

# COMMON ERRORS THAT ARE BEING MADE IN PREPARING AND PRICING BOQ IN SRI LANKAN CONSTRUCTION INDUSTRY

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## ABSTRACT

*In construction projects the Bill of Quantities (BOQ) has become a vital document in post contract stage as well as in pre contract stage, since the BOQ address the important three aspects of a project, that are time, cost and quality. Therefore, it is necessary to illustrate that if there is any error in BOQ that would directly affect the base of the construction projects. As a result, all stakeholders involved in a project have an extremely higher concern on those three aspects, as having an error free BOQ is vitally important. Errors can occur during preparation stage and pricing stage of the BOQ. Further, to minimize BOQ errors it is important to have a clear understanding on the errors which occur most frequently during preparing and pricing stages of a BOQ. Therefore, this research study is focused to identify the common errors that are being made in preparing BOQ in Sri Lankan construction industry. A literature survey was carried out to identify the importance and common errors of BOQ during preparation and pricing BOQ in construction industry and this paper presented the findings of it. The survey revealed the importance of BOQ in post contract stage as well as in pre contract stage. Moreover this research has identified the errors which occurred during preparation and pricing stages of BOQ separately, and the reasons for those errors. This would then lead to establish a mechanism to, either to eradicate or minimize errors in BOQ preparation and pricing within the construction industry and hence facilitate to sustain the BOQ as an important and reliable document in the industry.*

**Keywords:** Bill of Quantities (BOQ); Cost; Errors; Quality; Time.

## 1. INTRODUCTION

Since the involvements of stakeholders are high in the construction industry, in order to carry out the construction in an effective manner, certain documents are required to be included in the contract document. Out of those binding documents a Bill of Quantities (BOQ) is a critically important document (Lee, *et al.*, 2005). Traditionally Consultant is deemed to be the responsible person for the preparation of BOQ and prospective contractors should price it. However a priced BOQ represents merely an estimate therefore it should be to minimize the discrepancy between estimate and the actual cost (Lee, *et al.*, 2005). Further Davis, *et al.* (2009) revealed that there is a possible reluctance to use BOQ as part of the contract, because of the client's sensitivity to the claimed disadvantages, rather than advantages of BOQ. Therefore, BOQ should not have errors in description, quantities or with pricing which leads to substantial disputes regarding time, cost, and quality. In order to prevent those errors within the construction industry standards were developed and practiced in order to take off measurements (Lee, *et al.*, 2005).

Irrespective of the usage of standard methods of measurement certain errors are still available, and that would lead to many critical consequences. Client's main requirements and concerns are whether the project completed on time, within the estimated cost and within specified quality (Rashid, *et al.*, 2006). Moreover if the BOQ errors lead to time, cost and quality issues of projects it may affect to the sustainability of the practice of BOQ in the industry. Furthermore, Jaffar *et al.* (2011) have identified errors substantial changes in bills of quantities as a source of conflict in construction.

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## 2. IMPORTANCE AND USES OF BOQ IN CONSTRUCTION

According to Millican (1996 cited in Bandi, 2012) BOQ is a document used over 300 years as a one form. Further it is a critically important document in construction industry particularly under the traditional procurement method. Seeley (1997 cited in Davis *et al.*, 2009) stated that absence of a BOQ may lead to greater variability, increased risk in estimating and consequently more disputes. Based on the arrangement of Hackett, Robinson and Chan (2003 cited in Rashid, *et al.*, 2006), it can be illustrated that BOQ is a document specifying the qualitative and quantitative aspects of each and every essential parts of a proposed construction project.

Brook (1998 cited in Davis, *et al.*, 2009) illustrated that the BOQ has two primary uses in pre contract and post contract stages. In pre contract stage, BOQ assists contractors in the formulation of tender document, through breaking down the contract works in a formal, detailed, and structured manner for tendering (Australian Institute of Quantity Surveyors). Moreover, in post contract stage the BOQ assists contractor and Quantity Surveyor (QS) in preparation of interim payments and valuing variations, as well as it provides a financial structure for contract administration (AIQS, 2001 cited in Davis, *et al.*, 2009). Hence according to Rashid *et al.* (2006) BOQ is a multipurpose document. Furthermore BOQ can be seen, as a source of valuable information for not only the management of project cost but also the management of the project, because project cost management is an integral part of project management which strike a balance between competing demands among cost, time, quality and scope of a project (Rashid *et al.*, 2006)

However according to Molloy, Willis and Turner later it came to know that BOQ has its own uses at pre contract stage as well as in post contract stage (Rashid *et al.*, 2006).

### 2.1. IMPORTANCE OF BOQ IN PRE-CONTRACT STAGE

BOQ preparation is an activity performed during the pre contract stage. In traditional procurement the consultant is deem to be responsible to prepare the BOQ. Further according to Millikan (1996 cited in Davis *et al.*, 2009) errors in BOQ preparation stage may lead to various problems which would place a havoc in post contract stage.

Importance and the use of BOQ in the pre contract stage for many construction stake holders have been identified by many researches. In a nutshell these facts are identified and illustrated in Table 1 as follows;

Table 1: Importance/Use of BOQ in Pre Contract Stage

Importance / Use	For Whom	Source
Give sense of control of projects, in term of cost and finance	Architects and other consultants	Rashid <i>et al.</i> , 2006
As part of the Tender document for requesting competitive tenders from contractors	Consultant QS on behalf of the Client	Rashid <i>et al.</i> , 2006
Price the work on precisely the same basis, thus allowing for the fairest bidding	Contractor	Rashid <i>et al.</i> , 2006
Assessing Tenders	Consultant QS on behalf of the Client	Rashid <i>et al.</i> , 2006
Asset Management	Client	Davis <i>et al.</i> , 2009
Consultant's fee calculation	Consultant and Client	Davis <i>et al.</i> , 2009
For Projecting Cash flow and Budgeting	Contractor and Client	Rashid <i>et al.</i> , 2006
Work items and the quantities in the BOQ can be convert to a detail Work Breakdown Structure (WBS) of the project (for Project Planning)	Contractor	Rashid <i>et al.</i> , 2006 Adnan <i>et al.</i> , 2011

**2.2. IN POST CONTRACT STAGE**

Since the origin of the BOQ, its functions and use has remained same over the past without major changes. Even at present BOQ is still considered as a document for project costing and as part of tender document to obtain and assess competitive tenders from contractors. Bearing that fact in mind it is necessary to identify the other important features and uses to the stakeholders with in the construction industry. Therefore, Table 2 clearly emphasised the essence in BOQ as identify by many researches.

Table 2: Importance/Use of BOQ in Post Contract Stage

Importance / Use	For Whom	Source
BOQ serves as a post-contract administration tool and becomes a basis for the evaluation of progress payments.	Client, Consultant and Contractor	Davis <i>et al.</i> , 2009 Adnan <i>et al.</i> , 2011
BOQ provides a proper, common basis for the valuation of variations	Contractor and consultant	Carlidge, 2009 Davis <i>et al.</i> , 2009
The prices in the BOQ are a basis for comparing a contractor's price with current trends in the market. This provides a basis for management to determine the likely causes of risk factors	Consultant and client	Davis <i>et al.</i> , 2009
Preparing Material Schedule and for Material reconciliation	Contractor	Wainwright & Whitrod (1980 cited in Rashid <i>et al.</i> , 2006) Adnan <i>et al.</i> , 2011
Preparation of Final Accounts	Contractor and Consultant	Rashid <i>et al.</i> , 2006 Adnan <i>et al.</i> , 2011
Procure Sub contractors	Contractor	Rashid <i>et al.</i> , 2006 Adnan <i>et al.</i> , 2011
Effective and efficient project management (and site management)	Contractor and Consultant	Rashid <i>et al.</i> , 2006 Adnan <i>et al.</i> , 2011
Act as a legal document	Contractor and Client	Kodikara <i>et al.</i> (1993 cited in Adnan <i>et al.</i> , 2011)

Accordingly BOQ can be considered as a vitally important document in the construction industry which has become complimentary for key stakeholders as well as minor stakeholders in the industry.

**3. BOQ PREPARATION**

In traditional BOQ preparation can be divided in to two distinct stages as follows (Lee *et al.*, 2005);

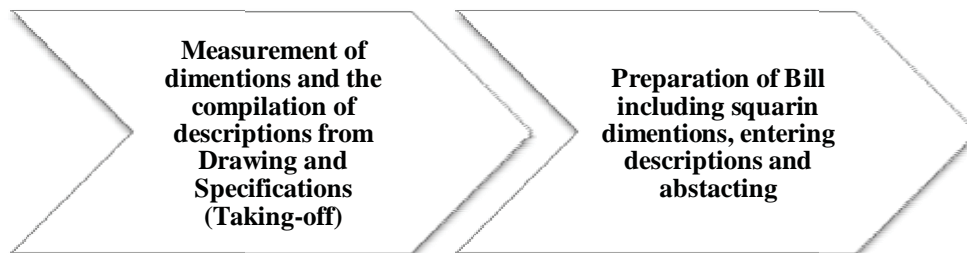


Figure 1: Stages of BOQ Preparation

In the process of preparing BOQ it is necessary to carry out a thorough examination on the design and specification. This process enables the QS to identify inaccuracies and inconsistencies in drawings and specification prior to tender, and to reduce subsequent problems in post-contract stage (Milliken 1996 cited in Davis *et al.*, 2009). Due to the fact that BOQ form a part of contract, accuracy of the bill preparation has become more important. Moreover if there are substantial errors it will lead to form a contract which involved a sum considerably beyond the consideration. Hence to mitigate errors and discrepancies QSs use standard methods of measurements when preparing BOQ, so that contractors can identify how quantities have been prepared and including and excluding of each and every item in the bill (Lee *et al.*, 2005).

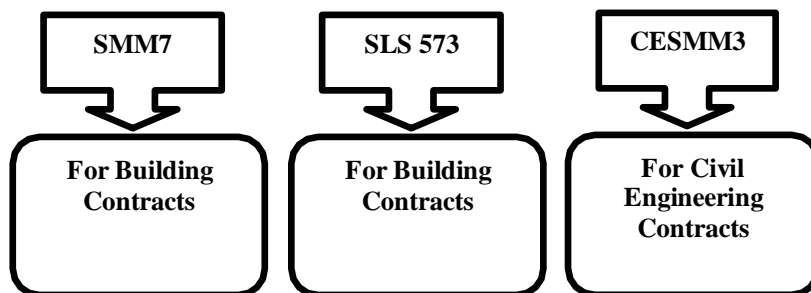


Figure 2: Standard Documents Used for Bill Preparation in Sri Lanka

However, in Sri Lanka consultants also use its own method of measurements to prepare BOQs and it may cause increase many of errors in preparation stage as well as in pricing stage, than using any standard method. Further, Perera *et al.* (2003) have identified opinions of consultants and contractors on reluctance in usage of standard method of measurements in Sri Lanka. The factors identified in the research by Perera, *et al.* (2003) clearly denoted the main reasons as illustrated in Table 3.

Table 3: Reluctant to Usage of Standard Method of Measurement (Perera *et al.*, 2003)

Consultant's Perspective	Contractor's perspective
Drawings are not prepared in detail at the time of preparation of BQs. Thus detailed itemization is not possible.	Lack of resources in estimating staff, time constraints within which tenders should be Submitted etc.
Standards lack clarity to a larger extent and the Quantity Surveyor is left with no assistance to solve such matters.	The cost information available for the contractors is not updated frequently and may not be suitable for accurate estimating.
Consultants have observed that contractors do not consider the relationships between items of work. Same costs are included in different items resulting in higher tender prices. This is because contractors are more familiar with all inclusive prices, and even when items have been separately identified they tend to price as usual ignoring the detailed itemization.	The contractors have not classified their overhead expenses and project costs to a sufficiently accurate and organized method.
Consultants sometimes lack experienced Quantity Surveyors competent enough to follow the SMM. Often the case is that there are lot of people who have emerged to the QS profession with their experience in the industry and not with adequate theoretical background. It is difficult for them to switch from their traditional ad-hoc practices to new standards that have been developed.	
The time available to prepare a BOQ is sometimes very short that detailed items cannot be measured.	

### 3.1. BOQ PREPARATION ERRORS

A standard method of measurement provides a uniform basis for measurement which leads to easy preparation of BOQ due to less complexity for the contractor. Further this is due to the fact that easier identification of cost in a significant and methodical manner. Moreover BOQ preparation errors will have effect on cost, since BOQ contains the cost deciding factors for the project (Perere, *et al.*, 2003). Irrespective of the usage of standard methods of measurement certain errors are still available. However, that would lead to many critical consequences. Improperly prepared BOQ may lead to greater variability, increased risk in estimating and consequently more disputes (Seeley, 1997). Therefore it is considerably important to have proper monitoring in both taking off and bill preparation stages since errors can happen during both stages.

Quantity is an important element in a BOQ; according to Adnan *et al.* (2011) providing in accurate quantity is a deficiency of a BOQ. Further Adnan *et al.* (2011) stated that because of this reason contractor price items like preliminaries at a higher cost to prevent the loss that the contractor might realized after winning the bid and when the contract is in process. Tharindu (2012) also has identified incorrect quantities as a problem of the BOQ. Include irrelevant preliminary items under preliminary bill can be identified as another error or deficiency of a BOQ, which can happen due to usage of preliminary items of another projects which are not in same scope and same nature, without doing any adjustments. Similarly same discrepancy might occur with standard specifications used in BOQ due to the same reason as in preliminary (Adnan *et al.*, 2011). Adnan *et al.*, (2011), & Tharindu, (2012) has identified insufficient information in description such as not mentioning the location, as another error of BOQ preparation. This would later become a plague for both pricing and quantifying. Further Adnan *et al.* (2011) emphasized that temporary works which are not a part of final product, would have less specification and work method leading to price with high allowances which increase the final contract sum and decrease the competitiveness of the bid. Hence this also can be identified as an error of a BOQ (Adnan *et al.*, 2011). Davis *et al.*, (2009), and Tharindu (2012) has identified omissions and discrepancies between drawings and BOQ as another error in BOQ preparation. This can happen due to the usage of out dated drawings and carelessness of the taker off. Further this would lead to under measurement, omitted items and mis-described items as stated by the New South Wales Public Works Department (1992 cited in Davis *et al.*, 2009).

Today, more often software packages are used to prepare BOQ, with its own format for inputting dimensions and formulating descriptions. However, a thorough knowledge of measurement conventions is essential in order to fully understand and appreciate the probable problems in the measurement process (Cartlidge, 2009). Therefore the usage of software packages also may lead to errors other than the above mentioned factors. Further it was explained that when two or more QSs involved in preparing a BOQ for same projects there may be omissions of some items and quantities, as well there may be double counting of items.

Further there are many errors in BOQ preparation which are identified through many research expertises. These errors are illustrated in Table 4 as follows.

Table 4: Identified Errors of BOQ Preparation

Errors	Source
In correct Quantities	Adnan <i>et al.</i> , 2011, Tharindu, 2012 Cartlidge, 2009
Including Irrelevant Preliminary items.	Adnan <i>et al.</i> , 2011
Including unnecessary specifications.	Adnan <i>et al.</i> , 2011
In sufficient information with descriptions.	Adnan <i>et al.</i> , 2011, Tharindu, 2012
Tender BOQ is invariably silent about the actual items of temporary works.	Adnan <i>et al.</i> , 2011
Omissions and miss discrepancies between drawings and the BOQ.	Davis <i>et al.</i> , 2009, Tharindu, 2012

## 4. BOQ PRICING

BOQ facilitate detail basis for estimating the cost for contractors. Further specification of the contract document, demonstrate quality and types of materials that must be priced for and used by the contractor (Cartlidge, 2009). Cartlidge (2009) stated that a unit rate prepared by the contractor should include some or all of following;

- Labour costs – the all-in labour rate. This is built up from operatives' wages plus statutory costs such as national insurance, etc.
- Material costs – the basic costs of materials plus the costs of delivery, unloading and storage and allowances for wastage
- Plant costs – the hire cost of mechanical plant plus delivery to site, operating costs (drivers and fuel), etc. Can be included in the preliminaries section, under the appropriate clause
- Overheads and profit – overheads are such items as head office costs. The profit margin will vary according to a number of external factors, including risk. Surprisingly, in the UK the profit margin for many general contractors is low. The contractor may choose to include overheads and profit in the individual unit rates or make suitable allowances elsewhere in the tender.

The total of all the BOQ amounts finally provide the estimated tender sum (later become the contract sum). According to the Sinclair, *et al.*, (2002) an estimate always attempted to target, the actual cost. Therefore an estimate should be prepared carefully without errors, with the intention that contractors have to price the BOQ properly with having minimum errors.

### 4.1. PRICING ERRORS

When pricing a BOQ errors can happen generally irrespective of the knowledge and experience of the estimator (Hurd, 2007). Errors which are performed during pricing of tender may cause to have unrealistic rate and it will finally cause to lose the tender or if win to have poor quality output. Therefore it is of greater importance to prepare an error less estimate to have confident on profit as well as competitiveness (Hurd, 2007). Further Hurd (2007) stated that an error free estimate is better for both client and contractor since construction cost estimate is vitally important for both.

In order to prepare an error less estimate Sinclair *et al.* (2002) identify factors to be considered which are listed as follows;

- Work method is a very important component of pricing and therefore disregarding all possible work methods for selecting most economical solution can be identified kind of error.
- Assume past performance will be repeated in future; this will cause to reduce contractors' profit or reduce the competitiveness of the tender.
- Labour charges may change according to different factors such as location difficulty of work, regulation, market conditions. Therefore, when pricing disregarding those factors and assume a constant rate become an error. Therkildsen (2012) also has stated under estimating labour cost as a mistake.
- Disregarding the material wastage factor according to the nature of work, because wastage factor may vary on location, work method.

Sinclair *et al.* (2002) also has identified that with the estimators experience and education level the degree of error can vary and with the time and manpower allocated for estimation the accuracy may also be varied. Further, Therkildsen (2012) stated estimating mistakes or error, as follows.

- Doing changes to the prices at last minute is very often. This may cause to have simple mistakes such as calculation or formula errors which can quickly convert a profitable project in to a loss.



- A company may have different expertise in several areas, therefore in estimating they will focus on those specific areas only, hence the possibility of having errors in areas which have not expertise with in the company become high.

To reduce perishing every contractor must have a clear tendering policy, lack of one may become an error for the estimation (Cartlidge, 2009). As specified in Davis *et al.* (2009) pricing based on BOQ description without considering specification can be identified as an error which later leads to an under estimate and further affect to the quality since contractors do not want to lose own money. According to Seeley and Winfield (1999 cited in Odeyinka, *et al.*, 2009) contractors increase the rate to cover the risk of pricing errors due to not utilizing in the field as well. Further, still there are arithmetic errors despite of the usage of calculators and other software (Hurd, 2007). There are certain other pricing errors as well. These are identified in Table 5.

Table 5: BOQ pricing Errors

Errors	Source
Careless consideration of Work method	Sinclair <i>et al.</i> , 2002
Assume output of a crew based on past performance	Sinclair <i>et al.</i> , 2002
Decide labour payments disregarding changing factors	Sinclair <i>et al.</i> , 2002, Therkildsen, 2012
Consideration of finished in place quantity of material	Sinclair <i>et al.</i> , 2002
Estimators experiences and education level	Sinclair <i>et al.</i> , 2002
Not having clear policy regarding tendering policy	Cartlidge, 2009
Ignore the Specifications and pricing according to the BOQ description	Davis <i>et al.</i> , 2009
Increasing rates to cover the increased risk which is taken by not using a quantity surveyor to price the projects	Seeley and Winfield (1999 cited in Odeyinka, 2009)
Ignorance of relationships between items of work. Same costs are included in different items resulting in higher tender prices.	Perera <i>et al.</i> , 2003
Lack of transparency of the estimation	Therkildsen, 2012
Last minute changes	Therkildsen, 2012
Focusing on items, which estimator is more expertise	Therkildsen, 2012
Pursuing every project	Therkildsen, 2012
Allocating resources incorrectly for the project	Therkildsen, 2012
Not taking a top-down approach for pricing	Therkildsen, 2012
Lack of successive risk estimation	Therkildsen, 2012
Wrong assumptions regarding items in the BOQ	BuildingAdvisor, 2012
Arithmetic errors of the estimating despite of the usage of calculators and other software	Hurd, 2007

## 5. CONCLUSIONS

BOQ is an important document within the construction industry, especially under the traditional procurement method. However there is a decline of using BOQ in near past and it may cause to the sustainability of the BOQ as a financial decision make tool within the construction industry. Literature confirmed that despite of the decline of usage, BOQ has its own important uses during the post contract as well as during the pre contract stages. Further literature express that there are errors in preparation and pricing of BOQ and those errors may lead to underestimate the use of BOQ in the

industry since those may affect to the accuracy and the confident of the users. Therefore, it is recommended to investigate further about those identified and unidentified errors to increase the reliability upon BOQ and hence try to sustain the BOQ with in the construction industry further as a good financial decision making tool.

## 6. REFERENCES

- Adnan, H., Nawawi, A. H. M., Akhir, S. M. M, Supardi, A. and Chong, H. Y. 2011. Bills of quantities: Perspectives of contractor in Malaysia. *Australian Journal of Basic and Applied Sciences*, 5(11), 863-873.
- Bandi, S., 2010. *Bills of quantities: raison d'etre?* [online]. Academia.edu, Available from: <http://www.academia.edu/1226228/> [Accessed 10 April 2013].
- Cartlidge, D., 2009. *Quantity surveyor's pocket book*, 1<sup>st</sup> ed. United Kingdom: Elsevier.
- Davis, P. R, Love, P. E. D. and Baccarini, D. 2009, Bills of Quantities: nemesis or nirvana?. *Emerald*, 27(2), pp.99 – 108, doi: 10.1108/02630800910956434
- Hurd, N., 2007. *How to avoid the five most common construction cost estimating errors* [online]. EzineArticles, Available from: <http://ezinearticles.com/?How-to-Avoid-The-Five-Most-Common-Construction-Cost-Estimating-Errors&id=554830> [Accessed 9 April 2013].
- Jaffar, N., Tharim, A. H. A. and Shuib, M. N., 2011. Factors of conflict in construction industry: a literature review. *The 2nd International Building Control Conference*, pp. 193-202, Available from: [www.sciencedirect.com](http://www.sciencedirect.com)
- Lee, S., Trench, W., & Willis, A., 2005. *Willis's elements of quantity surveying*. 10<sup>th</sup> ed. United Kingdom: Blackwell.
- Odeyinka, S., Kelly, S. and Perera, S., 2009. An evaluation of the budgetary reliability of bills of quantities in building procurement. *RICS COBRA Research Conference*, University of Cape Town, 10-11 September. PP. 435-446 Available from: [www.rics.org/cobra](http://www.rics.org/cobra)
- Perera, S., Karunasena, G. and Fonseka, T., 2003. A web-based user guide for Sri Lanka Standards 573: Standard Method of Measurement of Building Works. *Built Environment Sri Lanka*, 3(2), 67 – 74.
- Rashid, R.A., Mustapa, M., and Wahid, S.N.A., 2006. *Bills of quantities – are they still useful and relevant today?* [online]. Available from [http://eprints.utm.my/511/1/BQ\\_paper\\_Padang\\_12\\_6\\_06\\_Rosli.pdf](http://eprints.utm.my/511/1/BQ_paper_Padang_12_6_06_Rosli.pdf)
- Sinclair, N., Artin, P., and Mulford, S., 2002. Construction cost data workbook. *Conference on the International Comparison Program*, Washington, D.C. 11-14 March 2002. World Bank.
- Tharindu, J.M.E., 2012. *Problems related with BOQ and specification of tender document which causes to variations and disputes*. Unpublished undergraduate dissertation (BSc). University of Moratuwa.
- Therkildsen, M., 2012. *The top 10 construction estimatig mistakes* [online]. Construction Business Owner, Available from: <http://www.constructionbusinessowner.com/topics/software/estimating/top-10-construction-estimating-mistakes> [Accessed 8 April 2013].
- Anon, 2012. Construction estimating errors [online]. BusinessAdvisor.com, Available from: <http://buildingadvisor.com/estimating-errors> [Accessed 8 April 2013].