# CHAPTER 5

## DISCUSSION

### 5.1 Introduction

This chapter presents an in-depth discussion of the research results presented in the previous chapter. Based on the study's objectives, the discussion synthesises the results in light of emerging perspectives specific to Ghana's construction industry, existing literature, and the adopted theoretical lenses. The goal is to contextualise the findings and highlight their practical implications for BIM adoption in Ghana.

The chapter is organised to respond to the research questions that are outlined in Chapter 1. The triangulation approach used to integrate the findings from the qualitative and quantitative studies allows the discussion to draw insights from descriptive statistics, EFA, CFA, SEM, and thematic analysis. This approach enriches the analysis and empirically grounds the proposed adoption framework and conclusions in empirical evidence. It highlights the specific structural, cultural, institutional, and resource-based factors that foster or impede BIM readiness and adoption within the Ghanaian context.

Additionally, the chapter situates the study's findings within the existing literature to identify convergences and divergences while emphasising emerging perspectives specific to the Ghanaian construction industry. Such a comparison helps to position Ghana's BIM adoption journey within the broader global and regional discourse on digital transformation in the construction industry.

Finally, the chapter presents a proposed framework for effective BIM adoption in Ghana's construction industry. Based on the insights derived throughout the study, this framework is structured to provide a roadmap for accelerating BIM implementation and promoting industry-wide digital transformation.

### 5.2 State of BIM Adoption

The findings reveal a transitional maturity state in Ghana's construction industry, with most organisations operating an overlap of BIM Levels 0 and 1. This foundational stage of adoption is characterised by the use of both 2D and 3D CAD models. Moreover, this suggests a predominant use of CAD tools and traditional

documentation methods, with emerging efforts towards basic collaboration. This finding aligns with the works of Abubakar et al. (2014) and Arayici and Aouad (2010), who reported similar trends in other developing countries where organisations tend to adopt BIM incrementally, often beginning with visualisation tools before moving toward integrated collaboration. According to Sampaio et al. (2021), such a gradual approach allows organisations to build their capacities and confidence in the technology before expanding to more advanced applications.

Despite respondents acknowledging that their project management and decision-making processes are guided by BIM, a disconnect between acknowledgement and operational execution is suggested by the relatively lower mean score for its integration into routine workflow practices. This observation suggests a growing recognition of BIM's value among organisations within the Ghanaian construction industry, although actual integration remains limited and fragmented. This "acknowledgement-implementation gap' echoes a similar finding by Siebelink et al. (2021) and Saka and Chan (2020), who emphasised that although AEC firms recognise BIM's strategic value, adoption is often hindered by a blend of technological, financial or human capital limitations.

The industry's limited implementation of BIM Levels 2 and 3 highlights the lack of collaboration and data integration. Interestingly, legal clarity and workflow alignment are key factors that Ahmed et al. (2022) and Saka and Chan (2020) suggested are needed to make collaborative BIM Levels operational. Unfortunately, these factors are often underdeveloped in emerging markets (Abubakar et al., 2014). Moreover, the high standard deviation (1.765 to 2.033) across all the BIM Levels suggests uneven adoption of BIM and differing technological capabilities among firms. This result provides proof of the industry's fragmented progress toward full digital maturity. Contextual challenges, such as the lack of a national BIM policy and inadequate technical capacity, likely account for this uneven progress. According to Evans et al. (2021), these challenges are often evident across countries where the government has not yet mandated the use of BIM.

The results of EFA and CFA showed a single component, with the item "BIM technologies are fundamental tools guiding our project management and decision-making" having the highest standard coefficient. This reflected its impact in shaping

respondents' perception of BIM while reinforcing the argument by Kassem and Succar (2017a) that early adoption is often more managerial and symbolic than process-driven, especially in developing contexts.

Also, the high mean score for BIM Level 1 compared to Levels 2 and 3 suggests that organisations may primarily be using BIM for 3D visualisation and clash detection rather than across the full project lifecycle. This form of limited adoption reflects what Rogers et al. (2019) identified as a trial-use collaborative stage. It is believed to be consistent with the early stages of the technology adoption lifecycle, where the application is selective rather than expansive. On the other hand, the relatively high rating of BIM's role in project decision-making suggests that top management and professionals in Ghana's construction industry have a conceptual belief in BIM's potential but are hindered by infrastructural constraints, lack of training, and an absence of local case studies (Boakye et al., 2022). Moreover, studies by Liu et al. (2017) and Olugboyega et al. (2023) found that limitations in capacity and organisational reluctance hindered full-scale integration despite firms recognising BIM's strategic advantages. Because of that, Park et al. (2019) emphasised that broader organisational change and stakeholder alignment are necessary for proper implementation.

The common use of BIM Level 0 and Level 1 practices by organisations indicates a hybrid operational environment in the Ghanaian construction industry with an overlap of digital and manual processes. Such a situation arises either due to resource constraints or continuous reliance on a traditional workforce that is not BIM-ready. A similar situation was reported in Malaysia by Latiffi et al. (2017), suggesting that BIM diffusion is often non-linear and is much affected by institutional readiness. The gap between perceived usefulness and actual application underscores the need for increased technical capacity, organisational change, and policy support. These changes are crucial for promoting a more consistent and higher-level adoption of BIM across Ghana's construction industry.

## 5.3 BIM Awareness and Knowledge among Construction Professionals in Ghana

This section discusses the findings related to the first research question: "What is the current state of BIM awareness and knowledge among construction

professionals in Ghana? The results indicate a range of BIM awareness and knowledge among Ghanaian construction professionals.

### 5.3.1 Industry BIM Awareness

A widespread high level of BIM awareness was observed in the results of both qualitative and quantitative studies, aligning closely with previous studies that have found an increasing global awareness of BIM's conceptual benefits (Adam et al., 2021; Osei-Kyei & Chan, 2017). Most participants reported having encountered BIM either in discussions or through software applications. However, their exposure is limited to their use as a 3D design and visualisation tool rather than an extensive digital construction management platform. This observation was reflected more in the interviews, where participants admitted to knowing about BIM in principle but lacking clarity on its full capabilities, procedures for adoption and benefits beyond visualisation. Participant IE5 added, *"...currently, the level of awareness is a bit high, but the knowledge of its application is now at the geometric level where BIM tools are used by most to translate a design into a 3D model for visualization purposes."* Participant IE11 reinforced this view, asserting that *"....most industry players view BIM simply as a design tool rather than a comprehensive process."* This finding is consistent with the assertions by Appiah (2020a) and Acquah et al. (2018), who, in earlier studies, noted that BIM knowledge in Ghana tends to be surface-level and largely conceptual, with practical application still limited. It further reflects a broader trend in many developing countries, where BIM is often misconstrued as merely a 3D design tool rather than a collaborative system that spans the whole construction project lifecycle (Abdallah et al., 2023; Adam et al., 2021; Eastman, 2011a).

The survey results provide quantitative substantiation and extension of these insights from the interviews. Respondents demonstrated a high level of awareness of BIM, extending beyond simple 3D modelling. Its role in enhancing visualisation, stakeholder communication and reducing errors is widely acknowledged. However, the respondents' moderate awareness of international standards and implementation roadmaps for BIM suggests significant gaps in awareness, which could ultimately impact the decision to adopt. This echoes the observation made by Babatunde et al. (2020), who noted that a lack of familiarity with standardised BIM protocols