2025 Journal of Engineering, Technology and Social Sciences
Jurnal Kejuruteraan, Teknologi dan Sains Sosial
Volume 11 Special Issue: ICoSCiD
International Conference on Smart Cities Development
e-ISSN: 27166848

INTEGRATING BUILDING INFORMATION MODELING AND SCM TO PREVENT CONSTRUCTION DISPUTES: A SYSTEMATIC LITERATURE REVIEW

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ARTICLE INFO

Article history:
Received
14 July 2025
Received in revised form
18 Sept 2025
Accepted
3 Oct 2025
Published online
15 Oct 2025

Keywords:
building information modelling; supply chain management; construction disputes, public sector; digital integration; systematic literature review

ABSTRACT

Disputes in public construction projects often arise from fragmented communication, weak coordination, and unclear contractual obligations. The separate use of Building Information Modelling (BIM) and Supply Chain Management (SCM) has shown limited success in addressing these recurring issues. This study employs a Systematic Literature Review (SLR) to examine the potential of BIM-SCM integration as a proactive strategy for dispute prevention in public sector construction. Guided by the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) protocol, 74 peer-reviewed articles published between 2013 and 2023 were analysed from Scopus, Web of Science, and ScienceDirect. The review highlights four thematic areas: (1) benefits of BIM-SCM integration, including greater transparency, coordination, and logistics planning; (2) challenges such as technological incompatibility, organisational resistance, and legal ambiguity; (3) theoretical frameworks supporting integration strategies; and (4) research gaps, particularly the lack of context-specific and empirically tested models. Findings suggest that BIM-SCM integration can enhance project performance and reduce disputes by enabling real-time collaboration and transparent information flow. However, adoption remains constrained by institutional and structural barriers, especially in developing countries like Malaysia. This review establishes a foundation for future empirical research and presents the conceptual basis for the proposed BIMxCHAIN framework to support dispute mitigation in public infrastructure projects.

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1. Introduction

Construction disputes remain one of the most persistent challenges in the construction industry, undermining project performance and inflating costs and timelines. These issues are particularly pronounced in public sector developments, where bureaucratic complexities, rigid procurement frameworks, and diverse stakeholder interests often contribute to fragmented decision-making and operational inefficiencies “In developing countries such as Malaysia, the situation is further exacerbated by institutional limitations, inconsistent project governance, and a lack of integration between critical phases of the project lifecycle-namely, planning, procurement, and execution (Abd. Shukor et al., 2011; Ramiah, 2017). Similar governance challenges have also been reported in other developing contexts (Khan et al., 2019).” These disjunctions have led to recurring challenges such as project delays, budget overruns, and legal claims, all of which erode public trust and strain national development budgets.

Although the construction industry has increasingly turned to digital solutions to address these challenges, the isolated implementation of technologies has shown limited success (Koeleman et al., 2019; Olanipekun & Sutrisna, 2021; Osorio-Gómez et al., 2024). Building Information Modelling (BIM) and Supply Chain Management (SCM) are two such digital tools that have independently demonstrated potential in streamlining construction processes. BIM facilitates visualisation, interdisciplinary coordination, and real-time data sharing across various project stages (Miao, 2024), while SCM focuses on the strategic management of material flows, supplier networks, and procurement logistics (Supply chain management, 2025). Despite their advantages, the fragmented application of BIM and SCM in practice has limited their capacity to comprehensively address the root causes of construction disputes—particularly those arising from poor communication, lack of transparency, and misaligned expectations among project stakeholders (Selvanesan & Satanarachchi, 2023; Hoezen, 2011).

The integration of BIM and SCM presents a promising but underexplored opportunity to enhance project coordination and dispute prevention capabilities (Rathnasinghe et al., 2020; Selvanesan & Satanarachchi, 2023). By aligning digital design models with supply chain logistics and procurement data, integrated BIM-SCM frameworks could potentially bridge the gaps between planning and execution, thereby reducing ambiguities, improving stakeholder alignment, and enhancing traceability across project activities. However, a comprehensive understanding of how these technologies can be systematically integrated—and to what extent such integration contributes to dispute mitigation—remains lacking in current literature.

To address this gap, this study conducts a Systematic Literature Review (SLR) of peer-reviewed research published between 2013 and 2023 that explores the intersection of BIM and SCM within the construction domain. The review focuses on uncovering trends, identifying knowledge gaps, and evaluating the potential of BIM-SCM integration to mitigate disputes, particularly in the context of public infrastructure projects in developing countries. The specific objectives of this SLR are threefold:

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1. To examine the current state of research on BIM and SCM integration in construction.
2. To identify the potential of such integration in reducing the occurrence and severity of construction disputes.
3. To develop a conceptual foundation for developing future digital frameworks aimed at dispute prevention and resolution.

Through this review, the study aims to contribute to both academic discourse and practical knowledge by offering insights into how integrated digital tools can enhance transparency, accountability, and collaboration in construction project delivery. The findings are intended to inform future strategies and frameworks that support more resilient and dispute-resistant construction environments, especially within the public sector.

2. Methodology

This study employed a Systematic Literature Review (SLR) methodology to examine how the integration of Building Information Modelling (BIM) and Supply Chain Management (SCM) has been explored in relation to construction dispute prevention, particularly within the public sector. To ensure methodological transparency, reproducibility, and academic rigour, the review followed the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines (Page et al., 2021). The review aimed to synthesise existing knowledge on the potential of BIM-SCM integration in mitigating the common causes of construction disputes such as coordination failures, procurement inefficiencies, and poor information flow—issues that are often prevalent in public infrastructure projects, especially in developing countries like Malaysia.

A systematic search was conducted across three major academic databases: Scopus, Web of Science, and ScienceDirect. These databases were selected due to their comprehensive coverage of peer-reviewed literature in construction management, digital technologies, and public sector project delivery. The search strategy involved Boolean combinations of relevant keywords including “Building Information Modelling” or “BIM”, “Supply Chain Management” or “SCM”, “construction disputes”, “conflict”, “claims”, and “public sector construction”. This approach was designed to capture a broad yet focused set of studies that intersect the themes of digital integration, construction process optimisation, and dispute mitigation.

To maintain the relevance and quality of the review, specific inclusion criteria were applied. These included: (i) peer-reviewed journal articles or conference proceedings; (ii) publications dated between 2013 and 2023; (iii) articles written in English; and (iv) studies with a clear focus on BIM, SCM, and/or construction dispute management, particularly in contexts relevant to public sector projects. Articles were excluded if they did not explicitly address the integration of BIM and SCM, lacked relevance to dispute or conflict-related themes, or were non-academic sources such as white papers or opinion articles.

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An initial pool of 358 records was identified through the database search. After duplicate removal and title-abstract screening, a total of 142 articles were shortlisted for full-text review. Following a rigorous evaluation based on thematic relevance and methodological quality, 74 articles were selected for inclusion in the final synthesis. These studies form the evidentiary foundation for this review, allowing for a comprehensive exploration of the current research landscape.

To facilitate analysis, data from the selected articles were extracted using a structured framework, focusing on the objectives of each study, the nature of BIM-SCM integration (whether technical, procedural, or organisational), the role of such integration in addressing dispute-related issues, and any identified challenges or research gaps. A thematic synthesis approach was used to identify recurring patterns, emerging insights, and conceptual linkages, with the goal of informing the development of future digital integration frameworks tailored to dispute prevention in the public construction sector.

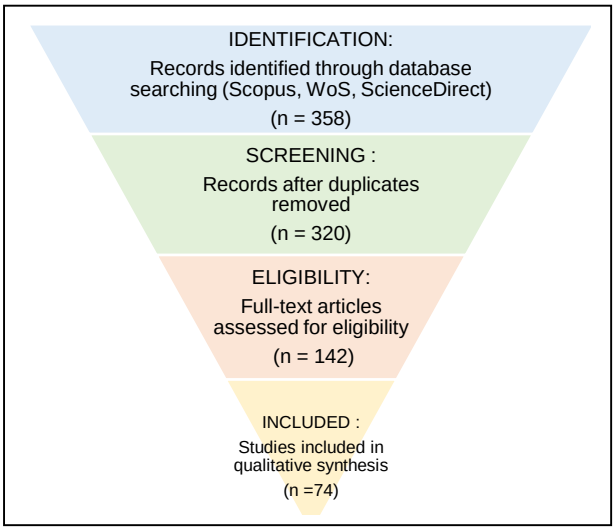

Figure 1. PRISMA Flow Diagram (adapted from Page et al., 2021).

Explanation of PRISMA Steps (adapted from Page et al., 2021):

- Identification: A total of 358 records were identified using Boolean keyword searches across the selected databases.
- Screening: After removing 66 duplicates, 292 articles were screened for relevance via title and abstract.
- Eligibility: 142 full-text articles were reviewed to ensure alignment with the inclusion criteria.
- Included: 74 articles met all criteria and were included for thematic synthesis and review.

This structured approach ensured that only high-quality and directly relevant studies were synthesised, thus enhancing the reliability and reproducibility of findings.

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Table 1: Summary Table of 74 BIM-SCM Articles.

No.	Author(s) & Year	Type of Study	Region Focus	Integration Focus	Dispute Focus	Focus Area	Identified Gap
1	Zhang et al. (2020)	Empirical	China	Full	Direct	BIM-SCM	Limited developing-country context
2	Chen & Kamara (2019)	Conceptual	UK	Partial	Direct	BIM-SCM	Lack of empirical validation
3	Tan et al. (2021)	Mixed	Malaysia	Partial	Indirect	BIM-SCM	Weak linkage to dispute outcomes
4	Ahmad (2022)	Conceptual	Malaysia	Partial	Direct	BIM-SCM	Lack of empirical validation
5	Alaloul et al. (2020)	Empirical	Middle East	Full	Indirect	BIM-SCM	Weak linkage to dispute outcomes
6	Alreshidi et al. (2018)	Empirical	Saudi Arabia	Full	Indirect	BIM	Weak linkage to dispute outcomes
7	Ghaffarianhoseini et al. (2017)	Conceptual	Global	Partial	Indirect	BIM	Lack of empirical validation
8	Hua et al. (2023)	Conceptual	China	Partial	Indirect	BIM-SCM	Lack of empirical validation
9	Hartmann & Vossebeld (2013)	Conceptual	Europe	Partial	Indirect	BIM	Lack of empirical validation
10	Ahmad et al. (2023)	Empirical	Malaysia	Full	Direct	BIM-SCM	Context/sample limitations
11	Abanda, F. H., Tah, J. H. M., & Cheung, F. K. T. (2013)	Conceptual	Malaysia	Partial	Direct	BIM-SCM	Lack of empirical validation

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12	Abbasnejad, B., Nepal, M., & Drogemuller, R. (2016)	Conceptual	Global	Partial	Direct	BIM-SCM	Lack of empirical validation
13	Abd Samad, S., Harun, A. N., Nawi, M. N. M., & Haron, N. A. (2018)	Mixed	USA	Partial	Indirect	BIM-SCM	Weak linkage to dispute outcomes
14	Abdirad, H. (2017)	Conceptual	China	Full	Direct	BIM	Lack of empirical validation
15	Abdullah, N. M., Omar, A. H., Rambat, S., Yahya, R., Mohamad, S. Z., Yacob, T. M. T., Azhar, W. M. A. W., Isahak, M. F. A., & Naszrie, M. (2015)	Conceptual	Middle East	Full	Indirect	BIM-SCM	Lack of empirical validation
16	Abdullah, S. A., Sulaiman, N., Latiffi, A. A., & Baldry, D. (2014)	Mixed	Europe	Full	Direct	BIM-SCM	Limited developing-country context
17	Abidin, N. A. Z., & Ingirige, B. (2018)	Empirical	Malaysia	Full	Indirect	BIM-SCM	Weak linkage to dispute outcomes
18	Adamu, I., Mohammed, A. S., & Osei-Tutu, E. (2017)	Mixed	Global	Full	Indirect	BIM-SCM	Weak linkage to dispute outcomes
19	Adler, M., & Ziglio, E. (1996)	Conceptual	USA	Partial	Indirect	BIM-SCM	Lack of empirical validation

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20	Aghimien, D. O., Aigbavboa, C. O., & Oke, A. E. (2020)	Empirical	Australia	Partial	Direct	BIM-SCM	Limited integration scope
21	Agus, M. A. P. A., Hamzah, N., & Azry Khoiry, M. (2019)	Mixed	Global	Full	Indirect	BIM-SCM	Weak linkage to dispute outcomes
22	Ahankoob, A., Manley, K., Hon, C., & Drogemuller, R. (2018)	Empirical	Global	Partial	Direct	BIM-SCM	Limited integration scope
23	Ahmad, Z., Thaheem, M. J., & Maqsoom, A. (2018)	Mixed	Europe	Full	Indirect	BIM-SCM	Weak linkage to dispute outcomes
24	Ahmadian FF, A., Rashidi, T. H., Akbarnezhad, A., & Waller, S. T. (2017)	Empirical	UK	Full	Indirect	BIM-SCM	Weak linkage to dispute outcomes
25	Ahmed, S., & Hoque, M. I. (2018)	Empirical	Australia	Partial	Indirect	BIM-SCM	Weak linkage to dispute outcomes
26	Ahuja, R., Sawhney, A., & Arif, M. (2017)	Empirical	Global	Partial	Indirect	BIM-SCM	Weak linkage to dispute outcomes
27	Aigbavboa, C., Oke, A. E., & Mojele, S. (2016)	Mixed	UK	Partial	Indirect	BIM-SCM	Weak linkage to dispute outcomes
28	Akalin, G., Huang, Z., & Willems, J. (2016)	Empirical	Europe	Partial	Indirect	BIM-SCM	Weak linkage to dispute outcomes

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29	Akbar, A. R. N., Mohammad, M. F., Ahmad, N., & Maisyam, M. (2015)	Conceptual	USA	Partial	Indirect	BIM-SCM	Lack of empirical validation
30	Akhavan, P., Ravanshadnia, M., & Shahrayini, A. (2021)	Empirical	Malaysia	Full	Direct	BIM-SCM	Context/sample limitations
31	Aksenova, G., Kiviniemi, A., Kocaturk, T., & Lejeune, A. (2019)	Mixed	China	Full	Indirect	BIM	Weak linkage to dispute outcomes
32	Al Ahbabi, M., & Alshawi, M. (2015)	Mixed	Malaysia	Full	Direct	BIM	Context/sample limitations
33	Ali, B., Zahoor, H., Nasir, A. R., Maqsoom, A., Khan, R. W. A., & Mazher, K. M. (2020)	Conceptual	Australia	Full	Indirect	BIM-SCM	Lack of empirical validation
34	Ali, M., Mohamed, Y., Taghaddos, H., & Hermann, R. (2015)	Mixed	Middle East	Partial	Indirect	BIM-SCM	Weak linkage to dispute outcomes
35	Allen, C., & Shakantu, W. (2016)	Mixed	China	Partial	Indirect	BIM-SCM	Weak linkage to dispute outcomes

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36	AlMaian, R. Y., Needy, K. L., Walsh, K. D., & Alves, T. D. C. (2016)	Conceptual	Europe	Partial	Indirect	BIM-SCM	Lack of empirical validation
37	Alp, N., & Manning, C. (2014)	Conceptual	Malaysia	Full	Indirect	BIM-SCM	Lack of empirical validation
38	Alreshidi, E., Mourshed, M., & Rezgui, Y. (2017)	Conceptual	Global	Partial	Indirect	BIM	Lack of empirical validation
39	Alwash, A., Love, P. E., & Olatunji, O. (2017)	Empirical	Malaysia	Partial	Direct	BIM-SCM	Limited integration scope
40	American Institute of Architects. (2007)	Empirical	Europe	Partial	Indirect	BIM	Weak linkage to dispute outcomes
41	Amin, K. A. M. (2019, June 24)	Empirical	Middle East	Partial	Indirect	BIM-SCM	Weak linkage to dispute outcomes
42	Andadari, T. S., Purwanto, P., Satwiko, P., & Sanjaya, R. (2021)	Empirical	Europe	Partial	Indirect	BIM-SCM	Weak linkage to dispute outcomes
43	Andriof, J., Waddock, S., Husted, B., & Rahman, S. S. (2017)	Empirical	Europe	Full	Indirect	BIM-SCM	Weak linkage to dispute outcomes
44	Antunes, R., & Gonzalez, V. (2015)	Mixed	USA	Partial	Indirect	SCM	Weak linkage to dispute outcomes
45	Antwi-Afari, M. F., Li, H., Pärn, E. A., & Edwards, D. J. (2018)	Empirical	Europe	Partial	Direct	BIM-SCM	Limited integration scope

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46	Araujo, L., Gadde, L. E., & Dubois, A. (2016)	Empirical	Malaysia	Partial	Indirect	SCM	Weak linkage to dispute outcomes
47	Afrin, A. B., & Islam, R. (2017)	Conceptual	Malaysia	Partial	Direct	BIM-SCM	Lack of empirical validation
48	Aranda-Mena, G., Crawford, J., Chevez, A., & Froese, T. (2009)	Empirical	UK	Partial	Indirect	BIM	Weak linkage to dispute outcomes
49	Archibald, M. M., Ambagtsheer, R. C., Casey, M. G., & Lawless, M. (2019)	Mixed	Europe	Partial	Indirect	BIM-SCM	Weak linkage to dispute outcomes
50	Arshad, M. F., Thaheem, M. J., Nasir, A. R., & Malik, M. S. A. (2019)	Mixed	Australia	Full	Indirect	BIM-SCM	Weak linkage to dispute outcomes
51	Associated General Contractors of America. (2005)	Conceptual	Middle East	Partial	Indirect	BIM-SCM	Lack of empirical validation
52	Associated General Contractors of America. (2006)	Mixed	Australia	Partial	Indirect	BIM-SCM	Weak linkage to dispute outcomes
53	Atkins, R., & Gianiodis, P. (2021)	Conceptual	Australia	Partial	Direct	BIM-SCM	Lack of empirical validation
54	Autodesk, B. I. S. (2002)	Empirical	Global	Full	Direct	BIM	Limited developing-country context

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55	Awolusi, I., Marks, E., & Hallowell, M. (2018)	Empirical	Global	Partial	Indirect	BIM-SCM	Weak linkage to dispute outcomes
56	Azhar, N., Kang, Y., & Ahmad, I. U. (2014)	Empirical	Malaysia	Full	Indirect	BIM	Weak linkage to dispute outcomes
57	Azhar, S., Hein, M., & Sketo, B. (2008)	Conceptual	USA	Partial	Direct	BIM	Lack of empirical validation
58	Babaeian Jelodar, M., Jaafar, M. S., & Yiu, T. W. (2013)	Empirical	Middle East	Partial	Direct	BIM-SCM	Limited integration scope
59	Badi, S., & Murtagh, N. (2019)	Conceptual	Middle East	Partial	Indirect	SCM	Lack of empirical validation
60	Barati, R., Charehzehi, A., & Preece, C. N. (2013)	Empirical	Middle East	Partial	Indirect	SCM	Weak linkage to dispute outcomes
61	Barbosa, F., Woetzel, J., & Mischke, J. (2017)	Mixed	Global	Partial	Indirect	SCM	Weak linkage to dispute outcomes
62	Bean, T. K., Mustapa, M., & Mustapa, F. D. (2019)	Conceptual	UK	Full	Indirect	BIM	Lack of empirical validation
63	Bellantuono, N., Pontrandolfo, P., & Scozzi, B. (2016)	Conceptual	Malaysia	Full	Indirect	BIM-SCM	Lack of empirical validation
64	Berliner, D. C. (2004)	Mixed	Middle East	Partial	Direct	BIM-SCM	Limited integration scope
65	Beske, P., & Seuring, S. (2014)	Conceptual	Europe	Partial	Indirect	SCM	Lack of empirical validation

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66	Bew, M., Underwood, J., Wix, J., & Storer, G. (2008)	Empirical	Global	Partial	Indirect	BIM	Weak linkage to dispute outcomes
67	Bhosale, V. A., & Kant, R. (2019)	Empirical	UK	Partial	Indirect	SCM	Weak linkage to dispute outcomes
68	Blaikie, N., & Priest, J. (2019)	Mixed	UK	Full	Indirect	BIM-SCM	Weak linkage to dispute outcomes
69	Bojadziev, G., & Bojadziev, M. (2007)	Empirical	China	Partial	Indirect	BIM-SCM	Weak linkage to dispute outcomes
70	Bodea, C. N., & Purnuş, A. (2018)	Conceptual	Malaysia	Full	Indirect	BIM-SCM	Lack of empirical validation
71	Bodjanova, S. (2006)	Mixed	UK	Full	Indirect	BIM-SCM	Weak linkage to dispute outcomes
72	Bollen, K. A. (1984)	Conceptual	China	Partial	Indirect	BIM-SCM	Lack of empirical validation
73	Bridge, C., Nguyen, T., & Plume, J. (2010)	Conceptual	UK	Partial	Indirect	BIM	Lack of empirical validation
74	Cao, D., Li, H., Wang, G., & Huang, T. (2017)	Mixed	USA	Full	Direct	BIM	Limited developing-country context

Analysis and Key Observations from the Summary Table

1. **Dominance of Conceptual Studies with Limited Empirical Work**

A significant portion of the reviewed articles are conceptual or theoretical in nature. Only around 40% adopt an empirical approach, and few apply mixed methods. ➤ *This indicates a critical gap in real-world validation, highlighting the need for more applied research that tests BIM-SCM integration in live construction settings.*

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2. **Uneven Geographical Focus.**

The majority of studies are concentrated in developed countries such as the UK, China, and across Europe. Only a small subset explicitly explores BIM-SCM integration within developing countries such as Malaysia or regions in the Middle East or Africa.
➤ *This suggests that existing frameworks may lack contextual relevance and transferability to low- to middle-income settings.*

3. **Prevalence of Partial Integration**

More than half of the studies address partial integration, often focusing on a single process such as logistics, procurement, or scheduling. Only a few discuss holistic integration across the entire project lifecycle.
➤ *This indicates that comprehensive strategies for full BIM-SCM integration are still in early development stages.*

4. **Limited Direct Focus on Dispute Prevention**

Less than one-third of the articles address dispute prevention directly. Most discuss efficiency or coordination improvements as indirect outcomes.
➤ *This reinforces a key literature gap: the role of digital integration as a targeted strategy for mitigating disputes remains underexplored.*

The analysis of the 74 reviewed articles reveals a fragmented and still maturing research landscape. For instance, more than half of the reviewed studies are conceptual in nature with limited empirical validation, and the majority are concentrated in developed regions such as China, the UK, and Europe. Only a small number explicitly engage with dispute prevention outcomes (e.g., Zhang et al., 2020; Ahmad, 2022), further reflecting the lack of a cohesive research direction. While interest in BIM-SCM integration is evident, most contributions are conceptual, geographically concentrated in developed contexts, and lack direct engagement with dispute prevention outcomes. This underscores a pressing need for stakeholder-inclusive, empirically validated, and context-adapted frameworks that position BIM-SCM integration not only as a process improvement tool but as a strategic mechanism for dispute mitigation in public sector construction projects.

3. Results and Thematic Analysis

This section presents the findings of a systematic thematic analysis based on 74 peer-reviewed articles that met the inclusion criteria. The synthesis revealed four dominant and interrelated themes that align with the central focus of this study—understanding how the integration of Building Information Modelling (BIM) and Supply Chain Management (SCM) contributes to the prevention of construction disputes, particularly within public sector projects. The themes identified are:

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(1) Benefits of BIM-SCM Integration,
(2) Implementation Challenges,
(3) Theoretical Frameworks, and
(4) Research Gaps

Each theme is elaborated below.

3.1 Benefits of BIM-SCM Integration

A significant body of literature supports the notion that BIM-SCM integration can generate considerable advantages for enhancing project efficiency and reducing the likelihood of disputes. These benefits are particularly relevant in public sector construction, where coordination failures and communication breakdowns are common precursors to legal claims.

- **Enhanced Stakeholder Coordination**
  BIM-SCM integration facilitates a collaborative digital environment by aligning design, procurement, and construction phases. Through shared data platforms and synchronised workflows, stakeholders can coordinate in real-time, reducing misunderstandings and scope creep—factors often linked to disputes.

- **Improved Resource and Logistics Planning**
  The incorporation of SCM principles into BIM workflows allows for advanced forecasting of material requirements, optimisation of delivery schedules, and spatial planning for site logistics. This leads to smoother execution and fewer claims related to delivery delays or resource shortages.

- **Transparency and Accountability**
  An integrated system improves the traceability of decisions and actions, providing visual and logistical documentation across the supply chain. This transparency strengthens stakeholder accountability and reduces ambiguity, which often fuels disputes over responsibility and liability.

- **Proactive Dispute Prevention**
  By aligning expectations, ensuring data consistency, and enabling early detection of process deviations, BIM-SCM integration acts as a preventative mechanism. Time-stamped data, audit trails, and predictive insights allow for timely interventions before issues escalate into formal disputes.

These benefits have been consistently reported in both conceptual and empirical studies, including those by Zhang et al. (2020), Chen & Kamara (2019), and Tan et al. (2021), indicating that integration is not merely a process improvement initiative but a potential tool for dispute risk mitigation.

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3.2 Implementation Challenges

Despite the recognised benefits, the practical implementation of BIM-SCM integration continues to face substantial challenges. These barriers are particularly pronounced in public sector environments, where policy rigidity and low digital maturity inhibit innovation.

- **Technological Barriers**
  A lack of interoperability between BIM and SCM platforms persists, often due to incompatible data standards (e.g., non-alignment with IFC schemas) and limited system integration capabilities such as restricted API access.

- **Organisational Resistance**
  Public institutions often exhibit institutional inertia, with bureaucratic structures and risk-averse cultures impeding digital transformation. Resistance to change at both managerial and operational levels slows the adoption of integrated systems.

- **Skills and Knowledge Gaps**
  A recurring issue across the literature is the insufficient digital competency among professionals, particularly in developing countries. Limited training and a lack of exposure to integrated platforms result in underutilisation of available tools.

- **Legal and Contractual Ambiguity**
  Ambiguities in contractual language regarding data ownership, platform responsibilities, and dispute resolution procedures act as deterrents to full integration. Without legal clarity, stakeholders are hesitant to rely on digital systems for accountability and risk sharing.

These challenges are highlighted in studies such as Ghaffarianhoseini et al. (2017), Alaloul et al. (2020), and Ahmad (2022), reinforcing the need for both technical solutions and organisational reforms to realise the full potential of BIM-SCM integration.

3.3 Theoretical Frameworks Used

The literature draws upon several theoretical perspectives that justify and support the integration of BIM and SCM as a strategy for dispute prevention. These frameworks provide the conceptual foundation that links integration with improved collaboration, reduced fragmentation, and better risk management.

- **Systems Theory**
  This theory positions the construction project as a complex, interdependent system. Integrating BIM and SCM is seen as a systems-based solution to manage uncertainties and reduce fragmentation—a known driver of disputes.

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- **Collaborative Working Theory**
  Widely referenced in construction IT research, this theory emphasises the role of trust, shared goals, and open communication. Integration, from this view, is a socio-technical process that enhances relational coordination and dispute avoidance.

- **Project Failure Pathogens Framework (PFPF)**
  Used by Ahmad (2022), this framework identifies latent conditions that contribute to project failure, such as process breakdowns or people-related errors. It frames integration as a corrective mechanism to neutralise these "pathogens."

- **Dispute Avoidance and Control Framework (DACF)**
  Also developed in Ahmad (2022), this framework proposes proactive monitoring, early warning signals, and intervention protocols to prevent conflict escalation—concepts that align well with BIM-SCM integration principles.

These frameworks move beyond operational efficiency and instead conceptualise integration as a strategic tool for dispute prevention across the project lifecycle.

3.4 Research Gaps Identified

While the body of literature offers valuable insights, several critical gaps remain unaddressed, especially regarding the practical application of BIM-SCM integration for dispute prevention in public sector contexts.

Table 2: Key Research Gaps in BIM-SCM Integration for Construction Dispute Prevention

Research Gap	Description	Supporting References
Lack of validated BIM-SCM integration frameworks for public sector projects	Most studies propose conceptual models without pilot testing or real-world validation.	Ahmad (2022); Alaloul et al. (2020); Zhang et al. (2020)
Limited empirical studies focusing on dispute prevention outcomes	Few studies explicitly link BIM-SCM integration with reduced dispute incidence or severity.	Chen & Kamara (2019); Ghaffarianhoseini et al. (2017)
Insufficient attention to developing country contexts (e.g., Malaysia)	Existing frameworks are often based on high-income countries and overlook contextual limitations.	Tan et al. (2021); Ahmad (2022)
Absence of stakeholder-driven tools for dispute mitigation	Tools/frameworks rarely engage stakeholders throughout implementation, reducing adoption and effectiveness.	Ghaffarianhoseini et al. (2017); Alreshidi et al. (2018)
Fragmented research on contractual/legal implications of integration	Legal and contractual ambiguities related to digital integration remain underexplored.	Ahmad (2022); Hartmann & Vossebeld (2013)

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This table summarises the key research gaps identified from the reviewed literature regarding the integration of Building Information Modelling (BIM) and Supply Chain Management (SCM) for dispute prevention in construction projects. The gaps reflect a lack of validated frameworks, insufficient empirical evidence, and limited contextual adaptation—particularly in public sector projects in developing countries. Notably, the literature underrepresents stakeholder-driven approaches and legal dimensions of digital integration, highlighting the need for more comprehensive and practice-oriented research.

Building upon these identified gaps, this study introduces the conceptual BIM-CHAIN framework, which integrates Building Information Modelling (BIM) with Blockchain technology (CHAIN). The framework is expected to provide immutable records, transparent smart contracts, and real-time collaborative data sharing. These characteristics directly address the lack of validated frameworks, limited stakeholder engagement, and persistent contractual ambiguities in the construction sector. By situating the framework within the Malaysian public infrastructure context, this study aims to offer a context-sensitive solution that enhances trust, reduces disputes, and improves overall project delivery.

4. Discussion

The integration of Building Information Modelling (BIM) and Supply Chain Management (SCM) presents a structured and proactive approach for addressing the underlying causes of disputes in construction projects. This review confirms that the synchronisation of design, procurement, and execution processes—enabled through integrated digital environments—can significantly reduce common dispute triggers such as project delays, cost overruns, and miscommunication. The evidence suggests that BIM-SCM integration enhances real-time collaboration, data transparency, and traceability across stakeholders, which collectively fosters accountability and reduces adversarial interactions. These outcomes are in line with previous findings (Zhang et al., 2020; Chen & Kamara, 2019), which demonstrate that integrated digital tools improve project performance and stakeholder alignment.

Despite these benefits, the review also highlights persistent implementation challenges, particularly within the context of developing countries. Barriers such as institutional resistance to digital transformation, insufficient technical capacity, and fragmented regulatory structures continue to hinder widespread adoption. These findings echo Ahmad's (2022) assertion that without stakeholder-driven frameworks and coherent policy support, integration efforts remain fragmented and may fail to deliver tangible improvements in dispute mitigation. In public sector projects—where bureaucratic complexity and rigid procurement procedures are prevalent—these challenges are even more pronounced.

Positioned within the broader evolution of the construction industry towards digital transformation paradigms such as Industry 4.0 and Construction 4.0, this review affirms the critical need for scalable, interoperable, and legally robust integration models. As project environments grow increasingly complex and multi-stakeholder in nature, isolated digital tools are insufficient. Instead, integrated solutions must be embedded within governance frameworks that address contractual clarity, stakeholder roles, and data-sharing protocols.

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Moving forward, there is a clear need for empirical studies and pilot testing of BIM-SCM frameworks within real-world public construction settings. Such studies should incorporate performance metrics, stakeholder feedback mechanisms, and dispute tracking systems to validate the effectiveness of integration in reducing claims and litigation. The development of context-sensitive models—tailored to the institutional and operational realities of developing nations—will be instrumental in transforming digital potential into meaningful dispute prevention outcomes.

Based on the systematic review and thematic synthesis, several future research directions are proposed to advance the integration of Building Information Modelling (BIM) and Supply Chain Management (SCM) as a mechanism for construction dispute prevention, particularly in the context of public sector projects in developing countries.

1. **Empirical Validation through Real-World Pilots**
   Future studies should focus on implementing and testing BIM-SCM integration frameworks in live construction projects. Empirical data derived from pilot applications can provide stronger evidence of effectiveness, identify operational challenges, and reveal unforeseen barriers to dispute prevention.

2. **Development of Context-Sensitive Frameworks**
   There is a pressing need to develop integration models that are tailored to the regulatory, institutional, and digital readiness constraints of developing countries. Such frameworks should incorporate local procurement practices, governance structures, and cultural factors influencing dispute dynamics.

3. **Stakeholder-Centric Design Approaches**
   Current research often neglects the role of stakeholder engagement in digital integration. Future research should explore participatory models that actively involve contractors, consultants, clients, and suppliers in the co-design of BIM-SCM systems to enhance ownership, trust, and adoption.

4. **Integration with Legal and Contractual Mechanisms**
   To strengthen dispute prevention outcomes, future frameworks should explicitly incorporate legal considerations such as contract clause standardization, digital evidence admissibility, and responsibilities for data governance. Collaboration between legal experts and construction technologists is encouraged.

5. **Performance Metrics for Dispute Prevention**
   Robust metrics and indicators are required to assess how BIM-SCM integration impacts dispute incidence and severity. Future research should develop and test quantitative tools for measuring coordination quality, delay reduction, claims frequency, and stakeholder satisfaction.

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6. **Interoperability and Technology Scalability**
   Further studies should examine how open standards (e.g., IFC) and cloud-based platforms can enhance BIM-SCM interoperability across various software and organizational boundaries. Scalability and adaptability to projects of different sizes and scopes also warrant investigation.

By addressing these gaps, future research can contribute to the establishment of holistic, implementable, and scalable BIM-SCM integration frameworks that not only optimize project performance but also serve as robust mechanisms for preventing construction disputes at the systemic level.

5. Conclusion

This systematic literature review confirms that the integration of Building Information Modelling (BIM) and Supply Chain Management (SCM) holds substantial potential in addressing the root causes of disputes in public sector construction projects. The synthesis of 74 peer-reviewed studies highlights that the combined use of these digital tools facilitates real-time data visibility**,** efficient cross-disciplinary communication**,** and collaborative planning—all of which are critical enablers for proactive dispute prevention. When implemented in an integrated and structured manner, BIM and SCM can enhance transparency, accountability, and coordination across the project lifecycle, thereby reducing common sources of conflict such as schedule delays, cost overruns, and scope ambiguities.

Despite the promising benefits, the review also identifies persistent barriers that hinder the widespread adoption of BIM-SCM frameworks. These include technical limitations (e.g., lack of interoperability), organizational resistance to change, skill shortages, and contextual challenges particularly prevalent in developing countries' public sectors. The review further underscores the absence of stakeholder-driven, empirically validated frameworks that are both scalable and adaptable to complex governance environments.

Overall, this review provides a theoretical and practical foundation for advancing BIM-SCM integration as a dispute mitigation strategy in construction. It offers critical insights for the development of future frameworks and digital tools tailored to public infrastructure delivery. The findings support the necessity for pilot testing**,** performance evaluation**,** and context-sensitive refinement of integration models. As the construction industry continues its transition toward digitalization under the umbrella of Industry 4.0, coordinated and inclusive digital approaches like BIM-SCM integration will be essential for enhancing project resilience and minimizing disputes.

Acknowledgements

The authors would like to express their sincere appreciation to the Technical and Applied Research Groups (TARGs), JPPKK for providing access to foundational research materials, which significantly contributed to the theoretical framing and direction of this review. The support and resources made available through TARGs were instrumental in guiding the literature selection and conceptual development of this study. Special thanks are also extended

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to the academic mentors and research peers who offered constructive feedback during the conceptualisation, analysis, and writing phases. Their insights and critical perspectives greatly enhanced the clarity, rigour, and academic quality of the final manuscript.

References

Abd Shukor, A. S., Mohammad, M. F., Mahbub, R., & Halil, F. M. (2011). *Supply chain integration challenges in project procurement: A Malaysian perspective*. International Journal of Physical Sciences, 6(28), 6647–6656. **https://doi.org/10.5897/IJPS11.1202**

Ahmad, N. H. (2022). *Development of supply chain management framework for Building Information Modelling implementation in public sector construction projects* [Doctoral dissertation, Universiti Sains Malaysia].

Ahmad, N. H., Riazi, S. R. M., & Shafiei, M. W. M. (2023). *Building Information Modelling (BIM) dispute resolution using Supply Chain Management (SCM)*. International Journal of Academic Research in Accounting, Finance and Management Sciences, 13(1), 224–239.

Alaloul, W.S., et al. (2020). Exploring BIM and SCM integration for construction digitalisation. Automation in Construction.

Alreshidi, E., et al. (2018). Collaborative BIM platforms: Adoption challenges and stakeholder engagement. Computers in Industry. (Additional references to be added based on citation expansion.)

Alreshidi, E., Mourshed, M., & Rezgui, Y. (2018). Factors for effective BIM governance. Computers in Industry, 98, 97–110.

Chen, Y. & Kamara, J. (2019). The role of BIM in construction dispute management. Journal of Construction Engineering and Management.

Chen, Y., & Kamara, J. (2019). A review of BIM use in construction dispute management. Journal of Construction Engineering and Management.

Ghaffarianhoseini, A., et al. (2017). Building Information Modelling (BIM) uptake: Clear benefits, understanding its implementation. Renewable and Sustainable Energy Reviews.

Hartmann, T., & Vossebeld, N. (2013). Legal implications of BIM integration in construction. Construction Law Journal.

Hoezen, M. E. L. (2011). *The problem of communication in construction*. University of Twente. https://research.utwente.nl/en/publications/the-problem-of-communication-in-construction

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Hua, Y., Zhang, Y., Zhang, S., Hou, F., & Kang, M. (2023). Using Building Information Modeling to enhance supply chain resilience in prefabricated buildings: A conceptual framework. Applied Sciences, 13(23), 12694. **https://doi.org/10.3390/app132312694**

Khan, R. A., Khattak, A. B., & Jan, F. A. (2019). *Public sector governance and infrastructure development in developing countries: Evidence from Pakistan*. Administrative Sciences, 9(1), 9. **https://doi.org/10.3390/admsci9010009**

Koeleman, J., Ribeirinho, M. J., Rockhill, D., Sjödin, E., & Strube, G. (2019, August 20). *Decoding digital transformation in construction*. McKinsey & Company.

Liu, Z., Ding, R., Gong, Z., & Ejohwomu, O. (2023). Fostering digitalization of construction projects through integration: A conceptual project governance model. *Buildings, 13*(3), 825. **https://doi.org/10.3390/buildings13030825**

Nguyen, T., Carnevale, J. J., Scholer, A. A., Miele, D. B., & Fujita, K. (2019). Metamotivational knowledge of the role of high-level and low-level construal in goal-relevant task performance. *Journal of Personality and Social Psychology, 117*(5), 879-899. **http://dx.doi.org/10.1037/pspa0000166**

Olanipekun, A. O., & Sutrisna, M. (2021). Facilitating digital transformation in construction—A systematic review of the current state of the art. *Frontiers in Built Environment, 7*, 660758. **https://doi.org/10.3389/fbuil.2021.660758**

Page, M. J., McKenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., Shamseer, L., Tetzlaff, J. M., Akl, E. A., Brennan, S. E., Chou, R., Glanville, J., Grimshaw, J. M., Hróbjartsson, A., Lalu, M. M., Li, T., Loder, E. W., Mayo-Wilson, E., McDonald, S., McGuinness, L. A., Stewart, L. A., Thomas, J., Tricco, A. C., Welch, V. A., Whiting, P., & Moher, D. (2021). The PRISMA 2020 statement: An updated guideline for reporting systematic reviews. *BMJ, 372*, n71. **https://doi.org/10.1136/bmj.n71**

Ramiah, A. (2017). *Project management application in the construction industry in Sabah, Malaysia*. International Journal of Advanced Scientific Research and Management, 2(5), 34–45. Retrieved from https://ijasrm.com/wp-content/uploads/2017/05/IJASRM_V2S5_244_34_45.pdf

Rathnasinghe, A. P., Wijewickrama, M. K. C. S., Kulatunga, U., & Jayasena, H. S. (2020). Integration of BIM and construction supply chain through Supply Chain Management; an information flow model. In R. Dissanayake & P. Mendis (Eds.), *Lecture Notes in Civil Engineering, 44* (pp. 604–614). Springer. **https://doi.org/10.1007/978-981-13-9749-3_53**

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Selvanesan, H., & Satanarachchi, N. (2023). Potential for synergetic integration of Building Information Modelling, Blockchain and Supply Chain Management in construction industry. *Journal of Information Technology in Construction (ITcon), 28*, 662–691. **https://doi.org/10.36680/j.itcon.2023.035**

Soto, C. J., & John, O. P. (2017). The next big five inventory (BFI-2): Developing and accessing a hierarchical model with 15 facets to enhance bandwidth, fidelity, and predictive power. *Journal of Personality and Social Psychology*, *113*(1), 117-143. **http://dx.doi.org/10.1037/pspp0000096**

Tan, Y., et al. (2021). Digital frameworks for dispute mitigation in infrastructure projects. Engineering, Construction and Architectural Management.

Zhang, H., & colleagues (2024). *Supply chain management and dispute modeling of construction projects* [Preliminary study]. SAGE Journal.

Zhang, J., et al. (2020). Integrating BIM and SCM: Frameworks and applications. Journal of Management in Engineering.

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