CoMBInES
CONFERENCE ON MANAGEMENT, BUSINESS, INNOVATION, EDUCATION AND SOCIAL SCIENCES

Volume 3 No 1 (2023)

Received : February, 15, 2023
Accepted : February, 17, 2023
Published : April, 14, 2023

Conference on Management, Business, Innovation, Education and Social Science
https://journal.uib.ac.id/index.php/combines

The Application Glodon Software During Pre-Contract Stage

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Abstract

This paper is aimed at exploring the use of Glodon software using BIM in construction. The objective of this paper is to identify the satisfaction level of the Glodon software during the pre-contract stage of the construction project. A structured questionnaire was used to analyze Glodon software users. The result shows that the draw function, identify function, and import and export BIM model are satisfactory functions in the Glodon software during the pre-contract stage. The findings will give an understanding of the limitations and acceptability of the software in practice. The limitation of this study is that it was done in Klang Valley, Malaysia, and explored the tool satisfaction in the software.

Keywords:

BIM; construction project; Glodon; pre-contract stage; software

Introduction

Building information modelling (BIM) is being used in the Malaysian construction sector and throughout the world to guarantee that construction planning, design, and construction are extremely efficient and collaborative.

The Director of the Public Works Department (PWD) first proposed the idea of implementing BIM in Malaysia in 2007, and the architecture, engineering, and construction (AEC) industries have been using BIM in Malaysia (Latiffi et al., 2013). BIM's potential to reduce construction costs and prevent design issues during the planning stage shows the government's awareness of this sector.

Each construction stakeholder uses BIM for a different purpose, according to Latiffi, Brahim and Fathi (2016). BIM helps the client better understand the requirements of the project, making it easier for the architect and engineers to prepare the work. Professionals use BIM to analyse and design projects. A four-dimensional (4-D) model is used to schedule the work and assist contractors in managing construction activities. Moreover, the management of the facilities' maintenance and operation is aided by BIM.

Additionally, BIM contributes to improved project cost estimation and quantity take-off accuracy. The statistics of the number of construction projects and the cost accounting of construction projects are the two fundamental duties that make up engineering cost management. Typically, two-dimensional design drawings are used to calculate the engineering quantity of conventional engineering costs (Li and Yu, 2019). It is impossible to maintain component information in detail on traditional hand-drawn and CAD designs; thus, estimating statistical quantities will take the cost engineer between 50% and 80% of their time to complete.

In Malaysia, the development of bill of quantities software is rapidly increasing. One of the software programmes being used in the Malaysian construction industry is the Glodon software used in the Malaysian construction industry is Glodon. Glodon, a company specializing in construction engineering, was founded in 1998 and was the country's first listed company. Glodon's long-term service is a digital building platform that supports professional applications in construction engineering. Glodon operates in several industry sectors, including planning and design, cost estimation, construction, and operation and maintenance. These segments involve a variety of business activities, including the sale of tool software, solutions, big data services, mobile applications, cloud computing services, intelligent hardware, and industrial financial services (Glodon, 2022). Glodon Software is a BIM-based cost estimating tool, but using BIM tools does not constitute BIM if the estimator does not also receive information from the designer, such as Industry Foundation Classes (IFC) files (Loh, 2018).

The pre-contract consists of inception, feasibility, outline proposals, scheme design, detail design, construction information, the preparation of a bill of quantities, and the tendering process (RIBA, 2013). The preparation of

the bill of quantities involves estimation work for the structure and architectural work. Along the construction life cycle, this estimation work typically recurs, particularly during the preliminary cost estimation stage during the initial design phase when the design is still lacking details or is still unfinished. Previously, cost estimates were created using blueprints and other types of 2D plan sheets (Olsen and Taylor, 2017). The type of measurement for the manual process is very time-consuming and a waste of paper, and due to many variables and uncertainty, a mistake often occurs during the process. Thus, cost estimation is a fault-prone process since most construction projects are megaprojects and are highly complex; hence, errors in both interpretation and construction document development are frequent (Alshawi and Ingirige, 2003). Because of the number of errors that occur during the construction document development process, the estimator has spent 50% to 80% of time preparing the cost estimation and processing material quantification jobs (Bečvarovská and Matějka, 2014). By using a digital building platform, the time required to prepare the cost estimation may be reduced and the quantities required may be more precise and efficient.

The purpose of this research was to determine the level of satisfaction with Glodon software during the pre-contract stage, with a focus on the Cubicost Takeoff for Architecture and Structure (TAS) and Cubicost Takeoff for Rebar (TRB) software. Due to the complexity and uniqueness of the construction, it should be primarily focused on structural work, architectural work, and reinforcement work when posing estimation and cost analysis problems. TAS and TRB are thus fully utilized in construction. Cost control will be much easier if the digital building platform can provide the needed quantity with high accuracy.

Literature Review

The construction industry in Malaysia is important to the Malaysian economy, contributing approximately 3–5% of the Gross Domestic Product (GDP) annually (Othman et al., 2021). he Public Work Department (PWD) has embraced BIM since its introduction in Malaysia in 2007 and plans to implement it in 10% of public projects over RM50 million under Rancangan Malaysia Ke-11 (RMK-11). In 2018, any public project with a budget of RM100 million or more was required to use BIM (Othman et al., 2021). According to Datuk Seri Dr Roslan Md Taha, the general director of PWD, there are a total of 18 projects in PWD that have implemented BIM at various stages up to 2017.

In 2015, a construction industry reform initiative was started, and BIM was encouraged once more to boost project productivity. Malaysia's Construction

Industry Development Board (CIDB) has been organizing an annual programme to promote BIM to industry practitioners to enhance construction standards. However, the Malaysian construction sector continues to apply the old method, which causes project delays, cost overruns, poor performance, and low productivity with poor quality. Traditional methods influence development and cause delays in worldwide competitiveness.

The coronavirus disease 2019 (COVID-19) pandemic is the most critical issue during that time. Tan Sri Muhyiddin Yassin, Prime Minister of Malaysia, indicated that it is time for ASEAN and Australia to step up their collaboration in the Fourth Industrial Revolution (IR4.0) (Povera, 2020). Because of the public's need for social distance, the use of digital technology has increased to provide a quick solution to the problems encountered in the sector in a safe and high-quality manner. As a result, the usage of digital technology has grown and has become the new norm in the construction industry.

Building Information Modelling (BIM) may be classified into three (3) stages: pre-contract, construction, and post-construction. Only the pre-contract stage of cost estimation preparation has been included in this research. The time necessary to produce the bidding documents to deal with both the architectural and engineers' drawings is restricted during the pre-contract stage. During this stage, errors are commonly caused by discrepancies between the architectural plans and the structural drawings given by both the architect and engineer. Therefore, it is crucial to use BIM in this business as it might lower the risk of error, save time during the pre-contract stage, provide the building owner with a better understanding by giving them a preview of the building itself, and improve pricing coordination and the project schedule. The precision of the cost estimate will increase with better price coordination of the building, and it will reduce design time and construction length as BIM tools can discover clashes and clash analysis at the design stage (Latiffi et al., 2013).

BIM has been used at the pre-contract stage in the modelling of existing conditions, planning, design, scheduling, estimate, and site analysis stages (Latiffi et al., 2013). BIM offers the capability to improve the accuracy of existing condition documentation throughout the existing condition modelling stage. On the other hand, BIM assists in the planning stage in identifying the problems with the order of the schedule and phasing component. Then, during the design phase, BIM serves as monitoring, control, and problem analysis, which aids in and promotes improved communication, speeds up the decision-making process, and increases the efficacy of the design. Additionally, during the scheduling phase, BIM gives the project manager and the contractors access to information on the equipment and materials needed,

the order in which the construction work will be completed, and the status of the project. Additionally, by utilizing BIM, estimators or a QS may immediately create a cost estimation from a three-dimensional (3D) project model during the estimate stage. Finally, employing BIM during the site research phase can save on utility usage and demolition expenses.

The elements provided by Glodon software can be classified into four categories: information exchange, visualization, classifications for standard estimating formats, and change management or revision control (Wu et al., 2014).

TAS and TRB's main advantage is to generate 3D models from 2D drawings rapidly because it supports input formats such as DWG and PDF. In addition, it is also able to export its results into other output formats such as PDF, Excel, and DXF. The software can also share its BIM model data among other Glodon products, such as TAS and TRB. With this, cost estimation will be much easier to perform by using the same BIM model. Another uniqueness of Glodon is its effectiveness in calculation checking. For example, the feature of the 3D model function helps the users view the rebar arrangement easier. The auto-calculation function with an explicit formula also helps in checking and viewing through 3D views or rebar inside the element. In addition, TRB generates 3D objects and can see through the concrete, hence having a view of the reinforcement arrangement. These functions help the QS do quantity checking for every reinforcement more effectively. In other words, since a good visualization helps with better and clearer understanding, this function in Glodon helps QS understand better drawings (Kymmell, 2008).

The main classifications are the ability to embed local standards and the flexibility of calculation rules. Since all areas hold their uniqueness in measuring methods and standards, Glodon, as a global software company, has embedded cost estimation tools with local measurement methods that are certified by the QS globally. In other words, Glodon's calculation rules cover the standards of different countries, including the Singapore-British Standard, the British Standard, and other Asian countries' standards such as Malaysia, Hong Kong, and more. For example, in Malaysia, when doing cost estimation, the Standard Method of Measurement (SMMs) should be referred to as the guideline on the structure of BQ and the ways to measure items for higher stability (Drogemuller and Tucker, 2003).

Glodon also displays and calculates the element based on local standards. In other words, based on different countries, Glodon will embed in the local measurement standard as the default automatically. Calculation settings, link settings, lap settings, and tension and compression bar settings can be changed according to the project description. Moreover, Glodon provides a

backup of the project file, and the backup files are available for up to 14 days. On the Backup Management tab, users can customize the location and time interval of backup files. By default, the save path is on the C disc drive, and the files will be backed up every three days. With this, users can pull up backup files to avoid losing data files or accidents.

Research Methodology

Quantitative research was used to measure and achieve the research's goal. The quantitative technique yields numerical data that may be statistically analyzed. (Creswell and Creswell, 2018). This method focuses on the amount of quantity, and questionnaires are normally used to collect data from many respondents to generate more accurate data for the analysis. Primary data gathering, often known as fieldwork, is first-hand information that has not been published. To gather data, the surveys were disseminated using Google Forms to developers, consultants, contractors, and sub-contractor firms in Klang Valley, Malaysia.

The next part goes through the questionnaire design in further detail. A total of 101 sets of questionnaires were collected. The collected data shows there are 85 respondents experienced in Glodon software and 16 respondents who are not experienced. Therefore, the analysis has captured those respondents who are experienced in Glodon software. This research was to determine the level of satisfaction with Glodon software during the pre-contract stage, with a focus on the Cubicost Takeoff for Architecture and Structure (TAS) and the Cubicost Takeoff for Rebar (TRB) software. Then, the collected data were analyzed and calculated by SPSS software.

Aside from the pre-contract stage, the survey does not address the other digital building platforms in this business or the user's satisfaction level. The respondents to this research have been separated into different groups based on their professions, such as client, architect, engineer, quantity surveyor, and manager, which are developers, consultants, contractors, and sub-contractor firms.

Results and Discussion

Frequency distributions are frequently used to summarize and compress data by grouping the data into smaller categories and lowering the number of data points that belong to each group. The gathered data may be displayed in a pie chart, a bar chart, or a tabulation to make the conclusions easier to understand. This is because they clearly define all variable types and population characteristics. This research was used to analyze demographic data.

As the questionnaire was set on a Likert scale basis, the Relative Importance Index (RII) Analysis was used to determine the relative importance of the quality factors involved, and this analysis was adopted to measure the Five Point Likert Scale in the research. A five-point Likert scale was applied in the questionnaire to examine the elements provided, satisfaction level, and methods to improve Glodon software during the pre-contract stage.

Table 1: Respondent's Job Position

		Frequency	Precent	Valid Precent	Cumulative Precent
Valid	Client	2	2.4	2.4	2.4
	Architect	0	0	0	2.4
	Engineer	1	1.2	1.2	3.5
	Quantity Surveyor	81	95.3	95.3	98.8
	Manager	1	1.2	1.2	100.0
	Total	85	100.0	100.0	

Table 1 shows the job positions of the respondents. Most of the respondents are quantity surveyors (QS), which have 81 respondents and are experienced in Glodon software. The respondent's position as a client has two respondents, and for engineer and manager, only one respondent is in each category.

Table 2: Respondent's Organization

		Frequency	Precent	Valid Precent	Cumulative Precent
Valid	Developer	2	2.4	2.4	2.4
	Consultant	56	65.9	65.9	68.2
	Contractor	26	30.6	30.6	98.8
	Sub-contractor	1	1.2	1.2	100.0
	Total	85	100.0	100.0	

Table 2 presents the respondent's organization, which is divided into 4 categories. Most of the respondents are working in a consulting firm that contains 56 people (65.9% of the respondents). Respondents working as contractors comprise 26.6% of the total, which is the second-highest category. For developer and subcontractor, only two respondents and one respondent are working in those categories.

Table 3: Ranking Of Satisfaction Level Of Glodon Software During The Pre-Contract Stage.

Functions	Relative Important Index (RII)	Rank
Draw function (2-point, by CAD line, Align, Split, Copy Entity to or from other floors, convert entity, model check)	0.795	1
Identify function (import drawing, identification option, identify schedule)	0.793	2
Import and export BIM model (IFC, RVT, TAS to or from TRB)	0.791	3
View function (Full screen, zoom and pan, entity display, 2D/3D)	0.791	3
Quantity (measurement setting, measurement rules, view quantity by category)	0.791	3
Elements (Staircase, ramp, wall, column, custom quantity)	0.784	6
BQ (link TBQ project, create BQ, reversely-check quantity in BQ)	0.779	7
Report (export to excel, create quantity summary, set floor range, custom report)	0.774	8
Merge with another project	0.758	9
Language and Unit	0.744	10
Keyboard Shortcut	0.739	11

Table 3 shows the respondent's ranking of the satisfaction level of Glodon software during the pre-contract stage by using the relative important index (RII). The draw function (rank = 1, RII = 0.795) and the identify function (rank = 2, RII = 0.793) are the top 2 rankings of the satisfaction function provided on Glodon software. The draw function, which provided 2-point, by CAD line, align, split, copy entity to or from another floor, convert entity, and model check, is the most important and most satisfied by the respondent, as it is the main function in the Glodon software that gives good visualization and helps with better and clearer understanding; this function in Glodon helps to understand better in drawings (Kymmell, 2008). The identify function was the second highest satisfaction according to the data collected, as it plays an important function in importing drawings, identifying options, and identifying schedules, which gives the ability to detect clashes and perform clash analysis during the design stage. Errors can be reduced, and with better price coordination of the building, the precision of the cost estimate will be improved, and it reduces time spent in design and the duration of the construction (Latiffi et al., 2013). It helps in the accuracy and avoids double work or discrepancy in the drawing by using the identification function. Import and export BIM models, the View function, and Quantity have the same RII of 0.791, and all three functions fall under Rank 3. Importing and exporting

the BIM model among IFC, RVT, and TAS to or from TRB allows the BIM model to be more flexible with various types of files, which avoids the error in providing quantities. The view function, in which the model can be viewed in full screen, zoomed, and panned, displays only the entity in 2D or 3D view. Quantity function includes measurement setting and measurement rules, which have been mentioned in the classification for standard estimating format and view quantity by category. Following Elements (Rank = 6, RII = 0.784), the elements provided such as staircase, ramp, wall, column, and custom quantity. ease the measurement of different elements in the project. BQ functions (Rank = 7, RII = 0.779) fall under the seventh place of the ranking. It provides the 40 functions linked with the TBQ project, creates BQ, and reverse-checks quantity in BQ as to ensure the quantity of the elements is correct. Report function (rank = 8, RII = 0.774) provides the report for BQ export to Excel, creates quantity summary, sets floor range, and creates a custom report. The last 3 rankings of the satisfaction level on the functions are merged with another project, language, unit, and keyboard shortcut. Merge with another project (rank = 9, RII = 0.758) provides the function of being able to merge the project model with another project. It is usually used in a large project where different people are preparing the different floors. Language and unit (rank = 10, RII = 0.744) and keyboard shortcut (rank = 11, RII = 0.739) are the least satisfied functions according to the collected data, as the functions are rarely used by the users.

Conclusion

The 85 respondents' satisfaction level with Glodon software during the pre-contract stage was calculated and analyzed. The scope of the study was done in Klang Valley, Malaysia, among the developers, consultants, contractors, and sub-contractor firms that were experienced in using the Glodon software. Despite the success of the research, limitations were faced, such as the limited time and scope of data collection and problems with the diversification of questionnaire respondents. It is recommended for future studies to expand the focused group to the entire country by conducting the same research and gaining research data in comparison to the respondent's satisfaction level in other states.

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