

Cost Management Evolution in Building Projects: A Review of Innovations and Challenges

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ABSTRACT

Cost management in building construction is critical for project success and sustainability. This review synthesises findings from fifty-seven journal articles published between 2013 and 2023, offering vital insights for the industry. It identifies prevalent practices and challenges, such as budget forecasting, cost control methods, risk management, and integrating advanced technologies like Building Information Modelling (BIM). The study emphasizes the importance of stakeholder collaboration and effective communication in mitigating cost overruns. More importantly, it equips practitioners with actionable strategies to achieve this, providing a roadmap for successful cost management. The narrative review method provides a comprehensive overview of the evolution and current trends in cost management, empowering practitioners and researchers to improve cost efficiency in building projects. The findings highlight the need for continuous improvement in cost management strategies and motivate practitioners to commit to this, ensuring successful project delivery within budget constraints.

Keywords: Cost management, Building construction, Risk management, BIM, Stakeholder collaboration.

INTRODUCTION

Cost management in building construction is vital for project success, ensuring adherence to budget and supporting sustainability. Its importance has grown due to rising construction costs, economic fluctuations, and increased demand for affordable housing. This review synthesises existing literature, offering a comprehensive overview of cost management methods and strategies.

Over the past decade, cost management has significantly evolved from traditional budgeting and cost estimation to more sophisticated approaches involving Building Information Modelling (BIM), which enhances visualisation, planning, and cost control (Al-Yami & Sanni-Anibire, 2019). Risk management has become integral, helping anticipate and mitigate cost overruns due to unforeseen issues (Choi et al., 2021). Accurate budget forecasting now involves detailed planning and analysis of materials, labour, and overheads. Integrating historical data and predictive analytics has improved accuracy, enabling better decision-making (Xue et al., 2018; Yin et al., 2019).

Traditional cost control relied on periodic financial reporting and manual tracking. In contrast, contemporary practices use real-time monitoring and automated systems to reduce budget overruns (Love et al., 2016; Asiedu & Ameyaw, 2021). Performance measurement techniques like Earned Value Management (EVM) track progress against budgets (Chen et al., 2016; Acebes et al., 2014; Batselier & Vanhoucke, 2017). Risk management now involves identifying potential risks early, assessing their impact, and developing mitigation plans. Common hazards include material price volatility, labour shortages, and regulatory changes, which

effective management anticipates and minimises (Zhou et al., 2019).

Adopting BIM and other tools has revolutionised cost management, improving accuracy and stakeholder collaboration, thus enhancing cost planning and control throughout the project lifecycle (Kokaraki et al., 2019). Effective communication among stakeholders, including developers, contractors, architects, and clients, aligns budgetary goals, reducing misunderstandings and fostering a shared sense of responsibility (Al-Yami & Sanni-Anibire, 2019).

A narrative review method was chosen for this study due to its flexibility and comprehensive nature, allowing for a broader exploration of the literature.

RESEARCH METHODOLOGY

Selection Criteria for Articles

The selection of articles was thoroughly processed to ensure the inclusion of relevant and high-quality research. The review focused on peer-reviewed journal articles published between 2013 and 2023, offering a decade-long perspective on the evolution of cost management practices. Databases such as Scopus, Web of Science, and Google Scholar were utilised for their extensive coverage of academic publications.

The inclusion criteria were:

- i. Peer-reviewed and published in English, focused on cost management in building construction.
- ii. Providing empirical data or comprehensive theoretical insights.
- iii. Published between 2013 and 2023.

The exclusion criteria were:

- i. Not focused on building construction.
- ii. Lacking substantial empirical or theoretical content.
- iii. Non-peer-reviewed publications such as conference papers and reports.

The initial search yielded 230 articles. After applying the criteria, fifty-seven articles were deemed relevant and included in the review.

Data Collection and Analysis

Data collection involved systematically extracting pertinent information from the selected articles. This began with thoroughly reading each article to identify key themes, methodologies, findings, and conclusions related to cost management in building construction.

Data extraction focused on:

- i. Cost management techniques and tools.
- ii. Challenges and barriers in cost management.
- iii. Advances in technology and their impact on cost management.
- iv. The role of stakeholder collaboration and communication.
- v. Case studies and empirical evidence supporting various cost management practices.

Thematic analysis was conducted using Braun and Clarke's (2006) six-phase framework: familiarisation, generating initial codes, searching for themes, reviewing themes, defining and naming themes, and producing the report. This provided a detailed understanding of cost management practices and their implications.

Reliability and validity of the findings were ensured through triangulation, which cross-referenced information from multiple sources, and peer debriefing with colleagues familiar with the subject matter, thus externally validating the findings.

OVERVIEW OF COST MANAGEMENT PRACTICES

Definition and Importance

Construction cost management encompasses planning, estimating, budgeting, financing, managing, and controlling expenses to keep the project within the approved budget. Effective cost management ensures efficient resource use, minimises waste, and maximises value through cost estimation, control, monitoring, and reporting (Adam et al., 2017). The primary goal is to avoid cost overruns, which can jeopardise a project's financial feasibility and lead to delays and other complications (Jin et al., 2019).

Historical Perspective

Due to the Industrial Revolution and improved construction techniques, construction cost management has advanced from basic budgeting and financial tracking to sophisticated methods. The 20th century saw the introduction of standardised practices like the Critical Path Method (CPM) and the Program Evaluation and Review Technique (PERT), which provide structured project management and cost control (Braglia et al., 2014; Pellerin et al., 2018).

The arrival of computers in the latter half of the 20th century further revolutionised cost management with software tools for budgeting, scheduling, and cost estimation, enhancing accuracy and efficiency (Caterino et al., 2021).

Evolution Over the Last Decade (2013-2023)

Over the past decade, cost management in building construction has evolved significantly due to technological advancements, economic pressures, and a focus on sustainability. Building Information Modelling (BIM) has enhanced planning, design, construction, and management by providing accurate cost estimations and effective cost control (Al-Yami & Sanni-Anibire, 2019; Jin et al., 2019). Moreover, cost management software and mobile applications have improved efficiency through real-time cost tracking and automated reporting (Ikechukwu et al., 2017; Lamptey-Puddicombe & Emmanuel, 2018).

Economic fluctuations and material price volatility necessitate robust risk management strategies, emphasising contingency planning to protect against cost overruns (Zhou et al., 2019). Sustainable construction practices have also influenced cost management by integrating sustainable materials and lifecycle costs, making projects cost-effective and environmentally responsible (Stanitsas et al., 2021; Ofori, 2019; Opoku et al., 2021).

Effective stakeholder collaboration, facilitated by technologies like BIM and cloud-based project management platforms, aligns all parties on budgetary goals and addresses issues promptly (Xue et al., 2018). Modern techniques such as Earned Value Management (EVM) integrate project scope, schedule, and cost objectives, allowing for objective performance measurement and timely corrective actions (Netto et al., 2020; Aramali et al., 2021).

Case studies illustrate the effectiveness of contemporary cost management practices. BIM in large-scale projects reduces cost overruns through improved coordination (Kokaraki et al., 2019). Similarly, applying EVM in various projects enhances cost control and performance (Chen et al., 2016; Acebes et al., 2014).

BUDGET FORECASTING IN BUILDING CONSTRUCTION

Budget forecasting is essential for managing costs in building construction, ensuring projects remain within financial limits. Accurate forecasts help project managers and stakeholders anticipate expenses, enabling effective financial planning and resource allocation.

Techniques and Tools

Several techniques and tools enhance accuracy and reliability in budget forecasting. Historical data analysis examines past project data to identify trends and inform future cost estimates, providing a reference for predicting labour, materials, and overhead costs (Asiedu & Adaku, 2019; Akinradewo et al., 2019). Parametric estimating uses statistical relationships between historical data and other variables to predict future costs, particularly in the early project stages, relying on mathematical models based on critical parameters like size, complexity, and location (Jrade & Jalaei, 2013; Saieg et al., 2013).

Building Information Modelling (BIM) has revolutionised budget forecasting by digitally representing a building's physical and functional characteristics, providing more accurate cost estimates, visualising the construction process, and identifying potential cost drivers (Jin et al., 2019). Additionally, cost management software and mobile applications offer real-time data analysis, automated reporting, and enhanced collaboration, with tools like Microsoft Project, Primavera P6, and Procore streamlining the budgeting process and providing accurate, up-to-date cost information (Asiedu & Ameyaw, 2021).

Case Studies and Examples

Several case studies demonstrate the effectiveness of modern budget forecasting techniques and tools in building construction. Bryde et al. (2013) found that BIM significantly improved cost estimate accuracy, reduced cost overruns, and enhanced project efficiency through better visualisation, improved coordination, and early identification of potential cost issues.

Similarly, parametric estimating in a U.S. residential development project predicted costs based on historical data and project parameters, resulting in accurate cost estimates and efficient resource allocation, avoiding budget overruns (Jrade & Jalaei, 2013; Saieg et al., 2013; Panteli et al., 2020).

Challenges and Limitations

Despite advancements in budget forecasting and tools, challenges persist, particularly with cost data accuracy. Reliable data is crucial for precise estimates, but its quality varies significantly across projects, leading to potential inaccuracies (Adam et al., 2017; Durdyev, 2020). Economic fluctuations also impact budget forecasting, affecting material prices, labour costs, and currency exchange rates. Project managers must monitor economic conditions and adjust forecasts to mitigate risks (Love et al., 2016; Asiedu & Ameyaw, 2021).

The complexity of construction projects complicates accurate cost estimation, as each project has unique variables and challenges. Techniques like parametric estimating can assist but may require adjustments as projects progress (Jrade & Jalaei, 2013; Saieg et al., 2013; Panteli et al., 2020). Additionally, adopting advanced technologies such as BIM, though beneficial for budget forecasting, presents challenges. BIM requires significant investment in software, training, and implementation, and small to medium-sized firms may face financial and technical barriers (Al-Yami & Sanni-Anibire, 2019).

COST CONTROL METHODS

Traditional Approaches

Traditional cost control methods in building construction primarily involve manual expense tracking and

periodic financial reporting, including detailed budgeting, cost coding, and variance analysis. Budgeting outlines expected costs such as labour, materials, equipment, and overheads, serving as a baseline for monitoring expenditures throughout the project lifecycle (Pilehchian et al., 2015; Lu et al., 2017).

Cost coding assigns specific codes to different items, organising and tracking expenditures by categories, which facilitates identifying budget deviations and generating detailed financial reports crucial for decision-making and cost control (Asiedu & Adaku, 2019; Akinradewo et al., 2019). Variance analysis compares actual expenditures to budgeted amounts, identifying discrepancies and analysing reasons for variances, aiding project managers in identifying cost overruns early and taking corrective actions (Braglia et al., 2014; Pellerin et al., 2018).

Modern Approaches and Innovations

Recent advancements in technology and project management have introduced sophisticated cost-control methods, such as real-time cost-tracking systems, automated reporting, and advanced analytical techniques. Real-time cost-tracking systems use software tools and mobile applications to monitor project expenditures continuously. This allows managers to promptly identify budget deviations, enhancing transparency and enabling immediate corrective actions to reduce cost overruns (Love et al., 2016; Asiedu & Ameyaw, 2021). Automated reporting tools improve efficiency by automatically generating financial reports, thus providing up-to-date cost information essential for effective decision-making and cost management (Netto et al., 2020; Aramali et al., 2021).

Advanced analytical techniques like Earned Value Management (EVM) have become integral to modern cost control. EVM combines project scope, schedule, and cost objectives to measure performance and progress, offering a comprehensive framework for tracking performance against the budget. This allows project managers to identify and address cost variances early, significantly improving cost control and project outcomes (Chen et al., 2016; Acebes et al., 2014; Batselier & Vanhoucke, 2017).

Effectiveness in Various Contexts

The effectiveness of cost control methods varies with the project's size, complexity, and stakeholder involvement. Traditional methods like detailed budgeting and variance analysis are adequate for smaller, less complex projects, providing a structured and easy-to-implement approach (Adam et al., 2017; Durdjev, 2020).

In contrast, modern cost control methods offer significant advantages for larger, more complex projects. Real-time cost tracking and automated reporting enhance transparency and enable prompt corrective actions. Integrating advanced analytical techniques, such as EVM, provides a comprehensive and objective measure of project performance (Al-Yami & Sanni-Anibire, 2019).

Challenges and Limitations

Despite advancements in cost control methods, several challenges persist, particularly in the accuracy of cost data, which is crucial for effective cost control. Variations in data quality across projects can lead to inaccuracies in cost tracking and reporting (Asiedu & Adaku, 2019; Akinradewo et al., 2019).

Implementing modern cost control methods, such as real-time tracking systems and automated reporting tools, presents financial and technical difficulties, especially for small and medium-sized construction firms, due to significant investment in software, training, and infrastructure (Ikechukwu et al., 2017; Lamptey-Puddicombe & Emmanuel, 2018). Moreover, the complexity of advanced analytical techniques like EVM requires expertise that may not be readily available in all project teams, making training and capacity building essential for effective cost control (Xue et al., 2018).

RISK MANAGEMENT

Risk management is essential in building construction cost management. It involves identifying, assessing, and mitigating risks that cause cost overruns and delays. Effective risk management addresses potential issues proactively, minimising their impact on the project budget and timeline.

Identification of Risks in Building Construction

The initial step in risk management is identifying potential risks from financial, operational, environmental, and regulatory factors. Financial risks, such as fluctuations in material prices, labour costs, and interest rates, can significantly impact project costs (Zhou et al., 2019). Operational risks involve equipment failure, labour shortages, and delays in material delivery, which can lead to project delays and increased costs due to additional resources or expedited shipping (Shojaei & Haeri, 2019; Tepeli et al., 2019).

Environmental risks include natural disasters, adverse weather, and environmental regulations, which can disrupt activities and increase costs. For example, heavy rains can halt work, requiring rescheduling and potentially extending the project timeline (Choi et al., 2021).

Regulatory risks involve changes in laws, building codes, and zoning regulations, which necessitate project design or modifications to construction methods and lead to additional costs. Staying updated with regulatory changes is crucial to avoid non-compliance penalties and costly adjustments (Iqbal et al., 2015; Gómez-Bull et al., 2023).

Risk Mitigation Strategies

Once risks are identified, mitigation strategies are developed and implemented next. In building construction, common strategies include contingency planning, contractual risk transfer, insurance, continuous risk assessment, and stakeholder engagement. Contingency planning allocates a budget for unexpected expenses, ensuring project continuity despite unforeseen costs (Gransberg, 2014; Oke et al., 2017).

Contractual risk transfer shifts certain risks to other parties through agreements, such as clauses transferring the risk of material price increases to the supplier, helping manage financial risks (Al-Qershi et al., 2017; El-Sayegh et al., 2020). Insurance provides financial protection against specific risks through various types, ensuring the project proceeds without significant disruptions (Linnerooth-Bayer & Hochrainer-Stigler, 2015; Brockett et al., 2019).

Continuous risk assessment involves regular evaluations to identify new risks and reassess existing ones, tracking progress and adjusting as needed throughout the project lifecycle (Jin et al., 2019). Engaging stakeholders, including clients, contractors, and suppliers, in the risk management process is crucial. Effective communication and collaboration help identify potential risks early and develop appropriate mitigation strategies, ensuring all parties know their roles in managing risks (Marcelino-Sádaba et al., 2014; Wu et al., 2018).

Impact on Cost Management

Effective risk management significantly impacts cost management in building construction. Identifying and mitigating risks early prevents cost overruns and keeps projects within budget. For example, contingency planning provides a financial cushion to absorb unexpected costs, reducing budget overruns (Gransberg, 2014; Oke et al., 2017). Contractual risk transfer and insurance manage financial risks, ensuring cost variations do not derail the project and allowing managers to focus on core activities without worrying about potential setbacks (Al-Qershi et al., 2017; El-Sayegh et al., 2020).

Continuous risk assessment and monitoring enable project managers to adjust the project plan as needed, minimising disruptions and ensuring smooth progress, leading to better cost control and timely completion (Al-Yami & Sanni-Anibire, 2019). Stakeholder engagement enhances cost management by fostering a collaborative approach to risk mitigation. When all parties actively manage risks, unforeseen issues are less likely, and the project proceeds more efficiently (Marcelino-Sádaba et al., 2014; Wu et al., 2018).

INTEGRATION OF ADVANCED TECHNOLOGIES

Integrating advanced technologies in building construction has revolutionised cost management practices, improving accuracy, efficiency, and collaboration among stakeholders.

Role of Building Information Modelling (BIM)

Building Information Modelling (BIM) is a digital model representing a building's physical and functional aspects, serving as a shared information resource for decision-making throughout its lifecycle (Almuntaser et al., 2018). BIM integrates design, engineering, and cost management into a cohesive model.

BIM enhances cost management by providing detailed, accurate estimates early in the project lifecycle. The model allows visualisation of the construction process, enabling project managers to identify cost drivers and make informed decisions to optimise costs. By simulating different scenarios, BIM forecasts costs more accurately, reducing budget overruns (Jin et al., 2019).

Furthermore, BIM improves coordination and communication among project stakeholders by providing a centralised platform for accessing up-to-date project information, reducing misunderstandings and conflicts. This collaborative approach ensures alignment on budgetary goals and fosters cooperation in addressing issues (Caterino et al., 2021).

Other Technological Innovations

Technological innovations such as cost management software, mobile applications, and advanced data analytics tools have significantly improved cost management in building construction. Software like Procore, Primavera P6, and Microsoft Project automate expense tracking, financial reporting, and budget management, reducing manual effort and time. These tools provide real-time data analysis for continuous cost monitoring and timely adjustments (Ikechukwu et al., 2017; Lamptey-Puddicombe & Emmanuel, 2018).

Mobile applications allow project managers and team members to access project information, track expenses, and communicate with stakeholders from anywhere, enhancing flexibility and efficiency (Netto et al., 2020; Aramali et al., 2021). Advanced analytics tools utilise big data and machine learning to provide deeper cost management insights by analysing data from past projects to identify patterns and trends which inform future cost estimates. Predictive analytics can forecast potential cost overruns, enabling preventive measures (Xue et al., 2018).

Benefits and Challenges

Integrating advanced technologies in cost management offers numerous benefits, including enhanced accuracy in cost estimation, increased efficiency, and improved collaboration. Technologies like BIM and advanced data analytics provide precise cost information, reducing errors and enhancing budget reliability (Caterino et al., 2021). Automation of cost tracking and reporting processes saves time and reduces administrative burdens, while real-time data analysis enables continuous monitoring and prompt corrective actions (Love et al., 2016; Asiedu & Ameyaw, 2021). Tools like BIM and mobile applications also improve stakeholder communication and coordination, ensuring common goals are met with minimal cost impacts (Kokaraki et al., 2019).

However, these technologies accompany challenges. The initial investment, including software purchases, training, and infrastructure upgrades, can be prohibitive for small and medium-sized firms (Caterino et al., 2021). Technical expertise is also necessary for effective use of BIM and advanced data analytics, requiring firms to invest in training and capacity building, which can slow adoption and integration (Almuntaser et al., 2018; Tan et al., 2021).

Impact on the Overall Construction Process

Integrating advanced technologies profoundly impacts construction by enhancing cost management and project execution efficiency. Accurate cost estimates and real-time tracking maintain budgetary control, reducing cost overruns and financial setbacks (Xue et al., 2018). Improved collaboration and communication among stakeholders lead to smoother workflows and fewer delays.

Technologies like BIM provide all parties with the same information, reducing misunderstandings and fostering cooperation. This collaborative approach boosts construction efficiency and improves project outcomes (Kokaraki et al., 2019).

STAKEHOLDER COLLABORATION

Stakeholder collaboration is crucial in cost management for building construction, necessitating active engagement from all involved. Effective collaboration enhances communication, aligns goals, and ensures efficient resource use, contributing to successful project delivery within budget constraints.

Importance of Stakeholder Collaboration

Projects in building construction involve diverse stakeholders, including clients, architects, contractors, subcontractors, suppliers, and regulatory authorities. Each stakeholder's distinct interests and responsibilities make collaboration essential for coordinating efforts and achieving common objectives. Effective stakeholder collaboration ensures agreement on project goals, timelines, and budgets, enhancing decision-making and problem-solving through shared information and expertise (Walker & Lloyd-Walker, 2015).

This collective approach leads to more efficient resource use and better project cost management. Additionally, collaboration fosters shared responsibility, motivating stakeholders to work together toward successful project completion (Ahern et al., 2014; Wen et al., 2018).

Communication Strategies

Effective communication is the cornerstone of successful stakeholder collaboration, managing expectations, resolving conflicts, and informing everyone about project progress and changes. Regular meetings maintain open lines of communication, allowing for project updates, addressing concerns, and making collective decisions, thus keeping stakeholders engaged throughout the project lifecycle (Pilehchian et al., 2015; Lu et al., 2017).

Technology such as project management software and collaborative platforms like BIM, Procore, and Microsoft Teams significantly improve communication by facilitating real-time information sharing, document management, and virtual meetings. These tools enhance transparency and ensure all parties access the latest project data (Almuntaser et al., 2018; Tan et al., 2021).

Clear and detailed documentation, including contracts, project plans, budgets, and progress reports, is essential for avoiding misunderstandings and providing a reference point for resolving disputes (Walker & Lloyd-Walker, 2015). Involving stakeholders in crucial decision-making fosters a collaborative environment. Seeking their input and feedback ensures their concerns and suggestions are considered, building trust and

commitment and enhancing cooperation and support (Ahern et al., 2014; Wen et al., 2018).

Case Studies of Successful Collaboration

Effective stakeholder collaboration in building construction brings notable benefits, as seen in several case studies. In the UK, the implementation of BIM in a large-scale residential project involved architects, engineers, contractors, and clients using BIM as a collaborative platform. This enabled real-time information sharing, coordinated efforts, and early issue identification, leading to significant cost savings, reduced rework, and timely completion (Almuntaser et al., 2018; Tan et al., 2021).

In a developing country, the construction of affordable housing units highlighted the importance of collaboration for cost management. Government agencies, non-profit organisations, local contractors, and community members participated through regular meetings, clear documentation, and inclusive decision-making. This alignment on project goals and budgets resulted in efficient resource use, timely completion, and a positive community impact (Walker & Lloyd-Walker, 2015).

Challenges and Solutions

Although stakeholder collaboration offers benefits, it can also present challenges, such as managing differing interests and priorities among stakeholders. Conflicts can arise from competing goals or a lack of alignment on project objectives. To address this, project managers should establish clear roles, set common goals, and facilitate open dialogue to resolve conflicts (Pilehchian et al., 2015; Lu et al., 2017).

Effective communication is another challenge, especially in large projects with many stakeholders. Miscommunication can lead to misunderstandings, delays, and increased costs. Implementing robust communication strategies, such as regular meetings and technology use, can mitigate these issues and enhance collaboration (Ahern et al., 2014; Wen et al., 2018).

CHALLENGES IN COST MANAGEMENT

Construction cost management is complex and multifaceted, often fraught with various challenges that can jeopardise project budgets and timelines.

Inadequate Cost Estimation

Inadequate cost estimation is a primary challenge in cost management. Accurate estimation is crucial for setting realistic budgets and ensuring projects stay within financial constraints. However, it is challenging due to numerous variables like labour, materials, equipment, and overheads, with errors potentially leading to significant budget overruns and delays (Adam et al., 2017; Durdyev, 2020).

Several factors contribute to this inadequacy, including the reliance on historical data, which may not reflect current market conditions such as material price fluctuations or labour cost changes (Tan et al., 2021). Additionally, incomplete or inaccurate project information during early planning stages can result in flawed estimates. Project managers must continuously update their forecasts with new information to maintain accuracy (Chen et al., 2016; Acebes et al., 2014; Batselier & Vanhoucke, 2017).

Project Delays

Project delays significantly challenge cost management, often arising from weather conditions, labour shortages, equipment failures, and regulatory issues. Each delay extends the project timeline and increases costs due to additional labour, equipment rental, and overhead expenses (Assaf & Al-Hejji, 2006; Yap et al., 2020; Adam et al., 2017). Weather-related delays are expected in building construction, where outdoor work

is affected by rain, snow, and extreme temperatures, disrupting schedules and necessitating rescheduling, which increases costs.

Effective project scheduling and contingency planning are crucial to mitigate these delays (Choi et al., 2021). Labour shortages, particularly in regions with high demand for skilled workers, increase labour costs and delays as tasks take longer to complete. Initiative-taking workforce planning and investment in training are necessary to ensure a steady supply of skilled workers (Shojaei & Haeri, 2019; Tepeli et al., 2019).

Economic Fluctuations and Material Costs

Economic fluctuations and volatile material costs also challenge cost management in building construction. Prices of materials like steel, concrete, and lumber vary due to market conditions, supply chain disruptions, and global economic trends, impacting project budgets and complicating cost control (Zhou et al., 2019). Disruptions from natural disasters, geopolitical events, or pandemics lead to material shortages and increased costs.

For instance, the COVID-19 pandemic disrupted global supply chains, causing shortages and price hikes for many construction materials. Project managers must adopt flexible procurement strategies, establish strong supplier relationships, and maintain contingency funds to mitigate these risks (Ikechukwu et al., 2017; Lamptey-Puddicombe & Emmanuel, 2018).

Other Common Challenges

Several issues commonly affect cost management in building construction. A lack of communication and collaboration among project stakeholders often leads to misunderstandings, errors, and rework, increasing project costs. Implementing robust communication strategies and fostering a collaborative project environment is essential for effective cost management (Almuntaser et al., 2018; Tan et al., 2021).

Additionally, misaligned incentives among stakeholders can lead to contractors cutting corners to save costs, compromising quality and safety. Ensuring all stakeholders have aligned incentives and are committed to achieving the same project goals is crucial for maintaining cost control and successful projects (Braglia et al., 2014; Pellerin et al., 2018).

DISCUSSION

Examining cost management practices in building construction reveals a complex landscape influenced by technological advancements, stakeholder collaboration, and challenges like accurate cost estimation, project delays, and economic fluctuations.

Technological Advancements and Their Impact

One significant trend in cost management is the integration of advanced technologies, particularly Building Information Modelling (BIM). BIM has transformed cost management by enhancing cost estimate accuracy and facilitating better stakeholder coordination. Studies show that BIM's detailed visual representation of the construction process helps identify potential cost drivers early, reducing budget overruns (Kokaraki et al., 2019). Using real-time cost-tracking systems and advanced data analytics further improves cost management efficiency and accuracy, enabling swift, informed decisions by project managers.

However, adopting these technologies presents challenges. The initial investment for implementing BIM and other advanced tools can be prohibitive for small and medium-sized firms. Additionally, the need for specialised technical expertise poses a barrier to widespread adoption. Despite these challenges, the benefits of improved accuracy, efficiency, and collaboration make these technologies invaluable in modern cost

management practices (Caterino et al., 2021).

Stakeholder Collaboration

Effective stakeholder collaboration significantly influences cost management. The involvement of all stakeholders, including clients, contractors, architects, and suppliers, ensures alignment on project goals and budgets. Collaborative platforms like BIM enhance communication and coordination, resulting in cohesive teams and successful project outcomes (Almuntaser et al., 2018; Tan et al., 2021). Case studies show that projects with high stakeholder collaboration experience fewer delays and cost overruns, underscoring its importance (Caterino et al., 2021).

However, achieving effective collaboration can be challenging due to differing interests and priorities, which can cause conflicts. Mitigating these issues requires clear roles and responsibilities, open communication, and stakeholder involvement in critical decisions (Pilehchian et al., 2015; Lu et al., 2017).

Challenges in Cost Management

Inadequate cost estimation is a persistent challenge in the construction industry, crucial for setting realistic budgets and avoiding cost overruns. Reliance on outdated historical data, incomplete project information, and market volatility often lead to inaccuracies (Asiedu & Adaku, 2019; Akinradewo et al., 2019). Continuous updating of estimates and using advanced data analytics can help, but the complexity of construction projects makes perfect accuracy elusive.

Project delays, caused by adverse weather, labour shortages, and regulatory issues, significantly impact cost management by extending timelines and increasing costs through additional labour, equipment rental, and overheads (Assaf & Al-Hejji, 2006; Yap et al., 2020; Adam et al., 2017). Effective scheduling, contingency planning, and initiative-taking risk management are essential strategies (Choi et al., 2021).

Economic fluctuations and material costs pose substantial risks to cost management. Prices of construction materials can vary widely due to market conditions, supply chain disruptions, and global economic trends, impacting budgets and complicating cost control (Zhou et al., 2019). Flexible procurement strategies, strong supplier relationships, and maintaining contingency funds are critical for managing these risks (Love et al., 2016).

CONCLUSION, RECOMMENDATIONS AND LIMITATIONS

Conclusion

Cost management in building construction is crucial for project success and sustainability. This review has highlighted the evolution of cost management practices, the integration of advanced technologies, and the importance of stakeholder collaboration. Accurate cost estimation, effective risk management, and real-time cost tracking are essential for maintaining project budgets and timelines despite advancements, challenges like economic fluctuations, material price volatility, and project delays persist, necessitating continuous improvement and innovation. Practitioners can manage costs and deliver successful projects by adopting advanced technologies, enhancing risk management strategies, and fostering stakeholder collaboration. Researchers can contribute by developing new models and exploring best practices to address cost management's dynamic and complex nature in building construction.

Recommendations

Several recommendations can enhance cost management in building construction for both practitioners and researchers. Practitioners should adopt advanced technologies such as Building Information Modelling (BIM)

and real-time cost management software to improve cost estimate accuracy, facilitate better project coordination, and enable initiative-taking management of potential cost overruns.

Training and capacity building are essential to ensure project teams can effectively use these technologies. Effective risk management strategies are crucial, including continuous risk assessment, contingency planning, and strong communication with all project stakeholders. Identifying and mitigating risks early can prevent significant cost impacts and ensure smoother project execution.

Researchers should focus on developing new cost estimation models that incorporate real-time data and predictive analytics to provide more dynamic and accurate cost forecasts, helping project managers better anticipate and manage cost variations. Further research should explore best practices in stakeholder collaboration and communication, examining how different strategies impact project outcomes and cost efficiency.

Limitations

Despite this review's comprehensive nature, several limitations should be acknowledged. While flexible and broad, the narrative review methodology does not adhere to the strict protocols of systematic reviews, potentially limiting the generalizability of the findings. Articles were selected based on specific inclusion criteria so that some relevant studies may be excluded.

Additionally, reliance on published literature means the findings are based on reported data and experiences, which may not capture all nuances of cost management practices in different contexts. Unpublished or grey literature and practical experiences from industry professionals could provide additional insights not covered here.

Lastly, the rapid pace of technological advancement means the state-of-the-art practices discussed may quickly become outdated. Continuous monitoring of technological developments and their applications in cost management is necessary to keep the recommendations relevant and effective.

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