Marriott Student Review

Volume 4
Issue 1 *Expectations*

Article 3

August 2020

Building Information Modeling: Risks, Benefits, and Trends in Construction

Tanner Duron
Brigham Young University, noname@gmail.com

Building Information Modeling

Risks, Benefits, and Trends in Construction

By Tanner Duron

"Any sufficiently advanced technology is indistinguishable from magic," wrote Arthur C. Clarke in his 1962 *Profiles of the Future: An Inquiry into the Limits of the Possible*. Clarke's statement has been affirmed during the Information Age with the astounding capabilities of computers. Computers allow the world's population to access near-infinite quantities of data seemingly out of thin air.

Another mind-boggling power of computers is their ability to help plan, design, and maintain the buildings that surround them, a technology known as Building Information Modeling (BIM). This technology is used primarily by professionals in the architecture, engineering, and construction industries, yet it is not implemented as widely as it should be. Despite some risks associated with BIM, the technology has proved beneficial and should be utilized more in the construction industry.

Introduction to BIM

According to Autodesk, a BIM software developer, "Building Information Modeling is an intelligent 3D model-based process that gives architecture, engineering, and construction (AEC) professionals the insight and tools to more efficiently plan, design, construct, and manage buildings and infrastructure."[1] BIM's various forms can be used to aid in the lifecycle of buildings of all sizes from inception to demolition.

BIM has been developed to advance Computer Aided Design (CAD) to a more useful product. As Figure 1 demonstrates, early uses of CAD in construction were limited to two-dimensional designs—lines on a screen to illustrate the placement of objects. On the other hand, BIM utilizes three-dimensional objects that are placed in a

space. These objects—walls, cabinets, HVAC components, wall finishes, floors, etc.—have height, width, and depth that can be manipulated to accurately represent the final product or system that will be installed in the building during the construction process.[2] BIM's effective use of three-dimensional space generates its high demand in the AEC industry. Figure 2 shows the same floor plan shown in Figure 1 after it has been migrated into a BIM software called Revit.

Benefits of BIM

BIM has become a powerful tool in the construction industry. It is versatile and is used by architects, engineers, and contractors alike.[3] One benefit of BIM is that it increases performance and quality in construction.[4] It is also easy to access, which permits collaboration between the contractor and trade specialists and aids in minimizing design and construction errors.[5] In addition, BIM has built-in cost estimating capabilities, can easily generate 3D renderings, can aid in scheduling projects, and detects conflict and collision instances within the model.[6]

Further developments in BIM have also created uses beyond the completion of a construction project. BIM use can provide resources for heritage and historical documentation, as-built renders, warranty and service tracking, energy management, emergency management, and retrofit planning. Using BIM software helps keep projects on schedule and under budget. It can also eliminate unforeseen modifications (also known in the AEC industry as change orders) by up to 40%. Cost estimation is provided with a margin of error of 3% and up to 80% reduction in generation time. The clash detection capabilities can save up to 10% of the contract value and reduce time required to complete the project by up to 7%. With these capabilities of BIM, construction projects improve in efficiency and quality.[7]

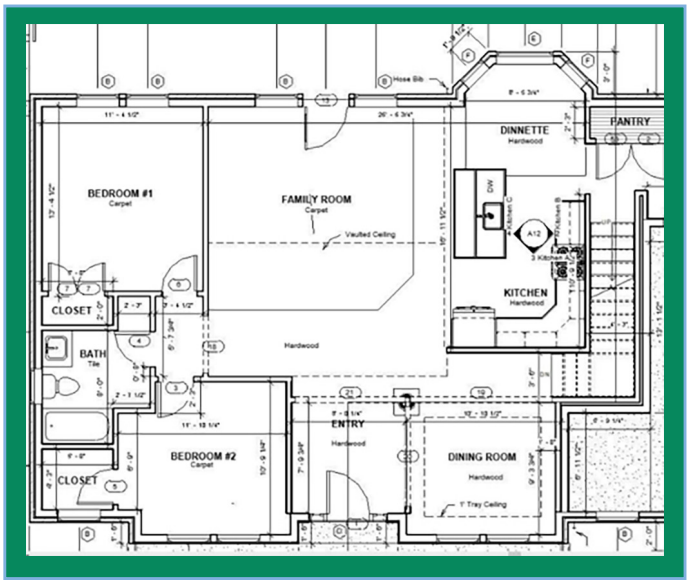

***Figure 1**. A house floor plan created in 2D. Photo courtesy of the author.*

***Figure 2**. Revit-generated model courtesy of the author.*

Risks of BIM

While there are clearly benefits to using the BIM technology, there are a few potential risks to be aware of. Nevertheless, if professionals can recognize and combat these risks, implementing BIM would still prove beneficial.

One risk is the possibility of subcontractors using software that is incompatible with BIM software.[8] Another risk is the potential for miscommunication between partners on projects, as most BIM work is performed off-site. Most projects require significant collaboration between contractors, engineers, architects, and trade specialists due to the increasing complexity of the systems that are installed in modern buildings. Allowing free access to project documents places intellectual property at risk of copyright infringement.[9] In addition to the security risks associated with information sharing, large group collaborations generate questions of liability among the many involved parties. The group must decide who will control data entry into the model and who will be responsible for any inaccuracies within the model. Many of these risks can be addressed by outlining the risks and clarifying other expectations and procedures in contractual documents.[10]

Furthermore, it is important to understand that BIM data reflects ideal conditions. Though the technology is powerful, it is unable to predict all real-world occurrences that will transpire during a project. Weather, labor efficiency, and government regulation are all unpredictable factors. Thus, schedules must be adjusted, and some unforeseen construction incidents can break budgets. A final issue to be aware of is the time and cost that must be invested to adopt the new software and train the employees on how to use it.[11] Still, long-term savings as previously mentioned can offset cost to train and incorporate BIM use. Professionals must evaluate these potential risks and based on their situations, determine if the benefits outweigh the costs.

Trends in BIM

Though BIM use is spreading throughout the world, it is not being effectively used at all stages of construction. In research conducted by Britani N. Harris, just over a third of survey respondents (38.3%) use BIM personally at least once a week. In the same research, Harris found that 37.6% of the respondents do not use BIM at all.[12] Figure 3 breaks down BIM use frequency within job roles of those surveyed.

Harris's research further revealed that BIM was not used at all on projects smaller than $1 million, nor was it used on 78.3% of projects valued at $1–10 million. Overall, use increased as project value increased.[13] Recently, the industry has been moving towards more widespread use of BIM on all projects. In 2016 the United Kingdom became a leader in BIM by legally mandating that all publicly funded building projects use BIM.[14] In 2020, all transportation projects in Germany were required to use BIM.[15] Further integration of BIM can be achieved through education of those seeking to enter the AEC industry. Though one could indeed "teach an old dog new tricks," many old-school contractors and engineers shudder at the thought of learning a new modeling software. As such, the rising generation must lead the way in fully integrating BIM in the industry.

Overall, long-term savings offset cost to train and incorporate BIM use.

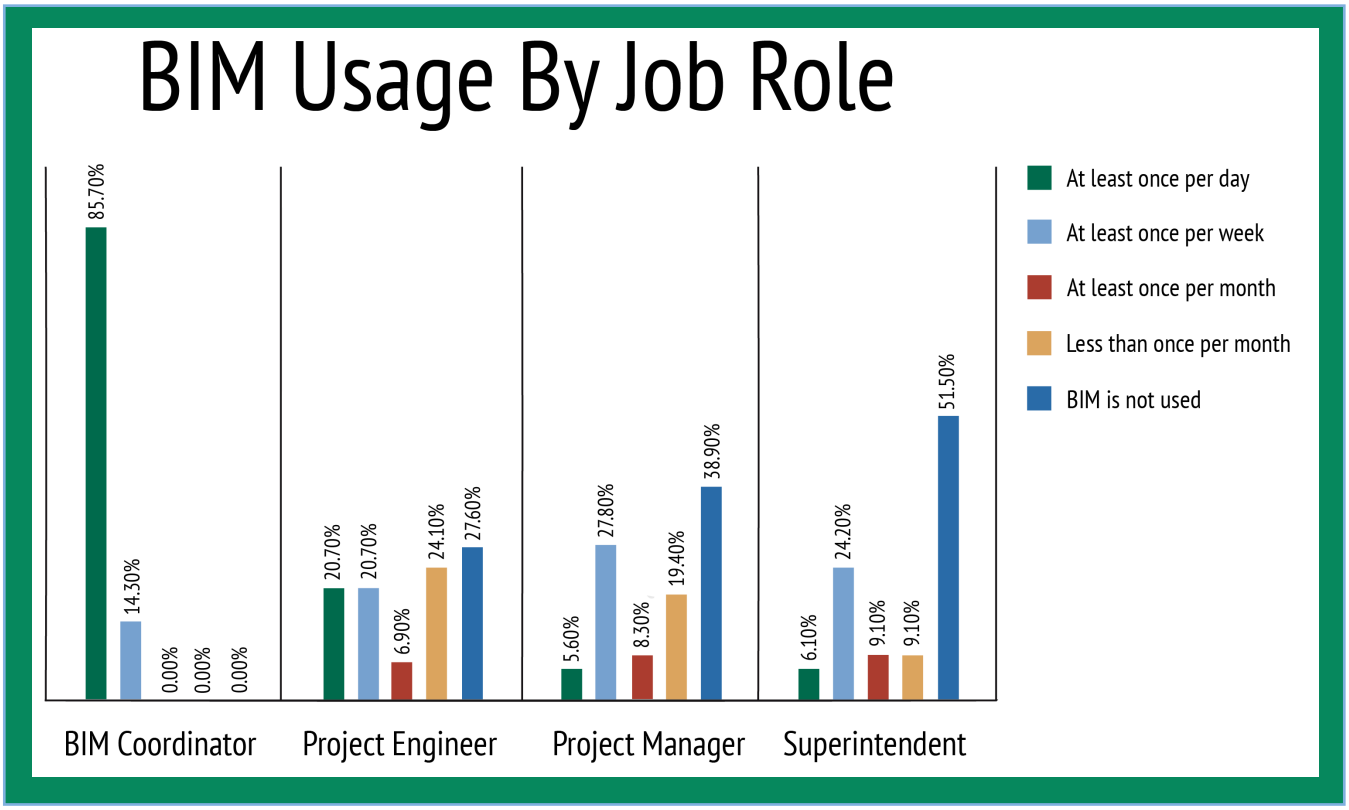

***Figure 3**. BIM usage by job role. Data provided by Britani N. Harris. Chart provided courtesy of the author.*

Conclusion

No aspect in the AEC industry is risk free, including using a sophisticated software like Building Information Modeling. However, the benefits of using BIM on construction projects might outweigh the risks that accompany its use. BIM is becoming an increasingly popular resource, but the rising generation must take the reins and fully apply it in the construction industry. Those who now hold the torch can help by educating the next generation of industry leaders in the many benefits and uses of BIM.

Notes

1 Autodesk. "What Are the Benefits of BIM?" Autodesk, Inc. Accessed October 28, 2019, https://www.autodesk.com/solutions/bim/benefits-of-bim.

2 Brian Capt, "Design Basics," Construction and Facilities Management 155: Construction Modeling (class lecture, Brigham Young University, Provo, UT, January 10, 2019).

3 Brian Capt, "Design Basics."

4 Lancine Doumbouya, Guoping Goa, and Changsheng Guan, "Adoption of the Building Information Modeling (BIM) for Construction Project Effectiveness: The Review of BIM Benefits," American Journal of Civil Engineering and Architecture, 2016 4, no. 3 (2016): 76.

5 Senem Seyis, "Pros and Cons of Using Building Information Modeling in the AEC Industry," Journal of Construction Engineering and Management 145, no. 8 (August 2019), https://ascelibrary.org/doi/10.1061/%28ASCE%29CO.1943-7862.0001681.

6 Salman Azha et. Al, "Building Information Modeling (BIM): Trends, Benefits, Risks, and Challenges for the AEC Industry," Leadership and Management in Engineering, 11, no. 3 (July 2011), 243.

7 Salman Azha et. Al, "Building Information Modeling (BIM)," 243.

8 Brian Capt, "Design Basics."

9 Salman Azha et. Al, "Building Information Modeling (BIM)," 243.

10 Senem Seyis, "Pros and Cons of Using Building Information Modeling in the AEC Industry."

11 Salman Azha et. Al, "Building Information Modeling (BIM)," 243.

12 Britani N. Harris, "Building Information Modeling and Construction Operations," (Master's thesis, San Diego State University, 2017) 65–67.

13 Britani N. Harris, "Building Information Modeling and Construction Operations," 65–67.

14 Infrastructure and Projects Authority (United Kingdom), Government Construction Strategy 2016-2020, London: Assets Publishing Service, 2016, https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/510354/Government_Construction_Strategy_2016-20.pdf.

15 "What is Building Information Modeling (BIM)?" Autodesk video, 3:31, September 5, 2018, https://www.autodesk.com/content/dam/autodesk/www/solutions/bim/videos/faq/what-is-bim-videoen.mp4.