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# A Review on the application of bills of quantities (BQ) in construction project procurement

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**Abstract:** In Malaysia, Bills of Quantities (BQs) is widely used in project procurement. BQs, prepared by Quantity Surveyors, serve as one of the primary components of the tender and contract documents. However, in spite of its extensive use numerous questions were raised concerning the effectiveness of BQs in meeting the needs of project procurement. This paper provides a review of the BQs including its functions, types and critiques. The paper concludes with questions on the effectiveness of the BQs and whether the quantity surveying profession has moved forward or is old issues and problems remained unattended.

**Key words**: Contract; Construction; Tender; Quantity surveyor

## 1. Introduction

This paper discusses issues and problems related to Bills of Quantities (BQs). It aims to stimulate a healthy debate related to the question being asked by many: how effective are the BQs? The objective is to examine the issue on whether a BQ is effective in meeting the needs of project procurement. Through extensive literature search, the debate revolves largely around the question of whether the value derived from having the BQs in project procurement commensurate with the effort in preparing the BQs.

The paper is presented in 5 parts. Part 1 introduces the paper. Part 2 and Part 3 provide an overview on BQs and presents an assessment on the effectiveness of BQs, respectively, while Part 4 presents the findings from the study and discussion thereof. Finally Part 5 concludes the paper.

## 2. BQ: An overview

In the traditional system of procurement, otherwise known as the Design-Bid-Build arrangement, BQ serves as one of the primary components of the tender and contract documents.

BQ is defined as a document that sets down various items of work in a logical sequence and recognized manners, in order that they may be readily priced by contractors (CIDB, 2010). The term quantities refer to the estimated amount of labor and materials required in the execution of the various items of work. Together these items give the total requirements of the contract.

The items of work are measured in recognized units, the method of which are detailed in the Malaysian Standard Method of Measurement of Building Works, Second Edition (SMM2) (The Institution of Surveyors Malaysia, 2000) for building projects and in the Malaysian Standard Method of Measurement for Civil Engineering Works (MyCESMM) (CIDB, 2010) for civil engineering works.

Seeley (Seeley, 1972) provides a historical background of the BQ. He reported that the BQ has its origin during the period of the Industrial Revolution in England. The use of BQs in construction project procurement is primarily a British practice (Hucker, 1993). However, it is also widely used in the Commonwealth Countries, perhaps due to the common legacy – that of one-time British rule and influence.

Turner (Turner, 1979) expanded on the works done by Seeley. Not only did he described the purposes, forms and the merits and demerits of using BQs, Turner also described the evolution taking place in the preparation and presentation of BQs and different types of tendering and contractual arrangements.

Zakaria (Zakaria, 1986) traced the history of the BQs in Malaysia. He reported that the first BQ was introduced in 1956 by the British expatriates working for the Public Works Department (or JKR). Since then BQs are widely used in construction project procurements in Malaysia – both in the public and private sectors.

BQs are prepared by Quantity Surveyors principally from drawings, specification and other documents provided by the designers. Table 1 provides a sample page of a typical BQ.

In essence, BQs are considered to be one of the most significant aspects of the services offered by Quantity Surveyors. For example, according to the Royal Institution of Surveyors Malaysia, preparation of BQs is listed as the fourth service, categorized

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under the basis services to be offered by professional Quantity Surveyors in Malaysia (RISM website at http://www.rism.org.my/) (Royal Institution of Surveyors Malaysia, 2016), see Fig. 1.

**Table 1:** Example of a typical BQ

| SECTION 'F4' - BUILDING WORKS - BUNGALOW (TYPE 'A') | | | | | |
|---|---|---|---|---|---|
| ITEM | DESCRIPTION | UNIT | QTY | RATE | AMOUNT (RM) |
| | ELEMENT NO. 1 - WORK BELOW LOWEST FLOOR FINISH | | | | |
| | Excavate and get out, part return, fill in and ram, deposit and spread in making up levels where directed within the site and remainder load and cart away | | | | |
| A | Pit for pile cap exceeding 1.50m deep | M3 | 16 | 15.60 | 249.60 |
| B | Pit for pile cap exceeding 1.50m but not exceeding 3.00m deep | M3 | 2 | 16.64 | 33.28 |
| C | Trench for ground beam not exceeding 1.50m deep | M3 | 5 | 15.60 | 78.00 |
| D | Over site to reduce level average 250mm thick | M2 | 39 | 3.90 | 152.10 |
| E | Ditto 200mm think | M2 | 160 | 3.12 | 499.20 |
| F | 100mm Thick bed of hard-core as described spread, levelled, | | | | |
| | well rammed and consolidated, watered and blinded with fine sand well rolled in and finished to receive apron (measured separately) | M2 | 17 | 9.46 | 160.82 |
| G | 100mm Thick ditto pool deck (Provisional) | M2 | 39 | 9.46 | 368.94 |
| | 50mm Thick lean concrete Grade 15 as described blinding screed spread and levelled under | | | | |
| H | Pile cap | M2 | 11 | 9.88 | 108.68 |
| J | Ground beam | M2 | 13 | 9.88 | 128.44 |
| K | Ground slab | M2 | 114 | 9.88 | 1,126.32 |
| L | Apron | M2 | 17 | 9.88 | 167.96 |
| M | Pool deck (Provisional) | M2 | 39 | 9.88 | 385.32 |
| | | To Collection : | | | 3,458.66 |

**Basic Services**

The scope of basic service is outlined as follows

1. Preparation of preliminary cost estimates and cost plans of the development project.
2. Advise on cost estimates in relation to design development of a project.
3. Advise on procurement, tendering and contractual procedures and arrangement.
4. Preparation of the Bill of Quantities or Specification document for tendering purposes.
5. Organize the calling of tenders.
6. Evaluation of tenders received in the form of tender reports.
7. Preparation and execution of the formal contract.
8. Interim valuation of works in progress on site for purposes of interim payments.
9. Preparation of financial statement of regular intervals during the construction period.
10. Settlement of the final accounts of the project.

**Fig. 1:** Basic services of quantity surveyors (Source: RISM, (2016))

## 3. Functions of BQs

There are four principle functions of the BQs (Seeley, 1972; Turner, 1979):

1. To provide a uniform basis for contractors tendering for a job – this is the single most important function of the BQs. It enables all contractors tendering for a job to price on exactly the same information with a minimum of effort.
2. To provide a basis for the valuation of variations – variations often occur during the progress of the work. The unit rates entered by the contractor during tendering will be used in the valuation of similar items of work executed as variations, either for addition or omissions.
3. To provide construction management information for all parties in the contract – the detailed nature of the BQs provide valuable information on the design, specifications, details of materials and workmanship, positional and labor requirements for the job. The information helps the contractor and the client in the programming and cost management of the project.
4. To provide basis for cost planning and cost analysis – the priced BQs provide valuable information to enable the client to analyze his cost plan and for detailed comparison. Its main purpose is, in this respect, to provide data for future cost plan and the like.

## 4. Type of BQs

There are generally two types of BQs: firm BQs and the approximate BQs. Both types are similar in all aspects except that the latter contain quantities which are approximate in nature.

The approximate BQs are used in situations where time is pressing that prevent for firm design and firm quantities to precede tendering. In these conditions, the approximate BQs are used at the

contract stage. Complete re-measurement based on the completed design and completed work and complete re-pricing using the tendered until rates to achieve the final account will have to be done. Under this method the contractor is responsible only for his price. Any errors or omissions in the BQs will be corrected and adjusted in the final account.

## 5. Assessing the effectiveness of bill of quantities

BQs are widely used in project procurement in Malaysia (Ali, 1986). For instance, the Public Works Department (JKR), the agency responsible for implementing all government projects, uses the traditional procurement system based on BQs as its main method of procurement. This method satisfies the government procurement requirements that: all projects must be let on open competition; each project must be clearly defined; and that all items of work are accounted for. Similarly, most public sector Clients also prefer to use BQs in the procurement of their construction projects.

Many writers including Seeley (1972), Turner (1979), Lenard (1992), Low (1992), Nik Farid (1995) and Khairuddin (2011) discussed the significance of BQs in project procurement. They all agreed that BQs provide an excellent basis for inviting competitive offers and for cost management of the project. They also agreed that BQs are vital for contractors to base their estimates on when making competitive offers.

In the context of Shariah compliant contract Khairuddin (2011); (Hasan, 2014; Rashid and Hasan, 2014a; Rashid, 2015) contended that *Istisna'* and in particular parallel *Istisna'* offers a viable alternative to the conventional construction contract arrangement. Within *Istisna'*, the requirements of unambiguous and clearly written contract documents that describe the proposed project are mandatory. In this instance, Khairuddin (2011); (Hasan, 2014; Rashid and Hasan, 2014a; Rashid, 2015) proposed that having a properly prepared BQ is considered appropriate and sufficient to address the said mandatory requirement.

Lenard (Lenard, 1992) reported the views of the Australian Institute of Quantity Surveyors that many problems would arise in projects where BQs are not used. The more important ones are:

1. Tenderers can manipulate the quantities and items of work to suit their own purposes.
2. Comparison of tenders is made more difficult because the scope of the works (as measured by the different tenderers) will vary between the bidders.
3. Accurate valuation of progress claim would be considerably more difficult and risky.
4. A total estimate for the project would be a serious of 'best guesses' based on overall floor area. This approach is dangerous and could have severe consequences for all parties concerned, with regard to both cost and time.
5. A group of builders may form an alliance to have a BQ prepared. This encourage contractors at a very early stage to get together to discuss possible strategies and at worse arrange for possible cover prices and collude for the allowance of tender fees.

However, in spite of its extensive use numerous questions were raised concerning the effectiveness of BQs including;

1. BQs cause delay in calling of tenders;
2. BQs do not promote speed, economy and 'build ability';
3. In view of continuing changes in construction techniques and contractual arrangements, BQs are no longer relevant in representing the approximate parameters of construction;
4. BQs are unnecessarily detailed;
5. Inaccuracies, errors and omissions often occurs in BQs leading to variations and claims for additional costs;
6. The use of BQs in project procurement are suitable for certain types of projects only; and

BQs do not fulfill the purpose it is supposed to fulfill that is in meeting the needs of project procurement.

## 6. Findings and discussion

From the review of literature, it has been found that on the one hand BQs offer significant advantages when employed in construction project procurement. However, the comments and criticism aimed at BQs suggest that they are indeed valid reasons for the effectiveness of BQs in construction project procurement being questioned. For instance Turner (Turner, 1979) asked two questions that he claimed were the negative effects of the BQs: BQs caused delay in calling of tenders and BQs do not promote utilization of the contractors' expertise in the design to promote speed, economy and 'buildability'.

In addition, Chong (Ming, 1990) questioned the efficiency of the BQs. He argued that BQ is no longer relevant in representing the appropriate parameters of construction in view of continuing changes in construction techniques and contractual arrangements. Cheah (Shin, 1990) reported that in Australia the detailed nature of the quantities is not favored by many in the Australian construction industry.

In moving forward, the construction industry continues to evolve as Clients and key stakeholders continue to seek better, cheaper and faster solutions in meeting their construction procurement needs. In addition to the introduction of newer technologies in construction such as the use of Industrialized Building Systems (IBS), green procurement and the likes, the construction industry is now embarking on BIM or building information modeling (see for example Sinclair (Sinclair, 2012) for Building Information Modeling (BIM) and the Architects).

Typically BQs are prepared by the Quantity Surveyors. Consequently the application of the said new technologies and approaches in procurement require the Quantity Surveying profession to look inward, to self-evaluate and to come up with the

necessary and appropriate strategies including coming up with the more efficient manner in preparing BQs and seeking a more effective use of the BQ in construction project procurement. Unfortunately, the Quantity Surveyors appear to be quite slow in responding to change, including in embracing new technologies such as Information and Communications Technologies (ICT). While other professions such as the Architects are busy experimenting and applying 3Ds, BIM and beyond in their design and supervision of building works and while the Contractors and Engineers are actively applying modern project management techniques including the application of proprietary software packages, most, if not a majority of Quantity Surveyors remained steadfast in their own 'traditional' ways of doing things.

Admittedly, many Quantity Surveying firms are already using proprietary software packages in measurement and in preparing BQs. However, much of these applications are limited to automation of what would have been the tedious tasks of calculating, summing and collecting quantities and standardization of descriptions for the BQs. Much of the actual 'measurements' are still being done manually and then only the resulting quantities are fed into the proprietary software package. As of now, very little information is available on how the Quantity Surveying profession would react to such newer technologies and on what would be required so as to enable them to grow to be in tandem with the other professions. It is not yet known how, for example, what would BQs to be like should BIM becomes mandatory in Malaysia!

## 7. Conclusion

The construction industry relies substantially on BQs when procuring construction projects largely due to the advantages it provides. However, there are questions and criticisms directed at BQs especially on its efficiency and effectiveness. Consequently further and in-depth studies are required in effort to ascertain the effectiveness of using BQs in construction project procurement and on the future of the BQs itself.

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