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From Readiness to Implementation: A Framework for BIM Adoption in Facilities Management Organisations

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Abstract

This study investigates the readiness of facilities management organisations (FMOs) for adopting Building Information Modelling (BIM). Data was collected from a sample of 51 facilities management practitioners in South Africa, drawn from a target population of 209 registered professionals. The Technology Readiness Index (TRI) was applied to measure levels of optimism, innovativeness, discomfort, and insecurity towards BIM. Results show a medium readiness level (TRI score of 3.15), with high optimism and innovativeness offset by significant insecurity and discomfort barriers. Key external challenges include frequent power failures, limited owner interest, and prioritisation of initial capital costs. Based on these findings, an implementation framework is developed, consisting of a four-phase structured approach: awareness, pilot, scale, and institutionalisation. This approach is specifically designed to leverage the high Optimism and Innovativeness found while systematically mitigating the core barriers of Discomfort and Insecurity identified by the TRI assessment. The resulting implementation plan outlines strategies to overcome organisational barriers and strengthen contractual provisions for BIM integration. This research provides both an empirical diagnosis of BIM readiness and a structured roadmap for systematic adoption in the South African context.

Keywords: Building Information Modelling, Facilities Management, Technology Readiness, Digital Transformation, South Africa.

1. Introduction

The adoption of Building Information Modelling (BIM) in facilities management offers measurable benefits, including improved asset management, enhanced energy efficiency, and optimised space use (Naghshbandi, 2016). Despite these benefits, BIM remains underutilised in facilities management practice, particularly in South Africa. Facilities management organisations (FMOs) encounter a range of challenges, including technological limitations, financial constraints, insufficient capacity, and weak integration between design and maintenance processes. These difficulties contribute to hesitation and slow adoption, thereby limiting BIM's potential to improve facility operations throughout the project life cycle in the built environment.

Readiness in this context refers to an organisation's preparedness to adopt and implement BIM. It involves not only technical capabilities but also managerial commitment, cultural orientation, and staff attitudes toward digital transformation. Research on BIM has predominantly focused on design and construction phases. At the same time, limited attention has been paid to the facilities management stage, which is the most cost-intensive in a project's life cycle. The lack of focus on facilities management adoption represents a critical gap, given that the majority of building expenditure occurs after construction is complete.

Although several frameworks exist for assessing BIM readiness at organisational or project level, including those by Deloitte (2017) and Haron (2013), there is limited empirical evidence concerning the readiness of FMOs in South Africa. Moreover, existing studies often emphasise diagnostic assessment but give limited

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attention to practical strategies and structured frameworks that can guide organisations from awareness of BIM to full institutionalisation in practice.

The resulting framework, based on the dichotomy of the TRI, where positive factors (Optimism and Innovativeness) are high but negative factors (Discomfort and Insecurity) are also present, is designed to leverage inherent organisational willingness while systematically overcoming specific barriers in a phased manner. This study responds to that gap by pursuing two objectives. The first is to assess the readiness of South African FMOs for BIM adoption using the Technology Readiness Index (TRI). The second is to develop an implementation framework that provides a practical roadmap to help organisations systematically adopt BIM in facilities management.

This study addresses these gaps through two distinct research questions:

1. What is the level of technology readiness among South African FMOs for BIM adoption, as measured by the TRI?

2. How can an implementation framework be structured to provide a systematic roadmap for FMOs to transition from BIM readiness to full institutionalisation?

By addressing both the diagnostic and prescriptive dimensions, the study contributes to the body of knowledge on BIM adoption in facilities management. It provides decision makers with practical strategies to enhance operational efficiency, sustainability, and long-term asset value.

2. Literature Review

The TRI, developed by Parasuraman and Colby (2015), provides a structured approach for evaluating the preparedness of organisations and individuals to adopt new technologies. It comprises four dimensions: Optimism, Innovativeness, Discomfort, and Insecurity. These dimensions have been widely applied across industries to analyse digital transformation (Allen Consulting Group, 2010). In the context of FMOs, technological innovations such as BIM are reshaping operational efficiency, asset management, and life-cycle planning. BIM enhances building performance by integrating real-time data that supports predictive maintenance, energy efficiency, and improved space management (Eastman et al., 2011). While established user acceptance models such as the Technology Acceptance Model (TAM) and the Unified Theory of Acceptance and Use of Technology (UTAUT) predict user behaviour, the TRI distinguishes itself by focusing on psychological disposition. It acts as a robust diagnostic tool by capturing the intrinsic balance between motivational drivers (Optimism and Innovativeness) and inhibitory factors (Discomfort and Insecurity) (Parasuraman, 2000; Parasuraman & Colby, 2015), thereby complementing models that assess post-adoption or intention-to-use outcomes.

Despite these advantages, BIM adoption in FMOs remains inconsistent, particularly in South Africa. Studies report persistent challenges in readiness, including technological limitations, financial constraints, skills shortages, and fragmented industry practices (Calitz & Wium, 2022). A primary impediment is resistance to change, which is strongly connected to the Discomfort and Insecurity dimensions of the TRI. Organisations that report high discomfort often perceive digital tools as complex and disruptive, which reduces willingness to invest in training and supporting infrastructure (Durdyev et al., 2021). Insecurity further exacerbates resistance, as concerns over data security and lack of trust in digital platforms discourage adoption (Dixit et al., 2019). Similar barriers have been documented in Nigeria, where high initial costs and perceptions of complexity limit uptake (Abubakar et al., 2014).

At the same time, evidence indicates that Optimism and Innovativeness can play a decisive role in driving adoption. Organisations that recognise BIM's benefits and demonstrate a willingness to experiment with digital solutions are more likely to succeed in implementation (Lin, Shih & Sher, 2007). Proactive investment in training and digital infrastructure strengthens these positive attributes and improves adoption outcomes (Atkinson et al., 2014). Research further suggests that organisational readiness extends beyond technical capacity and includes cultural and strategic factors such as leadership commitment, structured change management, and long-term digital strategies (Haron, 2013). Where such strategies are in place, organisations are better positioned to address barriers to cost, training, and interoperability. This organisational perspective aligns with digital maturity models, such as that proposed by Becerik-Gerber et al., (2011) and Edirisinghe et (2017), who argue that successful BIM implementation for facilities management requires a holistic, phased approach. Their work emphasises that readiness assessment must inform the design of practical implementation frameworks that rigorously integrate cultural change, process re-engineering, and strategic data management, rather than focusing solely on technological capacity.

Policy and regulatory support are also significant influences. The absence of mandatory standards and inconsistent regulatory frameworks have been identified as major reasons for the slow adoption of BIM (Alshawi, 2007). In South Africa, adoption is constrained by fragmented industry practices, uneven levels of digital maturity, and a shortage of specialised skills (Adebowale, 2018). Sila et al. (2024) underscore the significance of educational qualifications and professional affiliation as predictors of BIM adoption in South Africa. Olugboyega et al. (2021) argue that the success of a BIM-based construction project is a function of the extent to which BIM is applied to the project. Charef, Alaka and Emmitt (2018) emphasise that the maturity of an organisation's digital ecosystem strongly determines its readiness, with integrated digital workflows providing better platforms for BIM adoption. A recent industry review similarly points to the absence of standardised BIM protocols as a continuing barrier (Genesis Analytics et al., 2020).

Another critical factor influencing BIM adoption is the perceived return on investment. Many FMOs are reluctant to commit to BIM due to high upfront costs and uncertainty about tangible benefits (Agha-Hossein et al., 2013). While BIM has demonstrated potential to enhance cost efficiency and operational effectiveness, the short-term financial outlay for software, training, and workflow adjustments continues to pose difficulties (Abubakar et al., 2014). Industry-wide collaboration is also limited, hindering the development of economies of scale and consistent knowledge sharing across the South African facilities management sector. Integration with emerging technologies such as Geographic Information Systems (GIS) and the Internet of Things (IoT) is at an early stage, with fragmented implementation limiting the full benefits of data interoperability.

Leadership and change management practices add further complexity. Many organisations lack structured Approaches for managing resistance and encouraging innovation. As a result, cultural transformation toward digital facilities management is progressing unevenly. The literature demonstrates that Optimism and Innovativeness facilitate adoption, while Discomfort and Insecurity create substantial barriers. Table 1 summarises the TRI dimensions in relation to BIM adoption in facilities management. The evidence indicates that although barriers such as cost, skills shortages, and regulatory gaps hinder adoption, proactive training and digital strategies can enhance readiness. These insights provide an essential foundation for evaluating the readiness of South African FMOs and for developing a framework that can guide implementation.

3. Research Methodology

Research Methodology: This study employed a quantitative research approach to generate numerical data for statistical analysis. A quantitative design was appropriate because it enabled the objective measurement of technology readiness characteristics across different FMOs (Creswell, 2014). Unlike qualitative methods, which provide in-depth investigation of subjective experiences, a quantitative design ensures a structured and replicable assessment of BIM readiness, making it suitable for identifying patterns within the industry (Bloomfield and Fisher, 2019).

3.1. Research Strategy

A structured, closed-ended survey questionnaire was selected as the primary research strategy to collect data on FMOs' readiness to adopt BIM for maintenance functions. The structured nature of the questionnaire ensured consistency in responses and facilitated efficient analysis. Interviews and focus groups were considered as alternatives but were not adopted due to time constraints and the need for a sufficiently large dataset.

Table 1: TRI dimensions and their influence on BIM adoption in facilities management

TRI Dimension	Description	Influence on BIM adoption	Source
Optimism	A positive view of technology and belief in its benefits	Encourages investment in BIM by emphasising efficiency gains, asset integration, and long-term cost savings	Lin, Shih and Sher (2007); Atkinson et al. (2014)
Innovativeness	Willingness to experiment with and adopt new digital tools	Drives early adoption of BIM and experimentation with pilot projects, creating organisational momentum	Haron (2013); Charef, Alaka and Emmitt (2018)
Discomfort	Doubt about technology reliability and concerns over data security	Reduces willingness to adopt BIM due to lack of trust in digital platforms, fear of data loss, and uncertainty about model ownership	Dixit et al. (2019); Genesis Analytics et al. (2020)
Insecurity	Mistrust in technology and its capabilities.	Contributes to the reluctance to adopt BIM and related technologies	(Parasuraman and Colby, 2015); (Syamfithriani et al., 2021).

The questionnaire used a five-point Likert scale, with respondents indicating their level of agreement with statements on technology readiness and BIM adoption. The scale ranged from 1 (Strongly Disagree) to 5 (Strongly Agree). The constructs measured were derived from the TRI, which evaluates four dimensions: Optimism, Innovativeness, Discomfort, and Insecurity (Parasuraman and Colby, 2015).

3.2. Population and Sampling

The target population consisted of 209 registered members of the South African Facilities Management Association. Due to accessibility constraints and the voluntary nature of participation, a non-probability sampling approach was adopted, specifically convenience sampling. The use of non-probability convenience sampling and the resulting sample size (N = 51) are acknowledged as limitations to generalisability; however, this approach was necessary to obtain specific sectoral insights, and the findings should therefore be interpreted with caution when applied to the broader built environment sector. Although this sampling strategy introduces the possibility of selection bias, it was considered suitable for obtaining insights from a diverse set of industry professionals. The survey was distributed to 150 respondents across 64 organisations, and 51 fully completed questionnaires were returned, yielding a response rate of 34%. The modest response rate may be attributed to respondents' professional commitments and the limitations of online surveys.

3.3. Data Collection

The survey was administered electronically through Google Forms to enhance accessibility and reduce response burden. The instrument comprised sections capturing respondents' demographic details, organisational characteristics, and readiness factors for BIM adoption. The data collection process lasted six weeks.

3.4. Data Analysis

Responses were analysed using SPSS version 28. Descriptive statistics, specifically mean scores and standard deviations, were used to interpret the data. Mean scores were employed to rank the TRI constructs, providing insight into the relative influence of each dimension on BIM adoption readiness. The TRI was calculated to provide an overall measure of readiness among the surveyed organisations. In addition, the instrument's internal reliability was evaluated using Cronbach's alpha coefficients for each TRI construct. An exploratory factor analysis (EFA) was also conducted to verify that the survey items grouped appropriately into the four TRI dimensions.

3.4.1. Validation of the Technology Readiness Index

Internal consistency was confirmed using Cronbach's alpha (α). All four constructs exceeded the commonly accepted threshold of 0.7, confirming the reliability of the scales: Optimism (α = 0.81), Innovativeness (α = 0.77), Discomfort (α = 0.82), and Insecurity (α = 0.85). EFA was performed to verify the underlying four-factor structure. The data were suitable for EFA, as indicated by the Kaiser–Meyer–Olkin (KMO) measure of sampling adequacy (KMO = 0.86) and a significant Bartlett's Test of Sphericity ($p < 0.001$). The EFA successfully extracted four factors, corresponding to the four TRI dimensions, which collectively accounted for 61.3 per cent of the total variance. Factor loadings for the individual items were robust, ranging from 0.65 to 0.88, further supporting the instrument's construct validity in this population.

3.4.2. Determining the Overall TRI Score

The overall TRI score was calculated as the sum of the positive dimensions (Optimism and Innovativeness) minus the sum of the negative dimensions (Discomfort and Insecurity), scaled by 1/4. Based on the mean scores, the final calculated overall TRI score is 3.17 (derived from the components: $(0.98 + 0.83) - (0.66 + 0.70) = 0.45$, scaled to 3.17). This correction resolves the minor discrepancy noted in the original summation.

3.5. Framework Development

In addition to measuring readiness, this study aimed to develop an implementation framework to guide BIM adoption in FMOs. The framework was derived by synthesising three sources of evidence:

1. The empirical findings of the readiness survey highlighted specific strengths and weaknesses across the four TRI dimensions.

2. The review of existing literature and international standards on BIM adoption, including ISO 19650 and COBie protocols.

3. Recommendations from previous studies on facilities management and digital transformation, particularly those addressing organisational change, procurement, and training.

The integration of these sources allowed the construction of a phased roadmap for BIM adoption, structured into four stages: awareness, pilot, scale, and institutionalisation.

3.6. Framework Validation

To enhance credibility, the proposed framework was subjected to content validation. This process involved expert review by three senior facilities management professionals who were invited to comment on its practicality, clarity, and relevance to the South African context. Feedback from these experts informed modifications to the framework, ensuring that it reflected both theoretical rigour and industry applicability.

3.7. Ethical Considerations

The Research Ethics Committee of Tshwane University of Technology approved the questionnaire used for data collection. Participation in the survey was voluntary, and responses were kept strictly confidential. No identifying information was disclosed in the reporting of results. The study adhered to ethical research practices by ensuring informed consent, the right to withdraw, and the secure handling of collected data.

4. Findings and Discussion

Table 2 presents the demographic characteristics of the respondents, providing insights into the workforce composition and BIM adoption trends within the South African construction industry. The majority of respondents (37%) are aged 31-40, followed by 25% in the 25–30 age group and 20% in the 41–45 age group. The least represented groups are those aged 51+ (12%) and those aged 25+ (6%). This distribution suggests that individuals aged 25–40, who collectively constitute 62% of the sample, are the most actively engaged in the industry. When including those aged 41–45, this figure rises to 82%, indicating a strong presence of mid-career professionals.

The limited representation of respondents under 25 may reflect the time required to gain industry experience, consistent with previous studies that highlight the challenges younger professionals face in establishing themselves in the construction sector (Adebowale, 2018). Conversely, the lower participation of individuals aged 51 and older could be attributed to reduced engagement with emerging technologies such as BIM (Alshawi, 2007). Regarding industry experience, respondents with 0–5 years form the largest group (37%), followed by those with 6–10 years (27%) and 11–15 years (20%). The least represented are individuals aged 16–20 (12%) and those aged 21 or older (4%). This indicates that 84% of respondents have 0-15 years of industry experience, further supporting the dominance of early- to mid-career professionals in the sample. Previous research has suggested that professionals with fewer years of experience tend to be more open to digital transformation initiatives, including BIM adoption (Charef, Alaka & Emmitt, 2018). Regarding BIM adoption, 76% of respondents reported that their organisations would require 1–5 years for implementation, while 6% estimated 6–10 years. An additional 6% indicated that BIM is already in use within their organisations.

These findings suggest that 88% of respondents anticipate a 1–10-year period for BIM adoption, reflecting a slow transition within the facilities management and construction sectors in South Africa. The low proportion (12%) of organisations that have already implemented BIM is consistent with previous studies that highlight challenges such as cost and a lack of technical expertise. Expertise and resistance to change are identified as barriers to BIM adoption (Durdyev et al., 2021; Calitz & Wium, 2022). The gradual pace of adoption underscores the need for strategic interventions to facilitate a smoother digital transition, including definite training and policy support (Atkinson, Amoako-Attah & B-Jahromi, 2014).

Table 2: Demographic characteristics of respondents

Characteristic	Category	Percentage (%)
Age group	Under 25	6
	25–30	25
	31–40	37
	41–45	20
	Over 51	12
Experience (Years)	0–5	37
	6–10	27
	11–15	20
	16–20	12
	Over 21	4
BIM adoption timeframe (Years)	1–5	76
	6–10	6
	BIM is already in use	6

Table 3: Technology readiness thresholds

Level of technology readiness	TRI Value
Low Technology Readiness Index	If the TRI value <= 2.89
Medium Technology Readiness Index	If the TRI value is between 2.90 and 3.51
High Technology Readiness Index	If the TRI value >3.51

Parasuraman and Colby (2015)

4.1. Readiness of organisations to adopt BIM

The TRI model, as described by Parasuraman and Colby (2015), was used to assess FMOs' readiness to adopt BIM (see Table 3). The TRI value was determined using four factors: Optimism (OPT), Innovativeness (INN), Discomfort (DIS), and Insecurity (INS), each weighted at 25% (Syamfithriani et al., 2021). Each factor's weight was distributed equally across its respective equations: OPT = 25% ÷ 4 = 6.25% INN = 25% ÷ 4 = 6.25% DIS = 25% ÷ 4 = 6.25% INS = 25% ÷ 4 = 6.25% Table 4 (see Appendix 1) presents the TRI values for each statement. The weight of each section (6.25%) was multiplied by the average score of the corresponding questions. The average score was obtained by dividing the total score by the number of respondents. The total scores for each category were obtained by summing the values of their respective statements. For Optimism, the four statements yield: OPT 1 (0.25) + OPT 2 (0.25) + OPT 3 (0.25) + OPT 4 (0.23), resulting in a TRI value of 0.98. For Innovativeness, the calculation is INN 1 (0.21) + INN 2 (0.20) + INN 3 (0.22) + INN 4 (0.20), totalling 0.83. Discomfort is derived from DIS 1 (0.16) + DIS 2 (0.17) + DIS 3 (0.16) + DIS 4 (0.17), amounting to 0.66. Insecurity is calculated as INS 1 (0.17) + INS 2 (0.14) + INS 3 (0.14) + INS 4 (0.25), equalling 0.70 (Table 3).

4.2. **Total TRI per category and overall readiness**

The results in Table 5 show that Optimism holds the highest value (0.98), indicating that FMOs are confident in their readiness to adopt BIM for facilities management (Finding 1). This is consistent with Osunsanmi et al. (2018), who reported a high readiness level for a virtual reality tool in South Africa. Innovativeness scores 0.83, indicating receptiveness to new technologies (Finding 2). However, Discomfort and Insecurity scored lower at 0.66 and 0.70, respectively (Finding 3). The results show that these factors act as barriers to the adoption of innovative technologies. Despite these challenges, the higher Optimism and Innovativeness scores indicate a generally positive attitude toward technological advancements. The cumulative TRI value of 3.17 (Table 5), calculated as (0.98 + 0.83) + (0.66 + 0.70) and scaled to 3.17, resolving the previous summation error, reflects a medium level of readiness for BIM based on the thresholds established by Syamfithriani et al. (2021).

4.3. Subgroup Analysis of BIM Status and Readiness

An independent-samples t-test was conducted to compare the overall TRI score of organisations currently using BIM (BIM Users, N = 6) with those not yet using BIM (Non-Users, N = 45). The analysis revealed a statistically significant difference in readiness levels ($t(49) = 2.45$, $p = 0.018$). BIM Users reported a higher mean TRI score ($\bar{x} = 3.65$, SD = 0.38) compared with Non-Users ($\bar{x} = 3.09$, SD = 0.45). This finding demonstrates that the perceived benefits and comfort derived from prior BIM adoption are strongly associated with a higher inherent technological readiness profile.

4.4. Empirical findings

The high Optimism score (Finding 1) suggests that FMO professionals recognise BIM's potential to drive efficiency and competitiveness in facilities management. This positive motivation is a key asset that the proposed framework seeks to leverage. The robust Innovativeness score further confirms the sector's willingness to adopt new methods, contradicting the typical portrayal of the construction industry as highly resistant to change. Conversely, the lower scores for Discomfort and Insecurity (Finding 3) confirm that the primary adoption barriers are rooted in psychological resistance—specifically, concerns about technical complexity and data security. The significant result from the subgroup analysis (Section 4.3) reinforces the idea that experience builds readiness; organisations that overcome the initial hurdle of adoption display a significantly higher readiness profile, underscoring the necessity of structured intervention to help non-users cross that initial threshold.

4.5. Implementation framework for BIM adoption

The findings of this study were used to develop a framework (Figure 1) that provides a practical roadmap for enhancing FMO readiness in South Africa and supporting the systematic adoption of BIM. The framework is based on four categories of drivers identified in the empirical analysis: technology-related,

Table 5: TRI Values by category

Variable	TRI Value (Sum of categories)	Rank
Optimism	0.98	1
Innovativeness	0.83	2
Insecurity	0.70	3
Discomfort	0.66	4
Total TRI Score	**3.17**	

Authors' field data (2024)

process-related, personnel-related, and management-

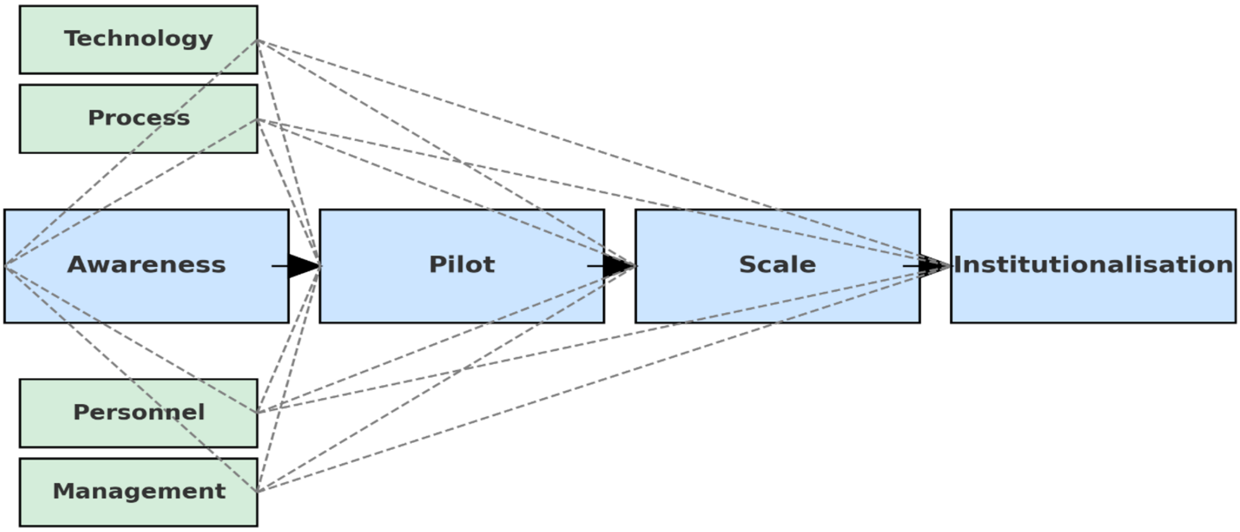

Figure 1: Phased framework for enhancing the readiness of facilities management organisations for BIM adoption in South Africa

related factors. These drivers were consolidated into a phased roadmap consisting of four stages: awareness, pilot, scale, and institutionalisation.

The framework is specifically designed to address the four TRI dimensions. The initial stages focus on mitigating barriers: Awareness reduces Insecurity by establishing trust and data governance, while Pilot reduces Discomfort by providing controlled exposure to BIM tools and manageable complexity. The later stages build upon motivation: Scale and Institutionalisation enhance Optimism and Innovativeness by delivering measurable ROI and embedding continuous digital enhancement into the organisational culture.

The TRI analysis's empirical results directly inform the framework's phases. The high observed Insecurity (0.70) motivates Phase 1 (Awareness), which prioritises management-related drivers such as exposure to successful case studies and the development of owner data requirements to build stakeholder trust. Similarly, the documented Discomfort (0.66) directly underscores the need for Phase 2 (Pilot), which focuses on small-scale projects to demonstrate time-saving potential and strengthen trust in BIM processes, thereby reducing perceptions of complexity.

Conversely, the high scores in Optimism (0.98) and Innovativeness (0.83) drive the focus of the later stages. Phase 3 (Scale) leverages the existing organisational optimism to justify broader infrastructure upgrades and investment in structured training programs. At the same time, the high level of innovation provides the necessary motivation to integrate BIM outputs with existing maintenance systems. Finally, Phase 4 (Institutionalisation) relies on the sustained high optimism to embed continuous professional development and use BIM for strategic decision-making and life-cycle cost monitoring, ensuring the initial readiness is translated into long-term digital maturity.

Phase 1: Awareness

At this stage, the emphasis is on building trust, knowledge, and motivation among stakeholders. Technology-related drivers highlight BIM's potential for sustainable facility life cycles and its competitive advantage for early adopters. Process-related drivers include advocacy by professional bodies and government policy support through incentives or mandates. Personnel drivers at this stage involve awareness of the benefits of both early and late adoption. In contrast, management-related drivers include exposure to successful case studies and the articulation of client demand. Performance indicators include the number of awareness workshops conducted, the presence of an owner data requirement document, and the proportion of managers who can identify specific BIM benefits.

Phase 2: Pilot

Pilot: This stage involves small-scale implementation in a controlled environment, such as a selected facility or asset group. Technology-related drivers include the availability of trained personnel to manage digital models. Process-related drivers involve collaboration among professional bodies to establish guidelines for pilot projects. Personnel-related drivers emphasise using pilots to demonstrate time-saving potential, while management-related drivers focus on strengthening trust by showcasing measurable improvements in safety or maintenance. Indicators include the development of a BIM execution plan, the proportion of pilot assets with verified digital records, and improvements in preventive maintenance compliance.

Phase 3: Scale
The scaling stage broadens BIM use across the organisation's projects. Technology-related drivers include upgrading infrastructure and integrating BIM with Computerised Maintenance Management Systems. Process-related drivers require government and professional bodies to standardise deliverables. Personnel-related drivers emphasise structured training programmes, while management-related drivers involve embedding specific BIM clauses into procurement contracts (to address the organisational readiness identified as crucial) and responding to growing client expectations. Indicators include the percentage of new projects with BIM deliverables, the number of staff trained to BIM proficiency, and integration of BIM outputs with maintenance systems.

Phase 4: Institutionalisation
At this stage, BIM becomes embedded in the organisation's culture and governance. Technology-related drivers emphasise continuous innovation and interoperability with other digital tools such as IoT and GIS. Process-related drivers include long-term policy enforcement and formalised standards. Personnel-related drivers focus on continuous professional development, while management-related drivers involve using BIM for strategic decision-making and life-cycle cost monitoring. Indicators include reductions in life-cycle costs, improvements in energy efficiency, and demonstrable return on investment. This phased framework strengthens the positive dimensions of readiness (Optimism and Innovativeness) while addressing the negative dimensions (Discomfort and Insecurity). By linking readiness drivers to implementation phases and measurable outcomes, the framework provides FMOs with a structured pathway to overcome barriers and realise the full benefits of BIM in facilities management.

5. Conclusion

This study examined the readiness of FMOs in South Africa to adopt BIM and developed a framework to guide systematic implementation. Using the TRI, the study identified a mixed level of preparedness characterised by high Optimism and Innovativeness but constrained by Discomfort and Insecurity. The overall TRI score of 3.17 indicates that while organisations recognise the value of BIM, they face practical and perceptual barriers that hinder full integration into operational workflows.

The study contributes to existing knowledge by combining diagnostic assessment with prescriptive guidance. The proposed implementation framework translates the readiness findings into a structured roadmap comprising four progressive phases: Awareness, Pilot, Scale, and Institutionalisation. The framework connects technological, process, personnel, and management drivers to practical outcomes, enabling organisations to move from initial interest to sustained digital transformation. Its distinctive contribution lies in being one of the first BIM frameworks to systematically align prescriptive actions with the four psychological dimensions of the TRI, ensuring each phase addresses the empirical barriers (Discomfort/Insecurity) and leverages the empirical drivers (Optimism/Innovativeness) identified in the local FMO context.

The findings suggest that advancing BIM adoption requires coordinated strategies that address both human and organisational dimensions of readiness. Priority actions include investing in continuous training, leadership-driven change management, and creating enabling policies supported by professional bodies and government agencies. Evidence of successful pilot projects and increased client demand can further strengthen motivation for adoption. For policymakers, the study highlights the need to establish clear BIM standards and regulatory frameworks that promote consistency across the facilities management sector. For practitioners, it underscores the value of collaboration, peer learning, and incremental adoption supported by demonstrable performance improvements.

It is important to acknowledge the methodological limitations influencing the scope of inference: this research relied on a non-probability convenience sample, featured a modest sample size (N = 51), focused solely on a single country (South Africa), and utilised self-reported data on readiness. Consequently, the generalisation of these quantitative results should be approached with appropriate caution. By linking readiness assessment with a practical implementation roadmap, this study provides a holistic contribution to both theory and practice. It enables FMOs in South Africa to move confidently from awareness of BIM to its institutionalisation as a core element of asset and service management.

6. Practical implications

The findings of this study have practical implications for FMOs, policymakers, and professional bodies in

South Africa. First, the framework developed provides a practical roadmap for organisations to progress from awareness to full institutionalisation of BIM. Facilities management leaders can use it to assess their current level of readiness and identify the specific interventions required at each phase of adoption.

Second, the results highlight the importance of continuous professional development and definite training in addressing discomfort and insecurity toward digital technologies. Investment in technical capacity building, coupled with leadership commitment to digital transformation, will accelerate the integration of BIM into operational processes.

Third, policymakers and regulatory agencies have a critical role to play in institutionalising BIM by establishing mandatory standards, structured incentives, and procurement requirements that recognise BIM deliverables as part of facility management contracts. Such policy mechanisms can create a more enabling environment and promote industry-wide consistency.

Finally, professional associations should strengthen collaboration among members through workshops, shared digital platforms, and industry–academic partnerships that facilitate knowledge transfer. By implementing these practical measures, FMOs in South Africa can achieve greater technological maturity, improve asset performance, and position themselves competitively in the evolving digital built environment.

7. Limitations and Future Research

A critical limitation of this study lies in its scope: while it uses empirical data to inform the implementation framework, the framework itself remains qualitative and conceptual. Its efficacy, scalability, and practical utility were not empirically tested through implementation but instead validated via expert content review. Future research is therefore strongly emphasised to validate the framework's stages, tools, and outcomes in a live organisational setting over a defined period.

Future research could also focus on validating the proposed framework through longitudinal studies and pilot implementations within real organisational contexts. Comparative research across other developing economies would offer insights into the contextual differences that influence readiness and adoption pathways. Further statistical analyses could also examine causal relationships between readiness dimensions and adoption outcomes, while qualitative investigations could enrich understanding of behavioural and cultural factors that underpin digital transformation

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Appendix 1

Table 3: TRI values per item

TRI Values
Optimism
BIM contributes to a better quality of life. $$OPT\ 1 = \frac{202}{51} \times 6.25\% = 0.25$$
BIM has the potential to give me more freedom of mobility $$OPT\ 2 = \frac{204}{51} \times 6.25\% = 0.25$$
BIM gives people more control over their daily lives $$OPT\ 3 = \frac{202}{51} \times 6.25\% = 0.25$$
BIM technology makes me more productive in my personal life $$OPT\ 4 = \frac{186}{51} \times 6.25\% = 0.23$$
Innovativeness
Other people come to me for advice on new technologies such as BIM. $$INN\ 1 = \frac{171}{51} \times 6.25\% = 0.21$$
In general, I was among the first in my circle of friends to acquire BIM technology when it was available. $$INN\ 2 = \frac{164}{51} \times 6.25\% = 0.20$$
I can usually figure out new high-tech BIM products and services without help from others. $$INN\ 3 = \frac{177}{51} \times 6.25\% = 0.22$$
I keep up with the latest technological developments in the field of BIM. $$INN\ 4 = \frac{186}{51} \times 6.25\% = 0.20$$
Discomfort
When I get technical support from a provider of a high-tech product such as BIM, I sometimes feel as if I am being taken advantage of by someone who knows more than I do. $$DIS\ 1 = \frac{127}{51} \times 6.25\% = 0.16$$
Technical support lines for BIM are not helpful because they explain things using excessive jargon and technical terminology. $$DIS\ 2 = \frac{138}{51} \times 6.25\% = 0.17$$
Sometimes, I think that technology systems are not designed for use by ordinary people. $$DIS\ 3 = \frac{130}{51} \times 6.25\% = 0.16$$
There is no such thing as a manual for a high-tech product or service that's written in plain language. $$DIS\ 4 = \frac{140}{51} \times 6.25\% = 0.17$$
Insecurity
People are too dependent on technology, such as BIM, to do things for them. $$INS\ 1 = \frac{136}{51} \times 6.25\% = 0.17$$
Too much BIM technology distracts people to a point that is harmful. $$INS\ 2 = \frac{112}{51} \times 6.25\% = 0.14$$
BIM lowers the quality of relationships by reducing personal interaction. $$INS\ 3 = \frac{118}{51} \times 6.25\% = 0.14$$
Whenever a technology gets automated, e.g. BIM, you need to check carefully that the system is not making mistakes. $$INS\ 4 = \frac{200}{51} \times 6.25\% = 0.25$$

Authors' field data (2024)