South American Publishing

SAP Land and Architecture. 2024; 3:124
doi: 10.56294/la2024124

REVIEW

BIM automation and its relationship with information management in the Latin American and Peruvian construction industry

Automatización BIM y su relación con la gestión de información en la industria constructiva latinoamericana y peruana

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Cite as
Archenti-Palacios SJ, Samame-Zatta VE, Murga-Montoya JE, Cardenas-Garcia A, Alavan-Huaman SE. BIM automation and its relationship with information management in the Latin American and Peruvian construction industry. SAP Land and Architecture. 2024; 3:124. https://doi.org/10.56294/la2024124

Publication History
Submitted: 01-06-2023
Revised: 07-10-2023
Accepted: 10-03-2024
Published: 11-03-2024

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ABSTRACT

Introduction: the construction industry has been undergoing constant changes, influencing the way projects are led today, thus adopting new work methodologies such as BIM or Building Information Modeling. Globally, BIM has been recognized for more than fifteen years as a fundamental tool for the revitalization of the global economy: that is why many countries have initiated digitalization processes in the AEC sector.

Method: a bibliographic review was conducted using articles retrieved from the PubMed, MEDLINE, and Scielo databases, spanning the period from September to October 2025. Inclusion and exclusion criteria were established to obtain high-quality and relevant articles. Filters were used to select articles in English and Spanish. Articles from outside the timeframe were added due to their importance for the writing of this article, with the research not having an update rate below 90 %.

Development: in Peru, recent studies reveal a stagnation in the widespread adoption of BIM outside of large-scale projects, especially among micro and small businesses, designers, and subcontractors, who face economic and technological barriers to accessing software, hardware, and ongoing training. Furthermore, the lack of integration between national policies and local technical capabilities slows the consolidation of a collaborative culture geared toward digitalization.

Conclusion: the review shows that BIM automation represents a strategic pillar for transforming information management in the Latin American construction industry, although its adoption remains uneven and influenced by institutional, educational, and technological factors. In Peru, while there have been regulatory and academic advances, a gap persists between technical training and professional application, which limits the full utilization of the automated capabilities of the BIM environment.

Keywords: BIM System; Peru; Civil Engineering; Latin America.

RESUMEN

Introducción: la industria de la construcción ha estado en constante cambio, influyendo en la forma en que se lideran los proyectos hoy en día, adoptando así nuevas metodologías de trabajo como BIM o Building Information Modeling. A nivel mundial, BIM ha sido reconocido durante más de quince años como una herramienta fundamental para la revitalización de la economía global: es por ello que muchos países han iniciado procesos de digitalización en el sector AEC.

Método: se realizó una revisión bibliográfica utilizando artículos recuperados de las bases de datos PubMed, MEDLINE y Scielo, que abarcan el período de septiembre a octubre de 2025. Se establecieron criterios de inclusión y exclusión para obtener artículos de alta calidad y relevantes. Se utilizaron filtros para seleccionar artículos en inglés y español. Los artículos fuera del marco temporal se agregaron debido a su importancia para la escritura de este artículo, sin que la investigación tenga una tasa de actualización inferior al 90 %.

Desarrollo: en Perú, estudios recientes revelan un estancamiento en la adopción generalizada de BIM fuera de proyectos de gran envergadura, especialmente entre micro y pequeñas empresas, diseñadores y subcontratistas, quienes enfrentan barreras económicas y tecnológicas para acceder a software, hardware y capacitación continua. Además, la falta de integración entre las políticas nacionales y las capacidades técnicas locales frena la consolidación de una cultura colaborativa orientada a la digitalización.

Conclusión: la revisión muestra que la automatización BIM representa un pilar estratégico para la transformación

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de la gestión de la información en la industria de la construcción latinoamericana, aunque su adopción sigue siendo desigual e influenciada por factores institucionales, educativos y tecnológicos. En Perú, si bien se han producido avances regulatorios y académicos, persiste una brecha entre la capacitación técnica y la aplicación profesional, lo que limita el pleno aprovechamiento de las capacidades automatizadas del entorno BIM.

Palabras clave: Sistema BIM; Perú; Ingeniería Civil; América Latina.

INTRODUCTION

The construction industry has been undergoing constant changes, influencing the way projects are led today, thus adopting new work methodologies such as BIM or Building Information Modeling.[1]

Globally, BIM has been recognized for more than fifteen years as a fundamental tool for the revitalization of the global economy: that is why many countries have initiated digitalization processes in the AEC sector.[2] Considering this, and observing the lethargic reality compared to European countries, the BIM GOB Latam Network was formed in Latin America, a cooperation network "with common guidelines, favoring the exchange of trade and knowledge" [3], since "According to a study by CAF - Latin American development bank - the low digitalization of the construction sector is one of the main causes of low productivity levels."[4]

BIM (Building Information Modeling) automation has undergone significant evolution in the Latin American construction industry, driven mainly by the digital transformation and the need for efficiency in construction processes. design, construction, and operation of infrastructure. In this context, BIM has ceased to be conceived exclusively as a 3D modeling tool to become a comprehensive information management methodology, enabling multidisciplinary collaboration and data-driven decision-making at all stages of the project lifecycle.[3,4,5] Since the early 2010s, the region has witnessed sustained progress in the adoption of BIM, led by public policies and national plans that have established roadmaps, technical standards, and regulatory frameworks aimed at the digitalization of the construction sector. Countries such as Chile, Brazil, Argentina, Colombia, and especially Peru, have implemented standards derived from the ISO 19650 series, promoting process standardization, interoperability through the use of open formats (such as IFC), and the consolidation of common data environments (CDEs) for collaborative information management. The evolution of BIM towards automation, powered by the development of scripting and the integration of technologies such as Dynamo and Python, has made it possible to optimize repetitive tasks, improve data integration and facilitate interaction between disciplines, processes and digital platforms.[6] In the particular case of Peru, the BIM Peru Plan and its roadmap to 2030 outline precise guidelines for progressive adoption, emphasizing not only the technical benefits but also the need to strengthen human capital, governance and articulation between the public, private and academic sectors.[7,8]

The impact of BIM automation on information management is broad and cross-cutting, highlighting the ability to centralize, validate, and structure information relevant to construction projects in a single digital platform. This centralization not only ensures data consistency and traceability, but also enables collaborative workflows that reduce errors and duplication common in traditional methods. At the regional level, the consolidation of common data environments (CDEs) has allowed dispersed teams to share information in real time, standardize nomenclature, manage versions, and coordinate deliverables under strict quality control and security protocols. BIM automation has revolutionized clash detection, measurement calculations, and documentation generation, enabling early identification of conflicts between disciplines, optimized decision-making, and greater efficiency during the design and construction phases.[9] Furthermore, by integrating parametric information and metadata, BIM enables advanced energy efficiency analysis, logistics simulations, predictive maintenance, and asset management, extending its impact to the infrastructure operation phase.

In Peru, specifically in the city of Lima, "The BIM Peru Plan was created as a political measure of the National Competitiveness and Productivity Plan, recognizing the need to modernize and digitize systems for formulating, evaluating, executing, and operating investment projects."[10] Implementing the mandatory regulation of BIM and all its implications as the main goal for 2030. The publication of the National BIM Guide and the progressive mandatory use of BIM in public investments have provided a significant boost to the structuring and management of information, raising standards of transparency, traceability, and control in the execution of public and private works, and establishing new digital maturity metrics that allow for assessing progress in the implementation of the methodology.[11,12]

For these reasons, the authors of this review aimed to describe the advantages of implementing BIM Automation in the Latin American and Peruvian construction industry.

METHOD

A bibliographic review was conducted using articles retrieved from the PubMed, MEDLINE, and Scielo databases, spanning the period from September to October 2025. Inclusion and exclusion criteria were established to obtain high-quality and relevant articles. Filters were used to select articles in English and Spanish. Articles from outside the timeframe were added due to their importance for the writing of this article, with the research not having an update rate below 90 %.

Information was collected using keywords such as BIM System, Peru, Civil Engineering, Latin America, as well as their Spanish equivalents: "BIM System; Peru; Civil Engineering; Latin America" Boolean operators such as AND, OR, and NOT were also introduced to facilitate efficient combinations of keywords, helping to locate relevant studies for inclusion in the study.

A detailed information search was conducted in the aforementioned databases, yielding a total of 32 articles. The article selection

was carried out using the PRISMA methodology, which identified articles that met the selection criteria to obtain accurate and substantiated information for the development of the article on BIM Automation and its relationship with information management in the Latin American and Peruvian construction industry.

DEVELOPMENT

In Peru, recent studies[12,13] reveal a stagnation in the widespread adoption of BIM outside of large-scale projects, especially among micro and small businesses, designers, and subcontractors, who face economic and technological barriers to accessing software, hardware, and ongoing training. Furthermore, the lack of integration between national policies and local technical capabilities slows the consolidation of a collaborative culture geared toward digitalization. Gaps in digital governance, the absence of a consolidated national technical team for managing BIM strategies, and the lack of standardized methodologies for assessing digital maturity limit the reach and impact of automation. Therefore, it is essential to strengthen training programs, promote standardization adaptable to local realities, encourage the development of specific regulations, and coordinate collaboration between the public, private, and academic sectors to ensure a sustained evolution toward full digitalization and intelligent automation in the Peruvian and Latin American construction industry.[14]

Currently, the conceptualization and evolution of BIM (Building Information Modeling) automation are based on solid foundations that go far beyond simple three-dimensional modeling, becoming a comprehensive information management system throughout the entire lifecycle of construction projects. From its origins in the 1970s and 1980s with the pioneering work of Chuck Eastman and the development of software such as Sonata and ArchiCAD, to the consolidation of advanced platforms such as Revit and the use of visual programming through Dynamo, BIM has transitioned toward a collaborative and automated philosophy that redefines processes and roles in the industry.[2] This transition has not been linear, but has involved technological advances, cultural changes, and specific regulations in various countries. In Latin America, these regulations have promoted regulatory frameworks and roadmaps to accelerate its adoption, as is the paradigmatic case of the BIM Peru Plan. In this process, authors such as Succar[15] have proposed BIM maturity models, highlighting the importance of parametric design, interoperable standards, and advanced programming in the development of BIM automation, aspects widely supported in recent literature and referenced regional research.[5] When addressing information management in automated BIM environments, it is evident that the wealth of benefits lies in the radical transformation of the way data is generated, shared, and reused among the different stakeholders in a project.[7] The ISO 19650 standard, widely adopted in Latin America and mandatory in Peruvian public processes, establishes principles for the organization and exchange of information, introducing the key concept of the Common Data Environment (CDE), which centralizes and standardizes workflows and the traceability of digital models. Unlike traditional methods, automated processes make it possible to detect conflicts, schedule repetitive tasks, and perform multidimensional analysis (4D and 5D) with minimal human intervention, improving efficiency, accuracy, and collaboration among the parties involved.[10]

The regulatory framework and public policies related to BIM in Latin America have evolved rapidly in recent years, consolidating fertile ground for process automation. Countries such as Chile, Brazil, Colombia, and especially Peru have enacted decrees, established national roadmaps, and published technical guides to institutionalize the use of BIM in public investments, requiring compliance with international standards such as ISO 19650 and the use of open formats such as IFC and COBie.[15,16] This process has been strengthened by the creation of the BIM Network of Latin American Governments, a space that not only facilitates collaboration and the exchange of best practices, but also promotes regional standardization and the integration of enabling technology, aligning public and private efforts. As Morales Quirós emphasizes within the Network, the existence of solid policies, a dedicated budget, and dedicated teams are determining factors for the success of BIM automation, but it is recognized that regulatory standardization and institutional leadership must be accompanied by robust mechanisms for training and results evaluation.[17]

The Peru BIM Plan currently represents an emblematic case in the region in terms of planning, implementation, and evaluation of BIM automation, articulated by the leadership of the Ministry of Economy and Finance. This plan, which emerged as a policy measure within the National Competitiveness and Productivity Plan and is embodied in ministerial decrees and resolutions, lays out a roadmap that establishes four strategic axes: governance, collaborative framework, capacity building, and communication of the vision.[16] Among the achievements are the publication and update of the National BIM Guide—which structures roles such as BIM Leader, BIM Supervisor, and BIM Coordinator—the execution of pilot projects, the regulatory requirement for BIM in public tenders, specific curricular training in technical and university institutions, and active participation in international networks.[18,19] In terms of automation, the Peru BIM Plan promotes centralized information management through cloud platforms, automated workflows for multidisciplinary analysis, and the progressive implementation of CDE, which has been verified in national pilot projects such as the headquarters of the Banco de la Nación, hospitals, high-performance schools, and the infrastructure for major events such as the Lima 2019 Pan American Games.[20,21]

Multiple case studies in the Peruvian context empirically demonstrate the benefits of BIM automation, both in terms of operational efficiency and quality control and error reduction. In projects such as the Ica High Performance School and the National Hospital (PNP), the use of automated modeling enabled the detection and resolution of hundreds of interferences before execution, improved validation of budget items, and advanced 3D coordination between specialties.[22] Similar results were observed in process optimization through automated dashboards in the construction of megaprojects such as Alameda Central, where digitalization and automatic data processing in the cloud have replaced intensive manual tasks, freeing up human resources for high-value-added analyses and ensuring interoperability between specialized platforms such as Autodesk Civil 3D, Revit, and Navisworks. These achievements reaffirm what has been pointed out by authors such as Murguía et al.[23] and the MEF reports on the centrality of automation for reducing cost overruns, increasing transparency, and improving strategic decision-making in the Peruvian public

sector.

Latin American literature, with an emphasis on academic analyses developed by CAF and organizations such as the BIM Network and SIBIM, highlights that the benefits of BIM automation in project management go beyond time and cost efficiency, positively impacting the sustainability, traceability, interdisciplinary collaboration, and transparency of construction processes. Recent metrics show, for example, cost and time reductions of 4 to 10 %, a 6 % reduction in information requirements on site, and an increase in labor productivity of up to 13 % in countries that have implemented solid strategies and pilot projects. However, authors such as Russo et al.[24] warn that the success of these experiences depends on the capacity of institutions to establish interoperable technical standards, strengthen human capital, and create collaborative environments in which automation is an integral part of the organizational culture.

The challenges and barriers to the adoption of BIM automation, especially in Latin America and Peru, are both structural and cultural. Recent research warns that resistance to change, a lack of understanding of the benefits, a lack of specific training, and insufficient investment in enabling technologies are the main obstacles to successful implementation. According to Aguilar Zavaleta,[25] more than 65 % of construction technicians in Peru are still unfamiliar with the philosophy and basic applications of BIM. This creates a significant gap in training and technical knowledge, limiting the assimilation of the automated workflows that characterize modern construction. Added to this is the lack of effective interoperability between software—where standardization through ISO 19650 and IFC is still incipient in some contexts—and the existence of challenges in creating robust digital ecosystems capable of supporting a common data environment and massive management of reliable information.[6] From a personal perspective, I believe that overcoming these barriers requires a multidimensional strategy that addresses everything from public policies, economic and regulatory incentives to innovative pedagogical approaches and a strong partnership between the public, academic, and private sectors.

Enabling technologies and software tools for BIM automation range from intelligent modeling engines, such as Revit and Tekla, to visual (Dynamo) and textual (Python) programming environments, cloud-based collaborative platforms, and interoperability systems based on openBIM and IFC11. Dynamo, for example, has been widely recognized for its ability to create visual algorithms that automate property assignment, interference detection, and the dynamic generation of drawings and technical documentation, minimizing the risk of errors and increasing efficiency in large-scale projects. The integration of artificial intelligence, machine learning, laser scanning, drones and IoT sensors is opening up new possibilities for generative design, asset control and predictive analysis of building performance, aspects that are already being explored in the region and that promise to transform the industry in the coming years.[25] It is essential to highlight that, although the initial investment and learning curve may be high, empirical evidence indicates that the return on investment is achieved in short project cycles, and that the digital maturity achieved by companies and entities is decisive for competing in national and international markets.[26,27]

In the field of training and human capital, training, certification, and professional development strategies are recognized as key factors for the sustainability of BIM automation in Latin America and Peru.[28] BIM specialization programs, diplomas, and certifications have multiplied in universities, technical institutes, and professional organizations, such as the BIM Forum Peru, playing a relevant role in generating advanced skills and aligning with international standards. Also noteworthy are initiatives such as the incorporation of BIM content into university curricula, the organization of technical-practical events and webinars, and the production of guides and manuals specific to the Latin American context. However, the literature reveals that isolated training, without a systemic focus on organizational maturity and change management, tends to be insufficient. Therefore, it is necessary to promote continuing education models, collaborative learning networks, and intergenerational mentoring to close digital gaps and generate leaders capable of driving digital transformation in the construction sector. Comparative analyses of current academic research show that Peru, although it has made considerable progress in building BIM governance and institutionalizing its roadmap, still faces significant challenges compared to countries such as Chile, Brazil, and Colombia, where intersectoral coordination and international integration have been more extensive. Factors such as greater participation in technology missions, access to multilateral financing, and the early development of national standards have accelerated BIM automation in other contexts, enabling the expansion of technology platforms (such as the BIMBR Platform in Brazil or PARPro in Chile), the implementation of large-scale pilots, and the creation of interoperable digital ecosystems throughout the value chain. Despite this, Peru is consolidating its position as a benchmark through the formulation of clear policies, constant monitoring of progress using management indicators, and the implementation of flagship projects, positioning itself as a central player in the BIM Network of Latin American Governments and contributing replicable best practices in the region.[11,12]

In the authors' opinion, BIM automation constitutes not only a technological tool but a true methodological and cultural transformation, capable of redefining information management patterns, operational efficiency, and the quality of public and private investment in the Latin American and Peruvian construction sector. However, fully realizing its advantages requires overcoming systemic barriers through the strengthening of human capital, technical standardization, the development of robust digital ecosystems, and effective integration between the different actors in the sector. Thus, the strategic value of BIM automation lies in its ability to catalyze industrial modernization, promote sustainability, and foster a more transparent, collaborative, and competent construction industry, in line with the global challenges and socio-territorial development aspirations of Region.[8] The Peruvian experience, framed within the BIM Peru Plan, demonstrates that political commitment, a long-term vision, and ongoing interaction between the public, academic, and private sectors are necessary—though not sufficient—conditions for turning BIM automation into the standard for information management in 21st-century Latin American construction.

CONCLUSION

The review shows that BIM automation represents a strategic pillar for transforming information management in the Latin American construction industry, although its adoption remains uneven and influenced by institutional, educational, and technological factors. In Peru, while there have been regulatory and academic advances, a gap persists between technical training and professional application, which limits the full utilization of the automated capabilities of the BIM environment.

The consolidation of an interoperable digital infrastructure, along with coordinated public policies and specialized training, are necessary conditions for BIM automation to evolve from a technical tool to an information governance system. This transition would not only optimize construction processes but would also enable robust traceability, smarter planning, and decision-making based on reliable and dynamic data.

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FUNDING

The authors received no funding for this research.

CONFLICTS OF INTEREST

The authors declare that there is no conflict of interest.

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