BIM And Construction Contracts: A Systematic Literature Review and Future Research Agenda

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Abstract: Building Information Modelling (BIM) has emerged as a transformative technology in the construction industry, reshaping project planning, contract administration, collaboration, and risk allocation. However, its integration into construction contracts continues to face conceptual, operational, and legal challenges. This systematic literature review synthesizes current research on the intersection of BIM and construction contracting to identify prevailing themes, gaps, and future research opportunities. The review examines contractual dimensions such as roles and responsibilities, liability frameworks, intellectual property rights (IPR), data ownership, interoperability challenges, and risk-sharing mechanisms within BIM-enabled projects. A key finding is the growing need for contract structures that support collaborative working environments, transparent information flows, and digital accountability. The study also emphasizes the importance of analytical tools such as cluster analysis, which can help categorize research contributions into thematic clusters—such as legal frameworks, technological integration, collaborative contracting models, dispute resolution, and BIM- based risk management. Such clustering strengthens the conceptual clarity of existing literature and provides evidence-based justification for emerging research directions. Despite increasing global adoption of BIM, significant gaps remain in contract standardization, digital liability frameworks, and dispute resolution protocols. Based on these gaps, the study proposes future research questions focused on: (i) developing standardized BIM contractual clauses applicable across jurisdictions; (ii) designing digital risk-allocation models for multi-stakeholder BIM environments; (iii) exploring the role of smart contracts and blockchain in automating BIM-related obligations; (iv) assessing how BIM maturity levels influence contract structure; and (v) evaluating legal implications of real-time data sharing and model-based decision-making. Overall, this review highlights the evolving interplay between BIM and construction contracts and underscores the need for rigorous legal—technological alignment to support efficient, collaborative, and digitally enabled construction project delivery.

Keywords: Building Information Modelling (BIM), Construction Contracts, Cluster Analysis, Digital Risk Allocation, & Contract Standardization.

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1 Introduction

The one-of-a-kind moment in history that the Architecture, Engineering, and Construction (AEC) industry is going through is the most important in the industry's history. The industry is still shaped around isolation, siloed stakeholders, and complex contracting. However, the industry is beginning to adopt new digital technologies. This transformation is due to the adaption of Building Information Modelling (BIM). Adjacent to its beginnings, BIM has evolved from a 3D modelling software to a complex digital setup. Currently, BIM encompasses many elements of a project such as design, engineering, construction management, finance, and legal as well.

Any more than a basic trim model or a more complex hyper-real simulation is processed and produced as a series of augmented meshes. This is where the 3D shared data environments, which in BIM context is called the Shared Information Spaces (SIS), Territory and Space Modelling, and Project Information Modelling come into speculation. These assist in the data-driven decision-making that is mandatory throughout a project's lifetime. These functions add to the final construction's efficiency, predictability, and accountability; and simultaneously disturb the construction's standard contractual arrangements. Unlike the traditional way of contracting which outlines defined roles, risks, responsibilities, and the governance of the performance, splits a construction project into linear, paper-based tasks. BIM on the other hand contracted a transformational way of construction, focusing on responsible shared, collaborative participative workflows, iteration, and structured adaptability.

Separation and lack of communication have created barriers around ownership of digital models, intellectual property rights, risk allocation, and dispute settlement frameworks. On the contrary, BIM's ability to reduce inefficiencies and improve integration and trust highlights the importance of innovation-focused legal frameworks.

This research aims to analyze and accumulate all the scholarly literature available concerning BIM and construction contracts. Instead of applying rigid legal and technical remedies, this research seeks to provide the basis for the debate by offering a synthesis of the discourse and the ecosystem of emerging and unresolved issues. The goal is to contribute to a more proactive and critical climate for discussion within the community of scholars, practitioners, and decision makers interested in more cohesive and robust modalities for the construction and engineering industry.

1.1 Significance of the Study

This study is significant as it brings coherence to the fragmented discourse surrounding the contractual aspects of Building Information Modelling (BIM). It develops a taxonomy of contractual challenges, highlights inconsistencies and gaps in existing literature, and reinterprets BIM-integrated contracts. Through a combination of bibliometric, thematic, and cluster analyses, the study offers a comprehensive overview

of how digital collaboration and information management are transforming the legal and managerial structures of construction contracts.

1.2 Study Objectives

The study attempts to synthesize and map academic studies on BIM and its contract dimensions. Its objectives are to:

- Addresses the emergence and citation trend of BIM integration in construction contract research.
- Acknowledges and sequences key seminal contributions in BIM and construction contracts.
- Investigates underlying themes.
- To highlight emerging research directions toward collaborative and performance driven contract models.

By realizing these aims, the study contributes to an understanding of how construction contracts can move towards data-driven, collaborative styles of governance through BIM.

1.3 Research Questions

Based on the detailed applications of BIM in recent years, the following research questions are drawn which could be interpreted through bibliometric analysis that is conducted to attain conceptual clarity in this area of research and practice.

RQ1 What is the year-wise trend analysis on the BIM Integration in Construction Contracts topic?

RQ2 What is the publication and citation trend on BIM Integration in Construction Contracts topic?

RQ3 What are the top author details on papers published in BIM Integration in Construction Contracts?

RQ4 Which are the top sources publishing on the BIM and construction contracts topic?

RQ5 Which are the top themes and keywords on BIM and construction contracts explored in recent years?

RQ6 What is the cluster model for the potential applications and research areas in BIM Integration in Construction Contracts topic?

RQ7 What is the cluster model for challenges and barriers to BIM applications in Construction Contracts topic?

2 Theoretical Background

BIM integration in construction contracts is based on several theoretical ideas that explain how digital collaboration influences legal and management systems in the construction industry. Building Information Modelling (BIM) encourages the sharing of information and coordination among all project participants, leading to a more integrated and transparent process compared to traditional, paper-based contracts [1][2]. It changes the way responsibilities, risks, and rights are distributed, requiring contracts to adapt to new methods of working.

One important concept supporting BIM-integrated contracts is relational contracting theory, which emphasizes cooperation, trust, and mutual understanding rather than rigid, rule-based relationships. In a BIM environment, projects depend heavily on teamwork and real-time data exchange, which means that trust and collaboration become essential parts of the contract [3]. Along with this, the adaptive governance approach suggests that contracts should be flexible and capable of adjusting to continuous design updates, model changes, and new digital requirements [4].

From a legal point of view, BIM also introduces new challenges such as data ownership, intellectual property rights, and model authorship. Since multiple stakeholders contribute to the same digital model, it becomes important to clearly define who owns and controls the information [5] [6]. This shows that contracts must evolve to include clear rules for data use, sharing, and responsibility.

Additionally, the idea of standardization is gaining importance. Different countries and organizations are developing standard BIM contract clauses and protocols like the CIC BIM Protocol (UK) and AIA E203 (US)to reduce confusion and improve consistency across projects [7] [8]. These efforts aim to make BIMbased contracting more reliable, transparent, and compatible with international practices. In short, the theoretical foundations of BIM integration in contracts combine technological innovation, collaboration, and legal adaptability. They show that construction contracts are evolving from static, paper-based documents to dynamic agreements that support teamwork, accountability, and digital transformation in the construction industry.

3 Data Selection and Research Method

In this study, a systematic literature review and bibliometric technique were used to understand the knowledge base and intellectual structure of research related to BIM integration in construction contracts. The bibliometric method is increasingly applied in construction management and legal research because of its ability to analyze large volumes of scholarly data, identify research patterns, and map thematic development [9] [10]. When a topic, such as BIM Integration in Contracts, has a broad and evolving body of literature, bibliometric analysis becomes an effective tool for identifying key authors, publication trends, and future research directions [10].

This study uses bibliometric mapping and qualitative synthesis to summarize the available research on BIM-integrated contracts, identify dominant themes, and present

evidence on how digital innovation is reshaping construction law and contract management. The following subsections describe the data collection and analytical methods adopted.

3.1 Data Selection

The data used for this study were collected from the Scopus database in January 2025, as this is one of the most comprehensive and widely recognized academic databases covering construction, engineering, and legal management research [9]. Scopus database ensures wide coverage of peer-reviewed journals relevant to BIM, project governance, and construction contracts.

3.2 Research Method

To achieve the research objectives, the study combined quantitative bibliometric analysis with qualitative thematic synthesis. The bibliometric component helped identify the research structure, influential contributors, and knowledge clusters, while thematic analysis helped interpret underlying ideas and theoretical linkages among studies. The initial search employed broad combinations of keywords, including "Building Information Modelling," "Construction Contracts," "Legal Framework," "Collaboration," "Project Performance," "Contract Administration," "Collaboration," "Contractual Framework," "Contract Provisions" and "Conceptual Framework." Based on preliminary screening, only papers explicitly focusing on BIM's contractual, legal, or governance aspects were retained.

After that a multi-stage filtering approach as given in Table 1 was adopted. This process resulted in 34 high-quality journal articles published between 2014 and 2025 that met the inclusion criteria.

Table 1. Filtering criteria

Stage	Selection Criteria	No. of Rejections	No. of Selections
1	Keywords search: 'building information modelling' OR 'BIM' AND 'construction contracts'	0	434
2	Publication year: 2014–2025	38	396
3	Subject area: Management and engineering	48	348
4	Document type: article and review	135	213
5	Source type: journal	8	205
6	Language: English	0	205
7	Relevance of articles: reading titles, abstract, and keywords	171	34
	Final number		**34**

Notes: This table summarizes the list of steps incorporated to arrive at the bibliographic data.

4 Data Analysis

The analysis of this study has been conducted by using the database of Scopus-indexed journals retrieved in January 2025. A total of 34 articles were published for the time span of 2014 to 2025. These 34 publications have been analyzed in the following manner. The analysis was conducted in the following manner.

I. Bibliometric Analysis

Bibliometric indicators including publication trends, citation counts, co-authorship, and keyword co-occurrence were analyzed to examine the structure of existing BIM-contract research. Citation and co-citation analyses identified key studies and intellectual foundations, while keyword co-occurrence revealed emerging themes such as risk allocation, ownership, collaboration, and standardization. Network mapping using VOS viewer visualized author collaborations and conceptual linkages. Descriptive and impact analysis assessed publication frequency, leading journals, regional contributions, and citation performance through h-index and g-index metrics.

II. Qualitative Thematic Synthesis

Thematic analysis was conducted to identify and interpret the top recurring themes within the BIM–construction contract literature. This analysis examined how key topics have evolved over time and how they collectively shape the understanding of BIM integration in contractual contexts. It provided insights into dominant research directions, conceptual linkages, and emerging focus areas. The thematic findings complemented the bibliometric analysis by revealing the depth, diversity, and progression of scholarly discourse in BIM-enabled contract research.

III. Cluster analysis

Cluster analysis groups related items to reveal patterns and relationships within a research domain. In BIM integration in construction contracts, it is applied to keywords to identify core topics and emerging trends, and to potential applications and research areas to map thematic focus and practical implementation. These cluster models provide a clear overview of the intellectual structure, highlight dominant research directions, and identify gaps for future investigation.

This mixed-method approach combining bibliometric mapping, thematic interpretation and cluster analysis provides a clear picture of the evolution, focus, and research directions of BIM-integrated construction contracts. The resulting findings and trends are discussed in the following section.

4.1 Bibliometric analysis

The bibliometric summary shows that from 2014 to 2025, 34 documents were published across 16 sources, involving 247 authors with an annual growth rate of 6.5%. Collaboration levels are high, with an average of 10.3 co-authors per paper and no single authored or international collaborations. The papers have an average age of 3.71 years, include 254 references and 264 keywords, and receive an average of 24.44 citations per document, indicating strong research impact and engagement.

Trend analysis of building information modelling

The trend analysis here helps ascertain the highest research and development undertaken period for BIM Integration in Construction Contracts which could be more concentrated to understand what transition and transformation has taken place during that period.

RQ1 What is the year-wise trend analysis on the BIM Integration in Construction Contracts topic?

This section analyses the temporal growth of research output, reflecting the evolving significance of BIM in legal and contractual contexts of the construction industry.

Table 2. Trend analysis on BIM Integration in Construction Contracts (year-wise)

Year	No. of Publications
2014	1
2015	1
2017	2
2019	2
2020	4
2021	6
2022	7
2023	3
2024	6
2025	2

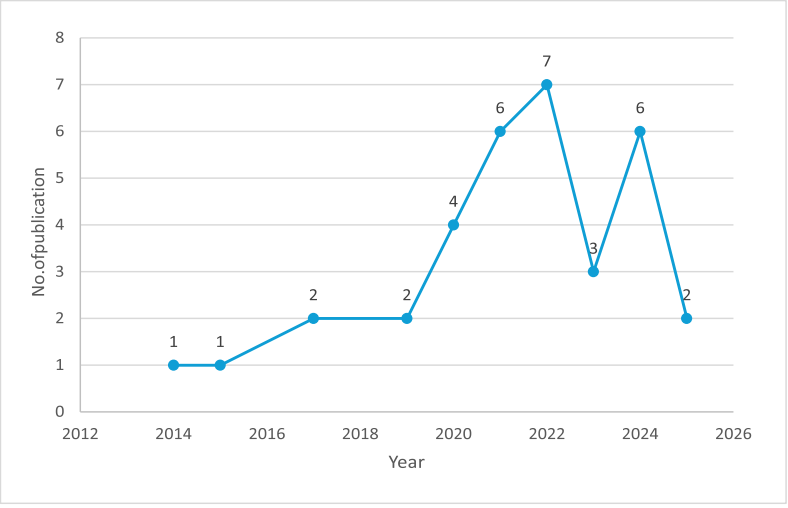

Fig. 1. Trend analysis on BIM Integration in Construction Contracts (year-wise).

Figure 1 illustrates the year-wise distribution of publications on BIM integration in construction contracts from 2014 to 2025. The trend shows a gradual increase in research attention over the years, with minimal activity between 2014 and 2017 (1 to 2 publications per year). A notable growth phase began after 2018, indicating the expanding academic and professional interest in contractual dimensions of BIM. The number of publications peaked in 2022 with 7papers, reflecting a period of intensified scholarly focus on this subject. Although a slight decline occurred in 2023 (3 papers), publication output again increased in 2024 (6 papers), suggesting sustained engagement by researchers. The minor drop observed in 2025 (2 papers) may be attributed to data incompleteness for the current year. Overall, the upward trend demonstrates that BIM-related contract research has evolved into a significant and maturing area of academic inquiry in the last decade.

Publication and author details

RQ2: What is the publication and citation trend on BIM Integration in Construction Contracts?

This section presents an overview of these trends to illustrate the evolving impact and scholarly interest in this area.

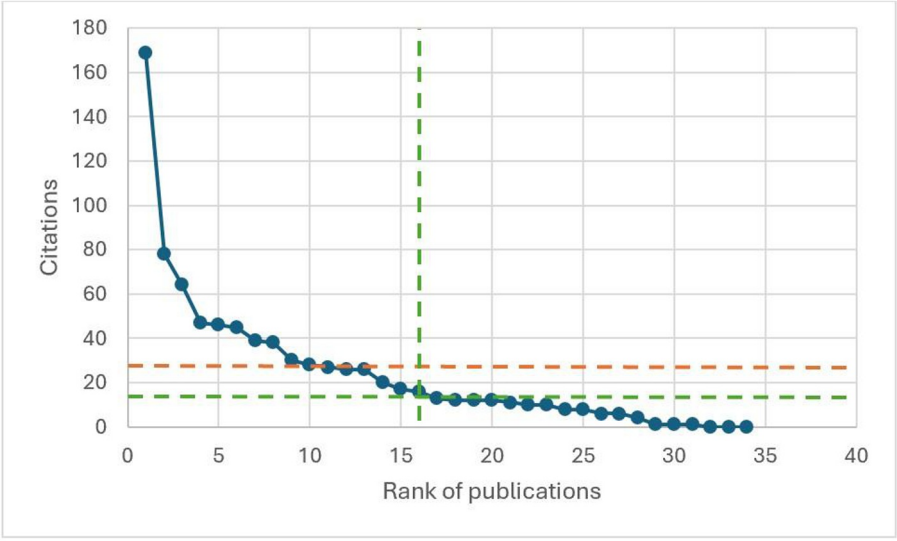

Fig. 2. Publication and citation trend on BIM Integration in Construction Contracts

The citation distribution of the reviewed literature, as presented in Figure 2, illustrates the overall research visibility and scholarly influence within the domain of Building Information Modelling (BIM) and Construction Contracts. The 34 analyzed publications exhibit a skewed citation trend, where a limited number of studies have attracted a substantial share of total citations, while the majority have fewer.

To evaluate the citation performance of the reviewed literature, three bibliometric indicators- H-index, G-index, and i10-index were computed based on the citation counts of 34 publications. The H-index denotes the maximum number (h) of papers that have each received at least h citations. In this study, the 16th ranked paper had 16 citations, while the 17th paper had fewer, resulting in an H-index of 16. The computed H-index of 16 signifies that 16 publications have received at least 16 citations each, demonstrating a moderate yet balanced research impact across the corpus.

The G-index emphasizes the influence of highly cited papers by considering cumulative citation strength. The top 28 publications collectively accounted for over 784 citations ($\geq 28^2$), yielding a G-index of 28. This indicates that the field has several high-impact studies contributing significantly to total citations.

The i10-index, representing the number of publications cited at least ten times, was found to be 23, suggesting that a substantial portion of the reviewed works have achieved consistent academic recognition and citation visibility.

In general, the resulting citation distribution displays a long-tail characteristic, indicative of a mature research area developing. A couple of pioneering studies act as anchors for citations, with a growing number of newer contributions actively building upon the field's scholarly visibility. This observation is a sign of a maturing and increasingly expanding field of study, underpinned by increasing scholarly interaction and interdisciplinary interest. The citation dynamics thus not only indicate the depth of established research but also highlight the nascent potential for innovation and knowledge integration in BIMsupported contractual arrangements.

RQ3 What are the top author details on papers published in BIM Integration in Construction Contracts?

Table 3 presents the year-wise distribution of publications alongside the number of contributing authors in BIM integration in construction contracts. The data reveals a growing trend in collaborative research, with both publication count and author involvement increasing significantly over time.

Table 3. Author publication details (year wise)

Year	No. of Publications	No. of Authors
2014	1	1
2015	1	3
2017	2	9
2019	2	7
2020	4	13
2021	6	14
2022	7	28
2023	3	10
2024	6	23
2025	2	8

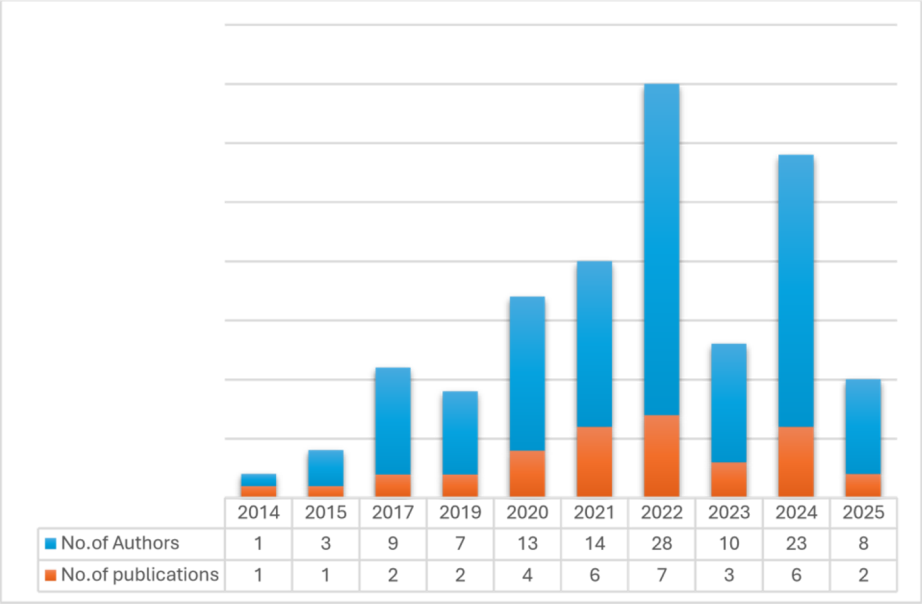

Fig. 3. Author publication details (year wise)

In Figure 3, over the period from 2014 to 2025, the dataset reflects a substantial overall growth in research collaboration, as indicated by the increasing number of authors and related publications each year, punctuated by two significant peaks in 2022 and 2024; particularly, 2022 saw an unprecedented surge with 28 contributing authors and 7 publications, underscoring the heightened collaborative efforts and research productivity during that time. This upward trend suggests that factors such as expanding institutional support, easier access to research funding, and improvements in communication technologies facilitated greater teamwork and co-authorship, helping researchers tackle increasingly complex and interdisciplinary topics. However, the temporary declines observed in 2023 and 2025 may reflect fluctuations in resource availability, changes in research focus, or exogenous influences like shifting policies, global crises, or saturation of certain topics, all of which periodically impact collaborative output and scholarly publishing. The data demonstrates a dynamic and responsive research ecosystem where collaboration and output are strongly intertwined, and peak years often correspond to periods of heightened academic opportunity.

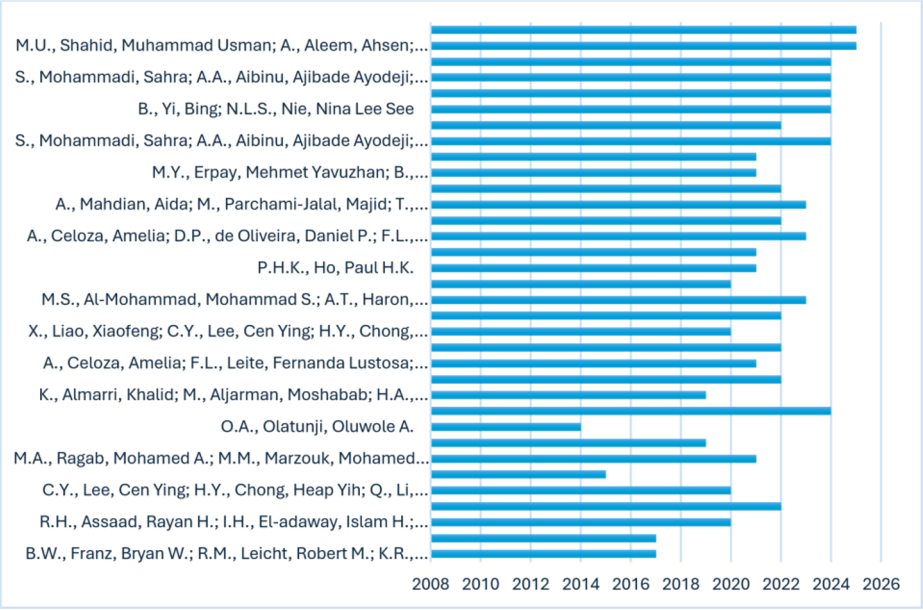

Fig. 4. Author details

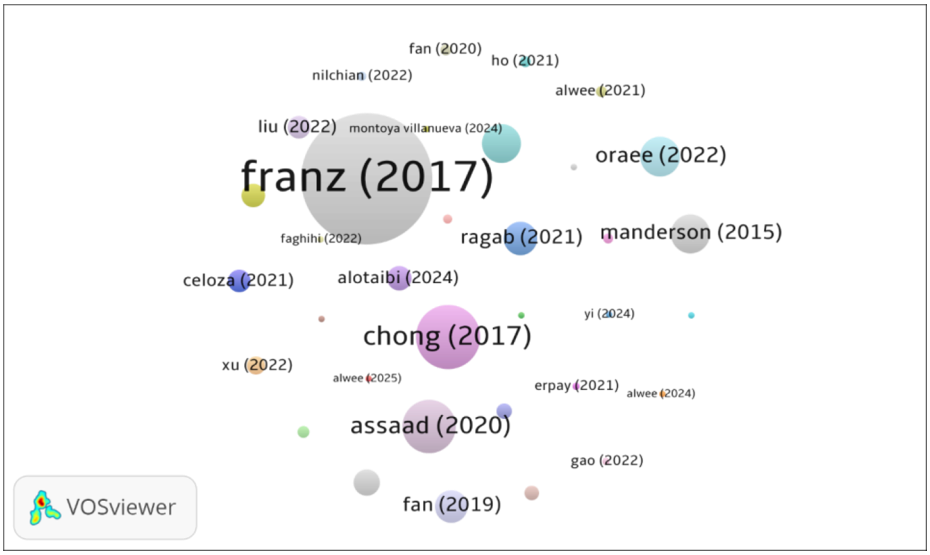

Fig. 5. Co-Citation Map

The co-citation map (Figure 5) identifies the most influential publications based on their frequency of being cited together. The network highlights several prominent nodes, with Franz (2017) and Chong (2017) emerging as central and highly co-cited sources, signifying their foundational influence on the theoretical development of BIM-enabled contract management. These studies have shaped discussions surrounding digital collaboration, legal frameworks, and

integrated project delivery. Other notable contributors, including Oraee (2022), Manderson (2015), and Assaad (2020), also demonstrate strong interconnections, representing the evolution of applied research in areas such as data governance, contractual risk allocation, and model-based coordination. The presence of more recent authors such as Liu (2022), Celoza (2021), and Alotaibi (2024) indicates a growing diversification of research focus, emphasizing automation, interoperability, and digital procurement processes.

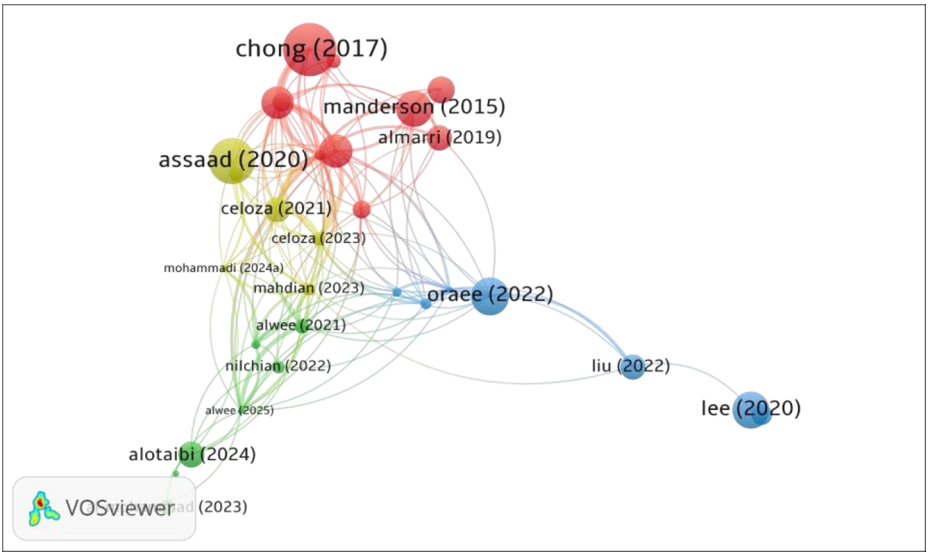

Fig. 6. Co-authorship network

The co-authorship network (Figure 6) visualizes collaborative relationships among researchers and identifies distinct thematic clusters. The red cluster, led by Chong (2017), Manderson (2015), and Assaad (2020), represents an established group that contributed early conceptual frameworks and case-based analyses of BIM contractual practices. The green-yellow cluster, including Celoza (2021), Nilchian (2022), and Alotaibi (2024), highlight emerging collaborative linkages focusing on technological integration and smart contract adoption. The blue cluster, centered around Oraee (2022) and Liu (2022), bridges these earlier studies with newer perspectives, reflecting strong cross-institutional and interdisciplinary collaboration that combines engineering management, legal, and information science perspectives.

RQ4 Which are the top sources publishing on the BIM and construction contracts topic?

Table 4 gives details about the various sources from which the reviewed publications were obtained, highlighting the journals that have actively contributed to research on BIM and construction contracts. The studies were published across a range of reputed international journals covering construction management, engineering, technology, and legal perspectives, demonstrating the multidisciplinary scope of the topic.

Table 4. Source of publication details (year wise)

Source of publication	No. of Publications	Year of Publication
Ain Shams Engineering Journal	1	2024
Buildings	3	2022, 2024, 2024
Construction Economics and Building	1	2015
Construction Management and Economics	1	2022
Engineering, Construction and Architectural Management	2	2019, 2022
International Journal of Building Pathology and Adaptation	1	2023
International Journal of Sustainable Construction Engineering and Technology	2	2021, 2024
Jordan Journal of Civil Engineering	1	2025
Journal of Construction Engineering and Management	6	2017, 2017, 2020, 2020, 2021, 2022
Journal of Information Technology in Construction	1	2021
Journal of Infrastructure Systems	1	2022
Journal of Legal Affairs and Dispute Resolution in Engineering and Construction	8	2021, 2021, 2022, 2022, 2023, 2023, 2024, 2024
Journal of the Chinese Institute of Engineers, Transactions of the Chinese Institute of Engineers, Series A/Chung-kuo Kung Ch'eng Hsuch K'an	1	2020
KSCE Journal of Civil Engineering	1	2019
Malaysian Construction Research Journal	1	2021
Proceedings of Institution of Civil Engineers: Management, Procurement and Law	1	2014

As shown in Table 4, The Journal of Legal Affairs and Dispute Resolution in Engineering and Construction and the Journal of Construction Engineering and Management emerged as the leading publication sources, contributing eight and six papers respectively. These journals primarily address themes related to contractual frameworks, dispute resolution, and project management within BIM-enabled environments. Other journals such as Buildings, Engineering, Construction and Architectural Management, and the International Journal of Sustainable Construction Engineering and Technology also made notable contributions. The temporal range from 2014 to 2025 reflects a steady rise in publications, particularly after 2020, indicating increasing scholarly engagement with BIMbased contractual research.

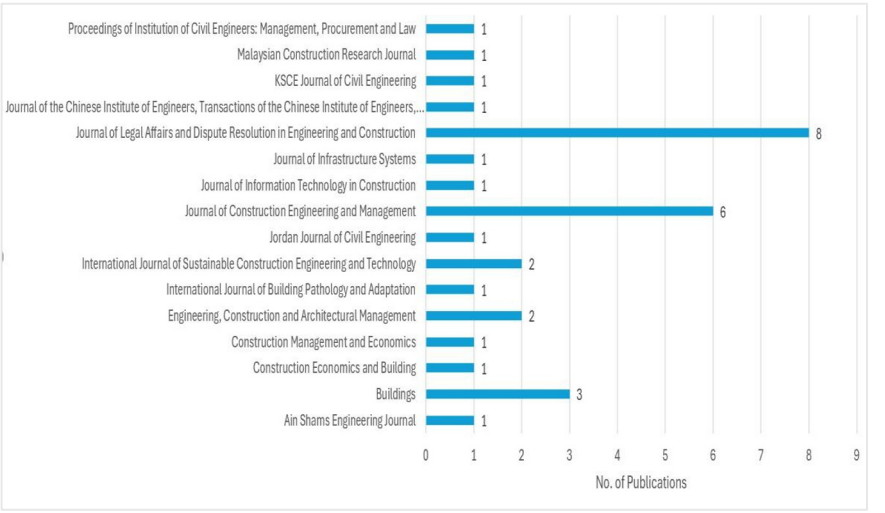

Fig. 7. Sources of publication

4.2 Thematic analysis

RQ5 Which are the top themes on BIM and construction contracts explored in recent years?

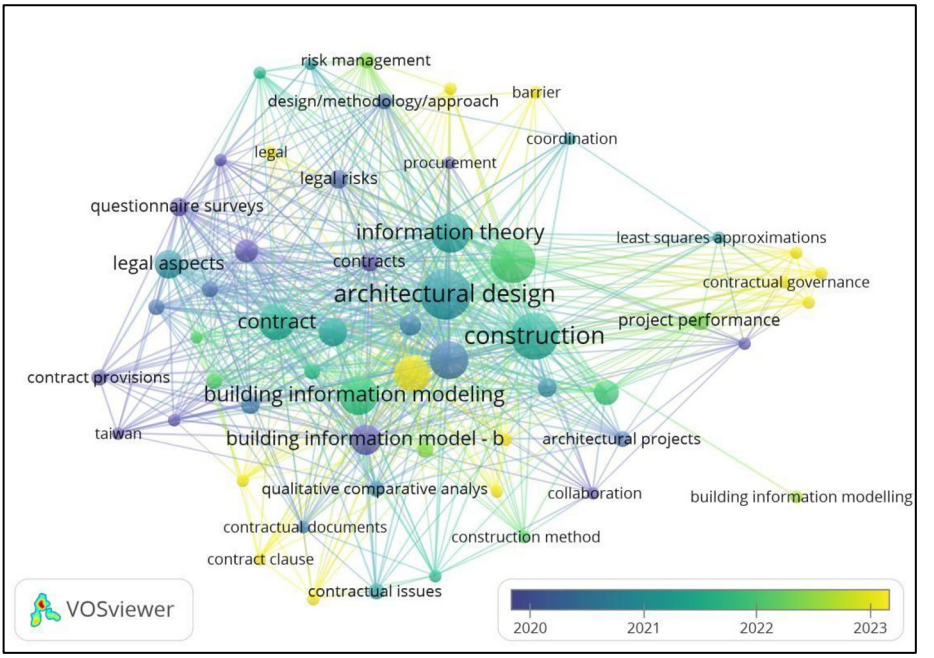

Fig. 8. Co-Occurrence Map of Research Themes Related to BIM and Construction Contracts

The VOS viewer keyword co-occurrence map visually represents the intellectual structure of research linking Building Information Modeling (BIM) with construction contracts. Larger nodes such as architectural design, construction, information theory, and building information modeling indicate the most frequently occurring and influential terms within the analyzed publications. Closely connected clusters reflect thematic overlaps — for instance, legal aspects, contract provisions, and risk management are linked with the contractual dimension of BIM, while coordination, project performance, and collaboration relate to its implementation and project management aspects.

The color scale denotes the chronological progression of research: early studies (blue regions, around 2020) concentrated on foundational issues like legal risks and contractual clauses, whereas recent works (yellow regions, 2023 onwards) have shifted towards advanced topics such as contractual governance, coordination, and performance outcomes. This evolution indicates a growing maturity in the field, moving from theoretical and legal exploration towards practical integration and performance-oriented applications of BIM in contractual and construction processes.

4.3 Cluster analysis

To understand the link and strength between keywords, and to draw related themes which could be under different aspects of the research head, distinct clusters are drawn based on the manual segregation of bibliometric data which fall under similar categories.

RQ6 What is the cluster model for the keywords in BIM Integration in Construction Contracts topic?

Figure 9 illustrates the keyword co-occurrence network generated using VOS viewer, which highlights the key areas associated with Building Information Modeling (BIM) and construction contracts. The size of each node represents the frequency of keyword occurrence, while the link strength indicates the level of co-occurrence among the terms. As shown, “Building Information Modeling” appears as the most dominant keyword, strongly connected with “construction,” “contract clauses,” “legal aspects,” and “model implementation.” The red cluster represents the legal and contractual aspects of BIM (including contract clauses, laws, and legislation), the green cluster reflects collaborative and managerial themes (such as contractors and execution plans), and the blue cluster focuses on technological and implementation aspects (including model implementation and information management). A smaller yellow cluster links to risk management and design methodologies.

This analysis indicates that research on BIM in construction contracts integrates technological, legal, and managerial perspectives, emphasizing the growing interdisciplinary nature of this field.

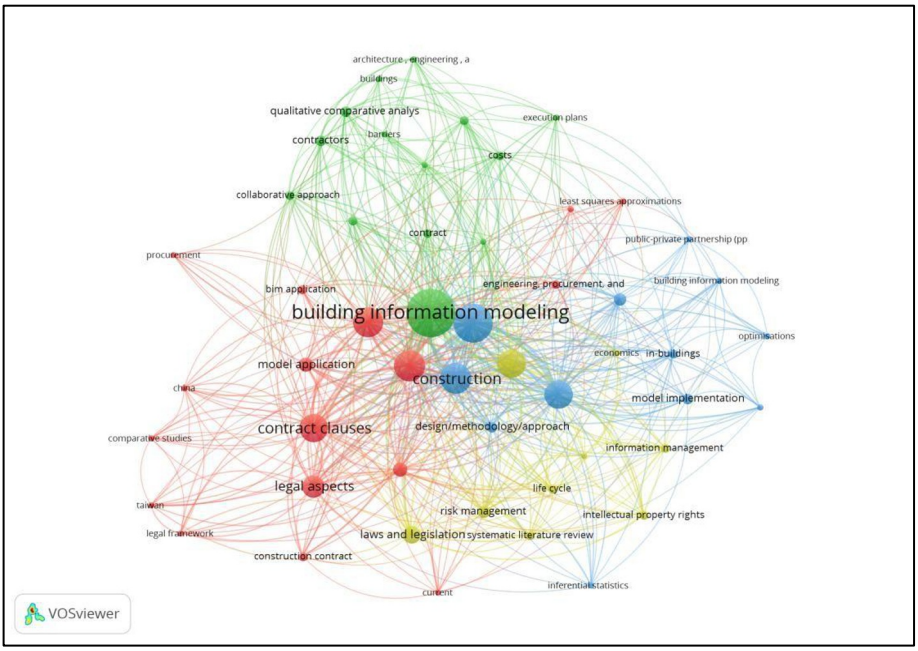

Fig. 9. Keyword co-occurrence network of BIM and construction contracts (generated using VOS viewer).

RQ7 What is the cluster model for the potential applications and research areas in BIM Integration in Construction Contracts topic?

Figure 10 depicts a focused keyword co-occurrence network generated using VOS viewer, highlighting a smaller yet significant thematic connection within the BIM and construction contract literature. The network shows limited but strong associations between a few core keywords, forming distinct clusters that represent related areas of study.

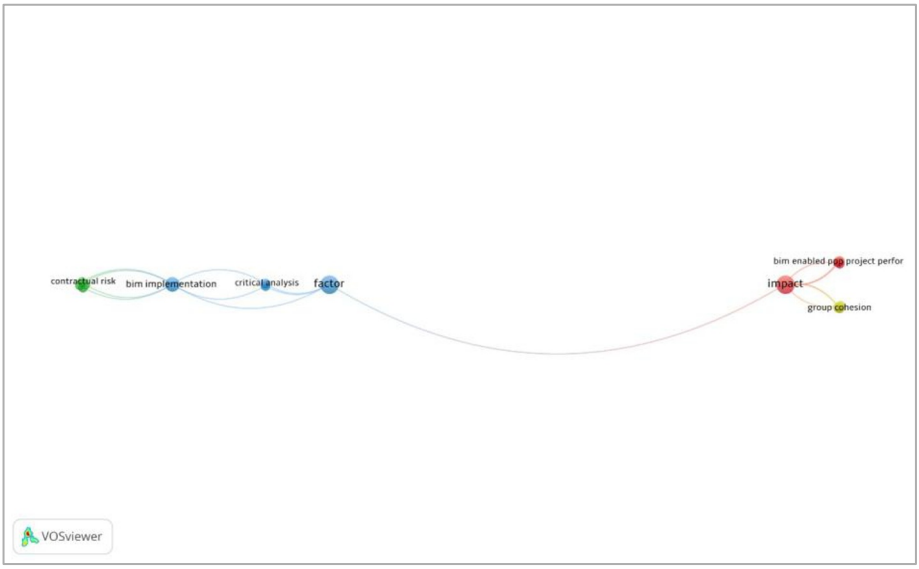

Fig. 10. Focused keyword co-occurrence network illustrating thematic linkages (generated using VOS viewer)

The green cluster centers on "contractual risk" and its linkage to "BIM implementation," reflecting research addressing risk allocation and management in BIM-based projects. The blue cluster includes "critical analysis" and "factors," indicating analytical studies focusing on identifying key determinants influencing BIM adoption and performance. The red cluster emphasizes "impact," "BIM-enabled projects," and "project performance," showing how BIM implementation outcomes are evaluated. A smaller yellow cluster connects "group cohesion" with the impact theme, suggesting attention to teamwork and collaboration in BIM-enabled environments.

Overall, the network shows how research themes transition from contractual and implementation aspects to project impact and performance evaluation, underlining the evolving focus of studies from risk management to outcome-based assessments.

5 Discussion

The findings from the bibliometric and thematic analyses provide a comprehensive understanding of the intellectual and conceptual evolution of research on Building Information Modeling (BIM) integration within construction contracts. The results reveal a consistent growth in publications from 2015 to 2025, reflecting the increasing recognition of BIM's role in transforming contractual practices in the construction sector.

5.1 Research Growth and Scholarly Impact

The publication trend indicates a steady rise in scholarly interest, especially after 2020, coinciding with global initiatives promoting digitalization and integrated project

delivery. The citation analysis demonstrates that foundational works addressing the legal, managerial, and governance aspects of BIM have laid the groundwork for subsequent research that explores operationalization within contract frameworks. Highly cited papers within this domain often emphasize risk allocation, data ownership, and collaboration models, indicating that these remain central issues in BIM-enabled contracting environments.

5.2 Thematic Evolution

The keyword co-occurrence map generated using VOS viewer highlights the core thematic clusters shaping the domain. Major terms such as architectural design, construction, information theory, and building information modeling appear at the center of the network, demonstrating their fundamental role in linking diverse sub-themes. The temporal color gradient (2020–2023) signifies the evolution of focus—from early research exploring legal aspects, contract provisions, and risk management (in darker tones) to recent attention on contractual governance, coordination, and project performance (in yellow tones).

This transition reflects the sector's movement from a theoretical exploration of BIM's legal implications toward a practical application of BIM-based governance frameworks aimed at enhancing collaboration and performance. Emerging clusters around contractual issues, governance, and qualitative comparative analysis suggest increasing interest in developing empirical evidence to support contractual adaptation to digital construction processes.

5.3 Integration of Legal and Technological Dimensions

The co-occurrence network demonstrates a close interlink between legal provisions, information management, and technological implementation, highlighting the interdisciplinary nature of BIM-integrated contracting research. The prominence of keywords such as contract, legal aspects, and risk management alongside building information modeling and architectural design indicates an ongoing attempt to balance technological capability with legal enforceability.

Furthermore, the clustering pattern underscores the progression from contractual compliance models toward performance-based governance structures, where BIM acts as a medium for transparency, accountability, and real-time collaboration. This shift signifies a paradigm change in construction management—from conventional document based contracts to data-driven, collaborative contracting ecosystems.

5.4 Emerging Research Directions

The analysis identifies several emerging themes that are gaining prominence, including contractual governance, coordination mechanisms, and project performance evaluation within BIM-based projects. These represent an evolving discourse focused on integrated digital contracting frameworks that facilitate coordination among stakeholders. In addition, the increasing linkage between BIM and information theory

highlights efforts to conceptualize BIM not merely as a tool but as a systemic enabler of knowledge exchange and decision-making within the contractual environment.

Overall, the discussion reaffirms that BIM is progressively reshaping contractual practices by fostering collaboration, transparency, and legal adaptability. The thematic evolution reveals a convergence between technological, managerial, and legal research domains, indicating a shift toward integrative contract models that align with digital construction workflows.

6 Conclusion

This study provided a bibliometric and thematic overview of 34 publications on BIM integrated construction contracts from 2015–2025. The results show a steady rise in scholarly output and strong interconnections among themes linking technology, law, and project management. The analysis indicates a clear evolution of focus—from legal and compliance aspects to contractual governance and performance improvement. BIM is increasingly recognized not just as a digital tool but as a strategic enabler for collaboration, transparency, and efficiency in contract administration. Future research should emphasize empirical validation of BIM-based contract frameworks and address emerging issues such as data ownership, interoperability, and accountability, ensuring the effective translation of BIM principles into contract practice.

Reference

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