# Chapter 15

# Building Information Modeling:
## Harnessing Innovations for Professional Proficiency

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## ABSTRACT

*Building information modeling (BIM) has changed architecture, engineering, and construction professionals' built environment conceptualization, design, building, and management. BIM tool evolution, principles, components, modelling methodology and software, user interface and basic functions, construction and post-construction benefits, safety, and intellectual property are covered in this chapter. BIM integrates geometry, spatial relationships, geographical data, and material qualities for interdisciplinary communication and decision-making. This synergy boosts project efficiency by improving design accuracy, timelines, and conflict resolution. Technical knowledge and professional teamwork are needed to use BIM effectively. BIM competency needs a paradigm shift in schooling and professional growth. As AEC digitises, BIM's potential is crucial for professional proficiency.*

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## 1. INTRODUCTION

Historically, the construction industry has been closely intertwined with processes of industrialization and urbanization (Osuizugbo, 2020). The construction industry encompassing the Architectural, Engineering and Construction sectors, this industry has consistently played a significant role in the socio-economic development of nations (Ullah et al., 2019). The construction industry is saddled with the task of providing infrastructures ranging from social, amenities, and housing to socio-economic development and industrialization (Ruya et al., 2018). Umar (2019) identified two vital roles of the construction project which are the specification of the resulting product (design information) and the initiation and control of the activities required for constructing the facility (management information). Nowadays, building projects (Raghavan, R. et al., 2022) have become increasingly complex and challenging, leading project teams to encounter unprecedented changes (Yusuf, 2020). Planning and constructing built facilities entail the collaboration of diverse stakeholders with various areas of expertise. Throughout this process, the continuous resolution and circulation of construction data among these stakeholders emerge as crucial determinants of success (Bormann et al., 2018).

However, due to disruptions in traditional digital information flows, a loss of pertinent information during data exchange is inevitable. This loss of data (Babu, S. Z. D. et al., 2022) results in increased costs for reproducing data, delays, and wastage, contributing to significant drawbacks in construction projects (Kushwaha, 2016). In response to these challenges, innovative approaches to building design, construction, and management are being adopted globally. While methods such as the design and build approach, project websites, and 3D printing facilitate rapid information exchange, they fail to eliminate issues associated with traditional paper-based communication, including the inability to detect parametric capabilities, conflicts, and constructability issues (Abdullah & Ibrahim, 2016). Presently, information technology applications in the construction industry encompass big data analytics (Aghimien et al., 2021), building information modeling (BIM) (Olanrewaju et al., 2021), digital twins (Opoku et al., 2021) and blockchain (Scott et al., 2021).

Building Information Modeling (BIM) emerged as a solution to the inefficiencies of Computer-Aided Drawing (CAD) by providing a comprehensive digital environment (Swapna, H. R. et al., 2023) that integrates all building information in an electronic file, accessible to various project stakeholders (Abdullah & Ibrahim, 2016). BIM adoption began in the mid-2000s and has gained traction among researchers in both developed and developing countries worldwide, including the Dominican Republic (Silverio & Suresh, 2021), Cambodia (Durdyev et al., 2021), Egypt (Marzouk, Elsaay & Othman, 2022), Pakistan (Akdag & Maqsood, 2019), China (Cui et al., 2021), the United States (Mutis & Mehraj, 2022), the United Kingdom (Dalui et al., 2021). In this chapter, the term 'BIM' refers to an activity, "building information modeling", rather than an object, "building information model". This differentiation underscores that BIM is not a tangible entity or a software category, but rather a human-driven activity that leads to comprehensive process transformations in the construction domain.

According to Al-Ashmori et al. (2020), BIM stands for Building Information Modeling and has emerged as a transformative innovation in the architecture, engineering, and construction (AEC) field, fundamentally altering how professionals conceive, design, construct, and manage built environments. Building Information Modeling (BIM) is a digital representation and collaborative process facilitating the creation, management, and sharing of information about a building project throughout its lifecycle (Hamma-Adama, Kouider & Salman, 2018). Amuda-Yusuf (2018) defines BIM as a methodology utilized in integrating digital descriptions of relationships among building digital objects, enabling stakehold-