

# Review on Application of Building Information Modelling in Interior Design Industry

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**Abstract.** Building Information Modeling (BIM) is a flourishing device and approach for Architecture, Engineering and Construction (AEC) which assist; the planning, design, constructions and operation with particular to commence the designing in several components of the building, a comprehensive understanding of the activities and needed in all aspects. An aspect of activities and needs is the first step to be analysed in the design and it is the responsibility of professionals' interior designers. To solve the problems, is required to attach with the certain factors such as space planning, specifications fixture, equipment and material, furniture and finishing, lighting fixing and service management. BIM application can provide interior designers such as simulation, analysis, design process and solution with team members. Furthermore, some of the interior designer also using BIM as to organize, documenting data and optimise detail information in solving the problem in the develop process. BIM technology and practices not only to improve the construction and design process development that only the project faster, cost effectively, and prolong but it also helps to increase the capacity of BIM professional by improvise the careers and fields. In the Malaysian context, BIM is still fresh in interior desogn industry.

## 1 Introduction

Nowadays, every evolution in technology has been achieved with advances in software technology and tools. Building Information Modeling (BIM) is a new a paradigm phrase in the planning and design profession. BIM is the one of tools is changing with a new period and time circulation. Building Information Modeling is the best way to discover about construction and one of the most promising developments in the architecture, engineering, and construction (AEC) industries and is driving an unprecedented revolution in the construction industry [6, 11].

The theory of BIM is to construct a building with the virtually elements, prior to building it physically and theoretical, to work out problems, and to simulate and analyze potential impacts [14]. BIM is the concept of building with emphasizing on the virtual environment to physically building was built with the potential problems can be expected during the construction stage and work processes can be carried out and the analysis can be done early [16].

Malaysian construction industry is very dynamic and complex. The implementation of BIM as a new technology and construction method in major construction for contractors, developer and stakeholders is more accurate. However, using BIM in industry is very limited and adoption was not successful as desired. Presently, Malaysia's construction industries have

improved the readiness and awareness for industry players to more concerned using BIM technology.

Defining the BIM in perspective of interior design aspect. Terminology on interior design will be establish to find out the factors and criteria when BIM using in interior design process. Furthermore, there is no description on the interior design in BIM aspect. Identification of the benefits and constraints of BIM aspect in interior design industry and understanding of the relationship between the sizes of interior design firm. The significant on BIM will be verified when the barriers and variables were find out in the literature and survey was achieve.

## 2 Literature Review

### 2.1 Definition of Building Information Modeling (BIM)

Building Information Modeling (BIM) is the latest software technology being introduced throughout the Architect, Engineering & Construction (AEC) profession. [4] defines BIM as a process supported by technology of computer generated model used in collaboration to populate information and simulate the planning, design, construction and operation of a facility. But for interior design profession is still lacking and most unpleasant using BIM approach. Skill sets and knowledge necessary for entry-level placement increasingly expands for young

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designers seeking employment with firms executing large-scale projects.

According to the [12] a building information model (BIM) is defined as “a digital representation of physical and functional characteristics of a facility. As such it serves as a shared knowledge resource for information about a facility forming a reliable basis for decisions during its lifecycle from inception onward”. Building Information Modeling (BIM) is a new and innovative technology, which has emerged in recent years and makes possible the efficient achievement of more sustainable designs. According to the [17] defines BIM in three dimensions:



**Figure 1.** Definition of BIM

Based on Figure 1 is shown a three terminology of BIM which is a product is set up the structure on dataset of building; a process defined the act of creating a BIM and a system is to comprises the business work and communication interm of quality and efficiency.

**Table 1.** BIM Terminology and Definitions

No.	Terminology	Definitions
1.	Building Information Model	A digital representation of the physical and the functional characteristics of a facility to serves as a shared knowledge resource for information about a facility, forming a reliable basis for decisions during its life cycle from inception onward. [13]
2.	Building Information Modeling	The human activity of using BIM software and other related software, hardware and technologies to create and use in a building information model [8]
3.	3-D BIM	A model that includes three dimensional (3-D) shape information and does not include the 4-D and 5-D characteristics described below [13]
4.	4-D BIM	A 3-D BIM that has objects and assemblies that have a cost dimension added to them. The cost information can be contained in the BIM or can be linked or otherwise associated to the building objects [13]
5.	5-D BIM	A 4-D BIM that has objects and assemblies that have schedule and time constraint data added to them can be contained in the BIM or can be linked or otherwise associated with project design and construction

		activity scheduling and time sensitivity estimating and analysis systems [13]
6.	2-D/3-D CAD	Two dimensional or three dimensional, Computer Aided Drafting is equivalent to conventional drafting, only performed on a computer.
7.	Integrated Practice	Uses early contributions of knowledge through utilization of new technologies, allowing Architects (Engineers, Owners, Contractors, Manufacturers, Firms, Individuals, Communities) to realize their highest potential as designers and collaborators while expanding the value they provide throughout the project life cycle [8]

**Table 2.** Understanding of BIM

No.	Technology	No.	Process
1.	Project simulation consist using 3D models integrated with project planning, design, construction and operation [9]	1.	Refining and adjusting according to project specifications and design changes to ensure the model are accurate [3]
2.	Introduced the object-oriented parametric modeling [1]		
3.	The process which is the element modified and adjacent or assembly automatically [15]	2.	To produce a design with optimized for quality, aesthetics, constructability, affordability, timeliness and seamless flow into lifecycle management [10]
4.	Define BIM is supplier, operation and maintenance producers, flow rates and clearance [2, 5]		

According to the Table 2, is divided in two categories of BIM, in technology is define that with 3D project can be simulated all operation and could be more organise. This statement is support by [1]. In process, i scan refine and produce the best way to more construct and the flow of process seemly fine.

## 2.2 Definition of Interior Design

According to [18], interior design is a multi-faceted profession in which creative and technical solutions are applied within a structure to achieve a built interior environment. These solutions are functional, enhance the quality of life and culture of the occupants, and are aesthetically attractive. Designs are created in response to and coordinared with the building shell, and acknowledge the physical location and social context of the project.

Design must adhere to code and regulatory requirements, and encourage the principles of environmental sustainability. The interior design process follows a systematic and coordinated methodology, including research, analysis and integration of knowledge into the creative process, whereby the needs and source of the client are satisfied to produce an interior space that fulfills the project goal.

### 2.3 The Contextual Understanding BIM in Interior Design

As interior designers, is to be a valued professional, knowledgeable, idealistic and capable to deliver as project team members to incorporate within interior design industry and technology [9]. Interior design industry should take the consideration in the consequence of combination of skills and knowledge as a critical to adopt in design process. Currently, there are no interior design specific set of BIM tools and they are not generating exterior construction or structural systems using by BIM [9]. Building Information Modeling can be beneficial during the design phase due its ability to organize information and data. Is also provides a stronger visualization of the building and interior. BIM is not utilizing during the core and shell phase or the interior design phase.

BIM has already been proven that is valuable resource for construction projects and documentation. With BIM is provided 3D and 4D visualization, detect clashes, manages changes, and database. It also pertains focusing on structural, building enclosure and design phase. BIM can do anything and beneficial to interior design such as 1) easy and speedy to develop an interior space; 2) ability to visualize the design phase; 3) ability to create multiple interior design on one building; 4) organized material information and selections, cost data, schedules, furniture locations efficiency and material quantities.

Interior designers using BIM to facilitate the data document and ultimately disseminate all of the detailed information about the solution interior designers develop [7]. As interior designers, creativity and technical solutions is part of the skill in built interior environment. This is requires for interior designers make a decision to be within a qualitative and quantitative aspect. During the design process, interior designers are responsibility to analyze all of the owner’s and occupant’s need. At this stage, interior designers will be established with the detail project requirements and project plan with collaborative team member to analysis the consequence. Interior designers must be developed in direct coordination because the interior projects involving within a new building and old building being renovation progress.

**Table 3.** The Applications BIM for Interior Designers

Stage	Activities
Programming and Schematic Design Development	<ul style="list-style-type: none"> <li>- To determine space needed to achieve all of the required activities of the occupants.</li> <li>- Virtual models and databases that are interrelated and interconnected</li> </ul>

	<ul style="list-style-type: none"> <li>- Space programs are utilized to initially all of the space elements.</li> <li>- the bubble and diagramming phases are utilized to study the locations and relationships between the spaces.</li> <li>- building design development</li> <li>- Coordination between members of the design team to space planning progress.</li> </ul>
Interior Building Components	<ul style="list-style-type: none"> <li>- assign the information to specify the type, size, construction, materials, finishes, performance, manufacturer and cost.</li> <li>- coordinate the vertical circulation components such as stairs and elevators</li> <li>- to simulate and define the specifying type, size, finish properties and fire rating.</li> </ul>
Furniture, Millwork, Fixtures, and Equipment	<ul style="list-style-type: none"> <li>- provide online BIM catalogues of their products to be used by interior designers.</li> <li>- specific specifications such as size, finish, model number, quality, and cost.</li> <li>- Provided generic models to create new models</li> </ul>
Ceilings and Lighting Design	<ul style="list-style-type: none"> <li>- Integration within interior spaces layout and ceiling system.</li> <li>- To ensure the light fixtures provided appropriate lighting quantities and types.</li> <li>- Fixture types and lamp types are both defined within BIM lighting plans.</li> </ul>
Interior Finishes	<ul style="list-style-type: none"> <li>- allows interior designers to detail each surface of an interior environment and specify how they will be installed, how they will perform, how much they will cost and how to maintain them.</li> <li>- provides interior designers to define all the interior component types and material finishes.</li> </ul>

In application BIM for interior design is mentioned that the several processes will establish in the interior design scope of work. With BIM, interior design industry is more manageable and workable to operate the system by coordinate the process.

### 3 Research Methodology

The research methodology includes a literature review, design tool analysis, case studies and interviews. The literature review studied of the significance of framework as well as the definition and application of BIM in the design practice for interior design discipline. Structured face-to-face interviews were carried out with BIM professionals including architects, clients, engineers, consultants and the government to collect opinions on the benefits of BIM for interior design disciplines and obstacles to its use.

Besides that, analysis structure using software device will be cover to study the implication for interior design in academic and profession context.

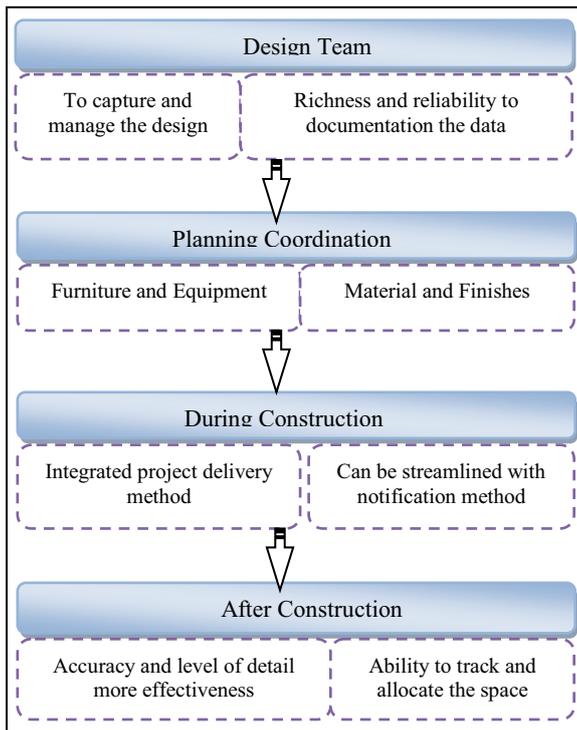


Figure 2. BIM in Interior Design Process

Basically, in interior design process a several stages were identified with the design team where is to capture and manage design. In the planning stage, furniture and equipment were located at the availability of finishes and material. During the construction, integrated is the best method to get the good result in design process. The after the construction phase, accuracy and level of detail were be achieve in the construction. This is also ability to track the defect and problem.

## 4 Discussion

Team buildings are very important for building owner which is architect, engineers, interior designers and contractors implement the accurate BIM from the beginning project till the hand over. The advantage using BIM in development progress were make the team building easier and speedy in work progress.

From the interior designer's perspective, it can conclude that BIM is more powerful and helping to improve contract documentation, preconstruction estimating, procurement, scheduling, coordination, and cost-efficiency and close-out documents in term of finishes, furniture and equipment that are essential to the environment aspect.

Through the pilot study, Jefree Ismail (2015) has mentioned that BIM in Malaysian context is still small users and this statement was supported by Jamal (2015). They identified that costing is the core barrier to improve the quality of work process. The ability of contractors to deliver the new technology also make it obstacle to achieve the process.

When is the BIM implement for interior design, there is a lot the advantage which is the design process is more speedily and organise. Time and cost can be save

without using more manpower. To support this study, several variables was identified as following: costing, time constrain, knowledge, technology, readiness, awareness, conflict in design, and this supportive with some barriers such financial barriers, time barriers, conflict in design barriers, skill workforce barriers and demand from industry are the limitation of the study.

There are many studies about BIM more focus to the architecture, engineering and construction (AEC), facilities management, 3D information model and digital innovations. Although this study about BIM in which it is more to the AEC, but researches on the implementation of BIM for Interior Designers industry is still untapped and lack the information. The limited literature on the implementation and effectiveness of BIM in the Interior Design industry is still far to describe. Constraints and problems in the implementation of BIM is identified the cause why the lack of use in this industry.

Via searching and evaluating which caused constraints and effectiveness is very significance. All results and analysis depends on the success of this study. Thus, the finding and conclusion of this study hopes to help in the research and development in the relevant literature.

## References

1. S. Azhar, A. Nadeem, J.Y.N. Mok, and B.H.Y Leung, 'Building Information Modeling (BIM): A New Paradigm for Visual Interactive Modeling and Simulation for Construction Projects', Proceedings of the First International Conference on Construction in Developing Countries (ICCIDC-I), Karachi, Pakistan, August 4-5, (2008)
2. S. Azhar, and S. Richter, 'Building Information Modeling (BIM): Case Studies and Return-on-Investment Analysis', Proceedings of the Fifth International Conference on Construction in the 21st Century (CITC-V), Istanbul, Turkey, 1378-1386, (2009)
3. J. Carmona, and K. Irwin, 'BIM: Who, What, How and Why', Building Operating Management, (October 2007)
4. CIDB, *Workshop of BIM Portal and Collaboration Platform for Affordable BIM, 9th-11th January 2013*, Holiday Inn Glenmarie, Shah Alam, Selangor. Kuala Lumpur: CIDB Internal Reports, (2013).
5. CRC Construction Innovation, 'Adopting BIM for Facilities Management: Solutions for Managing the Sydney Opera House', Cooperative Research Centre for Construction Innovation, Brisbane, Australia, (2007)
6. C. Eastman, P. Teicholz, R. Sacks and K. Liston, "BIM Handbook: A Guide To Building Information Modeling For Owners, Managers, Architects, Engineers, Contractors, And Fabricators," 2nd Ed., Wiley, Hoboken, NJ. (2011).
7. P. Elizabeth, "The Application of BIM for Interior Design and the Implication for Facility Management", BIM Academic Symposium,

- Building Innovation 2014 the National Institute of Building Sciences Conference & Expo, (2014)
8. F. Jernigan, *ASHRAE Vision 2020*. Atlanta: ASHRAE Vision 2020 Ad Hoc Committee, (2008)
  9. W. Kymmell, '*Building Information Modeling: Planning and Managing Projects with 4D CAD and Simulations*', USA: McGraw Hill Construction, (2008)
  10. McGraw-Hill Construction, "*Building Information Modeling: Transforming Design and Construction to Achieve Greater Industry Productivity*", McGraw-Hill Construction, New York, (2008)
  11. McGraw Hill Construction. "*Building Information Modeling (BIM) Transforming Design and Construction to Achieve Greater Industry Productivity*", (2009)
  12. National Building Information Modeling Standard (NBIMS), *Overview, Principles and Methodologies*, Version 1.0 — Part 1, [http://www.wbdg.org/pdfs/NBIMsv1\\_p1.pdf8](http://www.wbdg.org/pdfs/NBIMsv1_p1.pdf8) (last accessed on August 27, 2010).
  13. National Institute of Building Sciences (NIBS), 'United States National Building Information Model Standard,' Version 1. Retrieved May 29, 2013 from [http://www.wbdg.org/pdfs/NBIMsv1\\_p1.pdf](http://www.wbdg.org/pdfs/NBIMsv1_p1.pdf). pp 1-2, (2007).
  14. D. Smith, "*An Introduction to Building Information Modeling (BIM)*." *J. Build. Inf. Modeling*, 1(1), 12–14, (2007).
  15. J.D. Stine, '*Design Integration Using Autodesk Revit® 2012*,' Mission, KS: SDC Publications, (2011)
  16. S. Azhar, "*Building information modeling (BIM): Trends, benefits, risks, and challenges for the AEC industry*," *Leadership and Management in Engineering*, vol. **11**, pp. 241-252, (2011)
  17. US National Institute of Building Sciences (NIBS) United States National Building Information Modeling Standard, Version 1 – Part 1: Overview, Principles and Methodologies, Facilities Information Council, USA, (2007)
  18. National Council for Interior Design Qualification. *NCIDQ Examination Study Guide*. Washington, DC: NCIDQ, pp. 22–23.( 2000)