ever-changing technology and design dynamics being manifested from a progressive construction process.
## Definition: Industrialised Building System (IBS)

<table>
<thead>
<tr>
<th>Author/Researcher</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>CIDB, 2003b</td>
<td>A construction system which components are manufactured in a factory, on or off site, positioned and assembled into structures with minimal additional site work</td>
</tr>
<tr>
<td>Trikha, 1999</td>
<td>A system in which concrete components such as wall, floor slab, beam, column and staircase are mass produced at site or in factory are assembled to form the structure with minimum in situ construction.</td>
</tr>
<tr>
<td>Warszawski, 1999</td>
<td>A set of interconnected elements that joint together to enable the designated performance of a building.</td>
</tr>
<tr>
<td>Esa and Nuruddin, 1998</td>
<td>IBS is a continuum beginning from utilizing craftsmen for every aspect of construction to a system that make use of manufacturing production in order to minimize resources wastage and enhance value for end users.</td>
</tr>
<tr>
<td>Wardi, 1997</td>
<td>A system which uses industrialized production techniques either in the production techniques either in the production of components or assembly of the building or both.</td>
</tr>
<tr>
<td>Junid, 1986</td>
<td>IBS is a process by which components of a building are conceived, planned and fabricated, transported and erected at site. The system includes a balanced combination between software and hardware component. The software element include system design, which is a complex process of studying the requirement of the end user, market analysis and the development of standardized components.</td>
</tr>
</tbody>
</table>
Definition:
Industrialised Building System (IBS)

CIDB, Malaysia

‘A construction system which components are manufactured in a factory, on or off site, positioned and assembled into structures with minimal additional site work’
Definition: Industrialised Building System (IBS)

Classification of types of IBS according to CIDB:

- Type 1: Precast Concrete Framing, Panel and Box Systems
- Type 2: Steel Formwork Systems
- Type 3: Steel Framing Systems
- Type 4: Prefabricated Timber Framing Systems
- Type 5: Blockwork Systems
Definition: Cost Modelling

- **Ferry et al. (1997)**
  “The symbolic representation a system, expressing the content of that system in terms of the factors which influence its costs”.

- **Seeley (1996)**
  “a procedure developed to reflect, by means of derived processes, adequately acceptable output for an established series of input data”.

- **Ashworth (1999)**
  “techniques used for forecasting the estimated cost of a proposed construction project”.

Therefore, all methods, techniques or procedures used by quantity surveyors for cost estimation or cost forecast may be termed as cost models.
Type of Construction Cost Modelling

- Cost estimation models can be classified into three main generations:

  i. Traditional model
     - Conference,
     - Financial method,
     - Functional unit,
     - Superficial,
     - Superficial-perimeter,
     - Cube,
     - Storey enclosure,
     - Approximate quantity,
     - Bill of quantities.
Type of Construction Cost Modelling

ii. Non-traditional model
- Statistical / Econometric model (Regression analysis and Causal model),
- Risk / Simulation model (Monte Carlo simulation and Value management),
- Knowledge-based model,
- Resource-based model,
- Life cycle model.

iii. New wave model
- Artificial intelligent system (Neural network and Fuzzy logic),
- Other models (Environmentally and Sustainable development).
Type of Construction Cost Modelling

Choices of estimation models will be influenced by many factors:

- Information and time available
- Experience of the estimator/quantity surveyor
- The amount and form of cost data
- Purpose of the estimates
- Techniques to be adopted
Objective of the Study

To identify the most widespread or preferred incidence-in-use (IIU) of cost estimation model being employed by the Malaysian QS for projects using IBS.
Methodology

- Adopted a self-administered, 6 pages postal questionnaire
- The questionnaires were sent to all QS firms registered with Board of Quantity Surveyors, Malaysia (N=278)
- 15% firms responded and than computed and analysed descriptively using SPSS.
Analyses of Data
Demographic profile of the respondents

- Majority (94.9%) have between 10-30 years of working experience in construction industry.
- Majority (61.5%) have between 1-10 years of working experience in the organisation.
- Majority (64%) possess a high level of academic qualification; i.e., Degree holders.
- Majority covers a spectrum of high ranking personnel in which half (52.7%) of the respondents belong to the Top Management level, such as director, principal, managing here director, etc.

Therefore, the information provided by the respondents can be considered as highly reliable and authoritative.
## Currently-used Cost Estimation Model

**Table 1: Incidence-in-use (IIU) of Traditional Types of Cost Estimation Model**

<table>
<thead>
<tr>
<th>Modelling</th>
<th>Average Point</th>
<th>Average Incidence-in-use (IIU), N= 41</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conference</td>
<td>2.2</td>
<td>1% - 33%</td>
<td>8</td>
</tr>
<tr>
<td>Financial method</td>
<td>2.9</td>
<td>1% - 33%</td>
<td>6</td>
</tr>
<tr>
<td>Functional unit</td>
<td>3.0</td>
<td>34% - 66%</td>
<td>5</td>
</tr>
<tr>
<td>Superficial</td>
<td>3.9</td>
<td>34% - 66%</td>
<td>2</td>
</tr>
<tr>
<td>Superficial-perimeter</td>
<td>2.2</td>
<td>1% - 33%</td>
<td>7</td>
</tr>
<tr>
<td>Cube</td>
<td>1.8</td>
<td>0%</td>
<td>10</td>
</tr>
<tr>
<td>Storey-enclosure</td>
<td>2.1</td>
<td>1% - 33%</td>
<td>9</td>
</tr>
<tr>
<td>Approximate quantities</td>
<td>4.0</td>
<td>67% - 99%</td>
<td>1</td>
</tr>
<tr>
<td>Elemental estimating</td>
<td>3.7</td>
<td>34% - 66%</td>
<td>4</td>
</tr>
<tr>
<td>Bill of quantities</td>
<td>3.9</td>
<td>34% - 66%</td>
<td>3</td>
</tr>
</tbody>
</table>
## Currently-used Cost Estimation Model

### Table 2: Incidence-in-use (IIU) of Newer Non-Traditional Types of Cost Estimation Model

<table>
<thead>
<tr>
<th>Modelling</th>
<th>Average Point</th>
<th>Average Incidence-in-use (IIU), N=41</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regression analysis</td>
<td>1.5</td>
<td>0%</td>
<td>4</td>
</tr>
<tr>
<td>Causal model</td>
<td>1.5</td>
<td>0%</td>
<td>5</td>
</tr>
<tr>
<td>Monte Carlo simulation</td>
<td>1.3</td>
<td>0%</td>
<td>6</td>
</tr>
<tr>
<td>Value management</td>
<td>2.4</td>
<td>1% - 33%</td>
<td>1</td>
</tr>
<tr>
<td>Knowledge-based model</td>
<td>1.3</td>
<td>0%</td>
<td>7</td>
</tr>
<tr>
<td>Resource-based model</td>
<td>2.0</td>
<td>1% - 33%</td>
<td>2</td>
</tr>
<tr>
<td>Life-cycle model</td>
<td>1.7</td>
<td>0%</td>
<td>3</td>
</tr>
</tbody>
</table>
Currently-used Cost Estimation Model

Table 3: Incidence-in-use (IIU) of New Wave Types of Cost Estimation Model

<table>
<thead>
<tr>
<th>Modelling</th>
<th>Average Point</th>
<th>Average Incidence-in-use (IIU), N=41</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neural network</td>
<td>1.2</td>
<td>0%</td>
<td>2</td>
</tr>
<tr>
<td>Fuzzy logic</td>
<td>1.2</td>
<td>0%</td>
<td>3</td>
</tr>
<tr>
<td>Environmentally &amp; Sustainable development</td>
<td>1.6</td>
<td>0%</td>
<td>1</td>
</tr>
</tbody>
</table>
Findings

- Traditional types of cost model were, in general, still the most widely used.
- The newer, only the value management, resource based model, and life-cycle cost model costs being in general use.

Brandon (1982), had proposed to the construction industry to shift towards a more innovative and dynamic cost model.

From the study, it can be surmised that the continued and overwhelming use of the traditional types of cost model at the expense of the newer non-traditional types have somewhat stigmatised Brandon’s call for paradigm change.
Findings

Reasons why the traditional cost estimation modellings is still being widely used:

1. lack of familiarity with the newer techniques;
2. time constrain, plus lack of information and knowledge;
3. doubts whether these techniques are replicable to other projects;
4. most construction projects are not large enough to warrant the use of these techniques or research into them;
5. they require the availability of sound data to ensure confidence;
6. the degree of sophistication is seen as too superfluous for an average project;
7. the vast majority of risks are contractual or construction-related, and are fairly subjective such that they can be dealt with better on the basis of personal experience or from previous contracts undertaken by the company.
Conclusion

The traditional type of cost estimation models continue to be in widespread use irrespective of organisational type and size.

This phenomenon is comparable to findings from other similar researches conducted in countries like the UK, Hong Kong, Australia and Nigeria.
Conclusion

An appraisal or review of the cost estimation practices in construction projects is essential particularly of those using IBS.

This is vital in order for IBS to be well placed, and accordingly evolve with the various innovations that transpire within construction industry.

If need be, the appraisal must also be re-strategised to take advantage of the various benefits presented by the newer non-traditional and new wave cost estimation models in cost planning and control practices.
THANK YOU