HOW BIM COMPATIBLE ESTIMATING SOFTWARE IS ADOPTED IN THE AUSTRALIAN CONSTRUCTION INDUSTRY

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ABSTRACT

Building Information Modeling (BIM) has been widely accepted as an advanced technique and can be applied throughout the project lifecycle including design, construction, Occupational Health and Safety (OH&S), maintenance, and demolition. Estimating software is a significant management tool for project development; and currently there are two main categories: one type is BIM compatible, and the other type is non BIM compatible. There are very few research or investigation on the currently status of using BIM compatible estimating software in the Australian construction industry, and it is not clear how the functionalities of the BIM compatible software are utilized by the estimators. Therefore in this research, an extensive literature review was firstly carried out and used as basis for further investigation. An industrial survey was then carried out to find out the current status of adopting BIM compatible software in the Australian construction industry. It is found that industrial professionals have not prepared well for the adoption of the BIM compatible estimating software, and the users' demand of BIM compatible estimating functions are very low. The factors that may affect the BIM compatible estimating software adoptions have been discussed. In practice, it is not necessary to adopt BIM compatible estimating software unless the project tenders are mainly operated on BIM models. The estimating software adoptions are more dependent on the project design and organizational development strategies than any other factors.

Keywords: Building Information Modeling, BIM, estimating software

1. INTRODUCTION

Building Information Modeling were created to demonstrate the visual building models initially; however after continued technology development, BIM has been extended to a large category which contains many applicable aspects. BIM is not only a 3D building model for project visual demonstration, but also a multi-dimensional modeling tool for the entire project lifecycle from the design till the demolition, and it contains many aspects including software design, building design, project scheduling, cost estimating, data storage & analyzing, building lifecycle analyzing, facility management, construction techniques, building standards, etc.

   Estimating software is used to determine the overall project costs, and it helps the users to provide accurate budget estimation while saving time from manual spreadsheet calculations. There are two main categories of estimating software applications, one is non BIM Compatible and the other one is BIM compatible. The traditional cost estimating software is non BIM compatible, and it may be not able to help the software users to solve the difficulties and problems during the projects (especially the large scale projects) estimating. Many industrial professions and academic researchers have realized that the BIM compatible estimating is the solution for the difficulties and problems that occurring in the project development; and it has been approved by some large scale developments. Theoretically, the BIM compatible estimating software users may gain benefits from BIM; but it is addressed a low demand of BIM compatible estimating utilizing from the literatures review. It was found that till 2008 the majority of construction design was remaining on the 2D format (Azhar et al., 2008).

There was an industrial investigation which obtained on the usage of BIM compatible software in 2010, and the survey was focusing on the large scale construction firms in USA, Canada, and Middle East (Company scale at more than 5,000 employees and annual turnover more than 1 billion US dollars), and the researchers (Chasey & Pavelko 2010) found that:

- Only 55% of investigated companies were using BIM compatible software at that time.
- About 77% of investigated companies foresee to use BIM compatible software in their future projects.
- Most companies use BIM compatible software for design, construction, and management rather than cost estimating.

Those researches were obtained within the last 5 year, and the researches were mainly focusing on the large scale industrial practices and BIM utilizing circumstances in global construction industries. This research is to address the differences between BIM and non-BIM compatible estimating, determine the current BIM-compatible estimating adoption circumstances in Australian construction industry, and analyze the factors which affect the BIM compatible estimating software adoptions.

2. BIM ESTIMATING VERSUS TRADITIONAL ESTIMATING

Construction cost estimating software is the computer aided estimating tool which designed to help the user to determine the project costs. Construction contractors and quantity surveyors are the main users of estimating software. The process of BIM and non-BIM compatible estimating are defined in Figure 1 (Sylvester & Dietrich 2010). The figure shows that traditional estimating follows a single directional flow and BIM compatible estimating follows two-way directional flow. Compared with traditional estimating, the accuracy of estimation process using BIM relies on the BIM model because the project quantity is taken off from it.
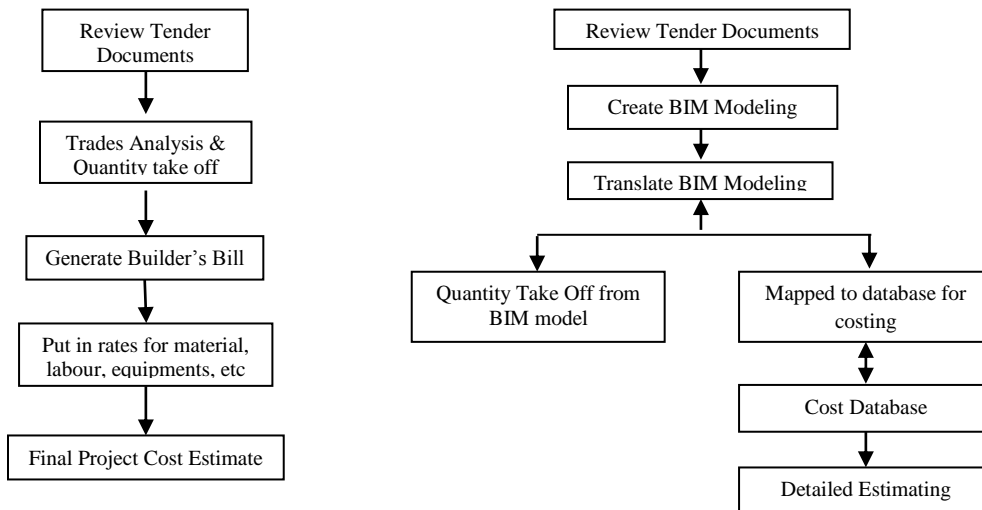

Figure 1: Traditional Estimating VS BIM-Compatible Estimating Process (Sylvester & Dietrich 2010)

There are many commonly used estimating software in the construction industry. In this research, CostX is selected to represent BIM compatible estimating software, and Buildsoft for non-compatible estimating software. The reasons of the two software selected are detailed as following:

It is well known that CostX captures the largest BIM compatible software market share in Australian constructions industry, and is currently used by "majority of large quantity surveying firms in Australia as well as in wide spread usage amongst development, construction and sub-contracting firms" (Exactal 2011). CostX is also recognised by Autodesk (the major 3D design software provider in the world) that it is the Australian most popular BIM compatible estimating solution (Autodesk 2011).

Buildsoft represents the non-BIM compatible software. As the legend of construction estimating software in Australia; it has become one part of Australian estimating software standards. As mentioned by Buildsoft, "there are more than 6000 users worldwide, and many education institutions in Asian Pacific teaching Buildsoft as the accepted standard" (Buildsoft 2011). "Must be able to use Buildsoft" is sometimes required as one of the general qualification and experience requirements to the people who are seeking for the estimator role in Australian construction industry (Seek 2011). Buildsoft is selected as the most suitable example to present the characteristics of non BIM compatible estimating software due to above mentioned circumstances.

CostX and BuiltSoft have many similar features and functions such as operating interface, 2D/3D view, job summary generating, on screen take off (2D), rate breakup sheet, etc. Table 1 presents the main differences between the two selected cost estimating software samples.

Table 1: The comparison of software' features and functions (Exactal 2011 & Buildsoft 2011)

Functions/Features	CostX	Buildsoft
Estimating Structure	Project – Trade – Item - Rate	Project – Trade – Item - Rate
Producing reports	Applicable	Applicable
On Screen Taken Off	Applicable	Applicable
Electronic Drawing Access (PDF)	Applicable	Applicable
Electronic Drawing Access (CAD)	Applicable	Applicable
Electronic Drawing Access (Autodesk Revit)	Applicable	Nil
Subcontractor Comparison	Applicable	Applicable
Rate Comparison	Applicable	Applicable
Drawing Comparison	Applicable	Applicable
CAD linked cost plans	Applicable	Nil
Quantity Taken Off Methodology (2D)	Applicable	Applicable
Quantity Taken Off Methodology (3D/BIM)	Applicable	Nil
Project Scheduling Tool	Nil	Applicable
Paper Drawing Measuring Tool (Scanned Pen)	Nil	Applicable
Training Provided	Applicable	Applicable

Estimating software are important tools for quantity surveyors or estimators to determine the project costs, so that the software productivity is one important aspect for the users. The major factors affecting CostX's working productivities are BIM access and software performances.

As Table 1 shows, CostX demonstrates the BIM compatible features: access Autodesk Revit format drawings and quantity take off from 3D BIM model. The BIM functions may bring the following benefits to the CostX users:

• In case of commencing any project designed by BIM, the user may not be required to purchase the BIM compatible software to access the BIM model; thus brings a potential cost saving.
• It is easy, simple and fast to understand the building details by viewing BIM models.

BIM compatible estimating software performs a faster quantity take-off than non BIM compatible estimating software. It is proved that CostX performs a faster speed in project quantity take-off than Buildsoft (Alder, 2006) though the overall accuracies from both software may be equivalent.

3. INVESTIGATION ON THE CURRENT STATUS OF USING BIM-COMPATIBLE SOFTWARE

Further to the above comparison on BIM-compatible and non-BIM compatible software, this research is to investigate the current status of adopting BIM-compatible software in the construction industry and determine the factors that affect the BIM compatible estimating adoptions. Both quantitative and qualitative research methods are used. Questionnaire survey was used to collect feedback from industry professionals, and follow-up interviews were used to find out detailed information and logic behind the data collected from the interview.

The questionnaire is designed to two sections according to the research objectives. One section of the questionnaire is the software feedback collections; and it focuses on: the software category, user's experience, key factors of software adoption, users' knowledge on BIM concepts, and the comparison of two software categories. The other section is designed to collect the participants' personal information such as education background, gender, age, working experience, software using experience, and so on. The purpose of the second section is to collect the data to find out how the user related factors affecting the software adoption in Australian construction industry.

In this research investigation, 32 survey questionnaire were collected, and the survey was carried out to cover a variety of background and construction organisations. Two survey participants were selected to be interviewed for detailed discussion. One interviewee is a senior estimator with more than 15 years' experience, and the other is a junior estimator with 2-3 years working experience. The survey participants' background information is summarized in Table 2.

Table 2: Participants' background summary

Participants' Age	20 – 70
Educational Level	Diploma – Master's Degree
Gender	Male and Female
Company Type	Tier 1 – Tier 3 Construction Companies & Quantity Surveying Firms
Working Position	Cadet – Chief Estimator
Working Experience	0 – more than 20 years

According to the questionnaire responses from the research participants, the survey participants adopted overall 6 software applications in their estimating works, and Figure 2 shows the percentage of each software applications were used by them.
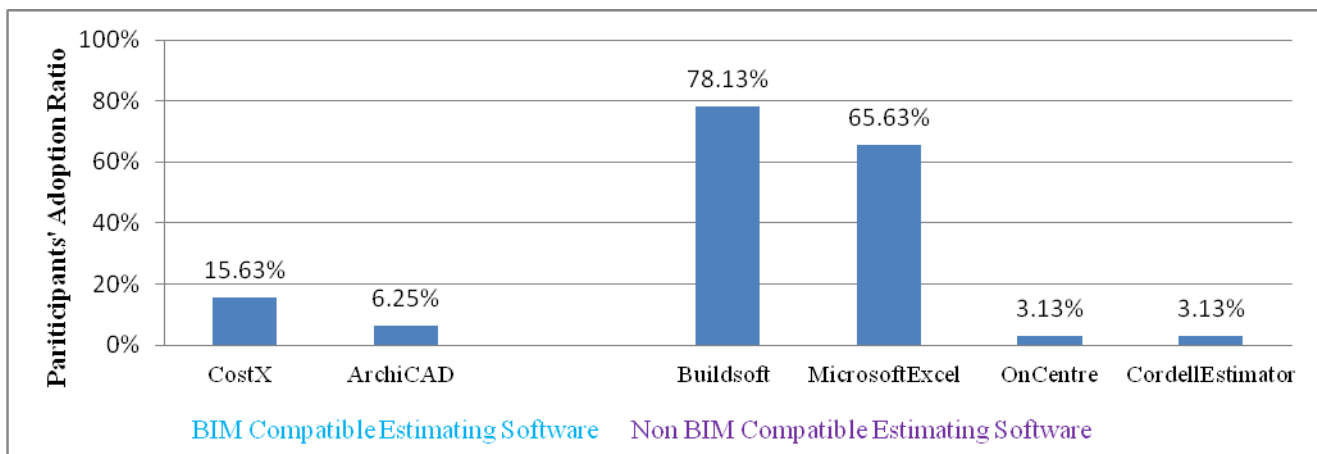

Figure 2: Adoption of Various Estimating Software

According to the survey responses, it was found that very few (about 3%) survey participants use only BIM compatible estimating software in their estimating works, 15.63% survey participants use both BIM and Non-BIM-compatible estimating software, and the majority of the survey participants (81.25%) use only non-BIM-compatible estimating software application in the estimating works (Figure 3).
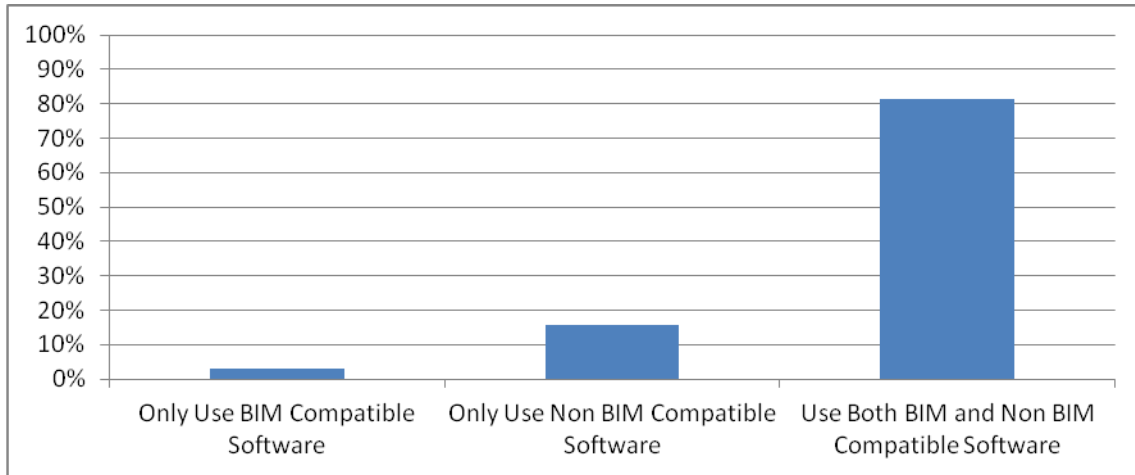

Figure 3: Adoption of BIM Compatible and Non BIM Compatible Estimating Software

When asked who made the decision to choose BIM or non-BIM compatible software, less than 1/3 (31.25%) participants state that they made the choice by themselves, but the majority of the participants (over 68%) use the adopted software according to their organisations' requirement This shows that in Australian construction industry; most users of estimating software are at passive positions.

Estimating software is designed to meet the industrial users' needs; the questionnaire survey listed some software functions which are widely used in both categories of the estimating software applications. The questionnaire participants are required to select 5 most important functions from overall 13 options, and the selections were made according to the participants' working experience and knowledge.

From the research participants' responses, there are 5 software functions selected by more than 50% participants. And the five functions are: "On Screen Take Off", "Rate Comparison", "Subcontractor Comparison", "Provision of Software Training", and "PDF Drawing Access". The selection percentage of the above five functions are addressed in Figure 4.
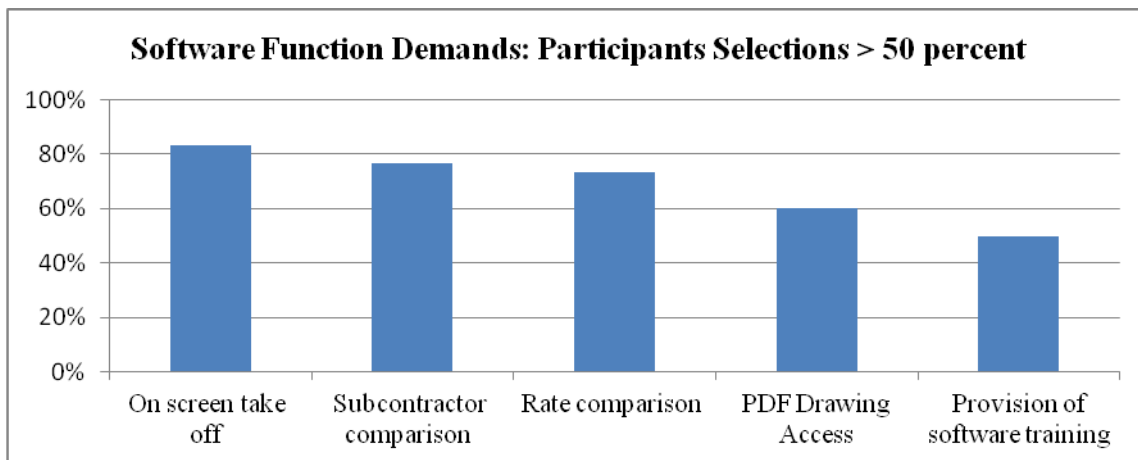

Figure 4: The five most important estimating software functions

There are 5 estimating software functions were selected by less than 20% participants, these functions are: "BIM Modeling Access", "CAD Linked Cost Plans", "3D drawing/BIM modeling quantity take off methodology", "Paper Drawing Measuring Tool" and "Drawing Comparison". This shows the BIM-related functions are not commonly used by estimators. It is also found from the survey data collection that there are only about 15% participants have used BIM modeling or other BIM related functions in their working experience, and the majority (about 85%) survey participants have never experienced BIM compatible estimating.

The survey also collected feedback about participants' satisfaction level on their currently-used estimating software. The participants were required to rate from various aspects on the software from disagree to agree (rate from 1 – 7), and the results are list in the following table, there is no noticeable difference between CostX and Builtsoft users.

Table 3: Participants' satisfaction level of the current estimating software that they are using

	Question	Mean
1.	The estimating software I am currently using meets all my requirements. I do NOT expect any change/improvement.	4.38
2.	The estimating software I am currently using is easy for beginners to learn.	6.09
3.	The estimating software I am currently using is simple and easy to operate.	5.97
4.	The estimating software I am currently using provides accurate measurement.	4.87
5.	The estimating software I am currently using provides fast speed measurement.	4.37

This shows that the survey participants are having an overall medium to high Satisfactory Level of the adopted Software.

The writer invited two industrial professionals to discuss the questions about the software adoptions. Participant A is a junior estimator with less than three year working experience. Participant B is a senior estimator with more than 20 years working experience as a quantity surveyor and estimator. Both participant A and B are overall satisfied with the estimating software that currently adopted, they felt that there are no urgent needs to upgrade Non BIM compatible estimating software to BIM compatible estimating software for their estimating works.

Both participants were asked to provide their opinions on the factors that may prevent adopting BIM compatible estimating software more widely, and their opinions are similar. They believe CostX and Buildsoft, in most cases, provide similar productivity and utility. The BIM compatible estimating software are not cheap; the procurement may cause the user thousands of dollars for just one user license. The software users always consider the balance of procurement costs and software qualities. Whether adopting BIM compatible software or not is largely dependent on the organizational development strategy or/and the clients' development strategy.

4. CONCLUSIONS

Based on the above findings from literature review, questionnaire survey and interviews, conclusions are drawn to answer the following three questions:
- Software functions in high user demand: BIM or Non BIM?
- Relationships between demand of functions and User scenarios
- Significant factors that affect the adoptions of BIM compatible estimating software

It was found that "On Screen Take Off", "Rate Comparison", "Subcontractor Comparison", "Provision of Software Training", "PDF Drawing Access" are the five most important software functions. About 88% percent participants chose the "on screen take off" as one of the most important estimating software functions. These five software functions can be all adopted by both Non BIM and BIM compatible estimating software, and no BIM compatible functions are chosen as important or essential estimating functions. In the survey, there are three BIM compatible software functions were listed. There are only 8.3% participants selected BIM modeling access, 4% selected BIM quantity take off methodology, and 0% selected Autodesk Revit Access, as important functions.

Only a few research participants have the experience of using BIM compatible estimating software, and less than 25% survey participants have applied BIM modeling in their estimating work. This shows that BIM compatible estimating has not been popularized in Australian construction industry. It is found that currently 2D estimating is still the majority estimating method in Australian construction industry. The above data has addressed that the BIM compatible software functions have not been recognized and accepted as efficient and significant estimating tools in the industrial professionals' opinions.

There is no co-relational relationship between software users' background such as educational level, gender, working experiences with the selection of BIM or non-BIM compatible software. The major factors that affect the adoptions of BIM compatible estimating software are the usefulness of BIM compatible software and the organizational development strategies.

BIM compatible estimating may have many benefits and advantages, however if there is little usefulness of BIM compatible functions, it will not be necessary for the industrial professionals to adopt the BIM compatible estimating software. The adoption of BIM compatible estimating software is dependent on the organizational development strategies. If an organization has put adopting BIM-compatible estimation as a high priority in its development strategy, adopting BIM compatible estimating software will be required in its daily practice.

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