

IDENTIFICATION OF ERRORS THAT ARE BEING MADE IN PREPARING BOQS IN SRI LANKAN CONSTRUCTION INDUSTRY

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ABSTRACT

The Bill of Quantities (BOQ) is a vital document in both pre contract stage and post contract stage of any construction project. The BOQ impacts three important aspects of a project namely time, cost and quality. Therefore, it is crystal clear that if there is any error in BOQ that would directly affect to the construction project. Since all the stakeholders involved in construction projects are extremely concerned on time, cost and quality aspects, it is critical that the BOQ for the project is error free.

Errors occur during both preparation stage and pricing stage of the BOQ. The BOQ preparation errors may relate to pricing errors as well as have an impact on the time, cost, and quality of the project. However the study is focused on identifying most common BOQ preparation errors and find solutions to minimise those errors to support sustainable procurement practice. Initially a semi structured interview was carried out to identify errors made in preparing BOQs and find reasons for the errors. Eventually, a questionnaire survey was done to identify the most significant errors that are made and how those errors would affect the project.

The surveys revealed that quantity errors as the most common error during the BOQ preparation stage, which becomes critical based on the type of the procurement method adopted. Employing experienced person as a reviewer was identified as the most preferable solution for minimising preparation errors. Further it was found that people involved have a greater impact on the BOQ preparation process and its accuracy.

Keywords: Bill of Quantities; Cost; Errors; Quality; Time.

1. INTRODUCTION

The construction industry performs a vital role in the development of a country. Especially in Sri Lanka, the contribution of construction industry for the Gross Domestic Product (GDP) was 39.3% in 2012 (Central Bank of Sri Lanka, 2013). However, with the involvement of large number of stakeholders the industry has become more complex (Enshassi, Mohamed, and Abushaban, 2009). Therefore, construction projects needs to be managed effectively, to have a successful outcome at the end. In order to have an effective management several standard practises have been established within the industry.

BOQ is a widely used standard document around the world, which specifies the qualitative and quantitative aspects of each and every essential part of a construction project (Rashid, Mustapa and Wahid, 2006)). Further, BOQ can be seen, as a source of valuable information for not only the management of a project's cost but also the management of the project, because project cost management is an integral part of project management for balancing competing demands among cost, time, quality and scope of a project (Rashid *et al.*, 2006).

BOQ is a document emerged after the industrial revolution of the 19th century in Europe (Bandi and Abdullah, 2012). Since the origin of the document its purposes has not changed a lot other than the method of measurements and technology. According to the literature even the BOQ has not changed, usage of the BOQ has decrease drastically with the invention of the new procurement methods. However, BOQ has numerous uses and advantages with regard to financial matters in construction and it is the most appropriate financial decision making tool in the construction industry. Therefore, BOQ is

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a useful document for the construction even though there is a decline in its usage rate. Further, there are various reasons for decline the usage of BOQs, and BOQ errors have become a significant issue for decline in the usage even though there are no much more researches, studies or attention from the industry practitioners towards BOQ errors.

Contract is a binding document between two or more parties; therefore none of the parties to the contract like to have documents with errors within the contract document, particularly regarding financial aspects. Therefore as the financial decision making tool within the contract document BOQ should be a error free document in order to obtain reputation and trust of users and hence to increase the use of the BOQ as a financial decision making tool in the construction for longer time. Even though generally the consultant prepare and the prospective contractors price the BOQ, errors in preparation as well as pricing affect the decline in the usage of the BOQ because cost is a major parameter and a concern of a client.

Since BOQ is an important document in project management it should be a reliable source for all the stake holders of the project. However, contractors prefer to have BOQ only as a source of information and not as a part of the contract, due to the risk of errors (Davis and Baccarini, 2004). Accordingly to remain as a reliable and useful document BOQ needs to be of almost no errors during both preparation and pricing stages.

1.1. IMPORTANCE AND USES OF BOQS IN CONSTRUCTION

BOQ can be identified as a document specifying the qualitative and quantitative aspects of each and every essential parts of a proposed construction project (Rashid, *et al.*, 2006). The BOQ has two primary uses in pre contract and post contract stages (Davis, *et al.*, 2009). In pre contract stage the BOQ assists contractors in the formulation of tender document, through breaking down the contract works in a formal, detailed, and structured manner for tendering. Moreover, in post contract stage the BOQ assists contractors and Quantity Surveyors (QS) in preparation of interim payments and valuing variations, as well as it provides a financial structure for contract administration (Davis, *et al.*, 2009).

Than the identified primary tasks BOQ performs several other roles during both pre contract and post contract stages. During pre contract stage, BOQ can be used for giving sense of control of projects, in terms of cost and finance, requesting competitive tenders from contractors, price the work on precisely the same basis, thus allowing for the fairest bidding, projecting cash flow and budgeting and assessing tenders (Rashid *et al.*, 2006). When considering post contract stage BOQ serves as a post-contract administration tool and provides a basis for the evaluation of progress payments, proper and common basis for the valuation of variations, basis for comparing a contractor's price with current trends in the market and basis for management to determine the likely causes of risk factors (Davis, *et al.*, 2009).

Thus, BOQ becomes a critically important document in construction industry especially under traditional procurement method. However, the greatest misunderstood aspect of construction contracts is the uses of the BOQ and further clients believe that the BOQ as an additional expense to them with no benefits to their projects (Jackson, 2011). However, contradictorily the absence of a BOQ may lead to greater variability, increased risk in estimating and consequently more disputes in construction projects (Davis, Love and Baccarini, 2009).

According to the analysis of expert interview, BOQ is a very important document in construction industry of Sri Lanka, which shows the breakdown of the contract price and can be used as a cost controlling document. According to the analysis BOQ has a good recognition within the Sri Lankan construction industry, since clients has opinions that BOQ can control the cost of their projects. However, in terms of effectiveness and quality of BOQs the participants were not satisfied. In terms of errors all participants accepted that there are errors in BOQs which become very critical in post contract stage. Hence, there is a possibility to reduce the reliability of the BOQ among stakeholders of the project and it affect to the sustainability of the document.

1.2. AIM AND OBJECTIVES OF THE RESEARCH

The aim of this research was to minimise BOQ preparation errors that are being made in BOQ preparation stage. In order to fulfill the aim, four objectives were established as follows;

1. Identify errors that are being made in preparing BOQs, from the point of view of Quantity Surveyors
2. Identify causes for errors that are being made in preparing BOQs
3. Identify most common errors and effect of those errors to the time, cost, and quality of the project
4. Recommend suitable solutions for eradicate or minimise identified errors.

2. METHODOLOGY

The methodology of this study can be divided in to three stages: The first one was a comprehensive literature survey, second was a semi structured expert interview which consists of gathering expert knowledge and opinion regarding the subject area of the BOQ and identify errors, causes for errors and solutions for errors. Three industry experts were selected for interviews as illustrated in the following Table 1. As the third and final stage a questionnaire survey was carried out in order to rank identified errors, causes for errors and possible solutions for errors. Questionnaires were divided among 40 numbers of quantity surveyors having both consultancy and contracting experiences and there was an 85.71% respondent rate.

Table 1: Details of the Respondents of the Expert Interviews

Interviewee	Experience	Degree Holder in the Field of QS	Chartered Member	Current Designation
Respondent 1	20 years	Yes	Yes	Consultant QS
Respondent 2	15 years	Yes	Yes	Consultant QS
Respondent 3	15 years	Yes	Yes	Contractor QS

Data obtained through the expert interviews were analysed using content analysis. Based on the answers and opinions of the interviewees common errors and solutions were identified. After the identification of errors and possible solutions through the questionnaire survey was carried out among quantity surveyors who have both consultancy and contracting experiences. Errors in BOQ preparation for the inclusion in the questionnaire survey were selected through both literature findings and data collected through expert interviews. Further respondents were requested to indicate whether those errors affect to the time, cost and quality factors of the project. Solutions were only selected from the data obtained through the expert interviews apart from that additional spaces were provided to indicate other known errors or solutions. Figure 1 shows the composition of the errors and solution included in the questionnaire.

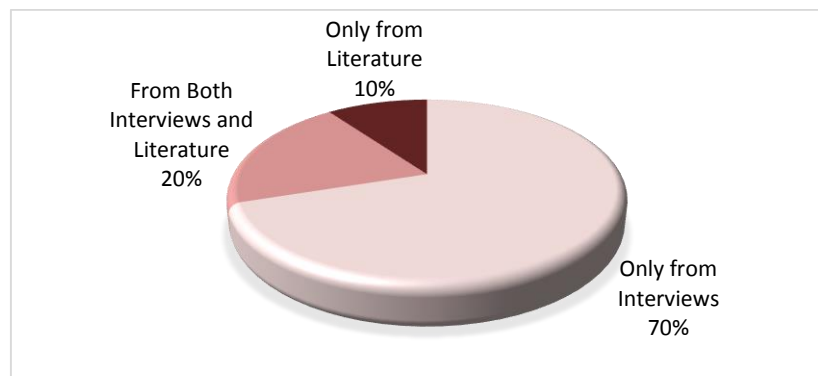


Figure 1: Composition of BOQ Errors Included in the Questionnaire

Data obtained through questionnaire survey were analysed and ranked with the use of Relative Important Index (RII). However, effect of errors to the time cost and quality of the project were analysed by using frequency distribution method.

3. BOQ PREPARATION AND ERRORS

3.1. RELATION BETWEEN ERRORS AND THE PROCUREMENT METHOD

Measure and Pay and Lump Sum are the two most common procurement methods currently practiced in Sri Lankan construction industry. Therefore the study mainly focused on those two methods.

According to the analysis, if there are errors in BOQs preparation under measure and pay procurement method clients will not get the correct picture about the budget for the project. Therefore they will lead to a change in actual budget. Further, with lots of errors there may be lots of variations. However under the lump sum procurement method at least contractor got the chance to identify and correct preparation errors in the BOQ, but if the errors were not identified it may finally become a loss to the employer or to the contractor depending on the nature of the error.

3.2. BOQ PREPARATION ERRORS

Finally from the literature, expert interview and the questionnaire survey fifteen BOQ errors were identified, and using RII most common errors were identified as shown in following Table 2.

Table 2: Common Errors that are being made in Preparing BOQs

Errors	RII	Rank
Quantity errors	82.67	1
Missed out items to be included	78.67	2
Arithmetical errors	70.67	3
Description errors	62.00	4
Errors in the Provisional Sum	52.67	5
Using irrelevant preliminary items	48.67	6
Errors in the Prime Cost Sum	48.00	7
Errors in unit conversion between imperial and metric	44.00	8
Errors in summery page (Not putting items in correct order)	40.00	9
Wrong headings and sub headings	37.33	10
Inadequate descriptions	3.33	11
Use incorrect preamble notes	2.00	12
Day work bill without clear item coverage	2.00	12
Typing errors	2.00	12
Errors in item numbering and page numbering	1.80	15

The analysis revealed that quantity errors as the major error in BOQs which may include inaccurately added or omitted quantities, depending on the incorrect quantity, BOQ item and the procurement method this may become critical at the post contract stage. Missing items to be included may cause unnecessary variations at the post contract stage. When considering errors within the descriptions there may be a number of errors such as incompatible with drawings and specifications, wrong terms, incorrect symbols like “,” or “.”, unclear writing styles, typing mistakes. However, finally all these errors will effect to the quality and the reliability of the BOQ, which has been recognised as a useful document within the construction industry all over the world.

Each and Every client of construction projects basically interested on time, cost and quality of their projects, and ultimately they wanted to have a quality output within a short time period and with a lowest

cost. However, as per the study it was identified that BOQ errors may directly or indirectly affect to the time, cost and quality of the project. Since BOQ is a document associate with project cost it directly affect to the cost of the project. Moreover there may be some indirect effect, to the time and quality of the project, through errors in BOQ preparation, because sometimes contractors may try to get advantage of those errors, during the post contract operations. Figure 2 shows the findings of the questionnaire survey on the effect of BOQ errors to the time, cost and quality of a project.

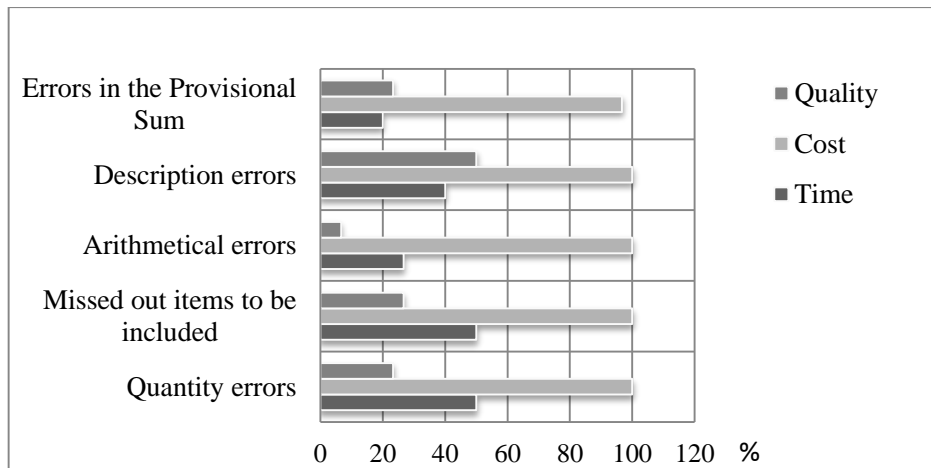


Figure 2: Five Most Common Errors that are being made in Preparing BOQs and Effects of Them to the Time, Cost, and Quality of Projects.

3.3. CAUSES FOR ERRORS THAT ARE BEING MADE IN PREPARING BOQs

The study identified several causes for errors that are being made in preparing BOQs. However, not following a proper standard method, use inexperience persons in the preparation process, and relying strongly on computers were identified as major causes of preparation errors in BOQs.

The practitioners involved with the BOQ preparation should have a good experience and knowledge and they should have the ability to read and understand drawings and other related documents properly. Further, using a standard document is very important, in Sri Lanka if most of the projects stated the standard method the BOQ is not in accordance with the standard method and this will lead to errors such as double counting and missing items. A standard method will provide a guide to prepare the BOQ. In present computer aided bill preparation is considered to be more common and it may be easy and time saving process. However, it may cause for errors because all the time most of the people rely on the computers and do not check their works, but even with the computers there may be errors. Totally there were ten causes identified which cause to errors in BOQs including the above discussed causes as shown in Table 3.

Table 3: Causes for Errors Being Made in Preparing BOQs

No.	Causes for Errors
1	Not using standard methods
2	Use in experience persons to quantify and prepare BOQs
3	Strongly rely on computers
4	Not understanding the project properly.
5	Less of practical knowledge
6	Not done the check list properly
7	Specification errors
8	Don't read the drawing properly
9	Not following the proper procedure (studies the drawing, does the checklist and starts the work).
10	Having a limited time and it is the last lap of the process.

3.4. SOLUTIONS FOR MINIMISING ERRORS THAT ARE BEING MADE IN PREPARING BOQS

The aim of this research was to identify and minimise errors that are being made in preparing BOQs in Sri Lankan construction industry. Hence, the study focused on identifying available practical solutions and ranking the identified solutions which would minimise BOQ preparation errors. Solutions identified through interviews were included in the questionnaire for ranking, and other than those mentioned solutions respondents has identified 2 more solutions. All together there were seven solutions for BOQs preparation errors and all those errors were prioritised with the use of RII as stated in Table 4.

Table 4: Solutions for Common Errors that are being made in Preparing BOQs

Solutions for BOQs Preparation Errors	RII	Rank
Use people with good experiences	93.33	1
Use a checker to check the final BOQ	89.33	2
Do the check list properly (T.O. List)	86.66	3
Follow a proper accepted method of measurement	84.66	4
Follow a proper procedure (such as study drawing, prepare the check list, then start to prepare BOQ)	84.00	5
Improve technical knowledge of people involved	3.33	6
Proper co-ordination of taking off team by an experience person	3.33	6

From the results of the questionnaire survey, solutions for BOQs preparation errors were ranked according to the agreement of respondents for provided solutions. Above Table indicates the results of the analysis of solutions for preparation errors being made in preparing BOQs according to that using people with good experience is the most agreed solution by the respondents which having 93.33% of RII value. Further, other stated solutions also have got RII values more than 80% so it can be emphasised that all identified solutions from the expert interviews had highly agreed by the respondents of the questionnaire survey. However, using a checker to check the final BOQ has become the second most agreed solution with 89.33% of RII value, respectively doing the check list (Taking off list) properly, following a proper standard method and following a proper procedure (such as study drawing, prepare the check list, then start to prepare the BOQ) has become to the third, fourth and fifth most agreed solutions, with 86.66%, 84.66% and 84.00% RII values respectively. Apart from that, respondents of the questionnaire survey has identified improve technical knowledge of people involved and proper co-ordination of taking off team by an experience person as another suitable solutions for minimise BOQ preparation errors.

4. CONCLUSIONS

Construction industry is an imperative industry of any country, since it has a direct and significant impact with the economic development of a country. Hence the construction should be carried out in an effective manner. In order to carry out construction in an effective manner contracts between each party become very important and the contract document can be identified as the key document available as the document governing major stakeholders in the construction industry in order to complete the project effectively. The contract document comprises with number of documents related to various aspects required for finalise the construction successfully, and from those documents BOQ is the key document related to the cost of the project, which is a key concerning factor of any employer.

Thus, this research study aimed to identify the common errors that are being made in preparing BOQs in Sri Lankan construction industry, which may affect greatly to the sustainability of the document. Further it identifies causes for those errors and suitable practical solutions for minimise those errors, in order to confirm the sustainability and trust towards the BOQ, as the key financial decision making tool in the construction.

From the available literature it was synthesised that the BOQ has multiple uses during both pre contract and post contract stages especially under the traditional procurement method, but disregarding those advantages there is a decline of the usage of BOQs. Even lot of issues causes for that decline, BOQ errors had been identified as a major disadvantage since it affect to the accuracy and hence reduce the

trust of the users. However, the opinions obtained through expert interviews together with the analysis of the questionnaire survey established a proper understanding of errors in BOQs and ways to minimise the errors in order to maintain the quality and reliability of the BOQ as a financial decision making tool in the construction industry of Sri Lanka.

Ultimately it can be recommended that in order to minimisation of errors in BOQ preparation, persons involved in has a greater effect and thus, to have even one personnel with adequate knowledge, skills, and experiences to coordinate the BOQ preparation process may leads to have error free BOQ with good quality. Other than the major recommendation stated above using proper standard documents during the BOQ preparation may leads to reduce the error margin of BOQs.

Finally it should be concluded that BOQ is an important and very useful document for the construction if it is used in an effective manner. However, this research study has identified regarding errors, which is a major shortcoming of a BOQ since it affect to the accuracy. Thus, with the usage of the results of this study, the error margin of the BOQ can be reducing up to a certain extent and increase the reliability upon the BOQ in order to sustain the BOQ as a vital document in the construction industry.

5. REFERENCES

- Bandi, S., and Abdullah, F., 2012. *Understanding the Challenges* [online]. In *Sustaining The Bills Of Quantities In Malaysia*. Paper presented at the 16th Pacific Association of Quantity Surveyors Congress (PAQS 2012). Available from http://www.academia.edu/1844415/Understanding_the_challenges_in_sustaining_the_bills_of_quantities_in_Malaysia [Accessed 8 April 2013].
- Central Bank of Sri Lanka, 2013. *Economic and Social Statistics of Sri Lanka 2013* [online]. Available from: www.cbsl.gov.lk/pics_n_docs/10_pub/_docs/.../econ_and_ss_2013_e.pdf [Accessed 10 April 2013].
- Davis, P.R., and Baccarini, D., 2004. The Use of Bills of Quantities in Construction Projects - An Australian Survey. In *Proceedings of the COBRA 2004 International Construction Research Conference of the Royal Institution of Chartered Surveyors*, Available from: http://espace.library.curtin.edu.au/R/?func=dbinjumpfullandobject_id=19836andlocal_base=GEN01-ERA02 [Accessed 10 April 2013].
- Davis, P.R, Love, P.E.D, Baccarini, D 2009, Bills of Quantities: nemesis or nirvana?. *Emerald*, 27(2), 99 – 108, doi: 10.1108/02630800910956434
- Enshassi, A., Mohamed, S., and Abushaban, S., 2009. *Factors affecting the performance of construction Projects in the gaza strip*. *Journal of civil engineering and management*, 15(3), 269–280. Available from <http://www.jcem.vgtu.lt> [Accessed 8 April 2013].
- 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/BOQ_paper_Padang_12_6_06_Rosli.pdf [Accessed 9 April 2013].
- Jackson, G.B., 2011. *The Use of Schedules of Quantities in Providing Financial Management in Construction Projects* [online]. Unitec New Zealand, Department of Construction, New Zealand. Available from <http://hdl.handle.net/325256/7819> [Accessed 10 April 2013].