



How Personal Background Shapes BIM Adoption: Linking Implementation Intentions and Concerns Through Behavioral Theory

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Abstract

Background and aim - Experts have ignored construction professionals' (CPs) interest and concerns in uncovering BIM implementation, relying on the assumption that once BIM is promoted, it will be implemented. This study contends that CPs are critical actors in BIM implementation, and it investigates their concerns and intentions toward BIM implementation, as well as the impact of their intentions and personal background on their concerns.

Methodology - By combining the Theory of Planned Behavior (TPB) and the Concerns-based Adoption Theory (CAT), the study gained insight into the role of positive and proactive personality and psychological capital in the formation of BIM implementation intentions and concerns. The BIM implementation intentions and concerns of the CPs were linked and captured in three hypotheses. Multiple Linear Regression was used to test the hypotheses.

Results - The CPs were concerned about their services, professional knowledge, and investment in BIM resources. The CPs are eager to learn more about BIM, why it is being proposed, and what it means for them. All of the CPs' intentions were discovered to have an impact on their concerns. BIM implementation programmes allow time for individual experience and interest in BIM, as well as give CPs enough time to learn BIM and become comfortable with BIM cycles.

Conclusion - The study concludes that the CPs' intention to implement BIM will not be realised until all of their critical issues are resolved.

Keywords: BIM implementation, BIM, BIM adoption, Theory of Planned Behavior, Concerns-based Adoption Theory

INTRODUCTION

Background

Construction professionals (CPs) play a central role in the successful implementation of Building Information Modelling (BIM) because they execute BIM tasks, follow established protocols, and provide discipline-specific expertise (Lindblad & Guerrero, 2020; Jin *et al.*, 2017). BIM, however, demands significant changes in traditional roles, relationships, and workflows. CPs must adopt new technologies, develop BIM competencies, and collaborate across a project's lifecycle (Zhang *et al.*, 2013). These expectations intersect with the reality that CPs differ widely in responsibilities, skills, and educational backgrounds—differences that make proactive attitudes and readiness essential to BIM success (Liu *et al.*, 2015). Despite repeated calls for training, workplace adjustments, and clearer definition of BIM roles and benefits, current BIM discourse often sidelines the perspectives of practitioners. Their intentions, concerns, and lived experiences are

frequently conflated with generic “barriers,” or assumed on their behalf (Olugboyega *et al.*, 2023; Liao *et al.*, 2021; Shukor *et al.*, 2021; Hall & Hord, 2020). This undermines implementation efforts and weakens the credibility of BIM strategies and policies.

BIM continues to evolve, producing differing interpretations and competency requirements across contexts (Liao *et al.*, 2021; Shukor *et al.*, 2021). CPs form their BIM concerns and intentions based on real problems, needs, goals, and opportunities encountered in practice (Shukor *et al.*, 2021). For this reason, researchers and industry stakeholders should not design implementation models without grounding them in practitioner interests and concerns (Hall & Hord, 2020; Olugboyega *et al.*, 2023; Shukor *et al.*, 2021). Understanding CPs’ perspectives is therefore not optional; it is the determining factor in whether BIM is adopted, delayed, or rejected (Olugboyega *et al.*, 2023). The existing literature on BIM adoption reveals several important gaps. First, much of the current research does not adequately centre the perspectives of construction professionals (CPs). Their concerns are often treated as generic “barriers” rather than examined as context-specific issues arising from everyday practice (Hall & Hord, 2020; Shukor *et al.*, 2021). Second, there is limited understanding of how CPs’ personal backgrounds—such as their professional discipline, years of experience, or demographic characteristics—influence their perceptions, concerns, and intentions regarding BIM. These individual factors remain largely overlooked in mainstream BIM studies.

A third gap lies in the scarcity of empirical evidence from developing countries. The persistent slow pace of BIM uptake in these contexts is insufficiently explained, largely because the motivations, apprehensions, and lived experiences of CPs have not been thoroughly investigated (Olugboyega *et al.*, 2023). Finally, while intentions are known to shape behaviour, the specific relationship between CPs’ BIM implementation intentions and their concerns has not been adequately explored (Liao *et al.*, 2021; Shukor *et al.*, 2021). This disconnect limits the development of grounded, practitioner-relevant strategies for BIM adoption. Understanding CPs’ perspectives is crucial for effective BIM implementation. Prioritizing their viewpoints allows for an accurate reading of their intentions and concerns instead of relying on assumptions. It also helps explain why BIM adoption may stall or proceed unevenly and supports the development of implementation strategies that are practical and aligned with real project conditions. In addition, it provides clearer direction on how traditional work processes can be adapted to foster self-driven and sustainable BIM uptake (Hall & Hord, 2020). Ultimately, BIM succeeds only when the professionals expected to use it understand it, accept it, and see tangible value in its integration.

Against this background, the study addresses one central research question: How do construction professionals’ BIM implementation intentions and personal backgrounds influence their concerns about BIM implementation? To unpack this, the study also explores three supporting questions: What concerns do CPs hold regarding BIM implementation? How do CPs’ personal backgrounds—such as discipline, experience, and training—shape their BIM intentions and concerns? How do CPs’ BIM implementation intentions influence the nature and intensity of their concerns? The study makes four key contributions. It provides a practitioner-centred understanding of BIM concerns and intentions, addressing a major gap in current research. It offers empirical insight into why BIM adoption remains slow in developing countries, where contextual and practitioner-level challenges are often neglected. It establishes a foundation for anticipating future needs related to the uptake of emerging technologies and new work methodologies. Finally, it informs the design of policies, training programmes, and implementation strategies that respond directly to CPs’ actual experiences rather than externally imposed assumptions.

1.2 Literature review

1.2.1 Prior work's contributions to understanding the link between CPs' BIM implementation intentions, their personal backgrounds, and their BIM-related concerns

Previous studies offer valuable insights into how construction professionals' (CPs') intentions and personal backgrounds shape their concerns about BIM implementation. The recognition of CPs as central actors in BIM adoption stems from their formal responsibilities, expected contributions, and obligation to follow BIM standards and use BIM tools (Lindblad & Guerrero, 2020). These expectations place their cognitive processes—how they perceive BIM, assess its value, and respond to its demands—at the heart of implementation outcomes (Jin *et al.*, 2017). When CPs view BIM as disproportionately benefiting clients rather than practitioners, their motivation to adopt it weakens, as shown by Jin *et al.* (2017). Similarly, Zhang *et al.* (2013) demonstrate that perceived inequities in benefits and excessive expectations can fuel dissatisfaction and undermine willingness to engage with BIM.

As BIM reshapes traditional work roles and relationships, CPs are required to develop new competencies, adapt workflows, and assume expanded responsibilities (Adam *et al.*, 2013). Successful implementation depends on active collaboration across the project lifecycle and the seamless exchange of data—tasks that demand both technical skill and behavioural readiness (Liu *et al.*, 2015). These escalating requirements influence the quality and performance of CPs, as highlighted by Olugboyega and Windapo (2019), but they also intersect with the substantial variation in CPs' backgrounds, skills, experience, and education. Such differences help explain why CPs do not respond uniformly to BIM. They also highlight why personal attributes, especially the capacity to manage change, matter. One attribute that emerges as particularly relevant is proactive personality. Research in organisational behaviour describes proactive personality as a stable tendency to take initiative, shape one's environment, and pursue improvements without waiting for external prompts (Crant *et al.*, 2016). Maan *et al.* (2020) show that proactive individuals are more likely to build adaptability resources, remain engaged in their work, and persist in solving problems. Proactivity is associated with higher job satisfaction and stronger motivation to apply one's capabilities. It also moderates key developmental outcomes—for example, Li *et al.* (2020) find that proactive personality strengthens the link between thriving at work and career adaptability.

These studies indicate that personal factors—especially proactive personality—play a major role in shaping how CPs experience BIM. Proactive professionals are more inclined to embrace new expectations, navigate uncertainty, and integrate unfamiliar digital practices. They rely less on external pressures and more on internal motivation and psychological resources to adapt. As a result, they are likely to experience different concerns, or interpret the same concerns differently, compared to less proactive peers. These insights suggest that CPs' implementation intentions and their personal characteristics—ranging from professional background to individual disposition—directly influence the concerns they develop about BIM. They shape whether BIM is seen as an opportunity or a burden, whether new responsibilities feel empowering or overwhelming, and whether organisational change is approached with resistance or initiative. Understanding this interplay is essential for explaining variations in BIM adoption behaviour and for designing support strategies that respond to the realities of those expected to implement BIM.

1.2.2 Research gaps relating to how CPs' BIM implementation intentions and personal backgrounds influence their concerns.

Although previous studies underline the central role of construction professionals (CPs) in BIM implementation, they also reveal several gaps in understanding how CPs' intentions and personal characteristics shape their concerns about BIM. Research has established that CPs are expected to take on expanded responsibilities, comply with BIM protocols, and use BIM tools effectively

(Lindblad & Guerrero, 2020). These expectations place their cognitive processes at the core of successful implementation (Jin *et al.*, 2017). Yet the literature stops short of examining how these cognitive responses—such as scepticism or reluctance—emerge from CPs’ backgrounds and professional realities. For example, the belief that BIM disproportionately benefits clients continue to suppress CPs’ motivation to adopt BIM (Jin *et al.*, 2017). Similarly, perceptions of uneven benefits and unrealistic expectations create dissatisfaction and hinder adoption (Zhang *et al.*, 2013). What remains unclear is how such perceptions differ across individuals and how personal attributes shape these concerns. Another gap arises from the growing mismatch between BIM’s demands and the varied profiles of CPs. BIM requires significant shifts in roles, collaboration patterns, and technical capability (Adam *et al.*, 2013; Liu *et al.*, 2015). These pressures influence CPs’ competence and work quality (Olugboyega & Windapo, 2019), but studies rarely investigate how differences in CPs’ backgrounds—discipline, experience, training, or exposure—affect their willingness or hesitation to meet these demands. The literature acknowledges that CPs differ widely in attributes and capacities, yet the implications of these differences for their BIM concerns remain understudied.

A further gap concerns personal disposition, particularly proactive personality. Research outside the BIM domain shows that proactive individuals are more adaptable, motivated, and capable of navigating complex demands (Crant *et al.*, 2016; Maan *et al.*, 2020). They engage deeply with their work, pursue solutions persistently, and display higher job satisfaction. Proactivity also enhances the impact of thriving on career adaptability (Li *et al.*, 2020). However, BIM research has not adequately explored how such personality traits shape CPs’ responses to BIM requirements or how proactivity moderates BIM-related concerns. Given BIM’s demands for initiative, continuous learning, and change management, this omission represents a significant knowledge gap. While prior studies highlight CPs’ centrality, changing roles, and the psychological weight of BIM adoption, the literature has not yet connected these insights to a systematic understanding of how CPs’ intentions and personal backgrounds shape the concerns they develop about BIM. The interplay between structural expectations, individual differences, and psychological dispositions remains largely unexplored. Addressing this gap is essential for explaining variations in BIM adoption behaviour and for designing support strategies that align with the realities, motivations, and capabilities of the practitioners expected to implement BIM.

1.2.3 Theoretical Framework: How CPs’ BIM Intentions and Personal Backgrounds Shape Their Concerns

This study draws on two complementary theories—the Theory of Planned Behaviour (TPB) and the Concern-Based Adoption Model (CBAM)—to explain how construction professionals’ (CPs’) intentions toward BIM, along with their personal backgrounds, influence the nature and intensity of their implementation concerns. TPB positions proactive personality and prior dispositions as central to how individuals form intentions. According to Ajzen and Albarracín (2007), Olson *et al.* (2020), and Hall and Hord (2020), intentions emerge from three belief structures: behavioural beliefs (what one expects to gain), normative beliefs (perceived social expectations), and control beliefs (perceived capability and constraints). These belief structures do not develop in isolation; they are shaped by factors such as training, discipline, professional exposure, and overall experience. In the context of BIM, CPs’ personal backgrounds therefore act as filters that shape how they evaluate the usefulness, effort, and feasibility of adopting new digital methods.

While TPB explains why intentions form, CBAM explains how individuals experience and respond to change. The concern-based perspective recognises that professionals undergoing or anticipating a transformation move through identifiable stages of questioning and adjustment. Their concerns tend to shift from self-oriented issues (for example, “What does this change mean for me?”) to task-oriented and impact-oriented considerations (“How will this work?”, “What results will it produce?”). Hall and Hord (2020) emphasise that these concerns evolve as

individuals gain clarity, competence, and engagement. This progression is directly shaped by their backgrounds and their readiness for change. Integrating these theories suggests that BIM adoption is neither linear nor purely technical. It is cyclical, time-intensive, and dependent on how CPs position themselves within the change. Their academic qualifications, disciplinary training, and experience influence their interpretations of BIM, their confidence in using it, and the types of concerns that surface at each stage of adoption. As BIM is a specialised and knowledge-dependent domain, its success rests heavily on professionals' perceptions—whether they see it as enabling, intrusive, feasible, or opaque.

Understanding these dynamics is essential for the construction industry. A CPs-centric approach becomes the foundation for effective BIM implementation: organisations must recognise the intentions driving practitioners' choices and the concerns that may slow or redirect adoption. Analysing behavioural responses to change provides insight into these intentions and concerns, allowing interventions—guidance, training, or support—to be targeted more accurately. Ultimately, BIM succeeds when the professionals responsible for delivering it see value, possess clarity, and feel equipped to carry it forward. From this integrated theoretical grounding, the study proposes the following hypotheses:

Hypothesis 1: There is a correlation between academic qualifications (Hypothesis 1a), profession (Hypothesis 1b), length of experience (Hypothesis 1c), and the intentions of construction professionals to utilise BIM.

Hypothesis 2: There exists a correlation between academic qualifications (Hypothesis 2a), profession (Hypothesis 2b), length of experience (Hypothesis 2c), and concerns related to BIM among construction professionals.

Hypothesis 3: Construction professionals' concerns about BIM implementation significantly influence their intentions to adopt BIM.

These propositions (as illustrated in Figure 1) reflect a theory-driven expectation where BIM adoption is shaped by who the professionals are, how they interpret change, and the concerns that arise as they confront the demands of a digitally transformed workflow.

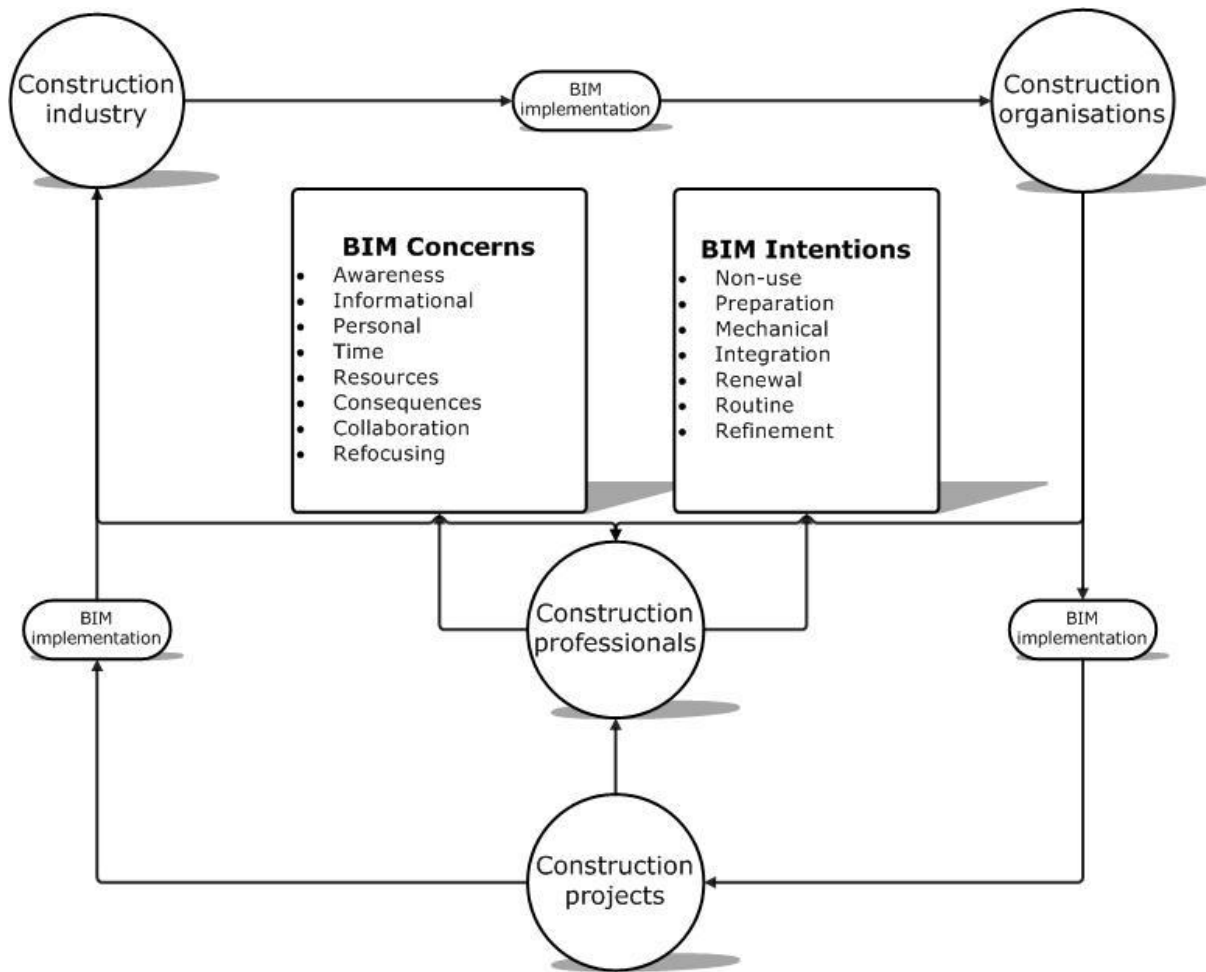


Figure 1: Research framework

METHODS

This study adopts a positivist research paradigm, grounded in the belief that the behaviour of construction professionals can be objectively examined through measurement, observation, and statistical reasoning (Park *et al.*, 2020). Positivist inquiry seeks to uncover predictable relationships among variables; for this reason, a structured questionnaire survey was employed to test the relationships between construction professionals’ BIM implementation intentions, their concerns, and their personal background characteristics (Davies and Fisher, 2018). The research extends the Theory of Planned Behaviour (TPB) by integrating the Concern-Based Adoption Model (CBAM) to generate a more comprehensive explanation of how background factors shape intentions and how professionals experience the practical and psychological demands of BIM adoption. While TPB explains how intentions emerge from behavioural, normative, and control beliefs, CBAM clarifies the staged nature of concerns that professionals experience as they encounter or anticipate change. These theories justify examining eight intention dimensions—orientation, preparation, mechanical use, integration, routine, refinement, renewal, and non-use—and eight concern dimensions—awareness, informational, personal, time, resource, consequence, collaboration, and refocusing.

Each of these reflects a theoretically established phase of adoption behaviour. TPB accounts for the formation of intention, while CBAM accounts for how individuals process, question, and respond to new practices. The target population comprised construction professionals who live and work in construction organisations in Nigeria. A random sampling approach was used to strengthen internal and external validity and reduce potential biases related to sampling or selection (Noor *et*

al., 2022). Member registers from the Federation of Construction Industry (FOCI) were compiled to create a comprehensive sampling frame. Using a 95% confidence level and a 0.05 margin of error, a representative sample was selected by generating random numbers with the RAND function in Microsoft Excel. Out of 298 individuals contacted, 273 completed the survey, yielding a response rate of 91.6 per cent. Respondents were not required to have prior BIM experience; their academic qualifications, professional discipline, and years of experience were documented to capture meaningful variation across the sample. The demographic characteristics of the participants are displayed in Table 1.

The questionnaire included sixteen items measured on a five-point Likert scale, designed to assess participants' agreement with statements reflecting BIM-related intentions and concerns. The instrument underwent a rigorous validation process. Content validity was first established through expert review, drawing on three academics with BIM specialisation and two senior industry practitioners, who assessed the clarity and relevance of each item. Their recommendations led to refinements in wording, sequencing, and scale layout. A pilot test involving twenty-five construction professionals (excluded from subsequent analysis) allowed further adjustment based on item comprehension, completion time, and preliminary statistical behaviour. Construct validity was then examined through exploratory factor analysis, which confirmed that items loaded cleanly onto the eight concern and eight intention constructs with factor loadings exceeding 0.50 and minimal cross-loading. In addition, reliability testing using Cronbach's alpha produced values ranging from 0.72 to 0.89 for concern constructs and from 0.70 to 0.92 for intention constructs, confirming strong internal consistency across all dimensions.

Likert responses were treated as quasi-continuous measures, a widely accepted approach in behavioural research when scales demonstrate strong reliability and approximate normal distribution. Where constructs involved more than one item during the pilot phase, subscale scores were calculated by averaging responses; in the final instrument, each intention and concern dimension was represented by a theoretically grounded single item, retaining the interpretive clarity of TPB and CBAM constructs. Data analysis was conducted using regression techniques tailored to the nature of the variables. Because academic qualifications, professional discipline, and experience are ordinal or interval-scale variables, and because the intention and concern measures behaved as ordinal linear variables with acceptable distributional properties, multiple ordinal linear regression was used to examine how background characteristics predicted BIM-related intentions and concerns. This approach is consistent with behavioural modelling practices that treat Likert-based indicators as suitable outcomes when they demonstrate adequate reliability and approximate continuity. To examine the direct relationship between intentions and concerns—both measured on Likert scales—multiple linear regression was applied. This choice is justified on the basis that five-point Likert measures can reasonably be treated as continuous when internal consistency is high and scale behaviour meets basic normality assumptions. The linear framework also aligns logically with TPB's proposition that beliefs and concerns exert linear influence on intention.

Multicollinearity diagnostics were performed prior to regression analysis. Tolerance values were below one and variance inflation factor (VIF) scores did not exceed a value of 11, indicating moderate but acceptable relationships among predictors and ruling out severe collinearity that might compromise coefficient estimation (refer to Table 2). Several measures were implemented to minimise the risk of Type I error. The instrument's content and construct validation procedures reduced measurement error, while high reliability coefficients helped prevent random noise from producing artificially significant effects. Multicollinearity checks reduced model misspecification risks, and all hypothesis testing was theory-driven rather than exploratory, thereby limiting the probability of false-positive findings. A conventional significance level of 0.05 was adopted, with results interpreted alongside effect sizes to avoid over-reliance on p-values.

Table 1: Demographics of the construction professionals

Demographics	Percentage
Number of respondents	273
Designation of respondents	Construction manager (32.95%), director (96.8%), facilities manager (5.68%), project manager (42%), others (12.5%)
Academic qualification	OND (1.14%), HND (12.5%), BSc (53.41%), MSc (28.41%), PhD (4.54%)
Profession	Architect (29.55%), Builder (27.27%), Electrical Engineer (3.41%), Facility manager (5.68%), Mechanical Engineer (5.68%), Quantity Surveying (12.5%), Town Planner (2.27%), Geotechnical Engineer (2.27%), Structural Engineer (11.36%)
Length of Experience	Less than 5 years (39.77%), 5-10 years (36.36%), 11-15 years (12.5%), 16-20 years (6.81%), 21 years and above (4.54%)
Number of projects executed	Less than 5 projects (40.9%), 5-10 projects (32.95%), 11-15 projects (15.9%), 16-20 projects (6.81%), 21 projects and above (3.40%)

Table 2: Collinearity statistics

BIM implementation concerns	Link between BIM implementation concerns, academic qualifications (AQ), profession (P), and level of experience (LE)		Link between BIM implementation concerns and intentions	
	Tolerance	VIF	Tolerance	VIF
Awareness concerns	AQ (0.943), P (0.800), LE (0.767)	AQ (1.060), P (1.251), LE (1.304)	0.843	1.187
Informational concerns	AQ (0.943), P (0.800), LE (0.767)	AQ (1.060), P (1.251), LE (1.304)	0.077	12.907
Personal concerns	AQ (0.943), P (0.800), LE (0.767)	AQ (1.060), P (1.251), LE (1.304)	0.089	11.252
Time concerns	AQ (0.943), P (0.800), LE (0.767)	AQ (1.060), P (1.251), LE (1.304)	0.184	5.425
Resources concern	AQ (0.943), P (0.800), LE (0.767)	AQ (1.060), P (1.251), LE (1.304)	0.300	3.330
Consequences concerns	AQ (0.943), P (0.800), LE (0.767)	AQ (1.060), P (1.251), LE (1.304)	0.340	2.943
Collaboration concerns	AQ (0.943), P (0.800), LE (0.767)	AQ (1.060), P (1.251), LE (1.304)	0.312	3.209
Refocusing concerns	AQ (0.943), P (0.800), LE (0.767)	AQ (1.060), P (1.251), LE (1.304)	0.390	2.565

RESULTS

Link between academic qualifications, profession, length of experience, and BIM implementation intentions of construction professionals

To test hypothesis 1, a multiple linear regression (MLR) of the link between academic qualifications, profession, length of experience, and BIM implementation intentions of construction professionals was conducted and presented in Table 3. The results in the table show that the academic qualification, profession, and length of experience of the CPs dependably anticipate their BIM implementation intentions. As shown in the table, the R2 values for the variables portray a dependable proportion of their intentions: *orientation* (19.3%), *preparation* (17.2%), *mechanical* (13.95%), *integration* (9.6%), *renewal* (9.2%), *routine* (7.8%), *refinement*

(13.6%), and *non-use* (6%). Academic qualification was uncovered to fundamentally affect every one of the CPs' intentions [*orientation* ($r=0.330$, $p=0.000$), *preparation* ($r=0.241$, $p=0.000$), *mechanical* ($r=0.384$, $p=0.000$), *integration* ($r=0.364$, $p=0.000$), *renewal* ($r=0.391$, $p=0.000$), *routine* ($r=0.264$, $p=0.000$), *refinement* ($r=0.363$, $p=0.000$), and *non-use* ($r=0.330$, $p=0.000$)]. The CPs' profession was only positive and significant correlated with *orientation* ($r=0.022$, $p=0.003$). The results uncovered that CPs' experience positively and significantly affects the *non-use of BIM* ($r=0.004$, $p=0.003$) and seeking of alternative to BIM ($r=0.154$, $p=0.000$). The T-statistics and F-statistics revealed that the results are dependable and exact. The outcomes completely support hypothesis 1.

Link between academic qualifications, profession, length of experience, and BIM implementation concerns of construction professionals

Table 3 presents the MLR that was conducted to validate hypothesis 2. As displayed in the table, academic qualifications, profession, and length of experience reliably predict the CPs' BIM implementation concerns [*awareness concerns* ($R^2=8\%$), *informational concern* ($R^2=5.7\%$), *consequences concern* ($R^2=1.5\%$)]. *Collaboration concern* ($R^2=3.2\%$), and *refocusing concern* ($R^2=13.4\%$). As indicated by the table, academic qualification was not positively and significantly associated with any of the BIM implementation concerns. The profession of the CPs only had a positive and critical relationship with *awareness concern* ($r=0.051$, $p=0.001$) and *time concern* ($r=0.012$, $p=0.000$). Experience of the CPs was found to be emphatically and fundamentally connected with *awareness concern* ($r=0.205$, $p=0.001$), *resources concern* ($r=0.132$, $p=0.000$), and *consequences concern* ($r=0.015$, $p=0.000$). The values of the T-statistics and F-statistics showed that the outcomes are measurably critical and solid. This outcome offers fractional support for hypothesis 2.

Table 3: Multiple Ordinal Linear Regression of the link between BIM implementation intentions, concerns, academic qualifications, profession, and level of experience

BIM implementation intentions	Constant	Academic qualification	Profession	Experience	R²	T-stat	F-stat	Sum of squares	Mean square	p-value	Durbin-Watson
Non-use	3.736	0.330	-0.129	-0.171	0.193	7.077	6.698	23.551	7.850	0.000	1.634
preparation	3.922	0.241	-0.144	-0.104	0.172	7.334	5.802	20.934	6.978	0.000	1.443
Mechanical	3.253	0.384	-0.106	-0.138	0.139	5.615	4.537	19.211	6.404	0.000	1.590
Integration	2.948	0.364	-0.069	-0.137	0.096	5.053	2.989	12.837	4.279	0.000	1.645
Renewal	2.266	0.391	-0.063	0.154	0.092	3.793	2.847	12.817	4.272	0.000	2.012
Routine	3.539	0.264	-0.065	-0.165	0.078	5.929	2.361	10.612	3.537	0.000	2.124
Refinement	3.062	0.363	-0.103	-0.082	0.136	5.741	4.418	15.853	5.284	0.000	2.442
Orientation	1.647	0.072	0.022	0.004	0.006	3.060	0.165	0.604	0.201	0.003	2.190
Number of positive and significance correlations		8	1	2							
Support or hypotheses		Support H1a	Support H1b	Support H1c							
BIM implementation concerns	Constant	Academic qualification	Profession	Experience	R²	T-stat	F-stat	Sum of squares	Mean square	p-value	Durbin-Watson
Awareness	1.923	-0.174	0.051	0.205	0.080	3.534	2.450	9.158	3.053	0.001	1.771
Informational	3.345	-0.281	-0.088	0.211	0.057	5.598	1.708	7.692	2.564	0.000	1.330
Personal	3.446	-0.329	-0.052	-0.122	0.055	6.303	1.625	6.126	2.042	0.000	1.550
Time	2.622	-0.141	0.012	0.111	0.023	5.046	0.666	2.269	0.756	0.000	1.555
Resources	2.644	-0.032	-0.022	0.132	0.010	4.229	0.289	1.426	0.475	0.000	1.989
Consequences	4.070	-0.359	-0.054	0.015	0.055	6.501	1.629	8.055	2.685	0.000	1.895
Collaboration	3.496	-0.007	-0.032	-0.163	0.032	5.549	0.937	4.692	1.564	0.000	2.284
Refocusing	0.954	-0.363	0.007	0.243	0.134	1.756	4.315	16.071	5.357	0.083	2.259
Number of positive and significant coefficient		0	2	5							
Support for hypotheses		Did not support H2a	Support H2b	Support H2c							

Impact of BIM implementation concerns on BIM implementation intentions of construction professionals

As per Table 4, the greatest concern of the CPs was ‘consequence concerns’ (MS=3.75). The next most significant concern that the CPs are having about BIM was "resources concern" (MS=3.73). The results uncovered an elevated degree of concern for BIM information and BIM-competent professionals (informational concern – MS = 3.65 and collaboration concern – MS = 3.63). Personal concern (MS = 3.54) is another huge BIM implementation concern of the CPs, as displayed in Table 3. As indicated by this outcome, construction professionals were concerned they would not be able to fund BIM implementation and would neglect to satisfy the implementation needs. This recommends the requirement for explicit professional development training for construction professionals based on their concerns and to guarantee that they can voice their viewpoints during the implementation process, as well as outfitting them with data connected with the aftereffect of the implementation to decrease their interests.

As displayed in Table 3, the CPs’ intentions for BIM implementation profoundly incorporate orientation (MS = 4.00), preparation (MS = 3.98), mechanical (MS = 3.84), integration (MS = 3.83), renewal (MS = 3.70), routine (MS = 3.61), and refinement (MS = 3.61). The CPs intended to make a move on the utilisation of BIM (Non-use of BIM = 1.97). This outcome proposes that the CPs will find out about BIM, plan the utilisation of BIM, thoroughly consider BIM, and settle on how BIM affects them. This implies that the CPs will take drives to find out about BIM. This means that the time has come to move BIM ideas and speculations from research articles to textbooks and social media where the CPs can easily access BIM information.

Table 4: Degree of BIM implementation concerns and intentions

BIM implementation concerns	Mean score
Awareness concern - <i>I am not concerned about BIM</i>	1.95
Informational concern – <i>I do not have adequate information on BIM</i>	3.65
Personal concern – <i>I do not know how BIM will improve my services</i>	3.54
Time concern – <i>I do not have time to use BIM</i>	3.63
Resources concern – <i>I do not have the resources to use BIM</i>	3.73
Consequence concern – <i>I do not know how the use of BIM will affect clients and projects</i>	3.75
Collaboration concern – <i>there are no BIM-competent professionals that I can work with</i>	3.63
Refocusing concern – <i>I have new ideas about BIM</i>	2.64
BIM implementation intentions	
Orientation – <i>I will take the initiative to learn more about BIM</i>	4.00
Preparation – <i>I will develop plans to begin using BIM</i>	3.98
Mechanical – <i>I will make changes to better organize and use BIM</i>	3.84
Integration – <i>I will coordinate with other project participants and colleagues using BIM</i>	3.83
Renewal – <i>I will seek more effective alternative to the established use of BIM</i>	3.70
Routine – <i>I will have an established pattern of BIM use</i>	3.61
Refinement – <i>I will make changes to BIM principles to increase its value</i>	3.61
Non-use – <i>I will not take action on the use of BIM</i>	1.97

An MLR of the impact of BIM implementation concerns on the BIM implementation intentions of construction professionals was conducted to test hypothesis 3. The results of the MLR are presented in Table 5 and show that BIM implementation reliably predicts the dependent variable

(BIM implementation concern). The CPs' BIM implementation intentions accounted for 21.1% of their *awareness concern*, 9.1% of *informational concern*, 13.8% of *personal concern*, and 28.5% of *time concern*. The other proportion of variance in BIM implementation concerns as accounted for by the BIM implementation intentions of the CPs is *resources concern* (7.3%), *consequences concerns* (19.2%), *collaboration concerns* (14.9%), and *refocusing concern* (24.8%). The table revealed that the 'orientation' of the CPs had the highest number of positive and significant coefficients, firmly followed by the 'routine'. "Renewal" had the least positive and significant coefficient. All the BIM implementation intentions of the CPs affect their BIM implementation concerns, as each of the variables has at least one positive and significant coefficient. This outcome offers full support for hypothesis 3.

'Orientation' is firmly associated with *consequences concern* ($r=0.438$, $p=0.001$) and *awareness concern* ($r=0.358$, $p=0.000$). The effect of orientation on *personal concern* ($r=0.271$, $p=0.001$), *time concern* ($r=0.299$, $p=0.000$), and *resources concern* ($r=0.146$, $p=0.004$) is additionally unequivocally positive and significant. *Preparation intention* was found to be emphatically, decidedly, and essentially connected with *time concerns* ($r=0.127$, $p=0.000$) and *resources concern* ($r=0.289$, $p=0.004$). *Mechanical intentions* have positive and critical relationship with *awareness concerns* ($r=0.096$, $p=0.000$), *personal concerns* ($r=0.433$, $p=0.001$), and *consequence concern* ($r=0.647$, $p=0.001$). *Renewal* was positively significantly correlated with *resources concern* ($r=0.039$, $p=0.004$); while integration had strong, positive, and significant association with *awareness concern* ($r=0.226$, $p=0.000$), *personal concern* ($r=0.223$, $p=0.001$), and *time concern* ($r=0.459$, $p=0.000$). As uncovered in the table, *routine intention* was firmly and emphatically critical with *awareness concern* ($r=0.271$, $p=0.000$), *personal concern* ($r=0.159$, $p=0.001$), *time concern* ($r=0.365$, $p=0.000$), and *resource concern* ($r=0.255$, $p=0.004$). The connections between *personal concern* and *refinement* ($r=0.159$, $p=0.001$), *consequences concern* and *refinement* ($r=0.077$, $p=0.001$), *time concern* and *non-use* ($r=0.088$, $p=0.000$), *resource concern* and *non-use* ($r=0.040$, $p=0.004$), and *consequences concern* ($r=0.239$, $p=0.001$) were firmly positive and critical. The results in table 5 further show that all the T-statistics are positive and above 2.0 (implying reliability and precision) and that BIM implementation intentions measurably and altogether anticipate BIM implementation concerns.

Table 5: Multiple Linear Regression of the link between BIM implementation intentions and concerns

BIM implementation concerns	k	β_1	β_2	β_3	β_4	β_5	β_6	β_7	β_8	R²	T-stat	F-stat	Sum of squares	Mean square	p-value	Durbin-Watson
Awareness	1.837	0.358	-0.306	0.096	0.226	-0.117	0.271	-0.134	-0.177	0.211	3.658	2.646	24.054	3.007	0.000	1.634
Informational	1.514	0.239	-0.266	0.375	0.254	-0.095	0.033	-0.011	-0.156	0.091	2.590	0.990	12.191	1.524	0.011	1.443
Personal	1.761	0.271	-0.366	0.433	0.223	-0.487	0.159	0.069	-0.012	0.138	3.386	1.582	15.423	1.928	0.001	1.590
Time	1.758	0.299	0.127	-0.381	0.459	-0.398	0.365	-0.229	0.088	0.285	3.970	3.940	27.831	3.479	0.001	1.645
Resources	1.774	0.146	0.289	-0.223	-0.148	0.039	0.255	-0.063	0.040	0.073	2.944	0.776	10.158	1.270	0.004	2.012
Consequences	1.582	0.438	-0.316	0.647	-0.148	-0.440	-0.007	0.077	0.239	0.192	2.745	2.350	28.161	3.520	0.001	2.124
Collaboration	1.679	0.205	0.224	0.002	-0.030	-0.324	-0.160	0.372	0.131	0.149	2.853	1.732	21.617	2.702	0.006	2.442
Refocusing	0.917	0.131	-0.578	0.400	0.359	0.031	0.274	-0.190	0.116	0.248	2.909	3.254	29.832	3.729	0.073	2.190
Number of positive and significant coefficient	5	2	3	3	1	4	2	3								
Support for hypotheses	Support H3	Support H3	Support H3	Support H3	Support H3	Support H3	Support H3	Support H3	Support H3							
BIM implementation intentions: β_1 =orientation, β_2 =preparation, β_3 =mechanical, β_4 =integration, β_5 =renewal, β_6 =routine, β_7 =refinement, β_8 =non-use, k=constant																

DISCUSSION

Link between academic qualifications, profession, length of experience, and BIM implementation intentions of construction professionals

The results suggest that the intentional effort of certain CPs to acquire knowledge about BIM may be limited. Notably, professionals in disciplines such as urban planning and geotechnical engineering tend to perceive BIM as less relevant or even inconsequential. This perception may stem from a combination of factors, including limited demand for BIM within their daily responsibilities or a scarcity of tasks that require direct engagement with BIM tools and processes. The findings indicate that a CP's professional background is a significant predictor of their BIM implementation intentions, with those more closely involved in project delivery demonstrating stronger motivation to adopt and explore BIM methodologies. Conversely, CPs whose roles are less central to direct project execution may perceive BIM as nonessential, reducing their likelihood of pursuing skill development or practical engagement (Lindblad and Guerrero, 2020). Academic qualification also appears to exert a notable influence on BIM implementation intentions. Professionals with advanced degrees exhibit a greater propensity to seek knowledge about BIM, develop the necessary skills for its effective use, collaborate with colleagues to leverage its capabilities, and actively explore alternative implementation approaches. This pattern likely reflects both their scholarly aptitude and a heightened appreciation for continuous learning and professional development. The awareness of competitive advantage associated with BIM, as observed among highly educated CPs, may further reinforce their enthusiasm and proactive engagement with the technology (Olugboyega and Windapo, 2019).

Professional experience, or tenure, similarly shapes BIM engagement. Some seasoned practitioners may demonstrate reluctance toward adopting BIM due to entrenched work habits, apprehension about ongoing technological advancements, or perceived complexity in integrating BIM into established practices. In contrast, professionals in the early stages of their careers tend to exhibit higher enthusiasm and a stronger aptitude for acquiring BIM-related knowledge, either through formal education or skill-enhancement initiatives. However, early-career engagement requires discernment and intellectual acuity to navigate the practical applications of BIM effectively within existing workflows, as well as persistence and strategic planning to ensure consistent, high-quality utilisation (Liao *et al.*, 2021; Shukor *et al.*, 2021). Experienced computational practitioners, by contrast, understand that although BIM may appear conceptually straightforward, successful implementation requires ongoing verification, planning, and adaptation to project-specific contexts. These findings provide empirical support for Hypothesis 1, which posits a relationship between CPs' academic qualifications (Hypothesis 1a), profession (Hypothesis 1b), and length of experience (Hypothesis 1c) and their intentions to adopt and utilise BIM. The evidence indicates that both formal education and professional context shape the motivation and capability of CPs to engage with BIM, highlighting the importance of aligning training and implementation strategies with practitioners' backgrounds to promote effective adoption.

Link between academic qualifications, profession, length of experience, and BIM implementation concerns of construction professionals

The study's findings indicate that even among CPs occupying pivotal roles in project design, such as architects and civil engineers, there exists a surprisingly limited interest in the adoption of BIM. This phenomenon may be attributed, in part, to the selective integration of digital technologies into existing workflows, which often focuses on specific tools or isolated applications rather than a comprehensive, process-wide adoption of BIM. As a result, the perceived relevance and urgency of BIM may be diminished within these professional domains, contributing to a lower level of engagement. Empirical observations further reveal that CPs' perceptions of BIM—specifically regarding awareness, data management, time commitment, resource allocation, and expected

outcomes—are influenced by both educational attainment and professional experience. Professionals with higher academic qualifications and extensive experience tend to exhibit more nuanced concerns about the practical demands of BIM, including its intrinsic value, the temporal investment required, and the resources necessary for effective implementation. This pattern suggests that CPs with substantial knowledge and expertise are not only more aware of BIM's potential benefits but are also more deliberate in evaluating the operational implications and strategic value of integrating it into their practice. Such professionals recognise that mastery of BIM may confer a competitive advantage, motivating them to carefully consider its practical application before fully committing to its implementation.

These findings provide empirical support for Hypothesis 2, which posits a relationship between CPs' academic qualifications (Hypothesis 2a), professional discipline (Hypothesis 2b), and years of experience (Hypothesis 2c) and their concerns regarding BIM adoption. In essence, higher educational and professional attainment is associated with more sophisticated and strategically oriented concerns. This observation is consistent with the work of Crant *et al.* (2016), Maan *et al.* (2020), and Li *et al.* (2020), who argue that individuals with proactive personality traits actively engage with innovations that enhance career growth, adaptability, and professional achievement. Similarly, it aligns with the perspectives of Olson *et al.* (2020) and Hall and Hord (2020), who emphasise that professionals prioritising competitiveness and growth are more likely to anticipate change, adopt new practices willingly, and navigate transformational processes within their field. The study underscores that concerns about BIM are not merely barriers or resistance; rather, they reflect a considered evaluation of the technology's demands, benefits, and strategic relevance, particularly among highly educated and experienced professionals. Understanding these nuanced concerns is essential for designing implementation strategies that account for CPs' expertise, motivations, and expectations, thereby facilitating more effective and sustained adoption of BIM within the construction industry.

Impact of BIM implementation concerns on BIM implementation intentions of construction professionals

The findings of this study provide strong support for Hypothesis 3, which posits that CPs' concerns regarding BIM implementation significantly influence their intentions to adopt the technology. These results are consistent with the work of Adam *et al.* (2013), Liu *et al.* (2015), and Olugboyega and Windapo (2019), who highlight that the evolving expectations associated with BIM are reshaping the traditional responsibilities, relationships, and operational practices of CPs. The transformation requires professionals to develop a comprehensive understanding of BIM, cultivate collaborative skills, and engage strategically with the technology to realize its potential. The primary concerns expressed by CPs center on several key dimensions, including the availability of BIM information, depth of knowledge, anticipated time investment, access to necessary resources, perceived value, and capacity for effective utilisation. These concerns indicate a proactive interest in acquiring the knowledge and skills required to navigate BIM's technical and collaborative demands. Professionals are particularly attentive to BIM's interactive processes, requisite components, and project impacts. Despite ongoing efforts to understand BIM, many CPs have not yet expressed significant apprehension about its adoption, reflecting a focus on comprehension rather than resistance. Their concerns, however, extend to the implications of BIM on professional practice, time allocation for BIM-related responsibilities, and resource management. Lindblad and Guerrero (2020) emphasize that CPs recognize the critical role they play in BIM adoption, which arises from both their expected duties and anticipated compliance with BIM protocols.

Interestingly, the study reveals a nuanced pattern which shows that while CPs exhibit minimal concern regarding awareness and innovation, this reflects a high degree of familiarity with BIM

rather than indifference. Nevertheless, gaps in practical knowledge persist, as CPs acknowledge that successful implementation requires not only access to information but also sufficient human, technological, and financial resources. The limited availability of comprehensive BIM resources, including textbooks and practical guides, constrains CPs' ability to fully grasp and leverage the technology. This underscores the need for empirical research that moves beyond theoretical promotion of BIM to demonstrate its cost-effectiveness and practical benefits, ensuring that adoption is evidence-driven rather than speculative (Jin *et al.*, 2017). Concerns related to financial implications, project execution challenges, and the impact of BIM on client outcomes are particularly salient. While BIM promises efficiencies in project delivery, such as reduced rework and improved information management, these benefits remain largely prospective and are scrutinized by CPs based on prior experiences with other system innovations, including lean construction, just-in-time methods, and sustainable construction practices (Liao *et al.*, 2021). CPs' apprehension regarding time, resources, and project outcomes reflects a careful cost-benefit calculation: BIM adoption is unlikely until the perceived advantages clearly outweigh the investments required for its integration.

Collaboration emerges as a critical determinant of CPs' BIM intentions. Successful implementation depends on multidisciplinary cooperation; BIM cannot be effectively adopted in isolation. Concerns about the availability of skilled colleagues, organizational capacity, supply chain readiness, and supportive management structures highlight the systemic nature of BIM adoption. CPs anticipate forming partnerships and networks to facilitate implementation, underscoring the role of organizational and industry-level preparedness in shaping individual adoption decisions. The empirical evidence also indicates that CPs' intentions regarding BIM are informed by a combination of understanding, planning, and conceptual preparation. Professionals weigh alternative applications and strategies for maximizing efficiency and minimizing resource utilization. Decisions to delay or refrain from adoption are driven by rational evaluation of time, material, and outcome considerations. Adoption is likely to remain limited until CPs are confident that the benefits of BIM justify the associated investments. This finding reinforces the importance of developing methodologies that enhance BIM's perceived value and demonstrate compatibility with existing workflows and resources. The availability of compatible procurement systems and project tools may further catalyze adoption, provided that CPs perceive integration as feasible and advantageous. The study illustrates that CPs' concerns regarding BIM are multidimensional and deeply intertwined with their professional context, resource availability, and prior experience with system innovations. These concerns shape their intentions to adopt BIM, highlighting the necessity for evidence-based implementation strategies, capacity-building initiatives, and organizational support structures that align with CPs' practical and professional needs. Failure to address these concerns may delay adoption, while targeted interventions that mitigate perceived risks and enhance perceived value are essential for successful BIM implementation.

The findings of this study support the formulation of the BIM Adoption Responsiveness Theory (BART), which posits that the adoption of BIM by CPs is determined by an interplay between their personal background, professional experience, and the nature of their implementation-related concerns. According to this theory, CPs' intentions to adopt BIM are shaped not only by their knowledge and expertise but also by their assessment of BIM's demands, benefits, and collaborative requirements within their operational context. Central to this theory is the role of professional background. Academic qualifications, professional discipline, and years of experience directly influence both the formation of concerns and the intention to adopt BIM. Professionals with advanced education and extensive experience are more likely to recognize the strategic value of BIM, anticipate challenges in its implementation, and actively acquire the skills required for effective adoption. Conversely, CPs in disciplines with limited BIM integration, such

as geotechnical engineering or urban planning, may display lower adoption intentions due to minimal task relevance and exposure.

Concerns act as a mediating mechanism between background and adoption intentions. CPs' concerns—encompassing awareness, knowledge, time, resources, collaboration, and perceived outcomes—reflect both anticipatory and reflective assessments of BIM. These concerns shape the readiness and willingness of professionals to engage with BIM, influencing whether they translate knowledge and awareness into actionable adoption behaviors. Intentions to adopt BIM emerge as a function of CPs' understanding of BIM processes, perceived benefits, and recognition of collaboration requirements. Such intentions are contingent on a rational evaluation of trade-offs between the investment of time and resources and the expected professional and project benefits. The theory further posits that proactive personality traits and psychological capital moderate the relationship between concerns and intentions. CPs with proactive dispositions are more likely to convert concerns into constructive intentions, seeking out knowledge, developing skills, and fostering collaboration to facilitate BIM adoption. Psychological capital—including resilience, confidence, and a growth-oriented mindset—enhances the likelihood that concerns lead to engagement rather than resistance.

Finally, the organizational and collaborative context conditions the translation of intentions into actual adoption behaviors. Access to skilled colleagues, organizational support, and system compatibility are critical. Concerns regarding team competency, resource availability, and organizational readiness influence whether CPs' intentions result in successful BIM implementation. BIM Adoption Responsiveness Theory (BART) extends the Theory of Planned Behavior (TPB) and the Concerns-Based Adoption Model (CBAM) to the construction industry. It explains why BIM adoption varies across professionals and emphasizes the importance of proactive engagement, professional expertise, and organizational support. Practically, the theory suggests that targeted training, resource allocation, and structured collaboration are essential to facilitate BIM adoption, and that demonstrating tangible benefits to CPs—not only clients—is crucial for successful implementation.

CONCLUSIONS

The study demonstrates that construction professionals' (CPs') personal backgrounds—encompassing academic qualifications, professional discipline, and years of experience—significantly shape both their intentions to adopt Building Information Modelling (BIM) and the concerns they hold regarding its implementation. The findings reveal that CPs with advanced academic credentials and extensive professional experience exhibit higher intentions to engage with BIM, actively seek knowledge, develop skills, and explore alternative approaches to implementation. Conversely, CPs in disciplines with limited engagement in BIM, such as urban planning and geotechnical engineering, often perceive BIM as less relevant, resulting in lower adoption intentions and diminished proactive efforts. Regarding the concerns of CPs, the study identified eight primary areas: awareness, information, personal implications, time, resources, consequences, collaboration, and refocusing. These concerns reflect both practical and cognitive dimensions of BIM adoption. CPs are attentive to resource allocation, project timelines, collaborative capacity, and the professional value of BIM, while simultaneously assessing how BIM adoption impacts their roles and responsibilities. Notably, the findings indicate that concerns are not uniformly barriers; rather, they function as mediators that shape the intensity and direction of CPs' adoption intentions.

The study further confirms that BIM implementation intentions directly influence the nature and intensity of CPs' concerns. Professionals with strong intentions to adopt BIM tend to exhibit proactive engagement with knowledge acquisition, collaboration, and problem-solving, which

mitigates certain apprehensions while heightening awareness of practical challenges such as resource allocation and time requirements. Conversely, low intentions are associated with limited engagement and higher uncertainty about the applicability and benefits of BIM, highlighting the interdependent relationship between intentions and concerns. This study makes several notable contributions to knowledge. First, it provides a practitioner-centered understanding of BIM adoption, emphasizing that CPs' personal characteristics and professional backgrounds are critical determinants of both intentions and concerns. Second, it elucidates the mediating role of concerns in the adoption process, clarifying that concerns are not merely barriers but essential indicators of engagement and potential adoption pathways. Third, the study extends theoretical models—namely the Theory of Planned Behavior (TPB) and the Concerns-Based Adoption Model (CBAM)—to the context of BIM implementation in construction, demonstrating their applicability for understanding adoption behavior in professional practice. Finally, the research offers empirical insights into how BIM adoption varies across disciplines, experience levels, and education, addressing gaps in prior studies that often generalized CPs' perspectives or overlooked the influence of personal background on adoption behavior.

The findings carry practical implications for both CPs and the broader construction industry. For CPs, understanding the link between professional background, adoption intentions, and concerns can inform targeted skill development, proactive engagement with BIM, and strategic planning to integrate BIM into project workflows. For organizations, these results underscore the importance of designing context-specific training programs, allocating sufficient resources, and fostering collaborative environments that align with the needs and expectations of professionals from diverse disciplines and experience levels. Additionally, the results highlight the need to communicate the tangible benefits of BIM to CPs, ensuring that they perceive both professional and organizational value in adoption, rather than viewing BIM solely as a client-driven initiative. While the study provides important insights, several limitations warrant consideration. First, the research was conducted among CPs in Nigeria, which may limit the generalizability of findings to other regions or countries with different technological adoption contexts or organizational cultures. Second, the study relied on self-reported survey data, which may be subject to social desirability bias or variations in respondents' interpretation of BIM concepts. Third, although the study explored the influence of personal background on intentions and concerns, other psychological or organizational factors—such as risk tolerance, organizational culture, and leadership support—were not explicitly examined. Future research should consider longitudinal studies to capture how intentions and concerns evolve over time as CPs gain more experience with BIM. Comparative studies across regions, project types, or organizational structures would further illuminate contextual influences on BIM adoption. Additionally, incorporating qualitative approaches, such as interviews or case studies, could provide deeper insights into the motivations and challenges faced by CPs during BIM implementation. Finally, future research could explore interventions that leverage proactive personality traits and psychological capital to enhance BIM adoption, providing actionable strategies for both professionals and organizations.

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