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Factors influencing BIM adoption in construction companies: A systematic review

Factores de adopción de BIM en empresas constructoras: una revisión sistemática

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Abstract

The adoption of Building Information Modeling (BIM) in construction companies is a multidimensional process influenced by technological, organizational, and environmental factors. In Ibero-America, its implementation presents specific characteristics associated with organizational capabilities and the institutional and production contexts in which companies operate. This study aimed to identify, systematize, and analyze the factors influencing BIM adoption and implementation in Ibero-American construction companies. A qualitative systematic literature review with an analytical scope was conducted. The search identified 245 records and, following duplicate removal, screening, and eligibility assessment, 22 studies were included in the qualitative synthesis. The evidence was organized according to the technological, organizational, and environmental components of the Technology–Organization–Environment (TOE) framework and analyzed through four dimensions proposed in this study: access, adaptability, organization, and implementation. The findings provide a basis for examining how technological conditions, organizational capabilities, and environmental factors influence the different stages of BIM adoption. Implementation also requires consideration of the interaction between technological resources, human competencies, work processes, and institutional conditions. It is concluded that BIM adoption in the Ibero-American contexts examined should be understood as a process that extends beyond the availability of digital tools and involves organizational capabilities and contextual conditions that influence its incorporation and continuity.

Keywords: Building Information Modeling, construction companies, systematic review.

Resumen

La adopción de *Building Information Modeling* (BIM) en las empresas constructoras constituye un proceso multidimensional condicionado por factores tecnológicos, organizacionales y ambientales. En Iberoamérica, su implementación presenta particularidades vinculadas con las capacidades de las organizaciones y las condiciones de sus entornos institucionales y productivos. El objetivo de esta investigación fue identificar, sistematizar y analizar los factores que condicionan la adopción e implementación de BIM en empresas constructoras de Iberoamérica. Se realizó una revisión sistemática de la literatura con enfoque cualitativo y alcance analítico. La búsqueda identificó 245 registros y, tras la eliminación de duplicados, el cribado y la evaluación de elegibilidad, se incluyeron 22 estudios en la síntesis cualitativa. La evidencia se organizó mediante los componentes tecnológico, organizacional y ambiental del marco TOE (*Technology–Organization–Environment*) y se analizó a través de cuatro dimensiones propuestas en esta investigación: acceso, adaptabilidad, organización e implementación. Los hallazgos permiten examinar cómo las condiciones tecnológicas, las capacidades organizacionales y los factores del entorno intervienen en las distintas etapas de incorporación de BIM. Asimismo, la implementación requiere considerar la articulación entre recursos tecnológicos, competencias humanas, procesos de trabajo y condiciones institucionales. Se concluye que la adopción de BIM en los contextos iberoamericanos estudiados debe comprenderse como un proceso que trasciende la disponibilidad de herramientas digitales y que involucra capacidades organizacionales y condiciones contextuales que influyen en su incorporación y continuidad.

Palabras clave: *Building Information Modeling*, empresas constructoras, revisión sistemática.

Introduction

The incorporation of Building Information Modeling (BIM) into the construction sector poses a challenge that goes beyond the availability of digital tools; it also involves acceptance of the methodology, coordination among participants, and changes to work practices. The evidence included in this review addresses the phenomenon from different perspectives: technology acceptance among professionals, the human factor within teams, implementation barriers, and the integration of BIM into project management. This diversity shows that BIM use is not a homogeneous phenomenon and that the conditions for its adoption must be analyzed by considering individual decisions, organizational capabilities, and the characteristics of the context in which it takes place.

From the perspective of technology acceptance, Sanchís-Pedregosa et al. (2020) examined factors associated with BIM adoption among construction professionals in Peru. Based on a survey of 73 architects and engineers, they found that perceived usefulness was a relevant determinant of intention to use, whereas perceived ease of use did not have a statistically significant effect. This result suggests that willingness to adopt BIM does not necessarily depend on whether the technology is perceived as easy to use, but also on the value professionals attribute to it for their work. From another perspective, Gómez-Valdés et al. (2023) examined BIM in construction project management through a bibliometric study aimed at identifying factors that limit its implementation. Both studies make it possible to approach adoption from the perspectives of user acceptance and the difficulties that constrain the incorporation of the methodology into the sector.

The human and organizational dimensions are also relevant aspects of the evidence examined. Based on three case studies, Coloma et al. (2019) analyzed the role of people in BIM projects and highlighted that collaboration may be constrained when motivation, individual capabilities, the allocation of responsibilities, and change management are neglected. Their analysis distinguishes between having collaborative tools available and ensuring that participants actually work in a coordinated manner. Complementarily, Campoverde (2025) explored BIM acceptance among employees of construction companies, considering the motivations and barriers associated with adopting it as a project management methodology. These contributions position BIM adoption as a process that requires consideration of people's responses and the organizational conditions in which the methodology is introduced.

The selected literature also includes research examining the relationship between BIM and project management in specific settings. Chávez et al. (2022) studied the methodology in relation to the planning of structural works in a Peruvian local government, while Pérez et al. (2024) examined its relationship with the efficiency and sustainability of architectural projects. Montoya and Brioso (2024), in turn, proposed a management model combining standardized contracts and BIM tools to optimize public–private partnership projects in Peru. Although these studies address different problems, they contribute to the examination of BIM adoption in planning, information management, and contractual coordination. However, the application of BIM in a specific project or

setting does not, by itself, demonstrate that an organization has institutionalized the methodology in its routine processes.

Environmental conditions are also part of the discussion on implementation. Lourenço et al. (2025) analyzed barriers to BIM implementation in Portugal, a context characterized in their study as a late adopter. In the field of public investment, Haro and Piñas (2025) synthesized evidence on the challenges, obstacles, and benefits of BIM application, highlighting the importance of technical capabilities and regulatory and institutional frameworks. Likewise, through a systematic review of BIM implementation in construction projects, Amen (2026) identified barriers related to a lack of trained personnel, resistance to organizational change, initial costs, and the absence of regulations, alongside facilitating factors such as leadership, ongoing training, role definition, and interoperability. These studies indicate that external and internal conditions may interact in BIM adoption, although their findings must be interpreted in light of their respective units of analysis and scopes.

Taken together, the selected studies address different subjects, scales, and approaches: technology acceptance, the human factor, implementation barriers, project planning, contract management, and institutional conditions. This heterogeneity makes it difficult to interpret the findings as though all studies measured the same phenomenon. Furthermore, results concerning BIM use in a project are not necessarily equivalent to those explaining the intention to adopt it or its sustained integration into a company. A synthesis is therefore needed to organize the identified factors and analyze which aspect of BIM adoption each one addresses, without attributing conclusions drawn from individual studies to the entire body of literature.

To address this need, this study organizes the evidence according to the technological, organizational, and environmental components of the Technology–Organization–Environment (TOE) framework. The technological component includes tools, infrastructure, interoperability, and information management; the organizational component includes competencies, training, roles, leadership, coordination, and change management; and the environmental component comprises regulations, standards, and institutional conditions. This framework makes it possible to classify factors according to the domain in which they arise, without assuming that they operate in isolation or have equal relevance in every context.

In addition, four analytical dimensions are proposed to interpret BIM adoption: access, adaptability, organization, and implementation. Access encompasses the conditions that enable its initial use; adaptability refers to the ability of individuals and teams to acquire competencies and adjust their practices; organization considers the integration of BIM into business roles, processes, and structures; and implementation encompasses its application in work activities and processes. These dimensions are analytical categories proposed by this study, not universal stages or a mandatory sequence that all organizations must follow. Their purpose is to distinguish different aspects of BIM adoption and examine the role that technological, organizational, and environmental factors may play in each.

Within this framework, the objective of this study is to identify, systematize, and analyze the factors influencing BIM adoption and implementation in Ibero-American construction companies, as well as to examine their relationship with the dimensions of access, adaptability, organization, and implementation. To this end, a qualitative systematic literature review with an analytical scope is conducted, and its thematic synthesis comprises 22 studies. The contribution of the study is to integrate the findings of these investigations into a common analytical structure that makes it possible to distinguish the identified factors, recognize the domains in which they operate, and examine their relationships with different aspects of BIM adoption. In this way, the study seeks to contribute to a more precise understanding of the methodology's adoption, considering not only its technical use but also the human, organizational, and contextual conditions that may influence its integration into work practices.

Methodology

A systematic literature review with a qualitative approach and descriptive-analytical scope was conducted to identify and analyze the factors influencing the adoption and implementation of Building Information Modeling (BIM) in Ibero-American construction companies. The process was structured with reference to the PRISMA 2020 guidelines (Page et al., 2021), in order to organize the identification, selection, appraisal, and synthesis of scientific evidence.

The literature search was conducted on April 10, 2026, in the Scopus, Web of Science, and SciELO databases, considering publications from January 1, 2020, through the search date. The strategy focused on the concepts of BIM, adoption, implementation, and factors influencing the construction sector, incorporating terms related to barriers, drivers, and challenges, as well as the Technology–Organization–Environment (TOE) framework. The following general search string was used: ("Building Information Modeling" OR "Building Information Modelling" OR BIM) AND (adoption OR implementation OR barrier* OR driver* OR factor* OR challenge*) AND (construction OR "construction companies" OR "construction firms" OR "construction industry").

The search targeted studies conducted in the Ibero-American context on the incorporation of BIM in construction companies and organizations related to the sector.

Publications from the specified period were included if they addressed BIM adoption or implementation and analyzed technological, organizational, or environmental factors, providing sufficient information about their objectives, methodology, and results. Duplicate records, documents that did not address the review objective, studies focused exclusively on technical aspects without analyzing organizational adoption, and full texts that did not meet the eligibility criteria after assessment were excluded.

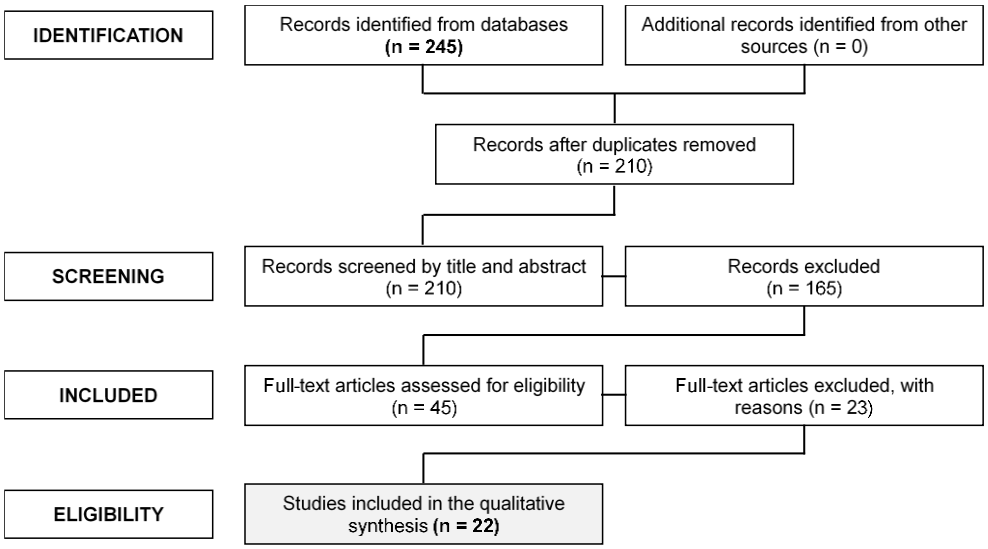
Selection proceeded through successive stages of identification, duplicate removal, title and abstract screening, and full-text eligibility assessment, with the participation of four reviewers. The review tasks were distributed across record deduplication, initial assessment, eligibility review, and verification of the selected studies; disagreements were considered for joint review. In total, 245 records were identified and 35 duplicates were removed, leaving 210 records for screening. Of these, 165 were excluded because they did not meet the thematic or scope criteria, and 45 proceeded to full-text assessment. Ultimately, 22 studies were included in the qualitative synthesis, while the remaining 23 were excluded for other reasons identified during eligibility assessment. The selection process was organized according to the structure of the PRISMA 2020 flow diagram.

Information was systematized using an extraction matrix that included authorship, publication year, country, objective, methodological design, context, results, and factors associated with BIM adoption. Methodological quality was examined using five criteria developed by the authors: clarity of objectives, appropriateness of the design, description of procedures, consistency between results and conclusions, and acknowledgment of limitations. These criteria enabled a qualitative assessment of the studies' robustness and relevance to the synthesis as part of the critical analysis of the evidence.

The results were analyzed through a comparative qualitative synthesis. First, the identified factors were classified according to the technological, organizational, and environmental dimensions of the TOE framework. The technological dimension included digital tools, infrastructure, and interoperability; the organizational dimension included competencies, training, leadership, coordination, and change management; and the environmental dimension included regulations, standards, and external conditions affecting adoption. The findings were then examined through four analytical dimensions proposed for this review: access, referring to the conditions that enable the initial adoption of BIM; adaptability, linked to learning and changes in existing practices; organization, related to its integration into internal structures, roles, and processes; and implementation, focused on its application in work activities. These dimensions were used as complementary analytical categories, rather than universal or necessarily sequential stages, to compare the studies and identify convergences, differences, and challenges in the Ibero-American context.

Figure 1

PRISMA flow diagram of the study selection process



Source: Author's own elaboration based on PRISMA 2020 (Page et al., 2021)

Results

Analysis of the 22 selected articles made it possible to identify how the adoption and implementation of Building Information Modeling (BIM) are addressed in the construction sector, considering the technological, organizational, and environmental factors of the TOE model and the analytical dimensions proposed in this review: access, adaptability, organization, and implementation. The corpus includes publications from 2020 to 2026 and reports experiences from Latin America and Europe in areas such as construction planning, project management, infrastructure, social housing, and heritage conservation. This diversity made it possible to examine both the conditions that facilitate or hinder BIM adoption and its applications in different construction contexts.

Regarding technological factors, the studies primarily address the use of digital models to integrate information, improve planning, and facilitate technical coordination during project development. Apaclla et al. (2025) examined the combined application of BIM and unmanned aerial vehicles in earthwork planning around the Chancay megaport in Peru. In other contexts, Baeza-Torres et al. (2021) analyzed the importance of BIM in infrastructure works, while Valenzuela et al. (2023) studied its implementation in Chilean bridges. Falcão et al. (2025), in turn, addressed interoperability in BIM-supported structural studies applied to architectural heritage. These studies demonstrate the diversity of technological applications represented in the corpus, from construction planning and monitoring to information integration in specialized projects. Data management is also a specific area of interest, as shown by Prieto-del-Río (2024), while da Costa et al. (2022) focused on developing guidelines for BIM implementation in the post-occupancy management of social housing in Brazil.

Organizational factors are related to the incorporation of BIM into companies' and institutions' planning, coordination, and management procedures. Chávez et al. (2022) studied its application in planning structural works for a Peruvian local government, while Osorio-Gómez et al. (2024) examined its implementation in small and medium-sized companies in the Colombian construction sector. In Peru, Pacheco et al. (2024) addressed the role of BIM in innovation and efficiency in construction management. In Brazil, de Aquino and Martinez (2025) presented a BIM-based integrated model for customizing low-cost housing, while Menezes-Firmino et al. (2025) proposed an Agile-BIM framework for public organizations. Montoya and Brioso (2024) also linked the methodology to contract standardization and the optimization of public–private partnership projects. Taken together, these studies situate BIM adoption within different organizational structures and management arrangements, from construction companies to public entities and housing projects.

With regard to the environmental factors in the TOE model, the studies examine the regulatory, institutional, and sectoral conditions that frame BIM adoption. Machado et al. (2021) analyzed the evolution of BIM regulation in Latin American countries, while Haro and Piñas (2025) reviewed the challenges, obstacles, and benefits associated with its application in public investment. In Europe, Lourenço et al. (2025) studied implementation barriers in late-adopting European Union countries, using Portugal as a case study. These studies incorporate external organizational conditions into the analysis and show that BIM implementation is also examined in relation to regulatory frameworks and the institutional characteristics of each context.

Organizing the findings through the four proposed dimensions enabled a cross-cutting interpretation of the studies. The access dimension includes the initial conditions for adopting BIM, including the availability of tools and technology acceptance. In this area, Sanchís-Pedregosa et al. (2020) examined BIM through a technology acceptance approach in Peru, while Machado et al. (2021) addressed regional regulatory conditions that contextualize its adoption. The adaptability dimension captures the relationship between existing practices and the introduction of new ways of working. Mêda et al. (2023) specifically examined the role of legacy practices in BIM adoption in Portugal, providing insight into the relationship between established routines and change processes.

The organization dimension groups studies that relate BIM to stakeholder coordination, planning, and management structures. This perspective is reflected in research on local governments (Chávez et al., 2022), small and medium-sized enterprises (Osorio-Gómez et al., 2024), public organizations (Menezes-Firmino et al., 2025), and standardized contracts for public–private partnership projects (Montoya and Brioso, 2024). The implementation dimension, in turn, covers the application of BIM in specific projects, sectors, and processes, such as earthwork planning (Apaclla et al., 2025), low-cost housing (de Aquino and Martinez, 2025), social housing management during the occupancy stage (da Costa et al., 2022), and road infrastructure (Perez-Montaño et al., 2026).

Finally, the studies also examine BIM applications in architectural projects and their relationship with efficiency and sustainability (Pérez et al., 2024), as well as its role in construction project management (Gómez-Valdés et al., 2023; Campoverde, 2025). Amen (2026) contributes a systematic review of BIM implementation in construction projects, while Falcão et al. (2025) and Prieto-del-Río (2024) broaden the scope to interoperability and data management. Overall, the corpus brings together research examining BIM through its technological, organizational, and environmental conditions, as well as through its adoption and application in different contexts.

The four dimensions provide a way to organize this diversity of approaches according to the review objectives, without assuming that all articles examine the same variables or represent successive stages of a single process.

Discussion

The results show that the adoption of Building Information Modeling (BIM) cannot be understood solely as the introduction of a digital tool into construction projects. Although its technological applications can improve planning, integrate information, and support technical coordination, its effective use also depends on how organizations incorporate the methodology into their work practices and on the conditions of the environments in which they operate. This relationship can be seen by comparing studies focused on technical applications, such as Apaclla et al. (2025), with those examining project organization and management, such as Osorio-Gómez et al. (2024) and Menezes-Firmino et al. (2025). In other words, having BIM available does not necessarily mean that it has been effectively integrated into construction management.

This distinction helps explain why the technological, organizational, and environmental factors of the TOE model should be analyzed together. From the technological perspective, interoperability and data management are relevant because the value of models depends on whether information can be shared and used throughout a project. Falcão et al. (2025), for example, address interoperability in BIM-supported structural studies, while Prieto-del-Río (2024) focuses on construction data management. However, technical integration alone does not resolve problems of coordination among stakeholders or adaptation of existing procedures. The organizational component is therefore equally important: the methodology must be incorporated into the responsibilities, information flows, and decisions that structure work. This relationship is also evident in studies of small and medium-sized Colombian companies by Osorio-Gómez et al. (2024) and Brazilian public organizations by Menezes-Firmino et al. (2025).

What happens, then, when an organization attempts to adopt BIM in a context where traditional practices continue to guide everyday work? The study by Mêda et al. (2023), which focuses on legacy practices in Portugal, helps situate this question within the adoption process. Introducing a digital methodology entails working alongside previously established procedures and adapting coordination and management practices. From this perspective, the adaptability dimension is important because it allows the relationship between BIM and existing practices to be examined, rather than assuming that adoption occurs automatically. Complementarily, Sanchís-Pedregosa et al. (2020) address technology acceptance in Peru, incorporating users' perspectives into the analysis. Both approaches help distinguish between the availability of a technology and the conditions that encourage its acceptance and use.

The institutional context also deserves attention. The evolution of BIM regulation in Latin America analyzed by Machado et al. (2021), together with the challenges of its application in public investment reviewed by Haro and Piñas (2025), shows that adoption does not depend exclusively on internal company decisions. Rules, institutional requirements, and sectoral conditions are part of the environment in which the methodology is implemented. Lourenço et al. (2025) add an analysis of implementation barriers in Portugal, situating the issue in a late-adoption context. Consequently, differences between countries and organizations must be considered when interpreting the results: the same methodology may face different adoption conditions depending on the regulatory and organizational environment.

The four dimensions proposed in this review—access, adaptability, organization, and implementation—help explore these relationships in greater depth. Access identifies the conditions required to begin using BIM; adaptability focuses on the adjustments needed in existing practices; organization examines its incorporation into work management and coordination; and implementation allows its application in specific projects to be observed. These dimensions should not be understood as rigid or necessarily consecutive stages. Rather, they offer complementary perspectives for analyzing a process in which technical progress, organizational difficulties, and institutional constraints may coexist. For example, an organization may use BIM in a specific activity without having integrated the methodology into all of its management procedures.

The scope of the corpus must also be acknowledged. The selected articles cover diverse contexts, from infrastructure and bridges to social housing, architectural projects, and public management. This breadth makes it possible to observe different forms of application, but it does not mean that all studies measure adoption using the same criteria or that their results are directly comparable. Furthermore, the inclusion of research from Latin America and Europe provides valuable contextual perspectives, although its findings cannot automatically be generalized to all countries or types of companies. This consideration is especially important when interpreting specific case studies, such as Apaclla et al. (2025) on earthwork planning in Peru or de Aquino and Martinez (2025) on low-cost housing in Brazil.

Overall, the main insight from this review is that understanding BIM adoption requires looking beyond the tool itself and considering the conditions that enable its incorporation into construction practice. Its technological

use, organizational integration, and institutional environment are related but not equivalent aspects. The TOE model provides a way to organize these factors, while the proposed dimensions offer a complementary perspective on access conditions, organizational adjustments, and effective application. Thus, the review does not propose a single pathway to adoption; rather, it provides a framework for interpreting the diversity of documented experiences and recognizing that BIM implementation must be analyzed in light of both its technical capabilities and the specific conditions under which organizations operate.

Conclusions

This review concludes that the adoption of Building Information Modeling (BIM) is a process that extends beyond the incorporation of digital tools. Its integration into the construction sector involves technological, organizational, and environmental factors that shape how companies gain access to the methodology, adapt their practices, and incorporate it into their projects. In this regard, having BIM available or using it on a specific project does not necessarily mean that it has been sustainably integrated into an organization's routine processes.

The main contribution of this study is to bring together the components of the Technology–Organization–Environment (TOE) model and four analytical dimensions: access, adaptability, organization, and implementation. This structure makes it possible to interpret the findings through complementary perspectives, distinguishing the conditions for adopting BIM, the adjustments required in work practices, its integration into organizational structures, and its application in specific projects. The proposed dimensions are not universal stages or a mandatory sequence, but categories that facilitate analysis of the diverse experiences represented in the corpus.

From a practical perspective, the findings highlight the need to address BIM adoption holistically. The availability of technological resources must be accompanied by the capabilities needed to use them, clearly defined work procedures, coordination among stakeholders, and institutional conditions compatible with their application. However, these needs may vary according to company size, project type, and operating context; implementation decisions should therefore respond to each organization's specific characteristics.

Finally, these conclusions are limited by the scope of the 22 articles analyzed, published between 2020 and 2026 and drawn from Latin American and European contexts. The thematic and geographical diversity of the corpus makes it possible to identify different forms of BIM adoption, but it does not ensure that the patterns identified represent all Ibero-American countries and construction companies equally. Future research should expand the evidence base in underrepresented contexts, compare organizations with different levels of adoption, and empirically assess the relationship between TOE factors and the proposed dimensions. This would make it possible to determine more precisely the conditions under which BIM implementation moves beyond occasional use and becomes an organizational capability.

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