Journal of Engineering and Applied Sciences 13 (10): 3430-3443, 2018
ISSN: 1816-949X


# Key Issues Affecting Contractor's Uses of Bills of Quantities (BQ)

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**Abstract:** There have been numerous studies which reported issues over the uses of Bills of Quantities (BQ) by contracting organisations. The issues have caused a baffling effect to the contractors thus vitiated BQ reputation as a valuable instrument for the construction industry. Though, concerns over the uses of BQ have been well documented abroad, there seemed to be limited data captured that corresponded to the Malaysian context. Hence, this study seeks to report findings made from a study that aimed to determine significant issues affecting the uses of BQ to the contracting organisations in the Malaysian construction industry. The study outlined three objectives which include identifying the uses of BQ to the contracting organisations identifying issues affecting the uses of BQ and determining the significant issues affecting the uses of BQ. Through the survey, questionnaires were distributed to 500 active G7 contractors selected at random of which 112 (22.4%) responded. Data was first tested for its reliability using Cronbach's Alpha while the Relative Significance Index (RSI) and the analysis of significance were used for data analysis. The results showed that 'Inaccurate/wrong quantities' 'insufficient information on quantities, i.e., location' and 'inaccurate descriptions' were the most significant issues affecting the uses of BQ. The findings were significant as it offered data that corresponded to the local context and input that the industry could consider for improvements.

**Key words:** Bills of Quantities (BQ), construction industry, information, distributed, affecting, documented

## INTRODUCTION

Steady reliance is placed on BQ as an integral part of construction documentation in Malaysia and abroad (Lenard, 1992; Hisham and Azman, 2008, RICS., 2011; Davis *et al*., 2009; Shamsulhadi *et al*., 2015). BQ is an essential instrument for transmitting project's descriptive as well as quantitative information (Ashworth *et al*., 2013) and formed one of the integral element in the Traditional Lump sum System (TLS) of construction procurement (Jaggar *et al*., 2001; Seeley, 1997; Lee *et al*., 2005). Data from the Construction Industry Development Board (CIDB) as presented in Table 1 shows unswerving preference towards the TLS in the Malaysian Construction Industry (MCI). This asserts that BQ has been profoundly practised hence, important to the industry.

In the context of the MCI Razali *et al*. (2016) have observed that BQ is mostly common for tendering and contracting. This aligned with earlier propositions made by Turner (1983), Blyth (2001), Morledge and Kings (2006) and Cunningham (2016) who maintained tendering as the primary use of BQ. Apart from tendering, it worth to note that BQ information was also useful as a basis to report on work progress and expenditure (Ashworth *et al*., 2013) an instrument for financial control and adjustment (Davis *et al*., 2009; Sierra, 1984a, b), a basis for future estimating (AIQS., 2001; Lee *et al*., 2011) and a detail account of building for asset maintenance (Davis *et al*., 2009; Lenard, 1991, 1992). It implies that BQ is useful in different stages of a project and assists the project's diverse participants.

While BQ showed to be useful, there have been numerous studies which reported issues over its uses by contracting organisations in the industry. These followed as the studies considered contractors as the main user of the BQ (Seeley, 1997; Teo, 2008; Towey, 2012). For instance, earlier studies by Ahenkorah (1993), Baccarini and Davis (2002) and Adnan *et al*. (2011) reported that BQ was inadequate for contractor's site management purpose while Kodikara and McCaffer (1993), Kodikara *et al*. (1993), Wood and Kenley (2004), Morledge and Kings (2006) suggested that BQ had offered limited information for contractors to prop their estimates. Razali *et al*. (2016) opined that concerns over the uses of BQ have caused a baffling effect to the contractors thus vitiated BQ reputation as a valuable instrument for the construction industry (Charles, 2007).

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Table 1: The frequencies on the use of TLS as compared to other types of procurement in the Malaysian construction industry (2012-December 2016-latest)

| | Years/percentage | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Procurement types | 2012 | Percentage | 2013 | Percentage | 2014 | Percentage | 2015 | Percentage | 2016* | Percentage |
| TLS | 7450 | 94 | 7685 | 96 | 7692 | 96 | 7060 | 96 | 5299 | 98 |
| Others | 442 | 6 | 355 | 4 | 333 | 4 | 284 | 4 | 111 | 2 |
| Total | 7892 | 100 | 8040 | 100 | 8025 | 100 | 7344 | 100 | 5410 | 100 |

*Adapted from CIDB Quarterly Statistical Bulletin

Although, issues over the uses of BQ to the contracting organisations have been well documented from studies conducted abroad (Kodikara *et al*., 1993; Skinner, 1980; Smith and Hoong, 1985; Wood and Kenley, 2004; Jaggar *et al*., 2001), there seemed to be limited data captured that correspond to the local context. Moreover, as the structure, culture and maturity of contractors in Malaysia differ significantly from those abroad (Lim and Mohamed, 1999; Yong and Mustaffa, 2013), there is a strong impetus for the country-specific investigation to be carried out. Besides, a review made towards articles published within the local context showed a plethora of review papers and practice notes. While these have been catalytic, these were somehow cursory (Shamsulhadi *et al*., 2015). Hence, systematic identification of issues affecting the uses of BQ within the local industry is considered timely. This adds up for the dearth of publications and provides data which is useful to the local construction industry.

Therefore, this study seeks to report a study that aimed to determine significant issues affecting the uses of BQ to the contracting organisations in the Malaysian construction industry. The aim was achieved by accomplishing three objectives which are: to identify the uses of BQ to the contracting organisations to identify issues affecting the uses of BQ and to determine the significant issues affecting the uses of BQ. Accordingly, the study is structured to firstly review previous studies on the uses of BQ. This includes an explanation of the approach to identify its relevant uses and followed by a review of issues that are affecting its uses. Next, the methodology is outlined before results and findings are presented. The study ends by discussing important insights gained from the study as well as some recommendations for the industry to consider.

**Previous studies on the uses of bq to contracting organisations:** Skinner (1979, 1980) had carried out detail investigation on the contractor's uses of BQ within a single contracting organisation in the UK. Through interviews, information on the uses of BQ was observed by identifying the specific tasks in eight procedures which utilised data from BQ. The eight procedures involved according to Skinner (1980) are; estimating planning estimating pricing, strategic/tactical planning procurement progressing controlling payment to main contractor and payment by main contractor. Skinner (1980) maintained that the tasks need to be arranged in a correct and timely sequence if the primary objective of building is to be achieved. For this reason, the tasks were further arranged in four significant project times which are: tender period pre-contract period construction period and Final account period. The study observed some 73 tasks which utilised data from BQ. Correspondingly, these were reflected as the uses of BQ to the contracting organisation.

The study by Skinner (1979, 1980) had prompted a study by Smith and Hoong (1985). It sought to firstly identify the uses of BQ in various stages of a project and subsequently determine the usefulness and quality of BQ produced for the construction industry in Singapore. A review indicates that the Skinner's approach to identifying and subsequently arranging the uses of BQ in four significant project times was adapted in the study. Despite, a major adjustment to the findings made by Skinner (1980) on the uses of BQ was eminent. This followed to the scale of the study, the study's locality and a large number of uses which were considered by Smith and Hoong (1985) as impractical as a basis for the study. It was observed that the uses of BQ identified by Skinner (1980) have been reduced by Smith and Hoong (1985) to just 20. There was also no reference to the procedures as outlined and applied by Skinner (1980) in the later's identification on the uses of BQ. Regardless, the study had managed to reduce the complexity of uses as apparent in Skinner (1980). This implies its practicality as the basis for a future study concerning the uses of BQ.

Further study on the uses of BQ was reported by Kodikara *et al*. (1993) as part of a much larger study carried out to examine the flow of BQ estimating data in the context of Sri Lanka (Kodikara, 1990). The uses of BQ were recorded from eight case studies by observing the interaction and tasks performed in five main procedures mentioned in the study as estimating purchasing planning site management and quantity surveying/financial control. The approach taken by Kodikara (1990) which highlighted the adaptation of procedures as the basis to identify the uses of BQ was found to be similar to the earlier approach taken by Skinner (1980). However, the organisation of the

Table 2: Evaluation of previous studies concerning the uses of BQ to contracting organisations

| Parameters | Sub-parameters | Skinner (1979, 1980) | Smith and Hoong (1985) | Kodikara (1990) and Kodikara *et al.* (1993) | Davis *et al.* (2009) | Adnan *et al.* (2011) |
|---|---|---|---|---|---|---|
| Category of studies | Principal study | √ | | √ | | |
| | Derivative study | | √ | | √ | √ |
| Approach to identify | Original approach | √ | | √ | | |
| the uses of BQ | Adaptational approach | | √ | | √ | √ |
| Arrangement of uses | Management function | √ | | √ | | √ |
| | Project time | √ | √ | | | |

uses in the four project times previously highlighted in the study by Skinner (1980) and later by Smith and Hoong (1985) was not featured. Nevertheless, the study by Kodikara *et al.* (1993) had managed to identify 21 tasks where BQ data was used. This further reduces the complexity of the uses suggested by Skinner (1980) and offers a different approach to identifying the uses of BQ.

A section in the studies by Davis *et al.* (2009) had sought to rank the important uses of BQ in the Australian construction industry. The studies had listed 20 uses of BQ adapted from various source of literature which includes Skinner (1979) and Kodikara *et al.* (1993). Following the approach, these were subsequently organised into three key activities of pre-contract post-contract and other activities. The result of the studies showed that the five most important uses were: To facilitate variation cost management to facilitate evaluation of progress payments results in risk reduction to tenderers obtains more competitive tender prices and to facilitate tender comparisons. In view of a much recent study, Adnan *et al.* (2011) embarked on a study to investigate the usefulness of BQ in the MCI. It surveyed among Malaysian contractors a list of 21 uses of BQ and concluded that the full potential of BQ was not extensively explored. The study adapts the full list of uses proposed earlier by Kodikara *et al.* (1993) as the basis for the investigation.

**Approach to identify the uses of bq to contracting organisations:** Previous studies reviewed are evaluated by applying a set of parameters and sub-parameters show in Table 2. This process is carried out to assess the suitability of the studies and its merit before syntheses are carried out to identify the uses of BQ relevant to the current study. As Table 2 shows, studies by Skinner (1979, 1980), Kodikara (1990) and Kodikara *et al.* (1993) are considered principal. These studies originated from the researcher's own observation on the uses of BQ. Besides, the approach taken in identifying the use of BQ is considered original. The approaches were developed purposely for fulfilling the research's requirement. Amongst these, Skinner (1979, 1980) works are considered as the most comprehensive as it identified the uses in accordance with management functions and project time.

Studies by Smith and Hoong (1985), Davis *et al.* (2009) and Adnan *et al.* (2011) are considered derivative. The approaches to identify the uses of BQ had comprised an adaptation from the principal or other studies. For instance, Smith and Hoong (1985) had adapted Skinner (1979, 1980) while Adnan *et al.* (2011) adapted Kodikara (1990) and Kodikara *et al.* (1993) in the research. An exception was made to Davis *et al.* (2009). The studies had adapted various sources of literature in assessing the rank on the use of BQ by the industry's practitioners.

The basis for the uses of BQ proposed in this study is derived by synthesising studies by Smith and Hoong (1985), Kodikara (1990) and Kodikara *et al.* (1993). This follows as these studies are found to be either principal studies as with Kodikara (1990) and Kodikara *et al.* (1993) or reflecting the principal study as with Smith and Hoong (1985). Accordingly, validation is carried out with experienced industry personnel in order to acquire local inputs and to inaugurate agreement on the proposal. This resulted to thirty uses of BQ shown in Table 3.

**Issues concerning the uses of BQ:** Issues concerning the uses of BQ were identified from the literature by interpreting and accentuating its underlying concept. This resulted in 29 issues as summarised in Table 4. To facilitate interpretation, the concepts which underlie each of the identified issues was defined, accentuated and integrated back in the list of issues identified from various sources of literature. The defined and accentuated concept depicted in (*bracket), helps the study to proceed by disclosing the gist of the issues and provide a preliminary appreciation on the category of issues embodied in the literature.

Though, Table 4 has managed to highlight the headings of the issues summarised, these, however, have been accentuated in fragment following the individual interpretation of the identified issue. There was no chance to confirm the theme and weight of the issues which were

Table 3: Uses of BQ to contracting organisations-validated outcomes

| Project period | Contractor's management functions | Uses of BQ |
|---|---|---|
| Tender period | Estimating | Materials enquiries to the supplier (details of material availability and method of assembly |
| | | Asking for materials quotations from suppliers |
| | | Asking for works quotations from sub-contractors (work trade) |
| | | Building up own price for work/items requested in the BQ |
| | Planning | Identification of task/activities and planning of construction method |
| | | Programming the duration of task/activities for tender pricing |
| | | Drafting method statement for the identified task/activities |
| Pre-contract period | Purchasing | Identification of material requirements to order from suppliers |
| | | Preparation of material schedules for ordering purposes |
| | Planning | Preparation of detail work programme, i.e., establishing the relationship among task/activities |
| | Site management | Planning for the allocation of materials for works |
| | | Planning for the allocation of plants/equipment for works |
| | | Planning for the allocation of labour for works |
| Construction period | Purchasing | Placing orders for materials to suppliers |
| | | Purchasing/leasing plants for works |
| | | Procurement of subcontractors |
| | | Scheduling subcontractor's work |
| | | Procurement of general labour |
| | Planning | Off-site manufacturing of building components |
| | | On-site manufacturing of building components |
| | Site management | Recording actual use of materials |
| | | Recording actual use of plants |
| | | Recording actual use of labours |
| | Preparation | Quantity surveying/financial control of claim document for interim valuations |
| | | Preparation of claim document for varied works to the client (variation orders) |
| | | Evaluation of claims submitted by sub-contractors employed for the works |
| | Quantity surveying financial control | Preparation of payment to sub-contractors |
| | | Monitoring planned and actual project's expenditure |
| | | Preparation of final claim document to the client |
| Defects and final account period | Quantity surveying financial control | Preparation of document for the closing of project's account (final account) |

Table 4: Summary of issues concerning the uses of BQ-aggregation of similar issues from various studies

| Source of predicament (issues) identified from the literature | Sources |
|---|---|
| BQ does not provide (*information) on the (time) and quantity schedule for the on-site delivery of materials required for the works | Adnan *et al.* (2011), Smith and Hoong (1985) |
| BQ (*information) provide no assistance to anyone drawing up a pretender programme (*time) | Contributed (1964) |
| BQ (*information) only represent cost breakdown structure with no link to actual project schedule (*time) | Hisham and Azman (2008) |
| SMM based BQ (*information) unable to provide a useful basis for contractor's work programme (*time) | Jaggar *et al.* (2001) and Smith and Hoong (1985) |
| Preliminaries bill and specification (*information) documents contain many unnecessary (*insufficient/ inadequate) items as a result of direct copy and 'standardised' document | Adnan *et al.* (2011) and Leon (1966) |
| BQ quantities and descriptions (*information) do not accurately provide information on work sequence and contractor's methods of operation (*working methods and planning) | |
| The specialist trades contractors consider that the tasks of planning (*time) could not be achieved by using the bills (*information) | Morledge and Kings (2006) |
| BQ (*information) is unnecessary for compiling (*format) subcontractor's quotations and is inadequate for reviewing materials quotations from the potential supplier as the quality of materials (*specification) are not clearly stated | Adnan *et al.* (2011) and Kinlay (1984a, b) |
| (*Information) in BQ are uncoordinated, aggregation on similar materials rather than operation (*format and working methods) | Kodikara *et al.* (1993) Kodikara and McCaffer (1993) |
| BQ (*format) is not in final forms for direct use by site personnel | Kodikara *et al.* (1993) |
| BQ (*information) requires sub-processes as the information are not presented in a standardised (*format) | Cornick and Osbon (1994) |
| BQ fail to become a mechanism to determine construction processes (*working methods). It does not consider input (*information) to the construction process (*working methods) but only identifies the end result or product of construction | Holes (1990) and Jaggar *et al.* (2001) |
| BQ only present (*information) that have been processed and in final form (*format). Detail (*information) such as supporting details on quantities measured, work location and types of operations (*working methods) the contractors have to employ are of use by estimators should access is given | Adnan *et al.* (2011), Turner (1983), Wood and Kenley (2004) |
| BQ (*information) had inadequacies for utilisation by contractors. (*Quantities) location of quantified information was not adequate for its purpose | Baccarini and Davis (2002), Wood and Kenley (2004) |

Table 4: Continue

| Source of predicament (issues) identified from the literature | Sources |
|---|---|
| BQ do not indicate (*information) as for where the quantity is located (*location) and therefore difficult to get a feel for the projects from the bill | Slattery (1994) |
| BQ disregard potential further value of reanalysing the (*information) into activities, operations or elements (*format) | Kinlay (1984a) |
| BQ (*format) is not adequate as it hinders effective use of (*information) contained | Rozali *et al.* (2006), Smith and Hoong (1985) |
| BQ fails to convey details (*information) of materials (*specification), plants and temporary works required for proper work execution (*working methods and planning) and to enable those resources to be identified, quantified and valued by contractor's estimator | Ahenkorah (1993), Adnan *et al.* (2011) |
| BQ only useful for tendering and financial control but not used extensively for contractor's site operation (*working methods and planning) | Smith and Hoong (1985) |
| BQ do not support contractor's management function. BQ (*information) disregard resource requirements and only measures (*quantity and units) fixed in place measurement | |
| Nett quantities and inaccurate quantities (*information) are major dissatisfaction among contractors the way(*quantities) are provided in BQ | Adnan *et al.* (2011) |
| BQ (*format) other than trade fails to facilitate contractor's pricing (*unsuitable format) | BOQ (1995) |
| BQ (*format) do not indicate project's buildability, work sequence and control of work (*inflexible format) | Skoyles (1968, 1964) |
| BQ (*format) do not adequately reflect the interaction (*inflexible format) between the design of a building and the production process (*working methods and planning) | |
| BQ (*format) is not adequate to fulfil its maximum functions (*unsuitable format) | Hughes (1978) |
| BQ (*format) and data presentation (*unsuitable format) are the major cause for the inefficient flow of estimating data. | Kodikara and McCaffer (1993) |
| BQ data (*information) fail to provide contractors with the information they need for proper planning, organising and managing of their work (*working methods and planning) | Contributed |
| BQ (*information) requires sub-processes by site QS as the information are not presented in a standardised format (*unsuitable format) | Leon (1966), Waterworth and Weddle (1978), Cornick and Osbon (1994) |
| BQ (*information) produced is inaccurate in terms of its quantities and descriptions. Inaccuracy is caused by an omission of important cost items, the disparity between drawing details and quantity list and over and under measurement of cost items | Rashid *et al.* (2016) and Rozali *et al.* (2016) |

As indicated (*) the accentuated concept in defining the identified issues key dissatisfaction identified and details of the dissatisfaction are presented in italic

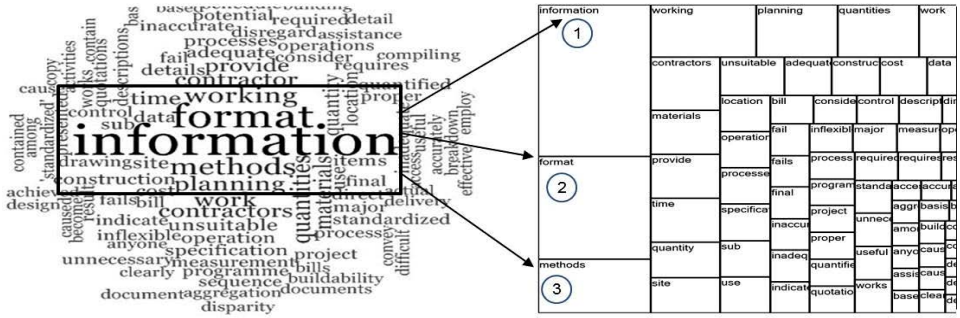


Fig. 1: The model for representing the frequency of concepts underlying the issues showing reference to three categories of the most occurring concepts

needed to suggest a focus for consideration. For this reason, a thematic analysis was carried out by counting the frequency with which certain words had occurred. The method helped by revealing the predilections that have exaggerated a certain number of concepts applied earlier in the review (Bryman, 2008). As shown in Fig. 1, a model representing the frequency of the accentuated concepts suggests that 'information', 'format' and 'methods' were the three most occurring concepts. Respectively, 'information' contain the most number of issues followed by 'format' and 'methods'.

An interpretative re-association of issues presented in Table 4 with the concepts developed in Fig. 1 was carried out to provide details for the study. The result shown in Fig. 2 suggests that the associated details were found to be mostly related to 'information'. In this regard, pertinent matters related to quantities/quantities location/quantity units, BQ descriptions, material specifications, time, preliminaries and temporary works have been identified and have corresponded well to the weight suggested in Fig. 1. Hence, as the outcome of the review has shown, these and other details associated with 'format' and 'contractor's method of working' have become the focus and issues to be considered in this study.

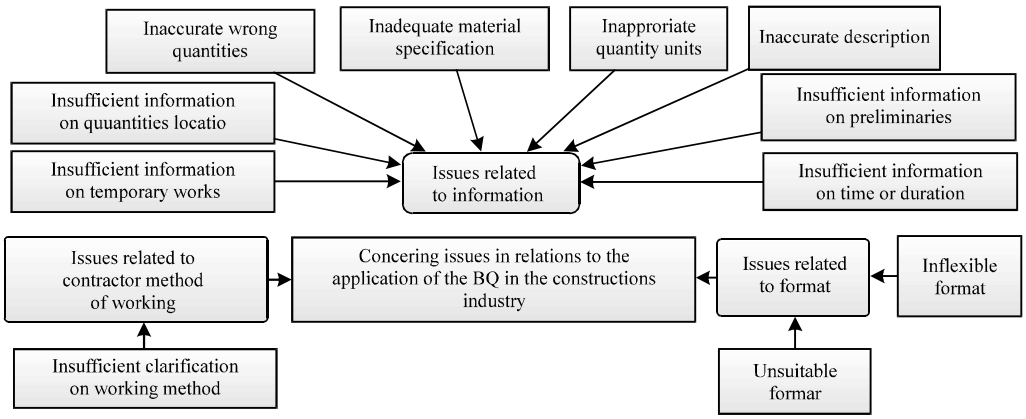


Fig. 2: The model for representing the main categories/details of issues concerning the application of BQ

## MATERIALS AND METHODS

**Questionnaire design and Likert scale:** The questionnaire designed for this study contained two sections. The first section aims to collect background information on the respondents, this forms the basis for assessing the credibility of the responses and the second section aims to solicit data concerning key issues affecting the uses of BQ. Respondents were prompted to identify the issues which are likely to affect the uses of BQ by responding on a scale from 1 (insignificant) to 5 (very significant). The 5-point rating scale used was 1 = insignificant, 2 = less significant, 3 = moderately significant, 4 = significant and 5 = very significant. Constructs used in the study were derived from the review of the literature as presented above and was laid in a matrix layout.

**Construct validity and pilot test:** As the questionnaire is designed to be self-administered, ample time has been allocated to design the survey questionnaire and to strategize data collection. The questionnaire was first probed by an academic expert to establish its face validity where suggestion to improve the layout was proposed. Next, a pilot sample of eighty contractors was drawn by convenience means. They resembled those of whom the questionnaires will finally be given and were asked to complete and comment about the questionnaire. The pilot survey yielded 28 responses or 35%. Slight modifications on the questionnaire design were made following comments received. The Cronbach's alpha reliability test conducted to the responses received indicates that all items in the questionnaire have scored above 0.700. This indicates that the instrument has good internal consistency and adequate for collecting reliable data (George and Mallery, 2003; Gliem and Gliem, 2003; Field, 2005).

**Population and sampling:** Questionnaires were sent to active G7 contractors as this was considered as the highest grade of contractor's registration in Malaysia. This translates into high capacity, expertise and self-sufficiency in terms of experience, personnel and systems that are in place (Takim *et al*., 2004). The sampling concentrated in Kuala Lumpur where the numbers and concentration of active G7 contractors are. A list of contractor's record obtained from an industry authority has subsequently become the sampling frame from which samples were finally drawn.

A random sampling technique which falls under the probability sampling technique was undertaken. The initial sample size based on the method proposed by Krejcie and Morgan (1970) was 297. Notwithstanding this, 500 sets of questionnaires were prepared and were subsequently mailed to cushion the possibility of non-response. This was in line with the suggestion by Roscoe (1975), Krejcie and Morgan (1970) and Yong and Mustaffa (2013) who suggested a sample size of 500 as appropriate for most research.

## RESULTS AND DISCUSSION

**Data analysis:** Two steps involved in the analysis. these are Step 1 calculation of Relative Significance Index (RSI), this is to determine the rank of the issues in relation to the respective uses of BQ and Step 2 determining the significance level of issues ranked in Step 1.

The RSI technique established the rank of items by comparing the relative indices within the item; the higher the RSI value, the stronger the effect of the item (Izran, 2011). In cases where two or more items having the same RSI score, a higher rank is assigned to the item with

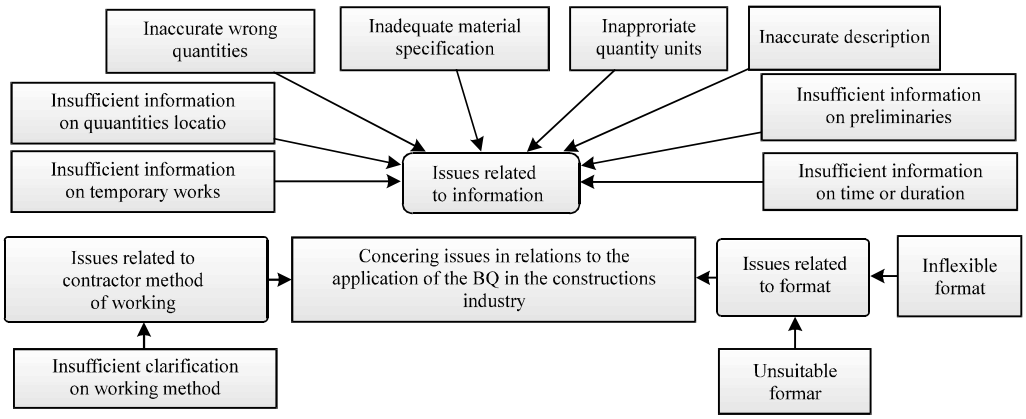


Fig. 2: The model for reprensenting the main categories/deatails of issues concerning the application of BQ

smaller standard deviation. The outcome from this analysis technique can be expressed as a percentage as was demonstrated by Jarkas and Bitar (2012). The following shows the equation of the RSI technique used in this study:

$$RSI\ (\%) = \frac{5_{n1}+4_{n2}+3_{n3}+2_{n4}+ns}{5(n_1+n_2+n_3+n_4+n_5)} \times 100$$

Where:

$n_1$ = No. of respondents who answered 'very significant'
$n_2$ = No. of respondents who answered 'significant'
$n_3$ = No. of respondents who answered 'moderately significant'
$n_4$ = No. of respondents who answered 'less significant'
$n_5$ = No. of respondents who answered 'insignificant'

In order to determine the significance level of issues ranked in Step 1 a method proposed by Dixon *et al.* (2005) and Izran (2011) was adapted in the analysis. The method suggests that levels of significance could be determined by ascertaining the Mean Significance Index (MSI-%) and Standard Deviation (SD) calculated from the RSI. The following shows the equation of the MSI-% technique adapted in this study:

$$MSI(\%) = \frac{\sum RSI(\%)}{N}$$

Where:

RSI (%) = Relative significance index derived from the first step of the analysis
N = The number of BQ related issues 11 (Fig. 2)

According to Izran (2011), ranked items with RSI-% equal to or more than one 1 SD above the MSI-% was considered very significant hence, Level 1. RSI-% that fell at or between the MSI-% value and 1 SD above the MSI-% was considered significant; hence Level 2. As the study aimed to determine issues that are considered significant, ranked items with RSI-% that are below the MSI-% were deliberately omitted from the discussion. This follows as they did not represent a significant portion of the average perception (Izran, 2011). Despite, ranked items that are below the MSI-% are not to be construed as insignificant. Rather as Dixon *et al.* (2005) have noted, these items should be interpreted as least worrying thus not necessarily triggered an immediate attention.

**Response rate and respondents background:** The survey managed to gather 112 responses. This accounted for an effective response rate of 22.4%. The responses were considered acceptable following Akintoye and Fitzgerald (2000) and Dulaimi *et al.* (2003) who stated that the normal response rate in the construction industry for the postal questionnaire is within 20-30%. The response rate was thus considered typical of a construction industry questionnaire survey and should provide an indicative view towards the concern highlighted in this study.

Table 5 shows that 45.5% (51 respondents) have between 15-19 years of experience in the industry. About 38.4% (43 respondents) have between 10-14 years of experience while respondents with either <10 years or more than 20 years of experience had accounted for <10%. Overall, 55.3% of all respondents have more than 15 years of experience. The responses received indicate that the survey had managed to capture responses from highly qualified personnel. This lent to increase the credibility of the data with their exposure and knowledge of the industry.

Table 5: Cross tabulation between the designation of the respondents and their experience (years)

| | Number of years involved in contracting business cross tabulation (showing frequency) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Designation | 6-9 | Percentage | 10-14 | Percentage | 15-19 | Percentage | ≥20 | Percentage | Total | Percentage |
| Civil engineer | 2 | 1.8 | 9 | 8.0 | 0 | 0.0 | 0 | 0.0 | 11 | 9.8 |
| Construction manager | 0 | 0.0 | 6 | 5.4 | 6 | 5.4 | 2 | 1.7 | 14 | 12.5 |
| Contract executive | 3 | 2.7 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 3 | 2.7 |
| General manager | 0 | 0.0 | 0 | 0.0 | 6 | 5.3 | 3 | 2.7 | 9 | 8.0 |
| Planning engineer | 2 | 1.8 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 2 | 1.8 |
| Project director | 0 | 0.0 | 9 | 8.0 | 22 | 19.7 | 4 | 3.6 | 35 | 31.3 |
| Project manager | 0 | 0.0 | 10 | 8.9 | 10 | 8.9 | 2 | 1.8 | 22 | 19.6 |
| Senior contract executive | 0 | 0.0 | 6 | 5.4 | 0 | 0.0 | 0 | 0.0 | 6 | 5.4 |
| Senior planning engineer | 0 | 0.0 | 3 | 2.7 | 7 | 6.2 | 0 | 0.0 | 10 | 8.9 |
| Total | 7 | 6.3 | 43 | 38.4 | 51 | 45.5 | 11 | 9.8 | 112 | 100.0 |

**Data analysis and results:** Table 6 presents the results of the analysis carried out to determine significant issues affecting the respective uses of BQ. The focus is an objective assessment where it aims to reduce data and provide summation to the findings. It highlights issues with RSI-% value that equal to or more than one 1 SD above the MSI-% and fell at or between the MSI-% value and 1 SD above the MSI-%. Accordingly, issues are segregated into their respective levels of significance. 'L1' (or Level 1) indicates very significant issues while 'L2' (or Level 2) indicates significant issues. Apart from these, the concentration of RSI-% reflected as total load of the issues to the overall uses of BQ was also shown. This would show the overall weight that the issues have in relation to the overall uses of BQ.

Results in general, showed that 5 out of 11issues indicated in Fig. 2 were perceived as very significant. These are Inaccurate/wrong quantities, inaccurate descriptions, inadequate material specifications, Insufficient information on quantities for instance, the location of the measured quantities and insufficient information on time/duration. The respective uses of BQ affected by these issues are as indicated in Table 6 (refer L1 or 'Level 1').

As for the weight of the issues given as load, results showed that issue concerning inaccurate/wrong quantities was impeding in 20 out of 30 uses of BQ. This represented the highest load followed by inaccurate descriptions (7 uses); inadequate material specifications (7 uses); insufficient information on quantities, for instance, the location of the measured quantities (5 uses) and insufficient information on time/duration (5 uses). The remaining issues had not been perceived by respondents as very significant in relation to any uses of the BQ. These are issues on insufficient information on preliminaries insufficient clarification on working methods inappropriate quantity units insufficient information on temporary works unsuitable format/presentation and inflexible format/presentation.

For the second level of significance, results showed that 8 out of 11 issues were perceived as significant. These are insufficient information on quantities for instance, the location of the measured quantities insufficient information on time/duration inaccurate descriptions insufficient clarification on working methods inadequate material specifications Inappropriate quantity units inaccurate/wrong quantities and insufficient information on preliminaries. The respective uses of BQ affected by these issues are as indicated in Table 6 (refer L2 or 'Level 2').

Based on the load, the results indicated five issues that considerably impeding to the uses of BQ. These are Insufficient information on quantities for instance, the location of the measured quantities (25 uses); Insufficient information on time/duration (24 uses); Inaccurate descriptions (23 uses); Insufficient clarification on working methods (20 uses) and Inadequate material specifications (20 uses). These are followed by Inappropriate quantity units (11 uses); Inaccurate/wrong quantities (10 uses) and insufficient information on preliminaries (6 uses). The remaining issues had not been perceived by respondents as significant in relation to any uses of the BQ. These are issues on insufficient information on temporary works unsuitable format/presentation and inflexible format/presentation.

**Discussion of findings:** Issues that have affected the maximum number of uses (in this case thirty) were proposed as the key issues. As Table 6 showed, these are inaccurate/wrong quantities insufficient information on quantities, for instance, the location of the quantities in BQ and inaccurate descriptions. The results implied that issues concerning 'quantities' and 'descriptions' were the key aspects of the findings. These are discussed as follows:

**Quantities:** The measured section is considered as the most important part of the BQ (Kodikara *et al*., 1993; RISM., 2011). It contained the measurement and quantified descriptions of the construction works

Table 6: Issues affecting the uses of BQ

| Issues of the BQ/Issues concerning the uses of BQ | MSI (%) | SD | *Results | Inaccurate/ wrong quantities | RSI-% Value Insufficient info on quantities, i.e., location | Inaccurate descriptions | Insufficient info on duration/ time | Inadequate material specifications | Insufficient clarification on working methods | Inappropriate quantity units | Insufficient info on prelim-inaries | Insufficient information temporary works | Unsuitable format and presentation | Inflexible format and presentation |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Tender period** | | | | | | | | | | | | | | |
| Material enquiries to supplier (details of material, availability of stock and method of assembly) | | | | | | | | | | | | | | |
| | 70.37 | 7.14 | **L1** | **78.21** | - | **77.86** | - | **78.21** | - | - | - | - | - | - |
| | | | L2 | - | 76.07 | - | 74.64 | - | - | - | - | - | - | - |
| Asking for material=s quotations from supplier | | | | | | | | | | | | | | |
| | 69.74 | 7.54 | **L1** | **77.68** | - | **78.93** | - | **79.29** | - | - | - | - | - | - |
| | | | L2 | - | 75.00 | - | 72.50 | - | - | - | - | - | - | - |
| Asking for work quotations from sub-contractors (work trade) | | | | | | | | | | | | | | |
| | 70.24 | 6.96 | L1 | - | - | **77.86** | - | **77.50** | - | - | - | - | - | - |
| | | | L2 | 76.96 | 75.89 | - | 73.39 | - | 72.50 | - | - | - | - | - |
| Building-up own price for works/items requested in the BQ | | | | | | | | | | | | | | |
| | 69.48 | 6.67 | L1 | - | - | **79.46** | - | **76.43** | - | - | - | - | - | - |
| | | | L2 | 75.54 | 75.36 | - | - | - | 70.18 | - | - | - | - | - |
| Identification of tasks/activities and planning of construction method | | | | | | | | | | | | | | |
| | 68.85 | 7.14 | L1 | - | - | - | - | - | - | - | - | - | - | - |
| | | | L2 | 75.36 | 74.82 | 74.46 | 72.68 | 75.54 | 73.21 | - | - | - | - | - |
| Programming the duration of task/activities for tender pricing | | | | | | | | | | | | | | |
| | 68.73 | 6.19 | L1 | 75.36 | - | - | - | - | - | - | - | - | - | - |
| | | | L2 | - | 74.46 | 72.50 | 72.86 | 74.11 | 70.89 | - | - | - | - | - |
| Drafting method statement for the identified task/activities | | | | | | | | | | | | | | |
| | 67.71 | 6.72 | L1 | - | - | **75.71** | - | - | - | - | - | - | - | - |
| | | | L2 | 73.21 | 72.32 | - | 72.68 | 71.07 | 73.75 | - | - | - | - | - |
| **Pre-contract period** | | | | | | | | | | | | | | |
| Identification of material requirements to order from suppliers | | | | | | | | | | | | | | |
| | 70.42 | 7.55 | **L1** | **78.57** | - | **78.04** | - | **80.00** | - | - | - | - | - | - |
| | | | L2 | - | 76.43 | - | 72.14 | - | - | 70.54 | - | - | - | - |
| Preparation of material schedules for ordering purposes | | | | | | | | | | | | | | |
| | 69.82 | 7.42 | **L1** | **78.93** | - | - | - | - | - | - | - | - | - | - |
| | | | L2 | - | 76.43 | 76.96 | 74.46 | 75.00 | - | 71.96 | - | - | - | - |
| Preparation of detail work programme B establishing the relationship among task activities | | | | | | | | | | | | | | |
| | 68.23 | 5.39 | **L1** | - | - | - | - | - | - | - | - | - | - | - |
| | | | L2 | 73.04 | 72.14 | 72.32 | 73.21 | 72.14 | 70.71 | - | 68.57 | - | - | - |
| Planning for the allocation of materials for works | | | | | | | | | | | | | | |
| | 67.24 | 5.38 | **L1** | **73.04** | - | - | - | - | - | - | - | - | - | - |
| | | | L2 | - | 70.89 | 72.14 | 70.89 | 70.18 | 68.21 | 67.50 | - | - | - | - |
| Planning for the allocation of plants/equipment for works | | | | | | | | | | | | | | |
| | 67.42 | 5.40 | **L1** | **72.86** | - | - | - | - | - | - | - | - | - | - |
| | | | L2 | | 72.32 | 71.25 | 72.68 | 69.11 | 68.75 | - | 67.86 | - | - | - |
| Planning for the allocation of labour for works | | | | | | | | | | | | | | |
| | 67.50 | 5.62 | **L1** | **73.39** | - | - | - | - | - | - | - | - | - | - |
| | | | L2 | - | 71.07 | 71.25 | 72.32 | 69.11 | 71.43 | - | 67.68 | - | - | - |
| **Construction period** | | | | | | | | | | | | | | |
| Placing orders for material to suppliers | | | | | | | | | | | | | | |
| | 70.00 | 7.60 | **L1** | - | - | **78.93** | - | **78.39** | - | - | - | - | - | - |
| | | | L2 | 76.61 | 75.00 | - | 77.14 | - | - | - | - | - | - | - |
| Purchasing/leasing plants for works | | | | | | | | | | | | | | |
| | 69.71 | 6.14 | **L1** | - | - | - | **76.07** | - | - | - | - | - | - | - |
| | | | L2 | 74.29 | 75.00 | 72.32 | - | 73.93 | 72.14 | - | 70.71 | - | - | - |
| Procurement of sub-contractors | | | | | | | | | | | | | | |
| | 68.56 | 6.70 | **L1** | - | - | - | **75.54** | - | - | - | - | - | - | - |
| | | | L2 | 74.29 | 72.50 | 73.04 | | 74.29 | 71.96 | 69.46 | - | - | - | - |
| Scheduling of subcontractors work | | | | | | | | | | | | | | |
| | 69.22 | 5.96 | **L1** | - | - | - | **77.32** | - | - | - | - | - | - | - |
| | | | L2 | 74.46 | 73.39 | 73.04 | - | 73.39 | 70.89 | - | - | - | - | - |
| Procurement of general labour | | | | | | | | | | | | | | |
| | 67.27 | 5.94 | **L1** | - | - | - | **74.82** | - | - | - | - | - | - | - |
| | | | L2 | 72.50 | 71.79 | 71.07 | - | 71.61 | 67.32 | - | - | - | - | - |
| Off-site manufacturing of building components | | | | | | | | | | | | | | |
| | 68.88 | 6.80 | **L1** | **76.25** | - | - | - | 75.71 | - | - | - | - | - | - |
| | | | L2 | | 72.50 | 73.93 | 75.18 | - | 71.79 | - | - | - | - | - |
| On-site manufacturing of building components | | | | | | | | | | | | | | |
| | 69.32 | 6.33 | **L1** | **76.96** | - | - | - | - | - | - | - | - | - | - |
| | | | L2 | | 72.68 | 75.18 | 74.29 | 75.36 | 71.25 | - | - | - | - | - |
| Recording actual use of materials | | | | | | | | | | | | | | |
| | 68.02 | 6.43 | **L1** | **77.32** | **75.89** | - | - | - | - | - | - | - | - | - |
| | | | L2 | - | - | 71.61 | 71.96 | 71.96 | - | - | - | - | - | - |
| Recording actual use of plants | | | | | | | | | | | | | | |
| | 66.33 | 4.98 | **L1** | **74.64** | - | - | - | - | - | - | - | - | - | - |
| | | | L2 | - | 70.89 | 68.75 | 69.46 | 68.21 | 67.32 | - | - | - | - | - |
| Recording actual use of labours | | | | | | | | | | | | | | |
| | 67.03 | 4.66 | **L1** | **76.07** | - | - | - | - | - | - | - | - | - | - |
| | | | L2 | - | 71.61 | 68.21 | 70.36 | 68.04 | 68.57 | - | - | - | - | - |
| Preparation of claim document for interim valuations | | | | | | | | | | | | | | |
| | 69.92 | 6.32 | **L1** | **80.89** | - | - | **76.61** | - | - | - | - | - | - | - |
| | | | L2 | - | 74.11 | 73.75 | - | 70.00 | 70.00 | 70.18 | - | - | - | - |

Table 6: Continue

| Issues of the BQ/Issues concerning the uses of BQ | MSI (%) | SD | *Results | Inaccurate/ wrong quantities | RSI-% Value Insufficient info on quantities, i.e., location | Inaccurate descriptions | Insufficient info on duration/ time | Inadequate material specifications | Insufficient clarification on working methods | Inappropriate quantity units | Insufficient info on prelim-inaries | Insufficient information temporary works | Unsuitable format and presentation | Inflexible format and presentation |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Preparation of claim document for varied works to client (variation orders) | | | | | | | | | | | | | | |
| | 70.13 | 6.64 | **L1** | **79.46** | **77.32** | - | - | - | - | - | - | - | - | - |
| | | | L2 | - | - | 74.64 | 75.00 | 71.79 | - | 72.50 | - | - | - | - |
| Evaluation of claims submitted by sub-contractors employed for the works | | | | | | | | | | | | | | |
| | 69.50 | 6.06 | **L1** | **78.93** | **75.71** | - | - | - | - | - | - | - | - | - |
| | | | L2 | - | - | 74.11 | 74.29 | - | 70.36 | 70.36 | - | - | - | - |
| Preparation of payment to sub-contractors | | | | | | | | | | | | | | |
| | 70.00 | 6.20 | **L1** | **79.82** | - | - | - | - | - | - | - | - | - | - |
| | | | L2 | - | 76.07 | 74.64 | 74.82 | - | - | 71.43 | - | - | - | - |
| Monitoring planned and actual project=s expenditure | | | | | | | | | | | | | | |
| | 69.98 | 5.60 | **L1** | **79.64** | - | - | - | - | - | - | - | - | - | - |
| | | | L2 | - | 73.57 | 72.14 | 74.11 | 72.68 | 70.00 | 70.54 | - | - | - | - |
| **Defect/Final Account period** | | | | | | | | | | | | | | |
| Preparation of final claim document to client | | | | | | | | | | | | | | |
| | 72.55 | 6.02 | **L1** | **83.75** | **78.75** | - | - | - | - | - | - | - | - | - |
| | | | L2 | - | - | 75.36 | 75.71 | 72.68 | - | 73.57 | 73.75 | - | - | - |
| Preparation of document for closing of project=s account (final account) | | | | | | | | | | | | | | |
| | 72.74 | 6.01 | **L1** | **83.75** | **80.18** | - | - | - | - | - | - | - | - | - |
| | | | L2 | - | - | 73.39 | 76.07 | - | - | 74.29 | 73.93 | - | - | - |
| Load of very significant issues in relation to the overall uses of BQ (total L1) **: | | | | 20 | 5 | 7 | 5 | 7 | 0 | 0 | 0 | 0 | 0 | 0 |
| Load of significant issues in relation to the overall uses of BQ (total L2) **: | | | | 10 | 25 | 23 | 24 | 20 | 20 | 11 | 6 | 0 | 0 | 0 |
| Total load of the issues in relation to overall uses of BQ (total L1 and L2) ***: | | | | 30 | 30 | 30 | 29 | 27 | 20 | 11 | 6 | 0 | 0 | 0 |
| Rank of the issues to the overall uses of BQ: | | | | 1-3 | | 4 | 5 | 6 | 7 | 8 | | | -----9-11----- | |

*L1 and L2 = Level 1 (very significant) and Level 2 (significant); ** Enumerated based on the frequency of which individual issues in L1 and L2 are affecting the uses of BQ; ***Enumerated based on the frequency of which issues in both L1 and L2 are affecting the overall uses of BQ

(Hackett *et al*., 2007). Quantities refer to the estimated amount of labour and materials required for the works (Ahamad and Khairuddin, 2005). This may be approximated in the absence of accurate information during the bill production stage (Hackett *et al*., 2007). Sierra (1984a, b) weighted on the need to provide the correct quantities since the contractor's resources are conditioned by the quantities stated in the bills.

Despite, there have been substantial criticisms in the way quantities were presented in BQ. Partly, this happened as quantities were customarily measured as fixed-in-place or nett-in-place (RISM., 2011) which found to be of little use for the contractors (Adnan *et al*., 2011, Baccarini and Davis, 2002). As a result of this practice, Holes argued that there was a little chance for BQ quantities to be leveraged as input to the construction processes. There was little flexibility offered with the measured data which resulted in substantial loss of its utility during the construction process (Smith and Hoong, 1985; Jaggar *et al*., 2001). In this regard, Turner (1983) argued that details supporting the quantities measured, work location and types of operations the contractors have to employ would be of great assistance should these were included as part of the presentation.

The calls to rethink the way quantities are to be reflected in BQ had long become the focal arguments in the literature. Leon (1966) and Waterworth and Weddle (1978) argued that despite no amount of 'accurate' can adequately comprehend the uncertainties in construction but such lack of information had prevented contractors from being able to plan and consequently increased his cost of building. The authors further stated that quantities produced on the basis of QS imagination might differ significantly with the contractor's actual method of operation hence, offered less value beyond the stage of tendering. In a study conducted by Kodikara *et al*. (1993), the researcher's which study sought to determine the amount of rework involved to eleven BQ information packages had found that 'quantities' was the information that requires the highest amount of rework (84.3%). This clearly was a waste in term of time and information which should have benefitted the industry.

Though criticisms abound, one of the earliest efforts carried out to expand the roles of BQ quantities shouldn't be left unnoticed. This came under a concept known as the Operational Bill (OB) where it moved from the traditional concept of measuring work as fixed-in-place to a new concept which measured the labour and materials separately in the bills (Skoyles, 1964; Skinner, 1980). The idea had sought to introduce a concept in which a scheme was divided into its actual site operations with an aid of precedence diagrams (Seeley and Winfield, 1999). This had involved fundamental divergence from the rules of SMM but with advantages posed to benefit the contracting organisations (Kwakye, 1997). This was considered innovative at the time as it was able to give the contractors much information for estimating. Regardless,

the practised of OB by the industry was reportedly poor (Skoyles and Fletcher, 1970). Hisham and Azman (2008) have noted that apart from some technical issues, the learning curve might be the reason for the poor reception by the industry.

The discussion presented thus far suggested that quantities was not a matter of issue that had just been discovered but one which had beleaguered the industry for a very long time. This has compounded for several reasons but was made severed as the industry had continuosly failed to notice and consider the contracting organisations as the main user of the information. From the historical perspective, BQ was originally sponsored by contractors (Kirkham, 2007). This, however, has changed to the building owners as alliancing among contractors escalated while giving them a sense of control over the financial aspects of the works (Rozali *et al*., 2006). It was very clear that the change in sponsoring had over time reduced the applicability of BQ to contracting organisations. This has resulted in information disparity which the contractors are now calling the industry to consider. The findings presented through this study has provided the evidence that supports the call.

**Descriptions:** Descriptions provide the starting point where works are comprehended (Shamsulhadi, 2011). It must be clear and concise yet able to provide instant views of what is expected from the item (Lee *et al*., 2005). This is the most difficult aspect in the overall taking-off process but one of the utmost values (Seeley and Winfield, 1999). Though, descriptions are important, details are not necessarily given on labour, plants and methods to carry out the works (Kodikara, 1990). Instead, as has been the practised, works are normally described as fixed in position (RISM., 2011). This leaves the contractors to decide on the most economical method to carry out the works.

Though, this has been the practised, criticisms nonetheless exist. For instance, Ahenkorah (1993) and Adnan *et al*. (2011) have pointed out this as the shortcoming in the descriptions. This simply disregards the resource requirement needed by the contractors (Baccarini and Davis, 2002). Yet, the persistence of the practice reflects common perception on this which leaves the decision to the discretion of the contractor responsible for the work.

According to Ahamad and Khairuddin (2005), item descriptions are part of the taking-off process in which all measured works must be accompanied by its own descriptions. The resaerchers added that designer's specifications found in the drawings or as separate documents must be described explicitly in reflecting the items measured. While the process in generating quantities is somehow objective, structured and tangible, the same however isn't entirely applies in descriptions writing. The process which is known as 'framing' (Lee *et al*., 2011) is more subjective in nature, susceptible to personal experience, individual firm's format and to some extent, language proficiency (Shamsulhadi, 2011). The industry responds to this was through a standard phraseology first published by Fletcher and Moore (1965) and local versions by Yong and Mustaffa (2013). Hence, this work was fundamental in achieving standardisation within the BQ.

The subjectivity found with descriptions might have given a basis to explain the finding of this study. It was perhaps perplexing for the contractors to comprehend the nature of the works described, yet to use them to their advantage. Wood and Kenley (2004) suggested that BQ had always present information that has been processed and form considered final. This was not flexible enough for contractor's uses (Smith and Hoong, 1985) which somehow requires further processing in meeting their objectives (Cornick and Osbon, 1994). Further explanation to this was bounded by the lack of data or studies that considered the adequacy of BQ descriptions. Despite, as has been shown in this study, descriptions were found as one of the key issues that were impeding thus requires consideration by the industry.

## CONCLUSION

The focus of this study was to determine the key issues affecting the uses of BQ by contracting organisations. Inputs for the study were first derived from literature review before data was gathered through a questionnaire survey. In the review process, thirty uses of BQ by contracting organisation were solicited while eleven impeding issues were identified. Data gathered from a survey was then subjected to rigorous analysis techniques before findings were presented and discussed.

The assessment showed that issues concerning quantities ('Inaccurate/wrong quantities' and 'Insufficient information on quantities, for instance, the location') and BQ descriptions ('Inaccurate descriptions') are the issues that were most impeding in all thirty uses of BQ. These have been the highlight in the discussion of this study and were proposed as the key issues that require an immediate attention. In relation to the findings, the identification of the key issues was an important contribution to data that applies to the local context. Besides adding up the literature, it also informed the industry on the core challenge affecting the uses of BQ in the industry today.

Overall, it is timely for the Malaysian construction industry to respond to the idea that information perhaps should best be shared and passed along the entire chain of the industry. Importantly, the information should reach to parties who are doing the actual work on site in forms that corresponds to their specific needs. This involves both traditional and non-traditional forms of information. In addition, there is a quite a gap in the literature on BQ which somehow suggests innovation has long overdue. It raised a vital question of whether BQ has progressed, or trapped in procrastination. Though some efforts had recently surfaced, the fear to constantly catching-up is felt as the industry is inclined to automate rather to innovate and improve. It was an irony (as data from the study had suggested) that BQ, despite its name is criticised for the quantities it tries hard to reflect. Hence, this should serve as a serious call or complacency would finally prove too costly to consider.

## ACKNOWLEDGEMENTS

The resaerchers would like to thank Universiti Teknologi Malaysia (UTM) for the funding provided under the Research University Grant Scheme (GUP: Q.J130000. 2621.12J38).

## REFERTENCES

AIQS., 2001. Guaranteed bills of quantities. Australian Institute of Quantity Surveyors, Sydney, Australia.

Adnan, H., A.H.M. Nawawi, S.M.M. Akhir, A. Supardia and H.Y. Chong, 2011. Bills of quantities: Perspectives of contractor in Malaysia. Aust. J. Basic Appl. Sci., 5: 863-873.

Ahamad, A. and A.R. Khairuddin, 2005. Measurement of Building Works Based on SMM2. Prentice Hall, Kuala Lumpur, Malaysia,.

Ahenkorah, K., 1993. Exploring the bills of quantities. Build. Economist, 1: 23-25.

Akintoye, A. and E. Fitzgerald, 2000. A survey of current cost estimating practices in the UK. Constr. Manage. Econ., 18: 161-172.

Ashworth, A., K. Hogg and C. Higgs, 2013. Williss Practice and Procedure for the Quantity Surveyor. Wiley-Blackwell, London, England, UK., ISBN:978-0-470-67219-8,.

BOQ., 1995. ACT (Australian Capital Territory) bills of quantities working group. Bank of Queensland, Brisbane, Australia.

Baccarini, D. and P. Davis, 2002. Bills of quantities: A literature review. Build. Economist, 1: 10-16.

Blyth, I., 2001. To bill or not to bill. Build. Economist Fyshwick Deakin West, 1: 4-12.

Bryman, A., 2008. Social Research Methods. 3rd Edn., Oxford University Press, New York, USA., ISBN: 9780199202959, Pages: 748.

Charles, E., 2007. The evolving role of the quantity surveyor. Build. Economist, 1: 35-36.

Cornick, T. and K. Osbon, 1994. A study of the contractors quantity surveying practice during the construction process. Constr. Manage. Econ., 12: 107-111.

Cunningham, T., 2016. The function and format of bills of quantities: An Irish context. Dublin Institute of Technology, Dublin, Republic of Ireland. http://arrow.dit.ie/beschreoth/54/

Davis, P.R., P.E.D. Love and D. Baccarini, 2009. Bills of quantities: Nemesis or nirvana?. Struct. Surv., 27: 99-108.

Dixon, R., R.L. Meier, D.C. Brown and R.L. Custer, 2005. The critical entrepreneurial competencies required by instructors from institution-based enterprises: A Jamaican study. J. Ind. Teach. Educ., 42: 12-16.

Dulaimi, M.F., F.Y.Y. Ling and A. Bajracharya, 2003. Organisational motivation and inter-organisational interaction in construction innovation in Singapore. Constr. Manage. Econ., 21: 307-318.

Field, A., 2005. Discovering Statistics using SPSS. Sage Publications, London, England,.

George, D. and P. Mallery, 2003. SPSS for Windows Step by Step: A Simple Guide and Reference. 4th Edn., Allyn and Bacon, Boston, MA., USA., ISBN-10: 0205375529, Pages: 400.

Gliem, J.A. and R.R. Gliem, 2003. Calculating, interpreting and reporting Cronbach's alpha reliability coefficient for likert-type scales. Proceedings of the Midwest Research-to-Practice Conference in Adult, Continuing and Community Education, October 8-10, 2003, The Ohio State University, Columbus, OH., USA., pp: 82-88.

Hackett, M., I. Robinson and G. Statham, 2007. The Aqua Group Guide to Procurement, Tendering and Contract Administration. Wiley-Blackwell, Oxford, England,.

Hisham, M.A. and W.N. Azman, 2008. Bringing back the dead: Operationalizing the bills of quantitites. Proceedings of the International Conference on Project Management, November 18-20, 2008, University of Malaya, Kuala Lumpur, Malaysia, pp: 1-1.

Hughes, G.A., 1978. The Anatomy of Quantity Surveying. Construction Press, Lancaster, England, ISBN: 9780904406924, Pages: 229.

Izran, S., 2011. Post occupancy evaluation of building performance in Malaysia. Ph.D Thesis, University of Technology, Malaysia, Johor Bahru, Malaysia.

Jaggar, D., A. Ross, P.E. Love and J. Smith, 2001. Overcoming information opacity in construction: A commentary. Logist. Inf. Manage., 14: 413-421.

Jarkas, A. M. and C.G. Bitar, 2011. Factors affecting construction labor productivity in Kuwait. J. Constr. Eng. Manage., 138: 811-820.

Kinlay, G., 1984. Bills of quantities-form follows function or does it. Build. Econ., 23: 2-3.

Kinlay, G., 1984. Bills of quantities-you pay the piper-why not call the tune. Build. Econ., 23: 5-6.

Kirkham, R., 2007. Ferry and Brandon's Cost Planning of Building. 8th Edn., Wiley, Oxford, UK., ISBN:9781405130707, Pages: 432.

Kodikara, G.W. and R. McCaffer, 1993. Flow of estimating data in Sri Lankan building contractor organizations. Constr. Manage. Econ., 11: 341-346.

Kodikara, G.W., 1990. Data flow in building contractor organizations. Ph.D Thesis, Loughborough University of Technology, Loughborough, England.

Kodikara, G.W., A. Thorpe and R. McCaffer, 1993. The use of bills of quantities in building contractor organizations. Constr. Manage. Econ., 11: 261-269.

Krejcie, R.V. and D.W. Morgan, 1970. Determining sample size for research activities. Educ. Psychol. Meas., 30: 607-610.

Kwakye, A.A., 1997. Construction Project Administration in Practice. Longman Company, Harlow, UK., ISBN:9780582294615, Pages: 340.

Lee, S., W. Trench and A. Willis, 2005. Williss Elements of Quantity Surveying. 10th Edn., Wiley-Blackwell, Hoboken, New Jersey, ISBN:9781405125635, Pages: 360.

Lenard, D., 1991. Cost efficiency in the building and construction industry. Build. Economist, 30: 5-14.

Lenard, D., 1992. Cost management in project delivery. Build. Economist, 1: 12-14.

Leon, G., 1966. Tendering documents and final costs. Quantity Surveyor, 23: 65-67.

Lim, C.S. and M.Z. Mohamed, 1999. Criteria of project success: An exploratory re-examination. Int. J. Project Manage., 17: 243-248.

Morledge, R. and S. Kings, 2006. Bills of quantities: A time for change?. Proceedings of the 21st Century International Conference on Built Environment in the (ICiBE 2006), June 13-15, 2006, Universiti Teknologi MARA, Shah Alam, Malaysia, pp: 49-56.

RICS., 2011. New Rules of Measurement (NRM): Bills of quantities for works procurement. Royal Institution of Chartered Surveyors, London, England.

RISM., 2011. Section: A general rules in the Malaysian standard method of measurement of building works. Royal Institution of Surveyors Malaysia, Petaling Jaya, Malaysia.

Rashid, A.K., S.F. Hasan, M. Fauzi, P.N.F. Naadia and S. Aripin *et al*., 2016. A review on the application of Bills of Quantities (BQ) in construction project procurement. J. Sci. Res. Dev., 3: 102-105.

Razali, A., A. Tajudin and A.F.A. Tajuddin, 2016. Importance and functions of bills of quantities in the construction industry: A content analysis. Intl. J. Eng. Sci. Invention, 5: 29-36.

Roscoe, J.T., 1975. Fundamental Research Statistics for the Behavioral Sciences. 2nd Edn., Holt Rinehart and Winston, New York, USA., ISBN: 9780030919343, Pages: 483.

Seeley, I.H., 1997. Quantity Surveying Practice. 2nd Edn., Macmillan Publishers, London, UK., ISBN:9780333689073, Pages: 632.

Shamsulhadi, B., A. Fadhlin and A. Hamimah, 2015. Research into the bills of quantities: Where can it be focused. Malaysian Surveyor J., 50: 15-24.

Sierra, J., 1984a. Bills of quantities: The roots of the quantity surveyor. Build. Economist, 22: 379-380.

Sierra, J., 1984b. Bills of quantities: The roots of the quantity surveyor. Build. Economist, 23: 1-10.

Skinner, D.W.H., 1979. An analysis of the utility of bills of quantities in the process of building contracting. Ph.D Thesis, Aston University, Birmingham, England.

Skinner, D.W.H., 1980. The contractors use of bills of quantities. The Chartered Institute of Building, Berkshire.

Skoyles, E. and L. Fletcher, 1970. Bills of quantities or the operational bill?. Archit. J., 1970: 233-240.

Skoyles, E., 1964. Introduction to operational bills. Quantity Surveyor, 21: 27-32.

Skoyles, E., 1968. Introducing bills of quantities (operational format). Quantity Surveyor, 24: 139-146.

Slattery, P., 1994. Bills of quantities: The builders view. Build. Economist, 1: 13-14.

Smith, J. and W.K. Hoong, 1985. Bills of quantities in Singapore: A survey of their use and application. Build. Economist, 24: 18-22.

Takim, R., A. Akintoye and J. Kelly, 2004. Analysis of measures of construction project success in Malaysia. Proceedings of the 20th Annual Conference on ARCOM Vol. 2, September 1-3, 2004, Heriot-Watt University, Edinburgh, Scotland, pp: 1123-1133.

Teo, A.L., 2008. Building Quantities. McGraw-Hill Education, Singapore, Asia,.

Towey, D., 2012. Construction Quantity Surveying: A Practical Guides for the Contractors QS. Wiley-Blackwell, Oxford, England, ISBN:978-0-470-65942-7,.

Turner, D., 1983. Quantity Surveying Practice and Administration. 3rd Edn., George Godwin Publisher, New York, USA., New York, USA.,.

Waterworth, H.W. and A.E. Weddle, 1978. Bills of quantities for landscape works. Quantity Surveyor, 35: 244-245.

Wood, B. and R. Kenley, 2004. The effectiveness of the bills of quantities in Australia. J. Constr. Res., 5: 291-309.

Yong, Y.C. and N.E. Mustaffa, 2013. Critical success factors for Malaysian construction projects: An empirical assessment. Constr. Manage. Econ., 31: 959-978.