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Framework for Enhancing Cost Management of Building Services

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Abstract

Cost is generally accepted as an essential ingredient of good design. However, the co-ordination and integration of building services constitute a major problem in the procurement and cost management of buildings coupled with gaps in knowledge by practitioners in the technology of building services. The study proposed a generic framework for integrating quantity surveyors services in the procurement and effective cost management of building services in Malaysia construction industry. The framework requires early involvement of design consultants including specialist designers and quantity surveyors. The most significant obstacle to the adoption of the framework is the industry commitment and the client's readiness to pay for additional services.

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1. Introduction

Cost is generally accepted as an essential ingredient of a good design and the main purpose of cost planning is to obtain a properly balanced building which meet – up with clients' requirements. There is a growing awareness of the importance of cost of building services. The cost of building services can represent between 15 – 70% of the total cost of buildings depending on the purpose of building and the sophistication of the building services. A major problem which has been identified was the lack of requisite technical skill by quantity surveyors (QS) in the technology of building services, similarly, consultant services engineers are not accustomed with the art of preparing necessary tender documents for the procurement of building services (Dent, 1980; Michie, 1981; Nanayakkahara & Fitzsimmons, 1999; McCaffrey, 2011). Meanwhile, clients often engage cost consultants at the early stage of building projects so as to get a reliable cost advice that will inform their business decision before committing fund to any project (Fortune & Cox, 2005). The value of the cost advice given by the QS is the reliability of early of the cost estimates (Swaffiel & Pasquire, 2000). This will provide a real opportunity to add value to the clients' business decisions. Therefore, the client will expect nothing but a reliable assessment of anticipated project value which will aid strategic decision making.

In Malaysia, it is widely reported that there is no uniform method for preparing building services bills of quantities (BoQ) and tender documents by industry practitioners', different consultants use different method to present project details to contractors and other industry stakeholders without reference to the rules standard method of measurement (SMM). Performance specifications and schedule of prices are used to invite tenders, where BoQ are used there are often inconsistencies in the method of preparation and the rules of measurement are spelt out in the preambles (Kumar, 2009; Sabaria, 2009). The problems with this approach are that, tender evaluation is made difficult and the cost of tender to contractors increases. At post contract stage, variation assessment and preparation of interim payment is complicated leading to disputes, delays, time and cost overruns as well as unhappy client (Molloy 2007, CIDB 2009, Sabaria 2009).

In the conventional practice, building services contractors receive information from the main contractor, process client requirements at their individual organisation level without input from the client and even designers (Hughes, 2003). Good ideas are held – back by specialist contractors in order to gain competitive advantage during the tender (Mathew & Howell, 2005). Leading to difficulties in optimising design solutions and reliable estimates by the design team. One of the main reasons being that, preparation of BoQ can only begin when certainty is established in the design (Potts 2004). Similarly, Al – Harbi et al., (1994), opined that estimates produced from incomplete project information that does not give all the details is liable for inaccuracy. Therefore a window of opportunity is missed by the QS at the early stage of building services design because of the lack of cost planning model to aid the value and financial analysis of the design. In addition, the lump sums contained in the building services tender are often not broken down into meaningful elements and few QS have the knowledge to assess the accuracy of the estimates (Potts, 2008).

The focus of this study therefore, is to propose a framework for planning and controlling cost of building services, whereby QS and consultant engineers can work together in collaboration with the downstream supply chain to develop a reliable cost estimate for the procurement of building services projects in a transforming economy. The objective of the study reported in this paper was to identify the barriers to pre – contract price forecast of building services and propose a standard – based pricing method for cost management of building services

2. Cost Planning of Building Services.

The traditional method of sequential design development inhibits effective cost management of building services because due consideration is not given to specialist designers and contractors. Pavitt & Gibb (2003) considered that non involvement of specialist contractors in the downstream supply chain always bring about serious problems during construction, especially at the interface between the building services design team and building services contractor. They pointed out that this normally occurs because of the following reasons:

- The communication gap between designers is often caused by poor coordination of the various design inputs
- Lack of management of interfaces and blurred divisions of responsibility”
- Procurement of specialist contractors’ design – (specialist contractors are not contractually recognised as a member of the team).

3. Barriers to Effective cost Management of Building services.

Successful cost management of building services according to Rawlison et al., (2007) is affected by design standards; physical constraints; coordination; design management; effective contractor involvement; programming of works and commissioning. McCaffrey, (2010) describes the roles of the building services quantity surveyors and identified some of the challenges they face in managing the cost of building services project as : insufficient design; the nature of the installation; lack of understanding by the main contractor; coordination of services; coordination of design; programming services; cost management of services and commissioning.

3.1. Design related problems:

Murray (1997) identified incomplete design as one of the major factors inhibiting the measurement of engineering services by quantity surveyors. Michie (1981) found that architect’s training in building services is limited and the services consultants are always appointed late during the design. Rawlison & Dedman (2010) stated that most M&E work involves an element of design by downstream supply chain. However, they are not usually reflected in contractual relationships according to Pavitt and Gibb (2003).

3.2. Co-ordination problems

This has to do with clashing of service works on site (for instance, plant rooms, duct layout). The architects’ practical training on the subject of building services is less than optimum, therefore, they have difficulty in fulfilling the coordination role giving the increasing content and complexity of engineering services Michie,(1981), Gura,(1984). Baldwin and Chan (1994) Summarised the problems as: Design related problems; coordination problems and procedural problems, they further outlined the probable areas of conflict resulting from lack of coordination as follows: (1) Services conflicting with the structural frame; (2) discrepancies in dimensioning as stated on different drawings (3) improper reservation of holes (4) conflicts between two or more services; (5) differences between the dimensions of the actual equipment and those in the detailed design; (6) differences in the location of equipment; (7) improper arrangement for the sequence of works; (8) difficulties in the identification of access points and services (9) difficulties in the support and fixing of services (10) insufficient space for the completion of adjacent finishing works; and (11) difficulty in inspection, commissioning and maintenance.

3.3. Impacts on Cost Management of Building Services

McCaffrey (2011) stated that variations and inaccurate estimation are major contractual cost issues that often arises on engineering services within the construction team as a result of incomplete design or coordination problems. In the first place, determining the impacts that variations can have on the contract price and time can be arduous due to the interconnected nature of the construction work and the difficulty in isolating factors to quantify those (Potts 20). Nevertheless, the most frequent effects of variation order in engineering services contract has been identified as increase in project cost; rework and demolition; delay and possible time overrun; increase in overhead expenses (Manzoor and Pheng, 2005; Bower, 2000). Sometimes when not properly administered, it can result to disputes between the contractor and the client (McCaffrey, 2011). Leading to rework; delay to an overall program and extension of time; and probable loss and expense claim by the contractor (Ibbs, 2005).

4. Adoption of Standard Based Pricing Mechanism for Building Services

To improve the quality of price forecast advice given by cost consultants, it is essential to consider enhancement of the process itself. In order to improve the process of producing a building project price forecast given in the early stages of design development, Skitmore (1991) suggested two approaches:

- Developing entirely new estimating techniques or
- Using detailed estimating techniques (e.g BoQ) in the early design stages.

Skitmore (1991), further, presented the general model of adopting detail estimating techniques as comprising items, quantites and rates usually contained in priced BoQ as

$$P = \sum_{i=1}^n q_i r_i$$

Where P represents the total cost/price, q and r, the item quantities and rates respectively, and subscripts (i = 1, 2... n) denotes the items involved. Therefore, the calculation of P depends on two main factors:

- Identification of the items, i and
- Estimation of the parameter values, q and r.

However, the accuracy of estimates of P is dependent solely on the combined accuracy of these 2 factors. In detail estimating, the identification of items and the parameter value q and r are contained in the bills of quantities. Each of these items is complete with the descriptions of materials, labour and workmanship for the work (qualitative information) and its quantity (parameter value q) (Seeley, 1997). The cost (parameter value “r”) of executing each item of work is often derived from the qualitative information provided in the BoQ. The methods of identifying these items (item classification); the cost significant information that will aid the generation of parameter value “r”; as well as the unit of measurement for generating parameter q are contained in the rules of a SMM.

The implication of earlier assertion is that the accuracy of the “parameter values” q and r can be enhanced by the information contained in the BoQ if the preparation is based on the detail rules of SMM. BoQ contains items of work necessary for the execution of a building project. These items of work are expressed in qualitative and quantitative term aspect of every constituent part of a proposed construction project. The process of appropriately identifying the items as well as “parameter values” q and r for effective price estimating are set out in the SMM. The SMM is usually set within the legal framework of construction contracts.

4.1. Identification of items and parameter values.

BoQ is a document detailing the qualitative and quantitative aspects of every item of a proposed construction project (Potts, 2008). Each of these items is complete with the description of material, labour and workmanship for the work and its quantity (Seeley, 1997). The way in which this information should be described, classified and inserted in the BoQ are set out and detailed in SMM. Dell’Isola (2002) observed that the description of item's attributes for the purpose of price estimating and effective cost control can take the following forms:

- Functional: - what purpose is the component serving?
- What material or materials make up the component?
- Location:- where in the building is the component located?
- Installation:- what methods are used to install or construct the component?
- Dimensional:- what are the physical dimensions of the component?
- Quantitative: - how many of the components exist within the building, and how much of the material making up the component are used?
- Qualitative: - what are the qualitative and performance properties of the component, including physical form, appearance, and capacity and so on.

4.2. Estimation of the parameter values, “q” and “r”.

A reliable price estimating requires the use of an acceptable standard framework to effectively communicate information from projects to projects as well as among project participants (Dell’Isola, 2002). Adoption of Standard Based pricing mechanism can provide more benefit but this implies that:

- The architect will prepare full architectural Drawings;
- The structural engineer will produce full structural information;
- Mechanical & electrical will produce detail services information;
- All information required from named subcontractor will be incorporated and
- All specialist designers will produce detailed information on their aspect of the work.
- The Quantity surveyor in collaboration with consultant engineer should prepare a bill of quantities and collate all tender documents in line with SMM.

Upon conclusion of tendering exercise and prior to award, an appraisal of tender documents submitted will be carried out by the quantity surveyors. Therefore, the following aspect should be negotiated because of their probable impact on the project.

Programme of work: - a comparison with the Client’s expectation on programme of work to reveal the possibility of implementation. In addition, implications of time allowed for execution of each aspect of work and lead time for supply and installations of equipment would have to be reviewed in view of any subsequent change order.

Bill of quantities/Elemental Cost Breakdown:- the bill will be negotiated item by item to ensure that rates are properly distributed, are not too high and are reasonable for execution of items of work against which they are inserted. Cost breakdown of works that cannot be detail into a bill of quantities will be negotiated based on work packages.

Schedule of rates/Prices: - Schedule of rates will also be analysed to ensure that it conforms to the bill and cost breakdown. This will serve as a basis for valuing variations of work that are not originally

contained in the documents. The percentage mark – up on labour, materials, plant and equipments including contractors overhead and profit will be determined and negotiated. This point represents a hard gate and agreement reached here will serve as basis for administering variation and managing the execution of the entire building services aspect of a project.

Conclusion

There is a general agreement that systematic cost information is critical for effective cost management of building services. The adoption of a standard method of measurement is a viable option to achieve this. However, the generic framework proposed for enhancing cost management of building services is a preliminary outline of something that should be developed into a precise tool allowing reliable forecast of building services cost. The outcome of the framework would be of particular value to clients and other project stakeholders in the construction industry but implementing the framework will require early collaboration between the consultant services engineer, specialist designers and quantity surveyors. However, the question arises that would the client be ready to pay for the co-ordination and integration of parties required in generating a more reliable cost estimate for building services.

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