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A systematic review of change control in construction projects: causes, impacts, and challenges

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ABSTRACT

Construction projects experience frequent changes that significantly impact time performance. Existing change control systems remain fragmented and lack integration with digital technologies. Throughout the construction project lifecycle, dynamically occurring changes require structured and easily accessible information through the implementation of effective Change Management practices. Change control becomes a crucial element in project management to minimize delays, cost overruns, and conflicts. This study aims to identify critical gaps in current change control practices and propose on change management in construction projects, focusing on the comparison of best practice approaches, industry strategies, as well as opportunities for the development of new methods. Method: A systematic literature review (SLR) was conducted using the PRISMA approach. A total of 790 articles were initially identified, and 121 relevant studies were selected after screening. The findings indicate the existence of various change management systems, but there is no approach that comprehensively integrates knowledge, Work Breakdown Structure (WBS)-based change management, and Building Information Modeling (BIM) technology in one integrated framework. This research informs the development of an evolving change management system in construction project management. The contribution of this research is to provide new insights for academics and practitioners on the importance of technology integration and innovative strategies in construction project change management.

KEYWORDS

Change control, Construction Project, BIM, knowledge management, WBS

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1. INTRODUCTION

Construction projects are frequently confronted with complex challenges arising from continuously evolving project stages that trigger various changes (Alnuaimi et al., 2010). One of the most critical issues in the construction industry is project delay, which is often closely associated with changes occurring during project execution. These changes not only affect project timelines but also significantly contribute to cost overruns. For instance, Love and Sohal (2003) reported that owner-initiated changes can increase project costs by approximately 2.4% to 3.15% of the contract value. Similarly, Senaratne and Sexton (2009) highlighted that rework resulting from unplanned changes may account for 10% to 15% of the total contract cost. Furthermore, Yang and Chen (2015) emphasized that project changes have substantial negative impacts, including increased costs, schedule delays, and reduced productivity. Therefore, change is an inherent element of project management, and its effective management is essential to

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resolve issues, achieve project objectives, and mitigate risks (Afelete & Jung, 2021). Changes in construction projects may involve adjustments in planning, design, or environmental conditions (Shoar & Chileshe, 2021). In particular, project owners often play a significant role in initiating changes through additional requests or change orders, with design modifications posing a considerable risk to project success (Yap & Skitmore, 2018). Such design changes, whether involving additions, reductions, or modifications to the original scope, can significantly influence project schedules and costs, while also increasing the likelihood of disputes between owners and contractors (Yap & Skitmore, 2018).

In addition to design-related issues caused by consultants, various external and internal factors—such as weather conditions, financial constraints, and material availability—also contribute to project changes experienced by contractors (Liu, 2013; Yawalekar et al., 2015). These factors frequently lead to disputes and claims in construction projects. The absence of an effective change control system has been widely recognized as a major contributor to cost overruns, project delays, and safety risks, highlighting the critical importance of robust change management practices in the construction industry (Keane et al., 2010). This situation reflects the inherent uncertainty and complexity that characterize construction projects.

In practice, changes are typically implemented through iterative processes that involve extensive data processing and knowledge generation. However, the knowledge generated during these processes is often not systematically documented, limiting its potential reuse in future projects. The inability to capture and store knowledge effectively hinders knowledge transfer and reduces the efficiency of managing subsequent changes. Therefore, there is an urgent need for a structured and efficient change management system to support project execution. Such a system plays a crucial role in maintaining project objectives, controlling costs, and preventing delays (Naji et al., 2022), thereby necessitating an integrated approach to change management and knowledge management (Liu, 2013; Yawalekar et al., 2015).

According to Project Management Institute (2017), change control aims to obtain formal approval for adjustments to the project cost baseline through the allocation of management reserves (Muhsen & Rezouki, 2022). Effective cost control ensures that the factors triggering changes are properly managed, that change requests are addressed in a timely manner, and that changes are controlled throughout the project lifecycle. The integrated change control process includes reviewing all change requests, authorizing and managing changes to project deliverables, documentation, and plans, as well as communicating decisions to relevant stakeholders. By evaluating change requests against project documentation, deliverables, and management plans, this process supports informed decision-making while minimizing risks associated with changes that are not aligned with project objectives (Project Management Institute, 2017). Nevertheless, previous studies indicate that existing change control practices are still predominantly implemented as standalone processes, with limited integration between change management, knowledge management, and digital technologies, thereby reducing their effectiveness in supporting project-wide decision-making (Liu, 2013; Senaratne & Sexton, 2009; Naji et al., 2022).

Based on the aforementioned discussion, this study aims to systematically review the existing literature on change control in construction projects to identify the major causes of project changes, their impacts on project performance, and the evolution of existing change control approaches. Furthermore, this study seeks to identify critical research gaps in current change control practices, particularly regarding the limited integration of change management, knowledge management, Work Breakdown Structure (WBS), and Building Information Modeling (BIM) in supporting effective project decision-making. Unlike previous studies that primarily focused on specific aspects of change control, this study provides a comprehensive synthesis of these interrelated aspects to establish a conceptual foundation for the development of a more

integrated change control system for construction projects (Liu, 2013; Senaratne & Sexton, 2009; Project Management Institute, 2017; Naji et al., 2022).

2. LITERATURE REVIEW

2.1. Change Control in Construction Projects

Change control is a critical component of project management that ensures any modification to project scope, cost, time, and quality is systematically managed. According to the Project Management Institute (2017), integrated change control involves identifying, evaluating, approving, and implementing changes while maintaining alignment with project objectives. This structured process is essential to prevent uncontrolled changes that may negatively impact project performance. However, in practice, change control in construction projects remains largely reactive and fragmented. Studies indicate that the absence of standardized procedures often leads to inefficiencies, disputes, and poor coordination among stakeholders (Keane et al., 2010). As construction projects are inherently dynamic, an effective change control system must not only ensure procedural compliance but also support proactive decision-making.

2.2. Causes of Change in Construction Projects

The literature identifies multiple sources of change in construction projects, which can be broadly categorized into design-related, contractor-related, owner-related, organizational, and environmental factors. Design-related issues, such as errors, omissions, and lack of coordination, are among the most dominant causes of change (Alnuaimi et al., 2010; Shoar & Chileshe, 2021). Additionally, modifications initiated by project owners, including changes in scope and specifications, significantly contribute to project changes (Yap & Skitmore, 2018).

External factors such as weather conditions, economic fluctuations, and regulatory changes further increase project uncertainty and trigger variations during project execution (Padala et al., 2022; Durdyev, 2021). Organizational issues, including poor communication and lack of integration between project teams, also play a critical role in generating changes (Ilter & Çelik, 2021). These findings suggest that changes in construction projects are inevitable due to both internal and external factors. However, most existing studies focus primarily on identifying causes rather than addressing how these changes can be effectively managed within an integrated system.

2.3. Impact of Change on Project Performance

Changes in construction projects have significant and multidimensional impacts on project performance. Previous studies consistently report that changes lead to cost overruns, schedule delays, productivity loss, and increased disputes among stakeholders (Aslam et al., 2019; Waty & Sulistio, 2022b). In particular, rework resulting from unplanned changes contributes significantly to inefficiencies and resource wastage. Furthermore, changes often disrupt workflow and reduce project performance by increasing uncertainty and complexity (Rahman et al., 2022). Disputes between project participants, particularly between owners and contractors, are also common consequences of poorly managed changes (Kisi et al., 2023). These impacts highlight the importance of implementing effective change control mechanisms to minimize negative outcomes. Despite extensive research on the impacts of change, there remains a lack of focus on how integrated systems can mitigate these impacts and improve overall project performance.

3. METHODOLOGY

This study aims to examine existing literature on change management in construction projects, with a focus on identifying best practices, strategies, and methodological developments within the industry. The objective is to understand the evolution of change control approaches and their

impact on project performance, as well as to explore key models, tools, and critical factors influencing the effectiveness of change management across diverse construction contexts. A systematic literature review (SLR) approach was adopted to ensure a comprehensive and structured analysis. Relevant sources, including journal articles, books, and research reports, were collected from major academic databases such as Scopus, ScienceDirect, and Emerald. The literature search was conducted using various keyword combinations related to change control in construction projects to establish a robust research framework. The review process followed the PRISMA guidelines to ensure transparency and consistency throughout the literature selection process (Moher et al., 2009).

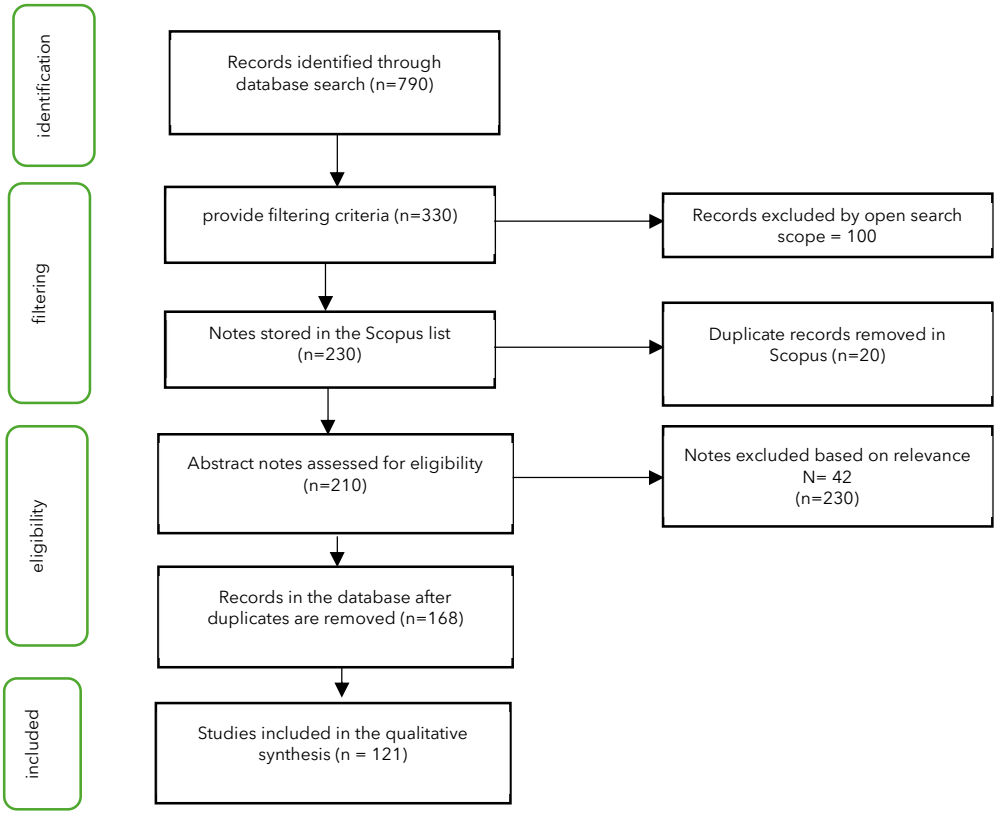

Figure 1. depicting the PRISMA flow chart for systematic review and meta-analysis can provide a visual representation of the process of searching and screening the study database, showing the systematic approach adopted to extract relevant insights from the literature

Source: Authors

As illustrated in Figure 1, an initial search identified 790 records, which were progressively screened using predefined inclusion and exclusion criteria until 121 studies were retained for qualitative synthesis. Most records were excluded during the initial screening because they did not specifically address change control in construction projects or did not satisfy the established eligibility criteria. Subsequent screening further removed duplicate and less relevant studies, resulting in a focused body of literature directly aligned with the objectives of this review. The final selection of 121 studies provides a robust foundation for analysing the causes, impacts, and evolution of change control approaches in construction projects, while enabling the identification of research gaps that support the development of more integrated change control practices in project management. From a project management perspective, this evidence base also provides a reliable reference for identifying recurring sources of change, prioritising preventive control strategies, and supporting the development of more systematic and evidence-based decision-making throughout the project lifecycle.

4. RESULTS & DISCUSSION

4.1. Evolution of Research in Construction Project Management

A review of the selected literature shows that Al Ameri, Rahman, et al. (2020) ranked the factors causing changes in UAE mega construction projects, whereas Al Ameri and Nasaruddin (2020) examined client-related changes and their effects on construction schedule performance. These studies support the identification of change causes and the assessment of schedule implications; they do not present a general change-management model or a methodology for capturing and reusing project knowledge. Together, these findings underscore the importance of synthesizing recurring themes in construction change management. Examining titles, abstracts, and keywords across different periods helps clarify the evolution of the research focus and identify the principal areas of discussion.

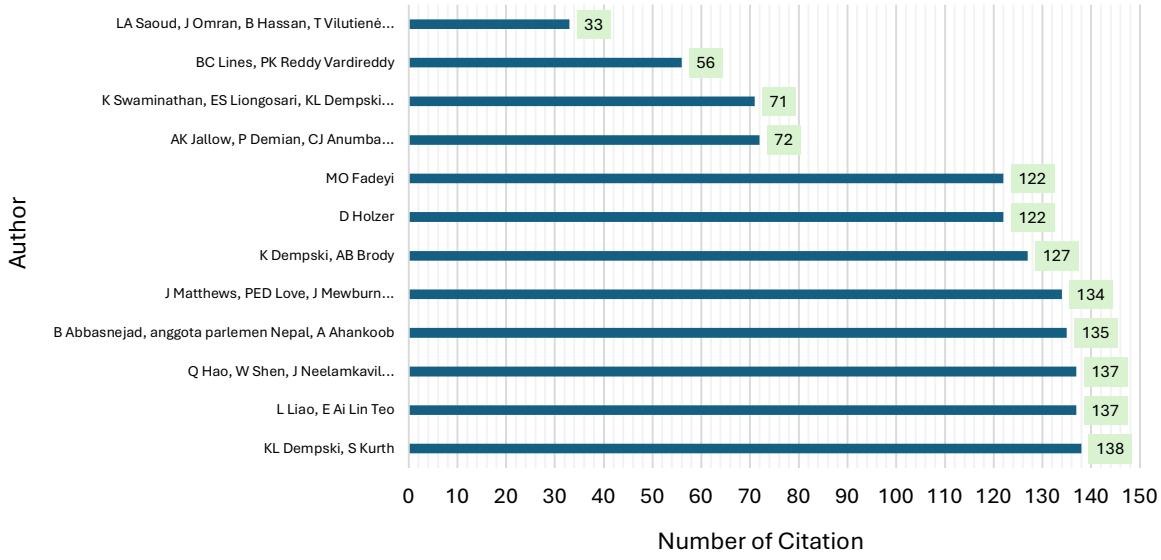

Figure 2. Number of researcher citations
Source: Authors

Figure 2 show the citation frequency of the most influential authors in construction change management research, reflecting their academic impact and contribution to the development of change control knowledge. The citation pattern indicates that research in this field has been shaped by a relatively small group of highly influential studies addressing key topics such as design changes, change orders, project coordination, BIM, and knowledge-based decision support. Furthermore, the highly cited literature covers diverse construction sectors and geographical contexts, demonstrating that change control is a universal challenge across construction projects. From a project management perspective, these findings highlight the growing emphasis on integrated and evidence-based change control practices that combine technical evaluation, stakeholder collaboration, knowledge management, and digital technologies to improve project cost, schedule, and quality performance.

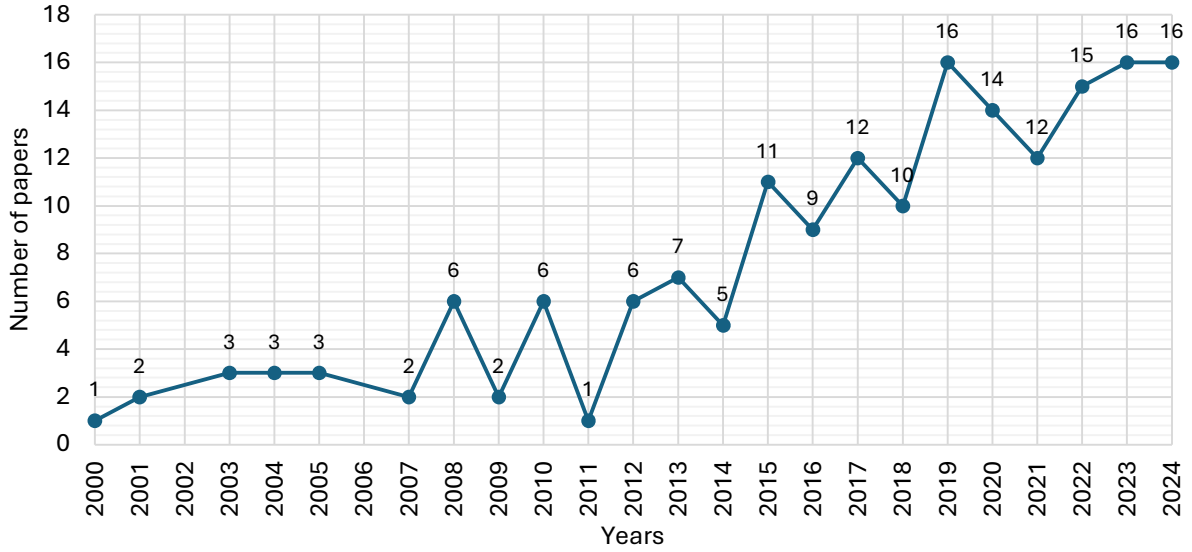

Figure 3. Annual Publication Trend
Source: Authors

Figure 3 illustrates the annual publication trend on construction change management from 2000 to 2024. The number of publications remained relatively limited during the early 2000s but increased markedly after 2015, indicating growing academic and industrial interest in improving change control practices. This upward trend reflects the increasing complexity of construction projects and the need for more systematic approaches to managing project changes. The sustained publication growth in recent years also suggests that research has expanded across various construction sectors and project environments, indicating that change control has become an increasingly important issue regardless of project type or geographical context. From a project management perspective, this trend highlights the continuing demand for more adaptive, integrated, and technology-supported change control approaches capable of addressing the evolving challenges of modern construction projects.

The combined results in Figures 2 and 3 indicate that construction change management has evolved into an increasingly mature research field, characterised by a steady increase in publication output supported by a relatively small group of highly influential studies. While the research foundation has become well established, most published studies continue to focus on identifying the causes, impacts, and management of project changes rather than developing integrated change control frameworks. This trend reveals a critical research gap and highlights the need for more comprehensive, technology-enabled, and practice-oriented approaches to support project management in increasingly complex construction environments.

Table 1. Causes of Change in Construction Projects

No.	Causes of Change	Reference
A	**Design-related changes**	
1	Errors and omissions of details in the design	(Afelete & Jung, 2021; Alnuaimi et al., 2010)
2	Uncertainty and complexity of design	(Shoar & Chileshe, 2021)
3	Balancing feedback in design	(Shoar & Chileshe, 2021)
4	Lack of coordination during design	(Yap & Skitmore, 2018)
5	Modification of the original design	(Alnuaimi et al., 2010; Keane et al., 2010; Liu, 2013; Yawalekar et al., 2015)
6	Dimensional errors in architectural drawings	(Wang et al., 2022)

No.	Causes of Change	Reference
7	Design improvements	(Bassa et al., 2019)
8	Design	(Alshdiefat & Aziz, 2018; Bassa et al., 2019; Muhsen & Rezouki, 2022; Oladiran et al., 2018)
B	**Contractor-related changes**	
1	Lack of coordination between contractor and owner	(Al Ameri, Rahman, et al., 2020)
2	Additional work	(Khalifa & Mahamid, 2019; Liu, 2013)
3	Change in construction method (adopting new technology)	(Famadico & Baccay, 2019)
4	Construction error correction	(Famadico & Baccay, 2019; Mohammed, 2016)
5	Improve the quality of work on site	(Rahman et al., 2022)
D	**Changes related to organization and management**	
1	Change in management	(Rahman et al., 2022)
2	Lack of timely and effective communication	(Abalo, 2019; Wang et al., 2022)
3	Lack of integration between departments	(Wang et al., 2022)
4	Poor project management	(Ilter & Çelik, 2021)
5	Insufficient detail of working drawings	(Bassa et al., 2019)
6	Ambiguity in project objectives or scope	(Bassa et al., 2019)
7	Shortage of skilled labor	(Alraie et al., 2022)
8	Poor procurement process	(Daniel & Waty, 2023)
E	**Project-related changes**	
1	Project complexity	(Waty & Sulistio, 2022a)
2	Inaccurate cost estimation	(Khoso et al., 2019)
3	Lack of resources	(Padala et al., 2022)
4	Changes in the financial status of each party involved in the project	(Durdyev, 2021)
F	**Changes related to the environment and site conditions**	
1	Difficult location conditions	(Durdyev, 2021)
2	Inappropriate site investigation	(Yap & Skitmore, 2018)
G	**Changes related to materials and equipment**	
1	Unavailability of equipment	(Bitamba & An, 2020)
2	Material specifications	(Alraie et al., 2022; Bitamba & An, 2020; Muhsen & Rezouki, 2022; Yap & Skitmore, 2018)
3	Lack of appropriate equipment	(Al Ameri, Rahman, et al., 2020)

The results of the document analysis (Table 1) reveal that changes in construction projects are driven by multiple interrelated factors, which can be categorized into design-related, contractor-related, owner-related, organizational, project-related, environmental, and economic factors.

Among these, design-related factors emerge as the most dominant source of change. Errors, omissions, lack of coordination, and design modifications frequently trigger changes during project execution. This finding indicates that deficiencies in the early planning and design stages significantly influence project performance. In addition, owner-related changes, such as scope modifications and financial constraints, are also major contributors to project variations. These changes often occur due to evolving project requirements and insufficient alignment between stakeholders at the initial stages of the project. Contractor-related and organizational factors, including poor coordination, inadequate communication, and lack of skilled labor, further exacerbate the occurrence of changes. These findings suggest that most project changes are not solely caused by external uncertainties but are largely driven by internal project management inefficiencies. A clear pattern emerges from the analysis, where internal factors (design, contractor, and management) contribute more significantly to changes compared to external factors such as environmental and regulatory conditions. This highlights that most project changes are not purely unavoidable but are often driven by controllable project management issues. The following table shows the impact of changes on construction projects.

Table 2. Impact of Change on Construction Project Performance

No.	Causes of Change	Reference
A	**Design-related impacts**	
1	Increase design costs	(Aslam et al., 2019; Zainudeen et al., 2008)
2	Ineffective design	(Bassa et al., 2019; Muhamad & Mohammad, 2018)
3	Increases the likelihood of design errors	(Bassa et al., 2019; Zadeh et al., 2014)
4	impact on project completion time (delayed completion schedule)	(Setiawan et al., 2019)
B	**Organization and management related impacts**	
1	Resources and equipment that have an impact	(Sarhan & Dulaimi, 2022)
2	Inadequate project change management	(Waty & Sulistio, 2022b)
3	Disputes between professionals	(Waty & Sulistio, 2022b)
4	Loss of productivity and efficiency due to distractions and out-of-order work	(Rahman et al., 2022)
C	**Impacts related to owners and contractors**	
1	Disputes between owners and contractors	(Amoah & Hlatshwayo, 2023; Kisi et al., 2023; Shash & Habash, 2021; Trangkanont, 2018)
2	Additional costs for contractors	(Al Ameri, Nasaruddin, et al., 2020; Kisi et al., 2023)
3	Delay in payment to contractors	(Trangkanont, 2018)
4	Increase construction costs	(Waty & Sulistio, 2022b)
5	Rework and dismantling	(Lature & Hinge, 2015; Rahman et al., 2022)
6	Decline in construction quality	(Rahman et al., 2022)
D	**Project and material related impacts**	
1	Loss of motivation	(Sarhan & Dulaimi, 2022)

No.	Causes of Change	Reference
2	Increases the likelihood of frustration among interested persons	(Al Ameri, Nasaruddin, et al., 2020)
3	Increase the possibility of material wastage due to rework operations	(Al Ameri, Nasaruddin, et al., 2020; Lature & Hinge, 2015)
4	Revision of reports, drawings, and project documents	(Lature & Hinge, 2015)
E	**Economic and governance-related impacts**	
1	Material price fluctuations	(Oladipo & Oni, 2012)
2	Inflation	(Oladipo & Oni, 2012)
3	Exchange-rate fluctuations	(Oladipo & Oni, 2012)

The analysis of the impact of change (Table 2) shows that changes have significant and multidimensional effects on construction project performance. The most critical impacts include cost overruns, schedule delays, reduced productivity, and increased disputes among project stakeholders. Rework and additional work are identified as major consequences of poorly managed changes, leading to inefficiencies and increased resource consumption. Furthermore, changes disrupt project workflows, resulting in decreased efficiency and loss of productivity. Another important finding is the high frequency of disputes between project stakeholders, particularly between owners and contractors. These conflicts are often caused by unclear scope changes, delays in decision-making, and inadequate documentation of change processes. Overall, the results indicate that ineffective change control not only affects project outcomes but also creates cascading effects that influence multiple aspects of project performance

4.2. Framework of the Change Control Process in Construction Projects

The findings of the literature review indicate that ineffective change control remains one of the primary factors contributing to cost overruns, schedule delays, and project disputes. To address these challenges, a structured change control process is required to ensure that project changes are systematically identified, evaluated, approved, implemented, and monitored throughout the project lifecycle. According to the Project Management Institute (2017), the integrated change control process consists of six sequential stages.

Figure 4 show the purpose of each change control process can be explained. The Change control process according to Project Management Institute (2017) consists of six stages which are further divided into several activities. In the first process, namely identifying changes, including identifying the relevance of changes, the goal is to detect changes that will and have occurred. Furthermore, identifying the causes of change with the aim of classifying changes based on the list of causes of change that has been made. The next process is to check contractual documents, namely technical specification documents, scope of work, schedule, budget, and responsibilities of all parties. This document serves as a reference to ensure that changes are in accordance with what has been agreed. This document prevents changes outside the terms of the contract and cause disputes. The next step is to conduct a general review of changes and a detailed review of changes by the engineering team with the aim of ensuring that the proposed changes are carefully evaluated. Preparing a change request form is used to ensure that proposed changes are implemented through a structured process and in accordance with specified procedures

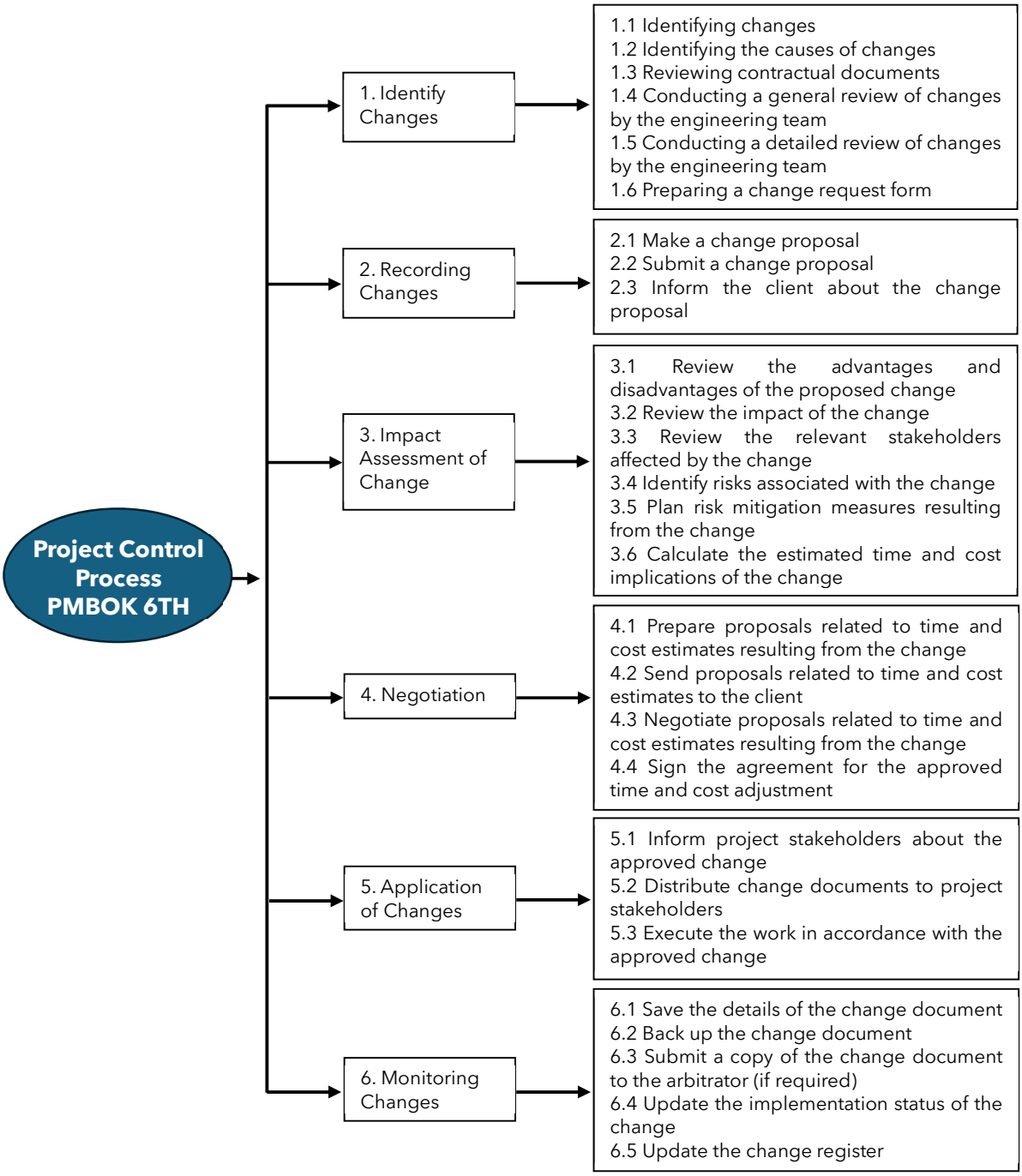

Figure 4. Change Control Process on Projects
Source: Project Management Institute (2017)

The second process is to record changes. Change recording documents include change logs and change request forms. The purpose of this process is to prevent changes that are made without the consent of the relevant parties. Secondly, it aims to archive knowledge that can be reused. This is what will continue in the knowledge management section. The third goal in this process is for transparency and accountability. The next goal is to make it easier for the project team or change control board (CCB) to evaluate the impact of changes on scope, time, cost, risk and quality. By recording changes, the project team can monitor and manage the impact of changes effectively.

The third process is change impact assessment which aims to thoroughly evaluate the consequences of the proposed changes. How it will impact scope, schedule, cost, quality, and risk. This process also influences whether the proposed change can be accepted, rejected or modified by the CCB or manager.

The fourth process is negotiation with the aim of avoiding conflicts and preventing risks in the future, producing decisions that have been formally agreed by various parties, which is no less important is to ensure that the project continues to run within the agreed limits.

The fifth process is the application of changes to implement the approved changes, maintain the consistency of the new plan, control the impact that occurs, increase the success of the project.

The last process is change monitoring with the purpose of focusing on monitoring the implementation of approved changes to ensure that the changes are implemented as planned and do not cause unintended negative impacts on the project. maintain control over the project, mitigate risks, and ensure successful implementation of changes. 6.5 Evaluation of Existing Change Control Systems. The evolution of change control systems in construction projects shows a transition from ad hoc approaches to more structured and technology-supported systems. Early approaches were characterized by a lack of standardization, resulting in frequent disputes and project inefficiencies.

Structured models introduced more systematic frameworks, enabling better documentation and evaluation of changes. However, these models often face implementation challenges due to their complexity and the lack of integration with project workflows. Modern tools and technological advancements have improved data management and change identification processes. Nevertheless, these systems often depend heavily on technology and may not fully address the underlying organizational and process-related issues. Despite these advancements, existing change control systems still face significant limitations, particularly in terms of integration, real-time decision-making, and adaptability to project complexity.

Despite the extensive identification of change causes in previous studies, most research remains limited to classification rather than providing actionable solutions. This indicates a gap between theoretical identification and practical implementation of effective change control systems. Therefore, this study extends previous research by synthesizing these findings into a structured understanding of change patterns, which serves as a basis for improving change control practices in construction projects. By integrating the findings from both the causes and impact analysis, it can be observed that poorly managed design changes not only trigger cost overruns but also propagate delays across multiple project stages, indicating a cascading effect of change in construction projects.

Table 3. Evolution of change-control approaches

No.	Main Object	Methods	Key Features	Challenges
1	Early approaches	Ad hoc and reactive methods (Maqbool & Rashid, 2017)	Limited standardization and weak documentation	Frequent disputes and cost/time overruns
2	Structured models	Integrated change control and configuration management (Project Management Institute, 2017)	Structured approval, documentation, and impact assessment	Implementation difficulty and process rigidity

No.	Main Object	Methods	Key Features	Challenges
3	Modern tools	Project control and inhibiting-factors management (PCIM); change control tool (CCT); knowledge-based decision support system (KBDSS) (Arain & Pheng, 2006; Isaac & Navon, 2008; Olawale & Sun, 2013)	Practitioner-oriented project control, early identification of change implications, and knowledge-supported decision-making	Implementation complexity and data/knowledge maintenance requirements
4	Technological advancements	Building information modeling (BIM) and automated processes (Liu, 2013)	Improved data integration, visualization, and impact analysis	Dependence on technology and data quality
5	Integrated project delivery	Integrated project delivery (IPD) principles and early collaboration (Liu, 2013)	Earlier coordination, fewer modifications, and improved performance	Limited adoption and contractual barriers

Table 3 show the evolution of change control approaches in construction projects, progressing from conventional administrative procedures to integrated and technology-enabled management systems. In this context, the Main Object represents the primary focus of each evolutionary stage, reflecting how the objectives and scope of change control have developed over time. Early approaches primarily focused on responding to project changes after they occurred through ad hoc decision-making with limited documentation. Structured models subsequently introduced formal approval procedures, documentation standards, and systematic impact assessments to improve accountability and consistency. Modern approaches further expanded this focus by incorporating decision-support tools capable of evaluating change implications before implementation, while recent technological advancements have integrated Building Information Modeling (BIM) and automated processes to improve visualization, coordination, and change analysis. The latest stage, represented by Integrated Project Delivery (IPD), emphasizes early stakeholder collaboration and shared decision-making to minimize changes before construction activities begin.

These evolutionary stages demonstrate that the objective of change control has shifted from simply documenting project changes to proactively supporting decision-making and improving project performance. For example, in building construction projects, BIM enables design modifications to be visualized and evaluated before field implementation, thereby reducing rework and design conflicts. In transportation and infrastructure projects, structured change control procedures facilitate the assessment of schedule and cost implications before approving variation orders, allowing project teams to minimise delays and budget overruns. Similarly, in

industrial projects such as oil and gas facilities, knowledge-based decision support systems assist project managers in evaluating technical, contractual, and operational consequences before implementing major engineering changes.

Although these approaches have significantly improved project control, Table 3 also demonstrates that each stage presents distinct implementation challenges. Early approaches were hindered by poor documentation and inconsistent decision-making, whereas structured models often introduced procedural rigidity. More advanced systems, including BIM and knowledge-based platforms, improve data integration and analytical capability but require high-quality project information, organisational readiness, and skilled personnel. Likewise, IPD offers substantial benefits through early collaboration; however, its implementation remains constrained by contractual arrangements and limited industry adoption.

Overall, the evolution summarised in Table 3 indicates that existing change control systems have progressively improved project coordination and decision-making but remain fragmented because they generally address individual aspects of change management rather than providing a fully integrated framework. This finding reinforces the need for future change control systems that combine structured processes, organisational knowledge, digital technologies, and collaborative project delivery into a unified management, approach capable of improving cost, schedule, quality, and overall project performance.

5. CONCLUSION

Current project management systems, despite being equipped with change management features, still have significant shortcomings. Their inability to capture lessons and integrate data in a structured manner is a major gap that must be addressed immediately. This is particularly urgent given the substantial potential of knowledge management in reducing project costs and improving performance. Important risk management processes such as risk control, monitoring and response have not been sufficiently scrutinized, especially in the context of integration with project management systems. In fact, these processes are crucial to ensure project success, especially in the face of inevitable change. Overall, there is a clear gap in the literature on how to integrate change control, knowledge management, BIM, and WBS to improve construction project performance. Further research in this area is urgent to meet the evolving needs of the industry. drent periods.

Through a review of previous articles, it is evident that integrating change management and knowledge management can provide a basis for identifying stages of work that are vulnerable to change and the associated risks. The synthesis of previous literature highlights the potential for integrating change management and knowledge management with Building Information Modeling (BIM). Utilizing BIM enables project visualization, design change data storage, and effective stakeholder communication. In addition, the comprehensive integration of change aspects through the information system allows easy access for stakeholders, thus easing the decision-making process.

Notably, existing research has not addressed the optimal mechanisms for seamlessly integrating knowledge management changes and practices into Building Information Modeling (BIM) systems, which highlights an area ripe for future investigation and development in the construction industry.

5.1. Practical Implication

The findings of this study indicate that the primary causes of change in construction projects are related to design issues and owner-initiated modifications, highlighting the need to strengthen early-stage planning, particularly in design coordination and stakeholder alignment. In addition, the implementation of structured change control systems—supported by proper documentation,

timely evaluation, and effective communication—is essential to minimize project delays and cost overruns. Improving coordination and transparency among stakeholders is also critical to enhancing overall project performance, especially in terms of time, cost, and quality control.

5.2. Limitations and Future Research

This study has several limitations, as it is based on a systematic literature review that relies on secondary data, making the findings dependent on the scope and quality of the selected literature and lacking empirical validation from real project cases. Furthermore, the study remains conceptual and does not develop or test a specific implementation model. Therefore, future research is recommended to conduct empirical validation through case studies or quantitative approaches, as well as to develop more adaptive and efficient change control systems to address the complexity of construction projects.

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