A COMPARATIVE STUDY OF BIM AND CAD (ARCHITECTURE)

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Thesis submitted in fulfillment of the requirements
for the award of the degree of
Bachelor of Civil Engineering

Faculty of Civil Engineering and Earth Resources
UNIVERSITI MALAYSIA PAHANG

JANUARY 2014

ABSTRACT

This thesis investigates the process flow of Building Information Modeling (BIM) for existing building in University Malaysia Pahang. This model was developed using Autodesk Revit 2014 (Architecture). One utilization activity which is visualization showed that, the visualization of this application is generally the simplest use of Building Information Modeling such as walkthrough. As visualization is the simplest it is also a great application because it enhances the overall outcome of any project. In conclusion, BIM technology helps to detect and solve problems. It is also increase the cooperation between the project team.

ABSTRAK

Tesis ini mengkaji tentang aliran proses *Building Information Modeling* (BIM) bagi sebuah bangunan sedia ada di Universiti Malaysia Pahang. Model ini telah dibangunkan menggunakan *Autodesk Revit 2014 (Architecture).* Salah satu aktiviti penggunaan adalah visualisasi. Penggunaan visualisasi menunjukkan bahawa ia secara umumnya adalah yang paling mudah untuk *Building Information Modeling* seperti *Walkthrough.* Oleh kerana visualisasi adalah yang paling mudah, ia meningkatkan hasil keseluruhan bagi mana-mana projek. Kesimpulannya, teknologi BIM membantu untuk mengesan dan menyelesaikan masalah. Ia juga meningkatkan kerjasama antara pasukan projek.

TABLE OF CONTENT

CHAPTER 5 CONCLUSION AND RECOMMENDATION

LIST OF FIGURE

CHAPTER 1

INTRODUCTION

1.1 BACKGROUND OF PROJECT

Building Information Modeling (BIM) is a process of development and use of computer to generate model and simulate the planning, design, construction and operation of a facility (Abid Nadeem., Brian, H. Y., Leung Johnny, Y. N., Mok, Salman, A., 2008). A BIM carries all information related to the building, including its physical and functional characteristics and project life cycle information. This can helps the architects, engineers and constructors to visualize what's to be built in the simulated environment and to identify the potential design, construction or other issues that may arise.

1.2 PROBLEM STATEMENT

As we know, CAD describes a building by independent 2D views such as plans, sections and elevations. Editing one of these views requires that all other views must be checked and updated, an error-prone process that is one of the major causes of poor documentation. In addition, data in these 2D drawings are graphical entities only, such as lines, arcs and circles. It is difference to the intelligent contextual of BIM models, where objects are defined in terms of building elements such as walls, beams and columns in 3D form.

1.3 SCOPE OF STUDY

This research will be conducted by finding an existing project and analyse the differences between using BIM method and conventional method. The type of structure to be analysed is a building. The respondent for this research is the engineer. The venue of this research is in Pahang, Malaysia. The method that will be used is; for BIM is Revit Suite and for the conventional method is CAD. This study will develop a 3D model for Architecture element. Identify process flow for capturing existing building (As-Build Drawing and Actual building condition). The existing building is FKASA Laboratory.

1.4 AIM

To compare BIM and CAD process flow in capturing architecture information for existing building.

1.5 OBJECTIVES

The objectives of this study are as follow:

- To explore, appraise and synthesise relevant literature related to architecture element.
- To test BIM process flow (architecture).
- To develop 3D model (architecture).

CHAPTER 2

LITERATURE REVIEWS

2.1 INTRODUCTION

According to Bryde, Broquetas, and Volm (2012), cost was the one most positively influenced by the implementation of BIM followed by Time, Communication, Coordination Improvement and Quality. They also state that BIM is an effective tool in improving certain key aspects of the delivery of construction project. By doing this research, we can know how many percentage of cost that BIM can reduce. This will generate many companies to use BIM in their company.

Motawa and Almarshad (2012) also said that BIM software provide the facilities of these integrated solutions and overcome such problems in a comprehensive manner.

We can give a building information model and it does easily can be adapted to graphically illustrate potential failures, leaks, evacuation plans and others.

In a journal called *"Building Information Modeling Two Years Later – Huge Potential, Some Success and Several Limitations"* written by Ian Howell and Bob Bachelor, state that the availability of a single BIM makes it possible to capture additional information throughout design, procurement and construction of a building, serving as a living record of the building for operations and maintenance throughout its lifecycle.

2.1 CONCEPT OF BIM

BIM is an IT of qualified method involves applying and maintaining an integral digital representation of all building information for different phases of the project lifecycle in the form of a data repository. The building information involved in the BIM approach can include both geometric data as well as non-geometric data. According to Ning Gu and Kerry London, BIM is one of the important areas in current Virtual Reality (VR) research and is expected to envision efficient collaboration, improved data integrity, intelligent documentation, distributed access and retrieval of building data and high quality project outcome through enhanced performance analysis, as well as multidisciplinary planning and coordination.

BIM also represents the process of enhancement and use of a digital computer building model to mimic and manage the planning, design, construction, and operation of a building facility. BIM has been speedily adopted in the AEC industry and digital building information models will likely be available for most buildings in the future.

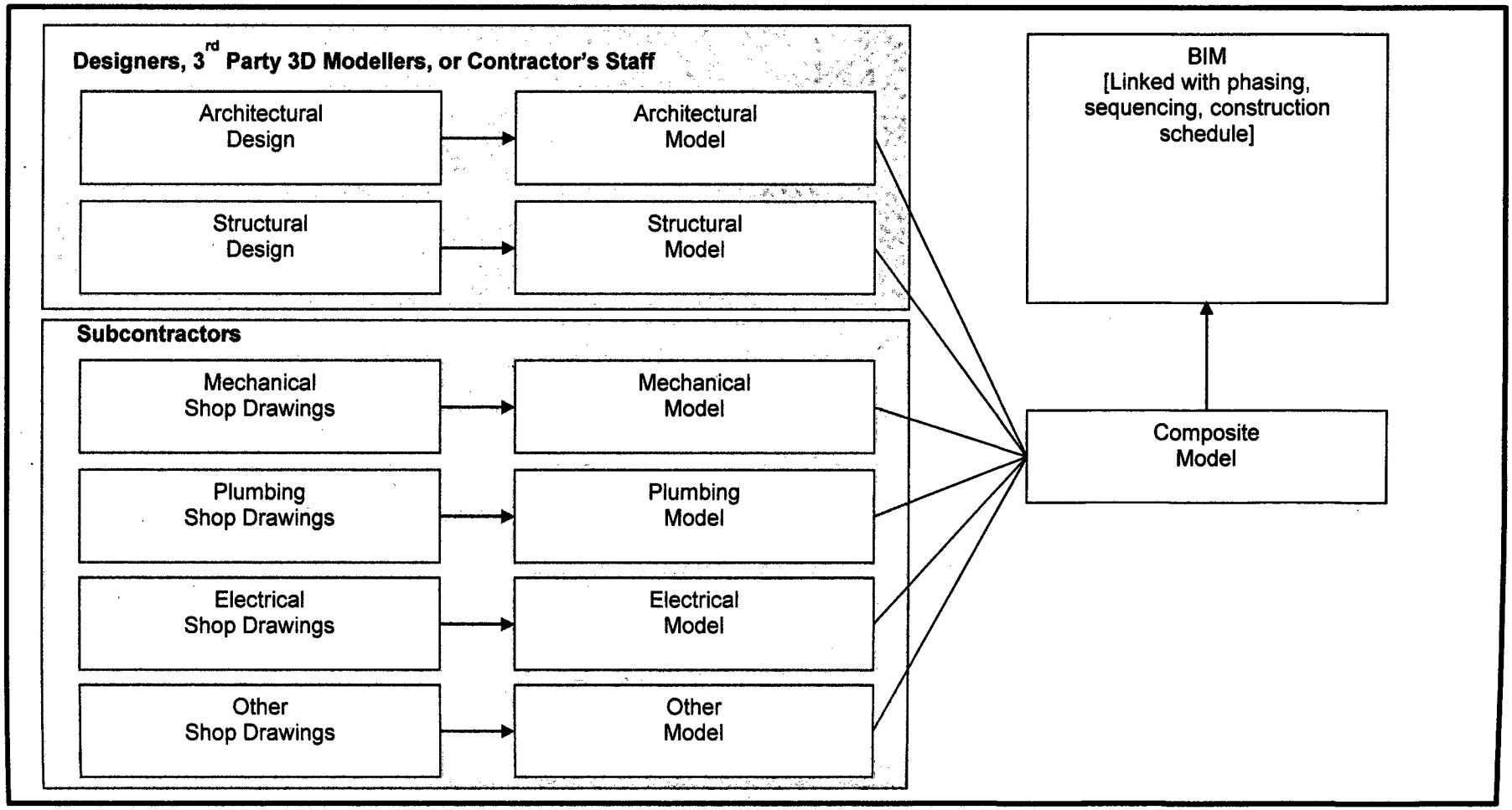

Figure 2.1: The Concept of BIM

2.3 BIM CHARACTERISTICS

Building information modelling solutions create and operate on digital database for collaboration, manage change throughout the databases so it will changes to any parts of database it coordinated. (Autodesk white paper, 2002).

2.3.1 Digital Databases

Traditionally, the building industry has illustrated building project through drawings and information for those illustrations is added by notes and specifications. Computer-Aided Design (CAD) technology automated the process and the idea of adding information to illustrations and graphics into software are extended through object-oriented CAD.

BIM has come with principle to be able gather all information in databases which is digital databases. The mission is to create and operate for collaboration through BIM. Once the building element created, the information will be available to be use or reuse at every point in the project.

The model can be organize and distribute to individual team members or sharing files through project collaboration such as Autodesk Buzzsaw service. Team member work independently on local set of data's and yet can be changes to the model from

each of these local databases in central shared location. Changes can be selectively rolled back to support investigations of options or changes in design direction.

2.3.2 Reuse Information

BIM solutions capture and preserve information for reused by additional industry-specific applications. Successful information technology solutions outside the building industry are based on one primary principle: Data is captured once, as close to its point of origin as possible, and stored in a way that it is always easily available and can be presented in context whenever required.

The moment an architect sketches the outline of a building on a site survey, data is created. The general size of the building footprint is now known. General program requirements and planning ratios can be applied to deduce the overall building configuration. Similarly, when an architect is working out the building plan, data is being created that can be represented in interior elevations, sections, and schedules. Conventional tool require all this data to be received at the point in the project where the information about building size or sections and schedules is required. BIM tools capture this data at the moment it is created, store it, and make it available for representation as information in other documents as needed.

2.4 BUILDING INFORMATION MODELING APPLICATIONS

According to Azhar (2001), building information model can be used for the following purposes:

- Visualization
- Fabrication/ shop drawing
- Code Review and Forensic analysis
- Facilities Management
- Cost Estimation
- Construction Sequencing
- Conflict, interference and collision detection

2.4.1 Visualization

Three-dimensional (3D) parametric modelling of building has been developed incrementally over three decades. It has evolved into building information modelling (Eastman et al. 2008), and can support a wide range of visualizations.

Visualization is seen a major advantage when utilizing BIM (Taylor & Bernstein, 2008) visualization tool provided by BIM enable the owner and the project team to capture valuable inputs from end-users and translate the client's intent into long-term values. This application is able to visualize the designs of a facility to the project network participants.

BIM produces accurate building models and details of it. The feature allows designers to use it more advance visualization such as for a rendering in urban building project with structure surrounding it or lighting study which the designer can see how new light shelf design will impact the indoor at all times of day throughout the season (Autodesk white paper, 2008).

2.5 SUMMARY OF THE CHAPTER

This chapter had summarized the literature review previous study of Building Information Modeling (BIM). In the introduction had been stated that BIM is an effective tool in improving certain key aspects of the delivery of construction project. Also, there had the elaboration about the characteristic of BIM. There are also stated that BIM major advantage is the visualization that it provided to user.

CHAPTER 3

METHODOLOGY

3.1 INTRODUCTION

This chapter will discuss about the methodology that will be used in this study. The methodology is important in making sure the study will be in tracks and follow the instruction properly.

3.2 FLOW CHART

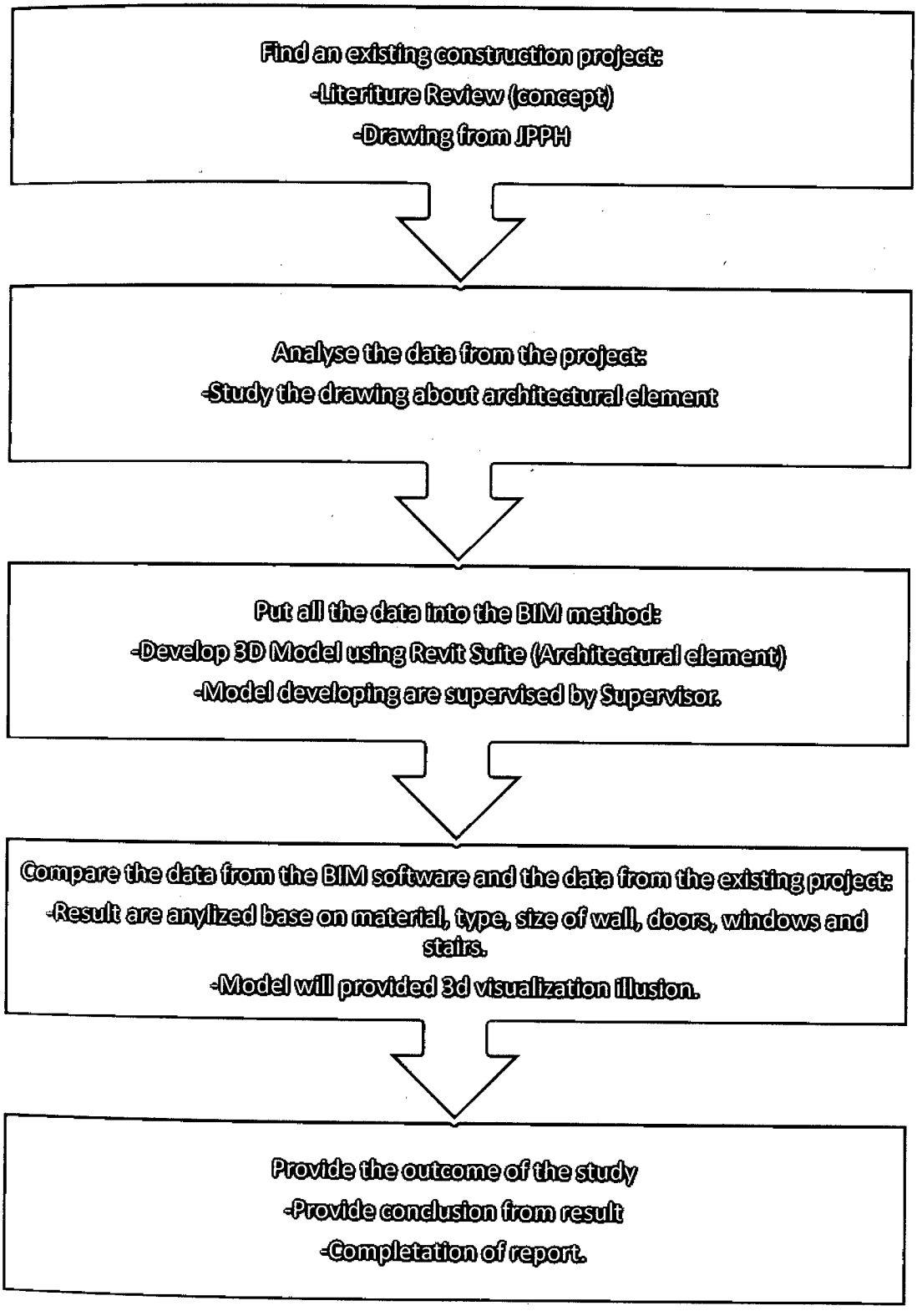

Figure 3.1: Methodology Flow Chart

3.3 MODELING SOFTWARE AUTODESK REVIT 2014

Autodesk Revit Building Information Modeling (BIM) software for architects provides tool to build building design. With the advantages of BIM, Revit (Architecture) helps to improve multi-discipline coordination of architectural design documentation, minimize errors, determine clash (if available), enhance collaboration between architects and extends project team members.

3.4 ARCHITECTURAL MODEL

There are several architectural elements that I had chosen such as

- Wall

  Wall is an essential in a building. In Revit, when we built a wall, it will assume wall as partition. The wall can be choosing its types, height and etc. it's a read-only value but can be changed when the wall had been placed.

- Floor

  Floor may be used to model architectural floors on a grade, which is not requiring support from other elements. Floor is as same as slab. It may be

used to model complex foundation shapes that cannot be created using Isolated or Wall Foundation tools.

- Door

A door is an opening or closing structure used to block off an entrance, typically consisting of an interior side that faces the inside of a space and an exterior side that faces the outside of that space. While in some cases the interior side of a door may match its exterior side, in other cases there are sharp contrasts between the two sides.

- Window

A window is an opening in a wall, door or vehicle that allows the passage of light and, if not closed or sealed, air and sound. Modern windows are usually glazed or covered in some other transparent or translucent material. Windows are held in place by frames. Many glazed windows may be opened, to allow ventilation, or closed, to exclude inclement weather.

3.5 3D PARAMETRIC MODELS

Architectural BIM design applications let users mix 3D modeled objects with 2D drawn sections, allowing users to determine the level of 3D detailing while still being able to produce complete drawings. Parametric is defined as geometry integrated non-redundantly, and allows for no inconsistencies. When an object is shown in 3D, the shape cannot be represented internally redundantly, for example, as multiple 2D views. A plan and elevation of a given object must always be consistent.

3.5.1 Start Program

To start a new model in Revit Suite Software, these steps should be following accurately.

a. Click Revit Icon. Below the Projects, click New, then click Browse, then click Templates, choose Metric, then choose Construction-Defaultmetric. OK

b. New Project will be displayed

3.5.2 Grid Line

a. Architecture tab, click Datum Panel, choose Grid.

b. Click Modify, use line to make layout.