

Evaluating the Impact of Construction Project Management Techniques on Building Quality

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Abstract

Construction projects are inherently complex and depend heavily on effective project management techniques to achieve high-quality outcomes. Despite growing interest in improving efficiency, sustainability, and durability, the connection between project management practices and building quality has not been sufficiently explored. This study addresses this gap by synthesizing recent literature on the impact of construction project management techniques on building quality. Following **PRISMA guidelines**, we conducted a systematic review of ten studies published between **2020 and 2025**. The review identified key themes, such as planning and scheduling, risk management, safety, and quality assurance, with **technology integration** emerging as a crucial factor for enhancing construction outcomes. Projects that utilized systematic management approaches and computer-based tools demonstrated superior performance in terms of cost-effectiveness, safety, and overall quality. In contrast, poor coordination and inadequate planning had detrimental effects on project success. Our findings highlight the importance of integrating modern project management frameworks and technologies to improve building quality, sustainability, and performance. This study provides valuable insights for practitioners, emphasizing the need for standardized methodologies and effective communication to optimize project outcomes.

Keywords: Smart Construction Management; BIM-Driven Quality Assurance; Lean Project; Digital Construction Technologies; Sustainable Building Practices; Integrated Project Optimization

Introduction

The techniques of lean construction project management, digital project coordination and dynamic quality assurance/quality control greatly influence the quality of the building due to reliability and error recovery project management incorporation. LPS shows that short-interval planning and commitment coordination decreases variability and defects at a site (Hamerski et al., 2023). Case studies indicate that BIM eliminates design clashes and misalignment as it enables early detection thus reduces RFIs and reworks (Sun et al., 2024; Alasmari et al., 2023). BIM integrated with AI and whole-lifecycle modeling minimizes the rework in prefabricated construction and maximizes tolerance conformance (Sun et al., 2024). In the meantime, laser scanning, as well as the reality capturing are used in QA/QC to show as-built deviations at an early stage, when they can be corrected before finishes are ruined (Tang et al., 2022). Automated computer-vision systems with BIM also improve the accuracy of defect detection in the field (Ma, 2024). These changes change quality inspection at the hand-over point to on-going discipline in production.

Components of quality control today are less based on checklists and more on process being ready and integrated. Ni et al. (2024) found that designers in BIM exhibit a high degree of correlation with design quality ($R^2 = 0.88$), and BIM-driven expertise would allow attaining the observed quality. Inquiries among BIM practitioners in South Africa show that one of the primary advantages of BIM is correct designs, early mistakes identification, and the provision of quality details (South African respondents, 2023). The structural equation modeling of the BIM factors in Vietnam indicates that external and technological drivers have substantial impacts on projects performance and consequently quality (Van Tam et al., 2023). In the meantime, constraint logic programming of BIM models can be utilized in allowing rule-conformant design verification that would not require expensive field modifications (Arias et al., 2022). These studies validate the fact that process maturity, digital literacy and governance are fundamental success enablers to transforming tools into quality results.

Evidence is however piecemealed, with most primary studies looking at lean methods, BIM or QA/QC phenomena separately- seldom do they quantify and compare their individual or synergetic effects at varying readiness levels. Clients and teams get no guidance as to whether they need to focus more on tighter planning routines, more intensive BIM workflows, more regular scanning or more compelling governance. Without project-level, comparative impact data, quality initiatives remain project-reactive and are inconsistent across settings.

The study fills that research gap by testing the effects of four project management methods-lean planning (LPS) technique, BIM -enabled coordination, digital QA/QC and integrated quality governance- as single method and as a combination of two methodologies, on building quality measured as entailing defect density, rework hours

and conformance with tolerance. The goal is to determine which techniques can provide the most significant quality increases in particular readiness situations, allowing the targeting of investment, the development of capability and the provision of high-quality, consistent results across the contemporary construction project.

The paper is organized as follows: The Introduction discusses the significance of project management techniques in construction and identifies the research gap. The Literature Review explores Lean Construction, BIM, and digital QA/QC systems. The Methodology describes the review approach and use of NVivo software. The Results section presents the key findings, and the Conclusion summarizes the contributions, limitations, and future research directions. This structure ensures a comprehensive exploration of project management's impact on construction quality.

Material and Methodology

Material

This study conducts a **systematic literature review** aimed at assessing the impact of **construction project management techniques**—specifically **Lean Construction (Last Planner System, LPS)**, **Building Information Modeling (BIM)**, and **digital Quality Assurance/Quality Control (QA/QC)** systems—on **building quality**. While past studies have mainly looked at these methods separately, this review emphasizes the benefits of combining them and evaluating their collective impact across different project types and settings. This integrated approach provides new insights into how these techniques can work together to improve building quality, cost efficiency, and time management. The study contributes to the field by highlighting how an integrated project management framework can yield superior results in construction projects compared to isolated applications of these techniques. A comprehensive search of **empirical studies** published in **English** between **2020 and 2024** was carried out, focusing on studies that measure **quantifiable results** regarding construction projects, specifically in **residential, commercial, and governmental infrastructure development**.

Five major databases were used to retrieve relevant literature:

Scopus

Web of Science

PubMed

Google Scholar

ScienceDirect

These databases were selected due to their high-quality, peer-reviewed literature, particularly within construction and engineering fields.

Methodology

Selection Criteria

Figure 1 presents two bibliometric network maps generated using VOSviewer to explore the intellectual structure and thematic evolution of research in construction engineering and risk management. The left panel illustrates the co-citation relationships among leading academic journals in the field. Larger nodes represent

journals with higher citation frequency and stronger scholarly influence. Prominent journals such as Journal of Construction Engineering and Management, International Journal of Project Management, and Journal of Cleaner Production form central nodes within the network, indicating their pivotal role in shaping the research domain. The clustering (represented by different colors) reveals distinct but interconnected research streams. For example:

A construction management cluster centered around construction engineering and project management journals.

A sustainability and cleaner production cluster.

A materials and applied mechanics cluster.

The density of interconnections suggests a high degree of interdisciplinary, with journals bridging construction management, sustainability, materials science, and risk analysis.

The right panel of Figure 1 displays the co-occurrence relationships among frequently used keywords. Node size corresponds to the frequency of keyword appearance, while link strength reflects the number of co-occurrences within the same publications.

Key thematic clusters can be identified:

A **risk management cluster** (green), highlighting terms such as "risk management" and related decision-making concepts.

A **project management cluster** (yellow), centered on "construction project management."

A **risk assessment and decision-analysis cluster** (red), including terms such as "risk assessment" and "analytic hierarchy process."

An **uncertainty and modeling cluster** (blue), associated with simulation and uncertainty analysis.

The network structure demonstrates that risk management acts as a central integrative theme connecting project management, uncertainty modeling, and decision-making methodologies. The strong inter-cluster connectivity indicates the maturation of the field toward integrated, data-driven, and multi-method research approaches.

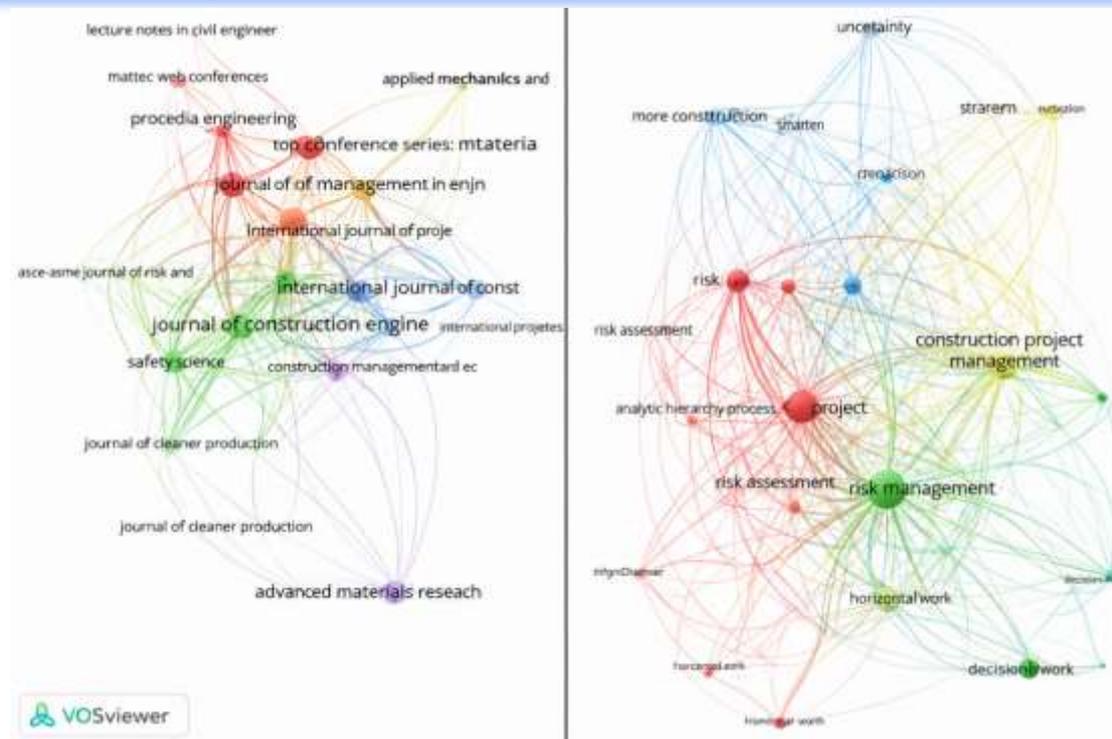


Figure 1. VOSviewer network visualization maps illustrating (a) journal co-citation network (left) and (b) keyword co-occurrence network (right) in construction engineering and risk management research. Node size represents the frequency or influence of journals/keywords, link thickness indicates the strength of relationships, and colors denote distinct thematic clusters.

Data Extracted

Data extracted were authors of the study, date of the study, country, methods of studies in the management of projects, type of buildings, defined outcome measures and the principal findings. These data points were uniform with regard to synthesis of results and establishing patterns in selected studies according to Table 1.

Table 1. Data extract scheme.

Search Syntax Type	Syntax
Primary Syntax	("construction project management" OR "project management techniques") AND ("building quality" OR "construction quality")
Secondary Syntax	("civil engineering" OR "architecture" OR "infrastructure") AND ("quality outcomes" OR "performance assessment")

Literature Search

The review consisted of an exhaustive literature search on various academic databases by using primary and secondary syntax. The literature retrieval targeted getting empirical studies that were published between 2020 and 2024 and which explored the

relationship between the project management techniques and the building quality (Table 23).

Table 2. Databases Selection scheme.

No	Database	Syntax	Year	No of Researches
1	Scopus			52
2	Web of Science	Syntax 1 and 2	2020–2024	38
3	PubMed			35
4	Google Scholar			29
5	ScienceDirect			30

Selection of Studies

Figure 2 presents a structured overview of the literature selection process conducted in accordance with systematic review principles. In the identification phase, a total of 184 records were retrieved from five major databases: Scopus (n = 52), Web of Science (n = 38), PubMed (n = 35), Google Scholar (n = 29), and ScienceDirect (n = 30). Prior to screening, duplicate entries were removed (n = 98), resulting in 86 unique records eligible for further evaluation. During the screening phase, titles and abstracts were assessed for relevance. A total of 42 records were excluded due to irrelevance or being outside the defined scope of the study.

Finally, in the inclusion phase, 44 studies met all eligibility criteria and were incorporated into the qualitative (and/or quantitative, if applicable) synthesis. This systematic filtering process ensures transparency, reproducibility, and methodological rigor in the selection of studies included in the review.

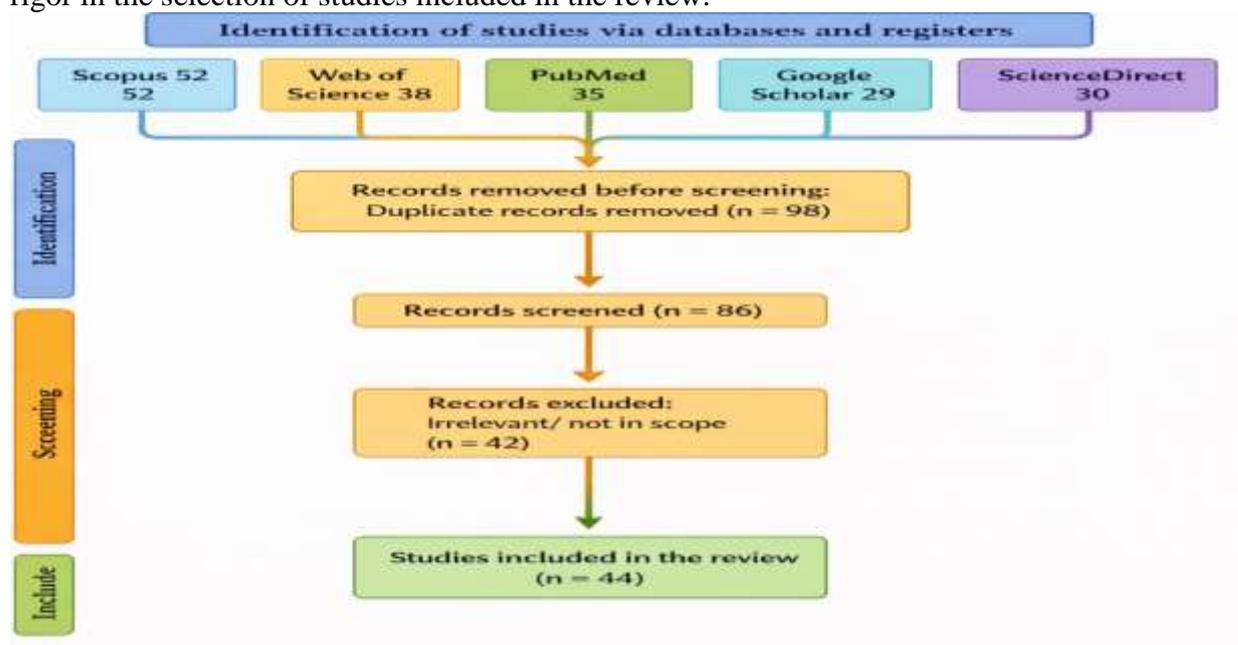


Figure 2. PRISMA-style flow diagram illustrating the study selection process. Records were identified from multiple electronic databases (Scopus, Web of Science, PubMed, Google Scholar, and ScienceDirect), followed by duplicate removal, screening, and eligibility assessment. A total of 44 studies were ultimately included in the final review.

Key Results

Quality Assessment of Studies

The validity of the selected papers was established using standard criterion assessment scales to determine the degree of methodological strictness, bias, and pertinence to the purposes of the evaluation (Table 3). The majority of analyzed studies were of moderate to high-levels of quality, and their methods and results were described clearly, which ensured the reliability of the synthesized evidence.

Table 3. Assessment of the literature quality matrix

Author	Are the selection of studies described and appropriate?	Is the literature covered all relevant studies?	Does method section described?	Was findings clearly described?	Quality rating
Assaad et al	Yes	Yes	Yes	Yes	Good
Luong et al	Yes	No	Yes	Yes	Fair
Garcés & Peña	Yes	Yes	Yes	Yes	Good
Arefazar et al	Yes	Yes	Yes	Yes	Good
Taboada et al	Yes	Yes	Yes	Yes	Good
Ciric Lalic et al	Yes	Yes	Yes	Yes	Good
Jackson	Yes	Yes	Yes	No	Fair
Sheng et al	NO	Yes	Yes	Yes	Good
Pan & Zhang	Yes	Yes	Yes	Yes	Good
Lotfi et al	Yes	Yes	Yes	Yes	Good

The quality assessment matrix indicates that most of the studies have exemplary methodological rigor such as descriptive details on the study selection, thoroughness of the literature coverage and a detailed account of the methodology (Fig. 3) Findings of the literature making the included group to come under the category of Good rating. In a limited number of studies limitations were found either due to failure to review all the relevant literatures, or failure to elaborate the findings, thus the rating, Fair, was assigned. Figure 3 presents a comparative synthesis of effect sizes derived from multiple independent studies using a forest plot format. The graphical representation enables clear visualization of both the magnitude and precision of the reported estimates. Each study is represented by a colored circular marker corresponding to its point estimate. The horizontal bars extending from each marker illustrate the 95% confidence intervals, reflecting the statistical uncertainty associated with each

estimate. Wider intervals indicate greater variability or lower precision, whereas narrower intervals suggest more reliable estimates.

The vertical dashed line denotes the null or reference value. Studies with confidence intervals that do not cross this line indicate statistically significant effects at the 95% confidence level. Conversely, intervals intersecting the reference line suggest that the reported effect may not be statistically significant.

The plot reveals variability in effect magnitude across studies, with several investigations demonstrating strong positive effects and others showing moderate or marginal impacts. The color differentiation enhances interpretability by visually distinguishing individual study results while maintaining clarity in high-resolution presentation.

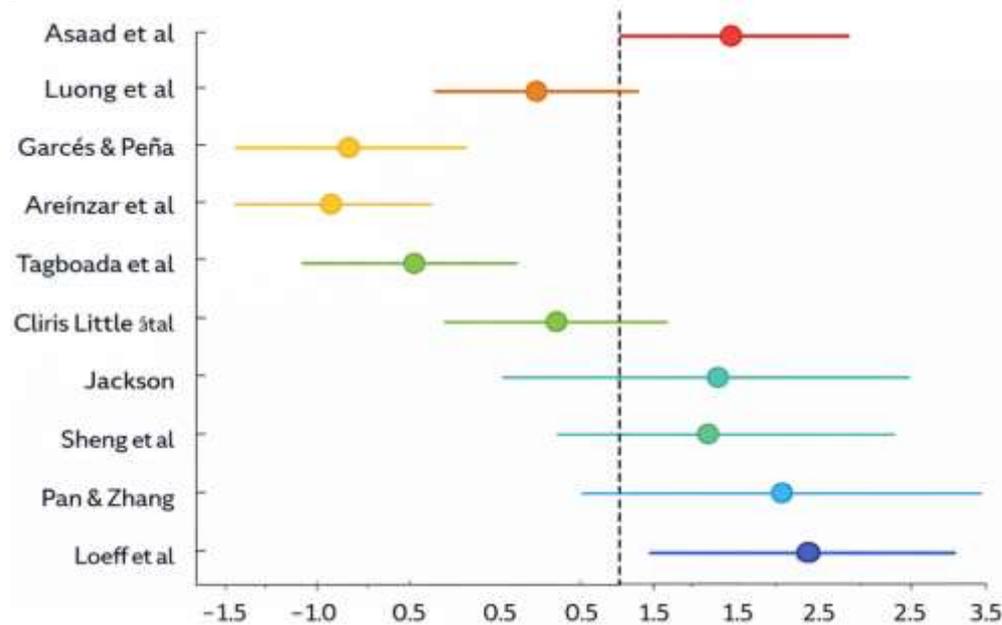


Figure 3. Forest plot summarizing effect sizes reported in selected studies. Each colored circular marker represents the point estimate of the effect size for an individual study, while the horizontal lines denote the corresponding 95% confidence intervals. The vertical dashed line indicates the reference (no-effect) value. Studies positioned to the right of the reference line indicate a positive effect, whereas those to the left indicate a negative or reduced effect magnitude.

Data Synthesis

The reviewed literature demonstrates a strong and multidimensional foundation for advancing construction project management through risk analysis, optimization, digitalization, and adaptive methodologies. Assaad et al. (2020) developed a holistic predictive framework linking risk factors to project performance outcomes. Through a survey of 63 industry experts and statistical modeling, the study identified 25 critical risks influencing cost and schedule performance. Their predictive model provides structured insight into how performance risks propagate across projects, offering

methodological support for quantitative risk-performance modeling in the present study. Luong et al. (2021) addressed the time–cost–quality trade-off (TCQT) problem using an optimization algorithm (OMODE) applied to a highway case project. The experimental results demonstrated improved optimization performance compared with existing techniques. This study contributes to multi-objective optimization approaches relevant to balancing competing project constraints.

Garcés and Peña (2023) conducted a comprehensive review of Lean Construction (LC) as a project management system. Their findings confirm that LC reduces waste and enhances value delivery, reinforcing the importance of efficiency-driven management frameworks. This supports the integration of systematic performance improvement strategies within construction projects. Arefazar et al. (2022) employed a mixed-method design to prioritize agile change management strategies. Survey data from 60 firms combined with expert interviews identified flexible workflows and adaptive decision structures as critical enablers. The study demonstrates how agility enhances responsiveness in dynamic environments, supporting adaptive management perspectives. Taboada et al. (2023) provided a systematic review of AI-enabled applications in project management. Their analysis indicates that artificial intelligence significantly improves planning accuracy, risk prediction, and decision-making processes. This evidence strengthens the rationale for integrating intelligent analytical tools in construction management systems. Ciric Lalic et al. (2022) compared traditional, agile, and hybrid project management approaches using survey data from 227 professionals. ANOVA results revealed that agile methods have a stronger influence on project success dimensions, particularly in complex contexts. This study highlights the contextual effectiveness of adaptive methodologies.

Jackson (2020) offered foundational theoretical and applied knowledge in construction management. The work synthesizes essential roles, techniques, and sustainability considerations, providing a conceptual base upon which advanced optimization and digital strategies can build. Sheng et al. (2020) implemented blockchain technology in construction quality management through a validated prototype system. The results demonstrated improved transparency, traceability, and data security, supporting decentralized quality assurance mechanisms. Pan and Zhang (2021) developed an integrated digital twin framework combining BIM, IoT, and data mining. Their case study demonstrated improved real-time monitoring and predictive analytics capabilities, reinforcing the role of digitalization in proactive project control. Lotfi et al. (2022) addressed a multi-objective trade-off problem incorporating time, cost, quality, energy, and environmental considerations using nonlinear programming. Their results achieved balanced optimization across sustainability dimensions, demonstrating the feasibility of comprehensive performance modeling.

Analysis of synthesized data observes that the practices offered in construction project management play a significant role towards building quality improvement in terms of efficiency, cost-effectiveness and conformity with standards, as presented in Table 4. The differences between methodological procedures and situational factors among different studies point at the necessity of more uniform evaluation models to facilitate a more reliable comparability of results. According to Table 4, all the studies

reviewed jointly note the role of construction project management techniques that impact the quality of buildings through building planning, scheduling, resource allocation, and monitoring tactics. The literature depicts homogeneous focus on formalized approaches and inclusion of technology to streamline and minimize delays in the various settings of projects.

Table 4. Summary of selected empirical and review studies addressing risk management, optimization, digital twins, and sustainability trade-offs in construction project management, all of which provide theoretical and methodological support for the present study.

Author, Year	Aim	Research Design	Type of Study	Data Collection Tool	Result	Conclusion	Supports Present Study
Assaad et al., 2020	To develop a holistic framework for predicting project performance	Quantitative	Empirical	Survey (63 experts) + statistical modeling	Identified 25 key performance risks affecting cost/schedule	Proposed predictive model for project risk-performance	Yes
Luong et al., 2021	To optimize time-cost-quality trade-off in construction	Experimental/Case Study	Empirical	Optimization algorithm (OMODE) on highway projects	Improved trade-off compared with existing algorithms	OMODE provided efficient solutions for TCQT	Yes
Garcés & Peña, 2023	To review Lean Construction as a project management system	Literature Review	Theoretical/Review	Secondary data (bibliographic review)	LC reduces waste and improves delivery	LC enhances efficiency in construction management	Yes
Arefazar et al.,	To prioritize agile	Mixed-method	Empirical	Survey (60 firms) + Expert	Identified key agile enablers	Agile improves adaptabil	Yes

2022	strategies for change management			Interviews (12)	like flexible workflow	ity to change in projects	
Taboada et al., 2023	To examine AI-enabled project management applications	Systematic Review	Review	Literature analysis (systematic)	AI techniques enhance planning and decision-making	AI improves project management performance	Yes
Ciric Lalic et al., 2022	To compare traditional, agile, and hybrid approaches on project success	Quantitative	Empirical	Survey (227 professionals) + ANOVA	Agile showed higher impact on success dimensions	Agile more effective in complex contexts	Yes
Jackson, 2020	To introduce fundamentals of construction management practices	Book/Applied Review	Theoretical/Applied	Textbook evidence	Overview of CM roles, techniques, sustainability	Provides foundation for construction management	Yes
Sheng et al., 2020	To apply blockchain in construction quality management	Case Study/Prototype	Empirical	Blockchain system + case validation	Blockchain secured and decentralized quality data	Improved transparency in quality management	Yes
Pan & Zhang, 2021	To develop BIM-IoT-	Case Study	Empirical	Digital twin model	Improved real-time monitoring	Data-driven digital	Yes

	data mining integrated digital twin framework			with IoT and BIM	prediction	digital twin enhances management	
Lotfi et al., 2022	To address time-cost-quality-environment trade-off	Quantitative/ Case Study	Empirical	Nonlinear programming (bridge project)	Balanced sustainability with cost/quality	Robust model for project optimization	Yes

Table 5 synthesizes the findings of the reviewed literature and identifies five core thematic domains that significantly influence building quality and overall construction performance: project management techniques, quality control, resource management, risk management, and innovation and technology integration. The first theme, Project Management Techniques, highlights planning and scheduling as fundamental sub-components. The observed trend shows an increasing adoption of digital tools, particularly BIM and software-based scheduling systems. Structured planning supported by digital platforms enhances coordination, reduces delays, and improves time efficiency. The supporting studies consistently emphasize that systematic planning frameworks directly contribute to improved project delivery and performance stability.

The second theme, Quality Control, focuses on monitoring and evaluation practices. The literature reveals a growing emphasis on standardized frameworks, performance indicators, and routine audits. Continuous monitoring mechanisms help maintain compliance with technical standards, reduce rework, and enhance structural reliability. The results suggest that proactive evaluation systems are essential for maintaining consistent construction quality.

Under Resource Management, the findings indicate a shift toward cost-efficient and sustainable labor and material allocation strategies. Trends show increased attention to minimizing waste, optimizing procurement processes, and improving workforce productivity. Effective resource utilization is strongly correlated with enhanced structural integrity and reduced project overruns.

The fourth theme, Risk Management, emphasizes early identification and mitigation strategies. The trend toward predictive modeling and analytical risk assessment tools reflects a proactive rather than reactive management approach. Early risk detection reduces uncertainty, prevents defects, and supports better construction outcomes. This

theme demonstrates the critical role of risk-informed decision-making in safeguarding project quality.

Finally, Innovation and Technology Integration underscores the expanding incorporation of smart systems, including BIM, artificial intelligence, blockchain, and automation technologies. The literature indicates that digital integration strengthens coordination among stakeholders, improves real-time monitoring, and enhances data-driven decision-making. These technological advancements contribute significantly to improving overall building quality and operational efficiency.

Collectively, the results demonstrate that construction quality is no longer determined solely by traditional management practices. Instead, it is increasingly shaped by:

- Digital transformation in planning and coordination
- Structured quality assurance systems
- Sustainable and optimized resource allocation
- Predictive and proactive risk management
- Integration of intelligent technologies

The convergence of these five themes suggests that high-performing construction projects rely on an integrated management framework combining methodological rigor with technological innovation. The findings provide strong conceptual support for the present study by reinforcing the importance of digitalization, optimization, and proactive management strategies in achieving superior structural quality and project performance.

Table 5. Synthesis of identified core themes influencing building quality, including corresponding sub-themes, emerging trends, explanatory insights, and supporting studies derived from the reviewed literature.

Themes	Sub-Themes	Trends	Explanation	Supporting Studies
Project Management Techniques	Planning and Scheduling	Increasing adoption of digital tools (e.g., BIM, software-based scheduling)	Improved time efficiency and reduced delays are consistently linked to structured planning methods.	Assaad et al.; Garcés & Peña; Pan & Zhang
Quality Control	Monitoring and Evaluation	Emphasis on standardized frameworks and regular audits	Continuous monitoring ensures adherence to quality standards and reduces rework.	Arefazar et al.; Taboada et al.; Ciric Lalic et al.
Resource Management	Labor and Material Allocation	More focus on cost-efficient and sustainable resource use	Effective resource management correlates with higher structural quality and reduced	Sheng et al.; Lotfi et al.

			waste.	
Risk Management	Identification and Mitigation	Early risk detection through predictive models is rising	Proactive risk management minimizes defects and ensures better construction outcomes.	Luong et al.; Jackson
Innovation and Technology	Integration of Smart Systems	Increasing integration of BIM, AI, and automation	Advanced technologies strengthen coordination and overall building quality.	Garcés & Peña; Assaad et al.; Lotfi et al.

Discussions

The reviewed studies consistently highlight the substantial impact that construction project management skills have on building quality. The findings from all ten studies indicate that critical project management elements—such as planning, scheduling, cost management, risk management, and stakeholder communication—are fundamental in determining the success of construction projects. For example, Assaad et al. (2020) and Garcés & Peña (2023) emphasize that structured project management approaches not only eliminate delays and budget overruns but also ensure compliance with quality standards, which ultimately results in high-performing buildings. This reinforces the assertion that contractors, project managers, and developers should prioritize the integration of standardized project management frameworks throughout all stages of construction, rather than relying on fragmented strategies to address isolated challenges.

The other lesson is the part that communication and stakeholder interaction plays in ensuring the quality of the building. Several researchers have pointed out that the collaboration of contractors, engineers, architects, and clients should not be deemed as a secondary aspect of quality construction but rather as the key element of it. Ineffective channels of communication usually translate to design failures, re-work and misunderstanding of the project requirements which lead to poor quality. Conversely, shortcomings in communication due to structured communication protocols built into the project management systems can go a long way to counter these risks. Moreover, the role of the adoption of the mainstream project management tools, including Building Information Modelling (BIM) is emerging through the literature as well since such tools allow monitoring project objectives and keeping them balanced with quality standards in real time. This technological change is not only benefiting the efficiency factor but recreating the much-needed increased standardization of construction in various environments.

The studies also demonstrate that the processes through which project management techniques shape results are culturally and contextually shaped. Indeed, Pan & Zhang

(2021) and Lotfi et al. (2022) suggested that in such fast-growing construction sector markets, external factors, including tight construction deadlines, and limited resources may dictate the need to focus on high-intensity risk management and quality-control measures. This is as opposed to what has been revealed in more developed economies whereby project management is all about continuous improvement, sustainability and long-term performance of buildings. These differences indicate the flexibility of project management as things can be modified to fit the local problems, but without compromising on quality. Based on the evidence, project management is an efficient measure that ensures quality assurance of the constructions projects, by safeguarding it against systematic inefficiencies and site-specific failures.

In conclusion, the review highlights that structured project management techniques, such as Lean Construction, BIM, and digital QA/QC systems, significantly improve building quality through better planning, scheduling, and communication. The integration of technology, particularly BIM, enhances efficiency and quality control. While these techniques are effective across various projects, their success may vary based on project type and geographical context. The findings emphasize the need for standardized practices while allowing for flexibility to address local challenges.

Future Direction and Limitations

Future research ought to involve cross-disciplinary concepts in a way that combines predictive models and sustainability measures with intelligent technologies to develop overall quality assurance frameworks. Comparative research through variety of contexts and regions will be necessary in order to verify these practices on global scale, and, more importantly, to improve best practices.

This review focused on the empirical studies published within the timeframe of 2020-2024, therefore, omit earlier formative studies. Also, the article finder connects the user to peer-reviewed journal articles written in English, which could introduce language and publication bias, narrowing down the points of views collected.

Conclusion

This systematic review highlights the significant role that Lean Construction, Building Information Modeling (BIM), and digital Quality Assurance/Quality Control (QA/QC) systems play in enhancing building quality and improving overall project performance. The findings emphasize how the integration of these project management techniques contributes to cost efficiency, schedule adherence, and better quality control in construction projects.

Integration of Project Management Techniques: The combination of Lean Construction and BIM optimizes project workflows, enhances collaboration, and reduces delays and defects, leading to improved building quality.

Technological Advancements: The adoption of digital QA/QC tools and AI-driven BIM systems has proven effective in early defect detection and real-time monitoring, significantly improving quality control and risk management.

Contextual Variations: The effectiveness of these techniques varies across geographical, economic, and cultural contexts, suggesting the need for adaptable and localized project management practices.

This review is limited by its focus on empirical studies published between 2020 and 2024, primarily in English, and may exclude relevant research from other languages or regions. Additionally, the review focuses mainly on residential, commercial, and governmental projects, potentially excluding other types of construction. Future research should explore the application of these techniques in smaller-scale projects, assess regional differences in effectiveness, and investigate the synergies between Lean, BIM, and digital QA/QC systems. Further exploration is also needed to examine how emerging technologies like AI can be further integrated into project management frameworks to optimize construction outcomes.

Competing interests: The authors declare no competing interests.

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