

Enhancing the effectiveness and efficiency by adopting Building Information Modelling in the service delivery of the Quantity Surveying practice of Sri Lanka

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Abstract—Building Information Modelling, in the global construction context of the new millennium, has grown into a new advanced paradigm where it is increasingly, universally recognized as a new buzzword. BIM has a great potential to incorporate with the construction project's life cycle. Thereby, it is more probable to be a standard practice. Incorporating of BIM applications, the practice of quantity surveying in the new millennium is undergoing a paradigm change from traditional manual techniques to completely automated digitalization in the purpose of providing the service in an efficient and effective manner. However, in Sri Lanka, traditional manual processes are still used in QS practice, which is problematic.

The execution of BIM applications for the QS practice is a fear among Quantity Surveyors due to the professional's existence is creating a threatened and challenging nature when employing BIM in the QS practice. Lack of government influence, unavailability of computer facilities with higher capacities and cost of software and hardware are distinguished as the main obstructions and are discussed here. The present knowledge about BIM applications relevant to the QS practice of Sri Lanka is explicitly explaining, BIM applications adoption that can have an influence on the QS's functions. Thereby, to overcome the deficiencies faced by QSs due to the usage of traditional manual methods, this study focuses on the strategies to integrate BIM by discovering the current status of using BIM within the QS operation.

Keywords—Building Information Modelling; Quantity Surveying; Sri Lanka.

I. INTRODUCTION

The global construction industry is moving in the direction of widespread of application of BIM (Building Information Modelling) application throughout inception, bidding, construction, facilities management and operation (Raic 2007). In the worldwide construction sector, particularly in the quantity surveying field, there has been a paradigm change from traditional service delivery techniques to completely automated, by using BIM (Jayasena and Weddikkara 2013). Implementation of BIM applications for

the Quantity Surveying practice is a fear among Quantity Surveyors in Sri Lanka because the professional's existence is disturbed by the threatening and challenging nature created when employing BIM within the QS practice (Nagalingam et al. 2016). Currently, projects stakeholders communicate design development and finalization of project requirements by online mode and sharing information demanded by sophisticated computer software schemes that is 3D (Three Dimensional) AutoCAD, Revit application for design principles and identify integration building components for proper constructability. The QSs' (Quantity Surveyor) role interface during project feasibility on word and stakeholders' same language need to communicate for the commercial advice and therefore, familiarization of those software packages is compulsory for the QS. Due to this new paradigm, BIM applications are developed and develop countries use BIM compulsorily in their construction projects. However, many countries are ahead compared to the Sri Lankan approach where BIM has gained gradual popularity in UK (United Kingdom), United States and few European countries (Khosrowshahi & Arayici, 2012). A study in UK has demonstrated this, by illuminating a statement specified in the Government Construction Strategy of UK, and then a Cabinet paper was publicized by the UK Cabinet Office. As a result, the objective of the government is expressed to entail: collaborative 3D BIM by 2016 with all the required information regarding project and asset documentation and digitalized data on its projects (Cabinet Office, 2011). Even establishing the standard was insufficient in the construction sector of the UK, as it further suffered from inefficiency and a lack of productivity and thus, the government was eager to strengthen the industry. With the government's 2011 construction strategic decision to implement BIM, currently UK is positioned as the global BIM leader (Hazem, 2020). UK formulated different levels of BIM and traditional applications, with the 2D model upgradable to the 3D model, which was defined as BIM Level 1. In 2011, a commitment was made to use BIM Level 2 in all government projects; modern policy mandates that by 2016, all projects must use BIM Level 2, which entails designing and storing 3D models in a shared environment; this step resulted in an

overall improvement in the use of BIM by both the private and public sectors. (Hazem, 2020).

By the year 2020, BIM Level 2 was elevated to BIM Level 3, where it is a solitary online model that comprises information regarding project management, costing and scheduling. Since then, there was a rise in employing BIM within the construction sector and in Quantity Surveying practice of UK (Hazem, 2020).

Thereby the QS needs to escalate the usage of BIM by understanding its potentials and developing streamlined methods to incorporate BIM into their current and future professional practices (Partridge 2015). Therefore, gap of the research is how to overcome the QSs' role in line with the new paradigm. The main aim of this research study is to enhance the delivery of service in an effective and efficient manner by employing BIM applications within the QS practice of Sri Lanka where the objectives are to discover the current state of usage of BIM application in the Quantity Surveying field, to analyse the barriers influencing the implementation of BIM and to determine strategies to encourage the use of BIM to escalate the effectiveness and efficiency within the Quantity Surveying operations in Sri Lanka.

II. METHODOLOGY

For this research, Pragmatism is the most suitable type of research philosophy because this study starts with a problem and tries to provide practical solutions that can be used in the future practice (Saunders et al. 2009). This research can be referred to as a Descriptive Research due to the wide range of surveys and fact-gathering inquiries, describing the current situation of the issues is the most essential goal (Kothari, 2004). Mix method is used as the research approach of this study where it combines both quantitative and qualitative methods (George, 2021). Surveys with closed-ended questions, observations where numbers are recorded, experiments and secondary data are comprised in this study where quantitative data are present. In this study, qualitative data are included in literature reviews that evaluate concepts and theories and observations articulated in words, interviews with open-ended questions, focus groups, and secondary data.

For this research study, the questionnaire was distributed among randomly selected 45 number of Quantity Surveyors and purposively selected 5 number of Chartered QS were interviewed among the population. The data collection methods are used for conducting this research are, literature survey; was undertaken to establish the research problem background and to obtain a solution to the research problem by articulating the objectives to be pursued. Close ended questionnaires were utilized in this study because they included predetermined answers and required less time to complete. Structural interview survey is to ask professionals' opinions regarding this study with pre-decided interview questions based on the requirement for the study. The responses compiled from the questionnaire were analysed

using RII (Relative Importance Index) method, correlation analysis and regression analysis which are based on the hypothesis. Hypothesis was constructed based on dependent and independent variables of the study and firstly the reliability and validity of the questions in the questionnaire was identified. The interviewees' opinions were analysed by content analysis.

III. RESULTS AND DISCUSSION

The questionnaire distributed was responded by 45 Quantity Surveyors. Among the 45 Quantity Surveyors, 4 Chartered QS, 21 Senior QS and 20 Assistant QS used to respond the questionnaire. Both the Pearson's correlation analysis and regression analysis showed that the relationship between independent and dependent variables are strong.

A. Current State of using BIM within the QS practice
The majority of the Sri Lankan construction organizations still uses manual methods in the QS practice, usage of standalone practice is high in Sri Lanka, and Architect is not formulating the BIM process. Even though sufficient details are available in the design development stage, manual methods are used by QS to carry out their tasks. This was proved from the detailed questionnaire that was used to collect data for the study and the diagrammatic analysis conducted is demonstrated by the below Table 1 and 2 and Figure 1 and 2.

Table 1. Results of using Convectional Manual methods in organizations

| Response given | Frequency | Percentage |
|----------------|-----------|------------|
| Yes | 35 | 78% |
| No | 10 | 22% |
| Total | 45 | 100% |

Figure 1. Results of using Convectional Manual methods in organizations



Table 2. Results of using Convectional Manual methods in Design Development Stage

| Response given | Frequency | Percentage |
|----------------|-----------|------------|
| Yes | 42 | 93% |
| No | 3 | 7% |
| Total | 45 | 100% |

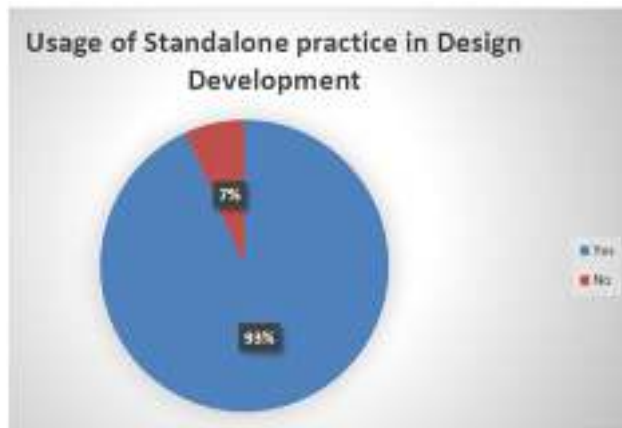


Figure 2. Results of using Convectional Manual methods in Design Development Stage

78% of Quantity Surveyors still uses traditional practices to deliver the service and also 93% of Qs still uses traditional methods even in the Design development stage. These indicate that Sri Lanka is a BIM infant country and lies in Level 0 of Bew- Richard model.

B. Barriers to implement BIM within the QS practice In the construction industry, according to the responses given by professionals regarding barriers to use BIM in the QS practice, lack of government influence (BA6) is the most significant hindrance of executing BIM within the QS practice of Sri Lanka. From the content analysis results, unavailability of efficient computers with high capacities, cost of software and hardware, absence of continuous power supply, continuous internet supply were identified as hindrances to implement BIM within the QS practice.

Table 3. RII Analysis for Barriers to execute BIM within the QS practice of Sri Lanka

| Barriers to execute BIM within the QS practice of Sri Lanka | Code | RII | Rank |
|---|------|------|------|
| Lack of client demand | BA1 | 0.84 | 4 |
| Absence of knowledge and experience | BA2 | 0.86 | 3 |
| Lack of confidence in Automation | BA3 | 0.80 | 5 |

| | | | |
|---|-----|------|---|
| High cost of software and hardware upgrades | BA4 | 0.87 | 2 |
| High training cost of employees | BA5 | 0.86 | 3 |
| Lack of government influence | BA6 | 0.89 | 1 |

C. Strategies to encourage the use of BIM within the QS practice

When considering the overall summary of the factors which act as strategies to encourage the use of BIM within the QS practice, it is essential to identify the most significant strategy as it brings numerous benefits to implement BIM to the QS practice of Sri Lanka. Thus, according to this study, the most significant strategy is government imposing regulations and developing the National BIM standard and National BIM execution plan while the least impacted strategy is addition of BIM as a compulsory module. According to the content analysis results, addition of practical sessions on QS related BIM software, was suggested as a strategy to implement BIM within the QS practice.

Table 4. RII Analysis for strategies to strengthen the execution of BIM within the QS practice of Sri Lanka

| Strategies to strengthen the execution of BIM within the QS practice of Sri Lanka | Code | RII | Rank |
|---|------|------|------|
| Addition of BIM as a compulsory module | S1 | 0.79 | 7 |
| Conducting Seminars, Workshops and short courses | S2 | 0.85 | 3 |
| Resist the change from traditional practice of organization culture | S3 | 0.83 | 4 |
| Establishing the advantages and importance of utilizing BIM | S4 | 0.80 | 6 |
| Encourage staff to use BIM applications | S5 | 0.82 | 5 |
| The government should impose regulations and develop the National BIM action plan | S6 | 0.87 | 1 |
| The government should initiate first in their public projects and others to follow in their construction projects | S7 | 0.86 | 2 |

IV. CONCLUSION AND RECOMMENDATIONS

This research study was directed to promote BIM within the QS practice. Literature surveys from past research findings

and a detailed questionnaire survey were conveyed to ascertain the present state of using BIM, identify the barriers and strategies. A semi structured interview survey was conducted along with the attempt to gather the perspective of professionals in the field of QS to govern the contemporary status of using BIM and to elaborate the most significant barrier and strategy that encourage the use of BIM within the QS practice of Sri Lanka. In order to accomplish the three prominent objectives, Pearson's correlation analysis, regression analysis and RII were used along with content analysis to analyze the findings.

Over the recent years in the new millennium of the QS practice, it is evident that the BIM has extended to a remarkable popularity and in general, BIM was increasingly recognized worldwide. According to the Bew-Richards BIM maturity model, Sri Lankan QS practice lies in the 'Level 0' as still conventional manual methods are being used by quantity surveyors. Thus, Sri Lanka can be considered as a BIM infant country. The findings concluded that the integration of BIM in QS practice is very low. According to the content analysis and RII analysis, the most significant barrier that hinders the adoption of BIM is lack of government influence.

The strategies to encourage the use of BIM within the QS practice were distinguished, and the responses of the questionnaires were ranked using the RII method to determine the most significant strategy that is used to promote the incorporation of BIM. Government imposing regulations and developing the National BIM guidelines and action plan obtained the highest ranking. The interviewees proposed that BIM should be standardized and the knowledge on BIM protocols should be shared among the QS professionals in order to enhance the usage of BIM within the Sri Lankan QS practice.

Recommendations were proposed through deep analysis, according to the overall outcomes of this study. The base for the recommendations is the past research outcomes and the recommendations gained through the experts when carrying out the interview. The interviewees recommended to conduct practical sessions on QS based applications related to BIM, high-capacity machines should be available along with continuous internet supply as the entire country covers and power supply. Through the detailed questionnaire survey it was recommended that realizing the merits and value of BIM and the government should pave the path to adopt BIM by imposing rules and regulations, policies, action plans, standards and using BIM in their projects and make application of BIM compulsory in all construction projects will facilitate to employ BIM rapidly within the QS practice of Sri Lanka.

REFERENCES

Kothari, C. R., 2004. Research methodology, evaluation and an application. In Proceedings of the twelfth international conference on Information and knowledge management (pp. 410-417).

Jayasena, H.S. and Weddikkara, C., 2013. Assessing the BIM maturity in a BIM infant industry.

Jayasinghe, L., 2019. The Effectiveness of building information modeling in Sri Lankan construction industry (Doctoral dissertation).

Nagalingam, G., Jayasena, H.S. and Ranadewa, K.A.T.O., 2013. Building information modelling and future quantity surveyor's practice in Sri Lankan construction industry.

Partridge, C., 2015. Channeling extraterrestrials: Theosophical discourse in the space age. In Handbook of Spiritualism and Channeling (pp. 390-417). Brill.

Raic, M., 2007. BIM in the architectural curricula: integrating Building Information Modelling (BIM) in architectural education. International Journal of Architecture, 1(1), 1-20.

Saunders, M., Lewis, P. and Thornhill, A., 2009. Research methods for business students. Pearson education.

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