CHAPTER 1

INTRODUCTION TO BIM: IMPLEMENTATION STRATEGIES IN THE CONSTRUCTION INDUSTRY

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1.1 INTRODUCTION

The concept of storing information in a building design was first introduced by Van Nederveen and Tolman (1992). They demonstrated a technique where a set of models, or also known as aspect models, was created to represent a building from different viewpoints. These viewpoints could store information concisely. This technique led to the introduction of the term "building information model". Ten years later, autodesk established a formalised strategy which followed the technique introduced by Van Nederveen and Tolman (1992), known as "building information modeling". In their white paper, autodesk outlined three characteristics of the strategy: Creation of digital databases, change management in the databases, and reuse of building information. Laiserin (2002) then standardised and subsequently popularised this term with an acronym called BIM. Laiserin (2002) described BIM as the next innovation, substituting the term computer-aided design (CAD). Since then, BIM has been widely discussed and applied in the architecture, engineering and construction (AEC) industry.

1.2 STATE OF THE ART OF BUILDING INFORMATION MODELLING

In this section, the terminology of building information modelling (BIM) is discussed extensively. The definition and concept of BIM is initially introduced, followed by the development of BIM in the AEC industry, and lastly, the key elements in implementing BIM in the design process consisting of BIM platforms and tools, collaboration, interoperability, and standardisation.

1.2.1 Definition and Concept of Building Information Modelling

According to the National BIM Standard-United States® Version 3 (NIBS, 2015), BIM is defined as a business process for generating and leveraging data to design, construct and operate the building during its lifecycle. It serves as a knowledge resource for any information related to the building. This definition is aligned with Eastman et al. (2018, p. 46), where they described BIM "a modelling technology and associated set of processes to produce, communicate and analyse building models". The process initiates with the production of intelligent 3D model which could be utilised for document management, coordination and simulation throughout the design process until construction, operation and maintenance phase. This could be deduced that BIM is a technological process which addresses three important elements: information management and exchange, coordination, and collaboration. The building information model could be regarded as a centerpiece of this technological process to influence the veracity and connectivity between these elements.

The initial concept of BIM which was introduced by Autodesk (2002) aimed to provide higher quality of building with much lower costs in a shorter duration and improved productivity. As discussed by Laiserin (2002), the dependency on two-dimensional (2D) CAD drawings was obsolete as it could not describe the breadth and depth of

the design process. Thereafter, Eastman et al. (2018) explained that the shift from CAD technology to BIM was due to the inclination of CAD users towards the concept of information sharing through the data provided in a building model. The progressive development of BIM over the years proved its advantages to building owners, designers, contractors, and facility managers (Eastman et al., 2018). BIM technology has high capability to accommodate the storage of rich information at the early stage of construction project which could then be synchronised further during construction and facility management. In return, the integration of BIM in facility operation and management systems could provide accurate measurement on the building performance that could be utilised for future construction projects (Pärn et al., 2017). Contractors in many countries had reported the successful implementation of BIM in terms of reducing cost while gaining higher profitability and productivity. The SmartMarket report by McGraw Hill Construction in 2014 revealed that the contractors in Japan, Germany, and France had achieved the highest return on investment (ROI) for BIM, followed by Canada, Brazil, Australia, New Zealand, United States, United Kingdom, and South Korea. The contractors declared that the reduction of errors and omissions as well as improved collaboration with building owners and designers are the two most prevalent benefits of BIM.

1.2.2 Progression of Building Information Modelling Implementation in AEC Industry

In determining the progression of BIM application in a construction project, the BIM Maturity Model® developed by Bew and Richards in PAS1192-2:2013 could be used. This model measures the BIM maturity in four levels. Each level defines the ability of the construction supply chain to operate and exchange information. This model was included in PAS1192-2:2013. This standard was then withdrawn and superseded by ISO 19650 (Dadmehr & Coates, 2019). The BIM Maturity Model® starts with Level 0 where information is produced through CAD tools.