

# Bridging the connection: Examining the Utilization of Building Information Modelling (BIM) in Interior Design

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## ABSTRACT:

Building Information Modeling (BIM) has emerged as a game changer in the architectural, engineering, and construction (AEC) industries, providing a holistic approach to planning, designing, building, and managing buildings and infrastructure. While BIM has gained popularity in commercial building and design software, its use in interior design is still understudied. This study bridges the gap by concentrating on the use of BIM software, specifically Autodesk Revit, in a professional interior design firm.

The study begins with an examination of the evolution and definition of BIM, emphasizing its intelligent model-based methodology that goes beyond 3D geometry to include time and cost factors. Despite the potential benefits, the shift from traditional design processes to BIM presents hurdles, particularly for interior design businesses, due to project complexities and interoperability issues. The interior design process is thoroughly investigated, highlighting its interdisciplinary character and rigorous technique. Interior designers must manage multiple phases, from project inception to post-completion evaluations, while adhering to practical, aesthetic, regulatory, and environmental standards.

The research distinguishes between interior designers and decorators, emphasizing the importance of interior designers in developing practical interior spaces through client engagement and consideration of building codes and structural elements. BIM is widely acknowledged in the AEC sector as a digital representation of physical and functional qualities that aids in project planning, design, construction, and operation. However, BIM research in interior design is still restricted, with only a few studies concentrating on tailored interior design procedures and green building design. This study intends to close this gap by looking into the protocols and practical implementations of BIM software in professional interior design businesses, revealing insight on how designers incorporate BIM into their daily duties. By investigating the problems and potential connected with BIM adoption in interior design, this study hopes to add to the continuing discussion about improving efficiency and sustainability in the AEC industry.

## Keywords:

Building Information Modeling (BIM), interior design, professional practice, Autodesk Revit, AEC industry, design process, interoperability, sustainability, project lifecycle, interdisciplinary, green building design, digital representation, technology adoption

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## I. Introduction

Building Information Modeling, abbreviated BIM, is not a new concept in CAD technology, but has been around for quite some time. BIM has lately gained popularity as a commercial building and design software because to the growing capability of personal computers. Although the Graphisoft ArchiCAD Virtual Building idea might have become the first software on the

market to use the building model, Autodesk Revit is currently thought of as belonging to the same concept as BIM. Up till now, this idea has shaped an increasing amount of CAD software. Building Information Modeling (BIM) is an intelligent model-based method that enables people to plan, design, build, and manage structures and infrastructure. By integrating 3D modelled objects with 2D sketched parts, users of architectural BIM

design software can control the level of 3D information while still producing detailed drawings. Traditional building design heavily relied on two-dimensional technical drawings, such as plans, elevations, sections, and so on. The three primary spatial elements of width, height, and depth are combined with time as the fourth dimension (4D) and cost as the fifth (5D) in building information modeling. Therefore, BIM is more than just geometry. It also encompasses the quantity and quality of building components, spatial linkages, light analysis, and geographic data. Many companies are working on projects using BIM technique all over the world. BIM is a highly promising advancement in the world of architecture, engineering, and construction (AEC). However, making the transition from traditional design methods and CAD technology tools to BIM is a difficult and time-consuming procedure that necessitates interoperability expertise. Applying BIM technology appears to be more difficult for design firms, especially those who work on interior design projects or interior-related parts, because of the nature of interior design projects and challenges such project scope, scale, staff capability, client expertise, etc. Moreover, interior designs usually involve an interaction with architectural difficulties, leading to more intricate approaches for designers and other involved parties. As such, applications of BIM in the field of interior design should pique the interest of the scientific community more. The primary focus of the current study is how BIM software, specifically Autodesk Revit, is used in professional interior design firms. Although a lot of research has been done on BIM by the interior design industry, little is known about how BIM is really used by designers in their daily work. The purpose of this study is to identify interior design methodologies used in professional practice. (Chen, H.; Hou, L.; Zhang, G. K.; Moon, 2021).

## II. Terminology of Building Information Modelling (BIM).

The newest software technology being introduced to the Architect, Engineering, and Construction (AEC) field is Building Information

Modeling (BIM). BIM is described as a technology-enabled process of computer-generated models used cooperatively to populate information and simulate facility planning, design, construction, and operation (Takim, R., Harris, M., & Nawawi, A. H., 2013). Nonetheless, the interior design sector still uses BIM sparingly and in an uncomfortable way. The skill sets and experience required for entry-level placement are increasing for young designers seeking employment with organizations that complete large projects. As stated in (Embi, M. R., and Abdul Hamid, A. B., 2016). A building information model (BIM) is "a digital portrayal of the practical and aesthetic features of a structure." As such, it acts as a shared knowledge repository for information about a facility, providing a solid foundation for decisions throughout its existence, beginning with its inception." Building Information Modeling (BIM) is a new and innovative technology that has evolved in recent years, allowing for the effective implementation of more sustainable designs. East, B., and Smith, D. (2016) define BIM in three dimensions.:

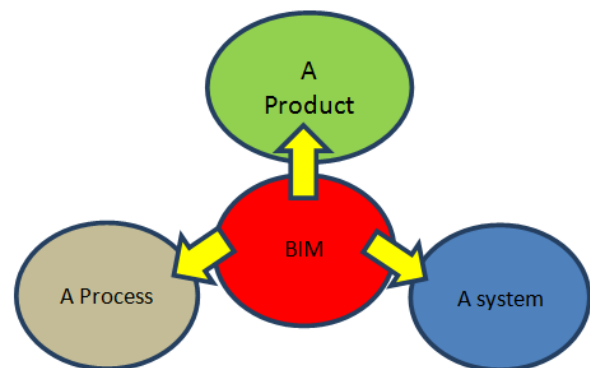


Figure 1. Definition of BIM. (Researcher,2024)

Figure 1 depicts three BIM terminology: a product that establishes the structure of a building dataset; a process that defines the act of developing a BIM; and a system that encompasses business activity and communication in terms of efficiency and quality.

Table 1 :Awareness of BIM.(Researcher,2024)

No	Technology	No	Process
1	Project simulation consists of 3D models that are integrated with project planning, design, construction, and operations. (Kymmell, W. (2008). <i>Building information modeling</i> )	1	Refining and updating the model based on project specifications and design modifications to ensure its accuracy. (Carmona, J., & Irwin, K. (2007)).
2	Developed object-oriented modeling with parameters. (Azhar, S., Nadeem, A., Mok, J. Y., & Leung, B. H. (2008, August).		

3	A procedure in which an element is updated and then adjacent or assembled instantly. (Stine, D. J. (2012).	2	To provide a design that is optimum for quality, aesthetics, feasibility, affordability, promptness, and seamless integration into lifecycle management. (Azhar, S., Khalfan, M., &Maqsood, T. (2012)).
4	Define BIM as suppliers, maintenance and operation factories, rates of flow, and settlement. (Azhar, S., & Richter, S. (2009).		

As indicated in Table 2, BIM is separated into two categories, with technology defined as the ability to simulate all operations and organise a project in 3D.

### III. Procedure for Interior Design

Comparing the field of interior design to other professions like education and healthcare, it is still relatively new. The field denoted by any title was not a reality sooner than during the 1900s, and the term "interior design" didn't start to be extensively used until after World War II. Over many years, there has been discussion and development over what defines interior design. The common misconception is that "individuals whose embellish spaces are interior decorators." They frequently fail to distinguish between decoration and design. Although decoration is a valuable and significant interior design element, it addresses more than only human interaction and behavior. The behavior and interaction of humans is fundamental to interior design. Science and art are both incorporated into the multidisciplinary area of interior design. According to the National Council for Interior Design Qualification (NCIDQ), interior design is a multidisciplinary field that uses technology and creative methods to construct built interior environments within predetermined parameters. These solutions are aesthetically pleasing, practical, and enhance the tenants' quality of life and culture. In response to and in tandem with the building shell, designs are created, keeping in mind the project's physical location and social context. Designs must support the principles of sustainable development while simultaneously adhering to legal and code requirements. In order to develop an interior space that satisfies the project goals, the interior design process adheres to a methodical and coordinated methodology that incorporates research, analysis, and knowledge within the creative process. This ensures that the client's needs and resources are satisfied. According to Knackstedt (2002), interior design is a field that is heavily influenced by society. Designers work with customers to determine their demands. To provide design solutions, they need a lot of consultants on their staff. They oversee the work of a wide range of resources, such as contractors, consultants, artists, and craftspeople. In the realm of professional interior design, clients rule dominant. (William, 2010 Handling an interior design project involves as

much creative thought as the design itself, and the best projects start with a well-planned project timeline. Usually, a project is broken up into multiple phases in order to establish critical benchmarks for the customer and the engineering team. (Grimley& Love, 2013).

An experienced interior designer's recommendations must both create a comfortable space and meet the functional objectives of the customer. It is vital for interior designers to guarantee that their designs comply with construction, fire, and regulations regarding accessibility. Interior design alternatives have to fulfill the sustainable design objectives set by owners (Piotrowski, 2001). A conventional interior design project will go through a number of stages, based on Pile (2007):

- (1) Project start-up: establish communication with the client, describe the project's objectives, budget, and timeframe; determine whether specialized knowledge is needed; decide on a designer-client contract; schedule design work; select the space(s) to be used;
- (2) Programming: compile or set a survey of the space(s), interview and accumulate requires information create an initial program, go over the program with the client, create a final program, get the client's approval for the program, distribute spaces, and create proximity investigations.
- (3) The initial stages are to create a preliminary design, discuss it with the client, update and complete it, and get the client's approval.
- (4) Design development includes creating a detailed design, selecting materials, deciding on colors and finishes, calculating costs, setting up the final design, creating a detailed budget, preparing a presentation, presenting it to the client, reviewing the budget with the client, making any necessary revisions, and getting the client's approval for the design and budget.
- 5) Bidding and working drawings: create requirements, comprehensive drawings, and construction drawings; estimate costs and request bids; plan construction and installation dates; choose

vendors and execute work orders; and prepare and issue purchase orders.

(6) supervision: oversee construction (including demolition where necessary), plan and expedite deliveries and construction, oversee installation and completion, inventory faults and errors and oversee correction, oversee move-in.

(7) After finishing, make any necessary alterations and enhancements, and get a post-move-in review ready.

#### **IV. Interior Designer and Interior Decorators**

An interior designer is a designer that specializes in creating interior spaces, while they can also work on exterior design and fascia, especially in the retail industry. The duties performed by interior designers differ widely, and the field of interior design is not well defined. It's common to use terms like decorator and designer interchangeably. The terms do not, however, agree on the extent of the job done, the level of schooling attained, and, frequently, the professional accreditation as an interior designer. The internal design or layout of the building is not the responsibility of an interior decorator. He or she is entirely absorbed with the furnishings, hues, materials, and textures of a room or particular interior area. Observing and expressing the occupants' personalities and styles in their surroundings is his or her job. To use the term, a decorator does not always need to have received professional training. Conversely, an interior designer usually works with the architect on the project from the beginning and sometimes even before. Knowing how each room will be used by the occupants is how interior designers help create useful interior space. They are aware of building rules and construction issues, but they may also take light, sound, and other design considerations into account. Because of this, in order to work, most countries need designers to obtain a permission and undergo professional training.

#### **V. BIM in Architecture, Engineering and Construction (AEC) Industry and Interior Design**

Building information modeling, or BIM, is described as "a digital representation of the functional and physical features of a facility" by the US National Building Information Model Standard Project Committee. A common knowledge resource for information about a facility that provides a strong foundation for decisions at every stage of its life cycle, from conception to demolition, is a building information model (BIM). For the

Architecture, Engineering, and Construction (AEC) Industry, Building Information Modeling (BIM) is a rapidly developing technology and approach that makes tasks like project planning, design, construction, and operation easier. In many parts of the world, 2D and 3D CAD technologies are gradually being replaced by BIM. More options are available with BIM than with CAD.

Research on BIM in interior design seems to be lacking. A few academic and applied studies concentrated on particular stages of the design process. In order to reduce the undue stress on stakeholders involved in the customized house project, Park, Kim, Kim, and Kim (2012) studied the integration of BIM technology into the customized interior design process (CIDP). In particular, when it came to interior design, these authors understood that clients wanted their living spaces to be unique, therefore they concentrated on the process of choosing the interior layout through client and employee collaboration.

In order to give customers, the finest solutions available and promote sustainable design globally, interior designers must keep up with emerging trends in addition to the expanding trend of green building design. To create successful green interior designs, interior designers must be aware of the crucial roles that BIM-based simulations and analyses play in creating green interior settings. According to Denzer and Gardzelewski (2011), students studying Architectural Engineering (AE) can benefit from Building Information Modeling (BIM) in many ways, and as BIM is widely used in industry, it should play a significant role in AE education. But they also said that BIM is a "disruptive technology" because it poses more substantial strategic challenges when implemented. Their study focused on the interaction between digital and analog techniques. Traditionally, the "back-of-the-envelope" or "napkin sketch" image is used to experiment with basic design concepts. Computer research and documentation are then used to create the final product. The researchers came to the conclusion that while most students were open to digital modeling, they found it difficult to integrate hand drawing into the design process. For this reason, it would be helpful to provide specific abilities. Additionally, students should be encouraged to employ hand drawings throughout the design process rather than following a straight line and sketching first, then modeling. Throughout the duration of the literature review, BIM research has continued and become increasingly concentrated on certain AEC industries and academic subjects. The interior design process is a growing subject in the

AEC business, but there are currently few BIM studies on it. The scientific community needs to do more research in this area.

## VI. The Applications BIM for Interior Designers

**Table 2.** The Applications BIM for Interior Designers. (Researcher,2024)

Stage	Activities
Coding and Conceptual Design Development	<ul style="list-style-type: none"> <li>- Determine the amount of space required for all of the inhabitants' activities.</li> <li>- Interrelated and integrated virtual models and datasets.</li> <li>- Space programs are used to initialize all of the space elements.</li> <li>- The bubble and diagramming phases are used to investigate the locations and relationships of the spaces.</li> <li>- Building design development</li> <li>- Coordination among design team members as space planning progresses.</li> </ul>
Interior Building Elements	<ul style="list-style-type: none"> <li>- Allocate data to define the kind, size, structure, materials, finishes, performance, manufacturer, and price.</li> <li>- Coordinate vertical circulation components, such as stairs and elevators.</li> <li>- Simulate and set specifications, including type, size, finish, and fire rating.</li> </ul>
Furniture, Fabrication, Fixtures and Machinery	<ul style="list-style-type: none"> <li>- Offer digital BIM catalogues of their items for use by interior designers.</li> <li>- particulars like size, finish, serial number, effectiveness, and price.</li> <li>- Supplied general models for developing new models.</li> </ul>
Ceiling and Lighting Arrangement	<ul style="list-style-type: none"> <li>- Incorporation with the internal space architecture and roofing system.</li> <li>- Assure that the light fixtures delivered enough lighting amounts and types.</li> <li>- BIM illumination plans describe both component and lamp kinds.</li> </ul>
Interior Finishes	<ul style="list-style-type: none"> <li>-It enables interior designers to explain every component of an interior setting, including how it will be placed, how it will operate, how much it will cost, as well as how to maintain it.</li> <li>- It allows designers to specify all of the interior element kinds and material choices.</li> </ul>

## VII. Conclusions

In summary, this study has filled a significant gap in the body of literature by offering original insights into the application of Building Information Modeling (BIM) in professional interior design firms. By exploring the concept, development, and importance of BIM to interior design practice, this study has brought attention to its revolutionary potential.

The research on the interior design process brought to light its multidisciplinary nature and meticulous approach, highlighting the importance of using BIM to satisfy requirements related to sustainability, functionality, aesthetics, and regulations. The study made a distinction between decorators and interior designers in order to emphasize the vital role that designers play in designing interior spaces through collaboration, adherence to codes, and structural considerations.

Within the broader Architecture, Engineering, and Construction (AEC) industry, Building Information Modeling (BIM) has become a potent instrument for decision-making and project management at every stage of the project's lifespan. BIM research in interior design is still rather restricted, despite its widespread application in architecture and construction. This suggests that further research and attention from the scientific community is required.

By investigating the procedures and real-world uses of BIM software, particularly Autodesk Revit, in expert interior design businesses, this study contributes to the closing of this disparity. By shining light on how designers integrate BIM into their everyday activities, this study aims to inform and encourage interior design practitioners to use technology to improve design outputs and client satisfaction.

In summary, using BIM enables designers to advance their careers, cooperate more successfully, and provide innovative solutions as interior design changes in response to market trends and technology advancements. With continued study and cooperation, the full potential of BIM in interior design may be achieved, propelling expansion and innovation in the AEC sector.

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