

Recent Advances in Knowledge Sharing for Construction Project Management: Opportunities, Challenges, and Future Research Directions

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Abstract

Construction projects are increasingly complex, fragmented, and data-intensive, making cross-organizational collaboration routine while leaving teams “information-rich but knowledge-poor”; that is, large volumes of drawings, BIM models, meeting records, site reports, and sensor data are produced, but they are not always transformed into reusable, context-sensitive knowledge for future decisions. To consolidate dispersed evidence and capture the shift from digital to intelligent knowledge sharing (KS), this study conducts a PRISMA-guided systematic literature review of KS in construction project management from 2015 to 2025. Through quantitative and qualitative analyses of 163 core articles, this paper identifies five central themes: organizational and behavioral mechanisms, performance–innovation–sustainable value, digital technology empowerment, knowledge mechanisms and organizational learning, and risk–supply chain–governance and security. The study also synthesizes key challenges in knowledge sharing and outlines future research directions. These findings provide guidance for researchers, practitioners, and policymakers seeking efficient, credible, and sustainable systems to enhance project management effectiveness.

Keywords: knowledge sharing; project management; systematic review; construction engineering; digital transformation

1. Introduction

The construction industry is widely recognized as one of the most hazardous sectors, reflecting the socio-technical nature of project work, where inherent complexity and exposure to unpredictable conditions jointly increase operational uncertainty and safety exposure. Such conditions, manifested in multi-stakeholder interdependence, rapidly changing work environments, and collision-related hazards, increase coordination demands and heighten the likelihood of adverse safety events. Against this backdrop, project management has increasingly shifted from the traditional “plan–execute–control” paradigm to a knowledge-based, collaborative process focused on value creation. From a strategic perspective, the project team’s knowledge functions as an enabling resource that underpins collective sensemaking, supports innovation, and strengthens risk management; these capabilities are aligned with the dynamic capabilities view and thereby shape

Academic Editor: Luna Leoni

Received: 3 June 2026

Revised: 5 July 2026

Accepted: 9 July 2026

Published: 25 July 2026

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project outcomes. As digital transformation accelerates and large-scale multi-organizational, cross-national projects become more prevalent, knowledge sharing becomes a central mechanism for integrating dispersed expertise, reducing information asymmetries, and facilitating cross-boundary organizational learning. In turn, by supporting timely coordination and resilient responses under uncertainty, these mechanisms align with principles of high-reliability organizing and enable organizations to enhance project performance and maintain long-term competitive advantage. In such multi-actor, temporary project organizations, critical knowledge is often distributed across contracts, roles, and firms, making knowledge integration and reuse a persistent governance challenge. In this study, the phrase “information-rich but knowledge-poor” refers to a specific breakdown in the data–information–knowledge chain in construction projects. Project teams often generate abundant explicit information, such as drawings, BIM models, schedules, inspection reports, meeting minutes, safety records, and digital monitoring data. However, these records do not automatically become actionable knowledge because they are frequently stored in fragmented systems, interpreted differently by different stakeholders, and detached from the contextual reasoning behind project decisions. As a result, lessons learned from design changes, risk responses, rework, or coordination failures may remain difficult to retrieve, interpret, and reuse in later project stages or future projects.

Within construction project management research, knowledge sharing is frequently treated as a prerequisite for effective coordination and improved project outcomes. Over the past two decades, research has repeatedly highlighted the importance of knowledge sharing in project management. In construction projects, knowledge sharing is often treated as a key condition for effective team coordination and for improving the quality of project outcomes. Early studies largely concentrated on basic technical and system-level support for knowledge sharing. For example, Li et al. used grounded theory and case studies to show that sharing knowledge can help project team members work together better by reducing information separation and increasing transparency. This makes coordination more efficient and helps with better resource allocation [1]. Moza et al. similarly showed that reliable knowledge-sharing systems can enable accurate information transfer, helping team members access needed resources and expertise in a timely way. This, in turn, improves the quality of decisions and the overall standard of project delivery [2]. Hisham et al. noted that knowledge sharing promotes creative exchange, motivating teams to approach problems from various perspectives, thereby fostering the development of innovative technical solutions and management strategies [3]. In the last few years, information technology has advanced quickly, and the economy has moved toward being built on knowledge. This has changed how knowledge is shared in projects. New digital tools and collaborative technologies are changing both the channels and the practices of knowledge exchange, allowing project members to communicate frequently and in multiple ways even when separated by time and location. For example, Christopher et al. argue that embedding knowledge sharing into engineering work through technologies such as BIM and point cloud data analysis can improve the accuracy and completeness of project inspections [4]. Sepani et al. further report that social media and online collaboration platforms create accessible communication spaces for cross-cultural and cross-regional cooperation in construction, which can speed up knowledge acquisition and support the parallel sharing of both tacit and explicit knowledge.

However, existing studies remain fragmented in at least three respects. First, many studies examine knowledge sharing through general organizational lenses without sufficiently accounting for the temporary, cross-organizational, and lifecycle-based nature of construction projects. Second, the growing body of literature lacks a recent synthesis that integrates both traditional managerial mechanisms and emerging digital-intelligent tech-

nologies. Third, while many studies report positive performance implications, less attention has been paid to the conditions, barriers, and governance arrangements that shape whether knowledge sharing becomes effective in practice.

Building on the above background, this study aims to systematically assess how knowledge sharing has been applied in construction project management. The review is intended to clarify the current research landscape, identify key gaps, and propose strategic directions for future work. To achieve this, the study combines qualitative thematic analysis with quantitative bibliometric analysis of peer-reviewed journal articles retrieved from major scientific databases. Guided by this approach, the study addresses the following research questions:

Question 1: How is knowledge sharing applied in construction project management?

Question 2: What are the barriers to knowledge sharing in construction project management?

Question 3: What are the trends and future directions in knowledge-sharing research within this field?

To address these issues, the primary objectives of this study are:

1. Conduct a comprehensive evaluation of knowledge-sharing applications in construction project management.
2. Identify and analyze challenges faced by the construction industry during knowledge-sharing processes.
3. Propose a future research agenda and suggest practical implementation directions.

The key contributions of this study are enumerated as follows: First, it makes the current state of knowledge-sharing applications across construction project processes clearer by putting together information from previous studies in a methodical way. Second, the results are useful for construction professionals because they show them where information sharing may be used to improve project management. Third, the study backs the creation of better ways for project-based companies to share information and manage their work, which will help them do better on projects and learn more as a group in situations that are complicated and always changing.

2. Methodology

To examine these issues in a structured way, this study applies a systematic literature review (SLR) to analyze how knowledge sharing is implemented in construction project management. An SLR is a clear way to find, evaluate, and combine current studies to help in research and making decisions. A key advantage is that it screens studies using explicit selection criteria, which reduces uncertainty and inconsistency during data handling. Kitchenham et al. describe SLR as a three-stage process: identification, execution, and documentation [5]. In the identification stage, researchers define the research questions, set inclusion and exclusion criteria, and specify search strategies. Next is the execution stage, where relevant studies are retrieved from databases such as Web of Science and Scopus, and review data are organized using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) framework [6]. PRISMA is widely adopted because it requires clear reporting of how records are identified, screened, excluded, and included, which strengthens the transparency and accuracy of the review process [7]. Finally, the selected literature is synthesized and analyzed using VOS viewer (v1.6.20) and Bibliometrix (v4.1.4), and the overall procedure is summarized in Figure 1.

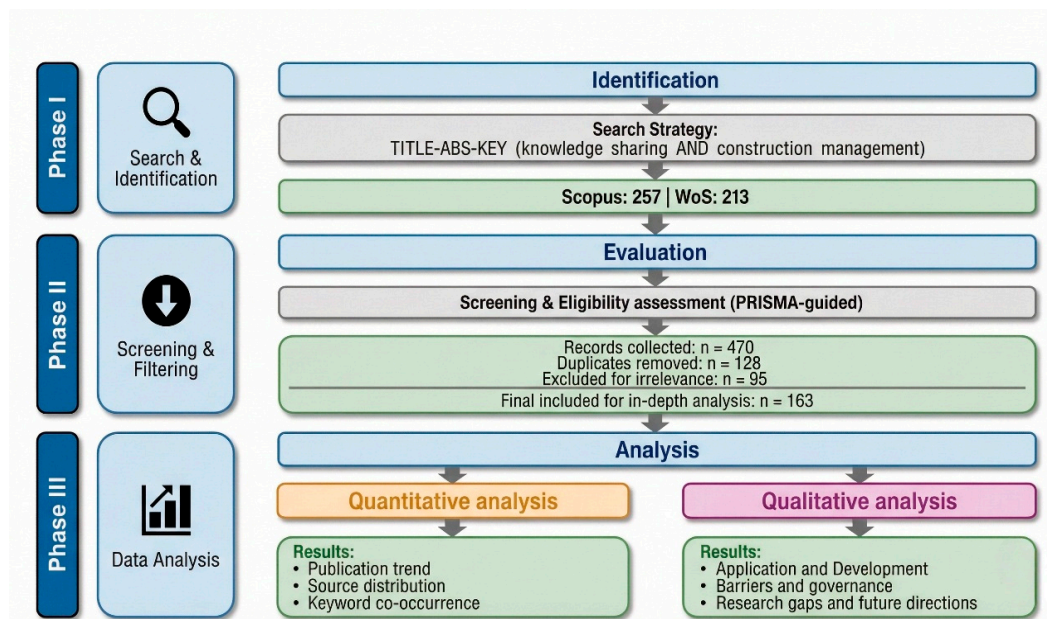


Figure 1. Research methodology Flowchart.

2.1. Data Sources and Definition of the Study Scope

To ensure broad coverage and data reliability, this study used Scopus and Web of Science as the primary databases for literature retrieval. These databases were selected because they index a wide range of peer-reviewed publications in construction engineering, project management, and related interdisciplinary fields, making them suitable for both systematic review and bibliometric analysis.

The review focused on studies published between 2015 and December 2025 that examined knowledge sharing in construction project management. The search was limited to English-language publications to ensure consistency in screening, coding, and interpretation across the review team. Only peer-reviewed journal articles were considered for inclusion. We acknowledge that this language restriction may have excluded region-specific evidence published in non-English outlets, particularly studies from Asia, Europe, and other non-English-speaking research communities. This issue is therefore explicitly revisited in the limitations section.

The search strategy was constructed by combining two groups of terms. The first group captured knowledge-related concepts, including “knowledge sharing*”, “knowledge management*”, “knowledge transfer*”, “knowledge exchange*”, and “information sharing*”. The second group captured construction project-related contexts, including “construction project*”, “construction management*”, “building project*”, “civil engineering project*”, and “infrastructure project*”. The key search terms are summarized in Table 1.

Table 1. Core search terms used in the database retrieval.

Category	Terms
Knowledge-related terms	“knowledge sharing*”, “knowledge management*”, “knowledge transfer*”, “knowledge exchange*”, “information sharing*”
Construction-related terms	“construction project*”, “construction management*”, “building project*”, “civil engineering project*”, “infrastructure project*”
Search logic	(Group 1) AND (Group 2)

Note: The asterisk (*) denotes a wildcard/truncation operator used in database searches to capture word variants.

In Scopus, the search was conducted in the title, abstract, and keyword fields. In Web of Science, the corresponding topic-related fields were used to ensure conceptual comparability across databases.

2.2. Data Filtering

The literature search was conducted in Scopus using the title, abstract, and keyword fields. With a cutoff date of December 2025 and a restriction to English-language publications, the Scopus search returned 257 records. Applying the corresponding search strategy in the Web of Science database identified 213 records. Therefore, the initial corpus contained 470 records before duplicate removal. The number 213 refers only to the Web of Science search output rather than to the total number of records retrieved.

After the initial retrieval, the PRISMA framework was applied to ensure a transparent and systematic screening process. A completed PRISMA 2020 checklist is provided as Supplementary File S1. First, duplicate records were removed, leaving 342 unique publications. Title and abstract screening were then conducted to exclude studies that did not focus on the construction industry or that only mentioned the search terms without substantive relevance to knowledge sharing in construction project management. This step removed 95 records, leaving 247 publications for full-text review.

In the first round of full-text assessment, the 247 remaining publications were reviewed for their alignment with the scope of this study. At this stage, 28 papers were excluded because they did not sufficiently address knowledge sharing in construction project management. Examples included studies that focused only on general information management, digital construction technologies, or project performance without substantively discussing knowledge sharing, transfer, exchange, capture, or reuse. This left 219 studies for the second round of full-text assessment.

In the second round of assessment, the remaining studies were manually examined in terms of research design, methodological clarity, relevance to the review questions, and the explicitness of reported findings. “Insufficient methodological information” refers to cases in which a study did not clearly report its data source, sampling procedure, analytical method, coding process, model specification, or evidence base. “Limited substantive relevance” refers to cases in which knowledge sharing was only mentioned as a background concept but was not analyzed as a central mechanism, practice, barrier, or outcome. During this stage, 56 papers were excluded because they lacked sufficient methodological transparency, provided limited extractable findings, or did not fit the construction project management context. Ultimately, 163 studies were included in the final review. Figure 2 presents the revised PRISMA flow diagram.

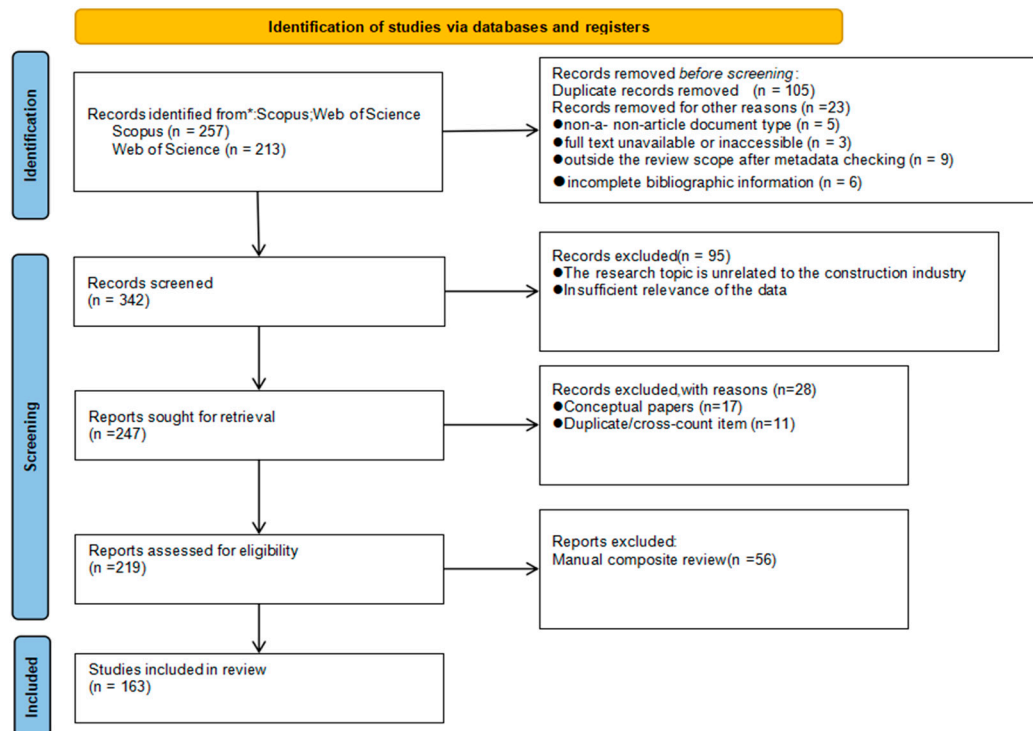


Figure 2. PRISMA Analysis Process Diagram. Note: The asterisk (*) denotes a wildcard/truncation operator used in database searches to capture word variants.

3. Results

To develop a clear picture of how knowledge sharing has evolved in the construction industry and how it is currently applied in construction projects, this study requires a systematic analysis of the available evidence. Following the PRISMA framework (Figure 2), the study screened and selected the literature in a transparent and reproducible way. In total, 163 articles met the inclusion criteria [8–170]. The main characteristics, research contexts, methodological approaches, knowledge-sharing focus, principal findings, and thematic classifications of all 163 included studies are presented in Supplementary Table S2.

3.1. Quantitative Analysis: Bibliometrics and Visualization

This study first uses bibliometric methods to describe knowledge-sharing research in construction engineering in a quantitative way, with the goal of clarifying the field's knowledge structure and how it has evolved over time. Bibliographic records were extracted from the predefined sample, after which author keywords and database-assigned keywords were merged and standardized to improve consistency. Keyword co-occurrence analysis was conducted using VOS viewer. The analysis adopted full counting, association-strength normalization, and a minimum keyword co-occurrence threshold of 5. Keywords with similar meanings, spelling variants, and singular/plural forms were manually standardized before visualization. The clustering resolution was set at 1.00, and the minimum cluster size was set at 5. These settings were selected to balance network readability and thematic coverage. The network results are shown in Figure 3.

In addition, Bibliometrix was used to calculate annual publication trends, source title distribution, leading countries/regions, productive authors, and citation-related indicators. These additional indicators were used to strengthen the quantitative evidence base and support the subsequent thematic interpretation. The yearly publication trend is presented in Figure 4.

From the co-occurrence network of keywords in Figure 3, it can be observed that “construction management” and “project management” occupy central positions within the network and demonstrate strong connectivity with multiple thematic clusters. These keywords function as pivotal nodes that bridge diverse research streams, including performance evaluation, sustainability, digital technologies, and decision-making frameworks.

This structural configuration indicates that knowledge sharing in construction project management has evolved from a relatively narrow focus on communication and coordination toward a broader, more integrated research agenda. The strong links between project management-related terms and keywords such as performance, innovation, BIM, and risk suggest that knowledge sharing is increasingly treated as an enabling mechanism embedded in project governance, digital collaboration, and value creation processes rather than as an isolated organizational behavior.

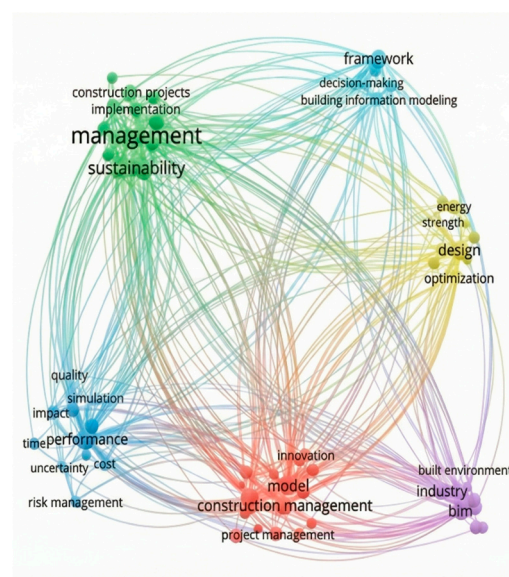


Figure 3. Keyword co-occurrence network generated using VOSviewer (v1.6.20). Note: The network was generated using VOS viewer with full counting, association-strength normalization, a minimum keyword co-occurrence threshold of 5, clustering resolution of 1.00, and a minimum cluster size of 5. Synonymous terms and spelling variants were manually standardized before visualization.

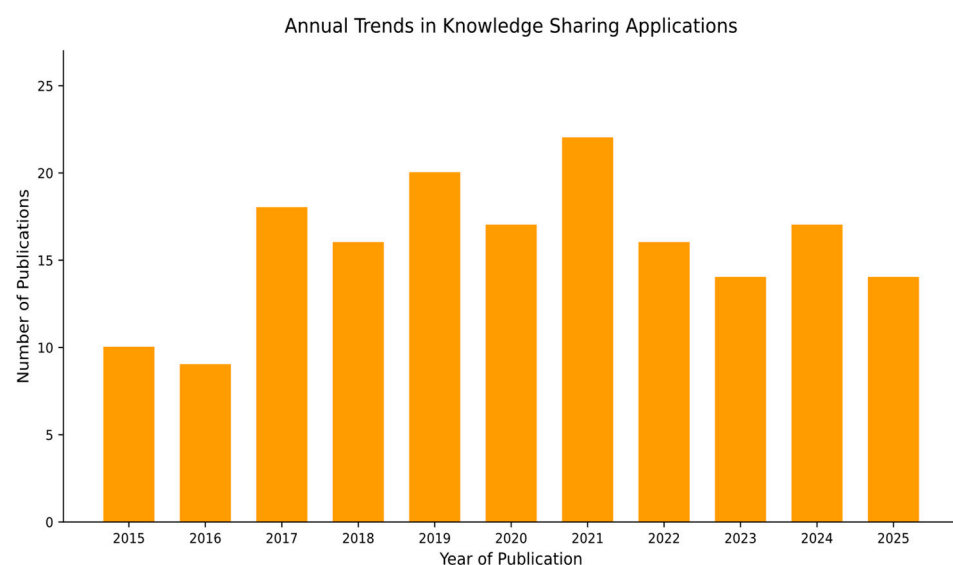


Figure 4. Annual publication trends of knowledge-sharing studies in construction project management, 2015–2025.

The revised annual publication pattern in Figure 4 covers the full review period from 2015 to 2025. The results show fluctuating but sustained research attention during 2015–2025, with relatively higher publication counts in 2019 and 2021. This pattern suggests that knowledge-sharing research in construction project management has developed through gradual accumulation rather than a simple linear increase. Therefore, the trend should be interpreted as a descriptive publication pattern rather than evidence of a direct causal relationship between digital transformation and research output.

As digital tools extend across the full project lifecycle, projects tend to involve more cross-organizational collaboration and a larger number of information interfaces. This raises the demand for information-sharing mechanisms that are traceable and for knowledge that can be reused across tasks and partners. In the keyword co-occurrence network, the appearance of terms such as “Building Information Modeling (BIM),” “Information Technology,” and “Blockchain” highlights the growing role of modern technologies in enabling knowledge sharing in construction project management. BIM is a good example. BIM is a digital platform that enables project participants to work collaboratively by organizing project information and allowing multiple stakeholders to access and update shared data across design, construction, and operations. This supports joint information interpretation and decision-making, which can reduce coordination frictions and rework. Consequently, recent studies increasingly examine how technology platforms streamline knowledge capture and sharing, strengthen stakeholder communication, and enable data-informed project execution [133]. As research deepens, an increasing number of case studies demonstrate how knowledge sharing and innovation can be achieved in the construction industry, particularly in areas such as risk management, project scheduling, resource allocation, and smart buildings [171].

The source title distribution in Figure 5 suggests that research on knowledge sharing in construction project management is published mainly in outlets such as the Journal of Construction Engineering and Management, the International Journal of Project Management, the Journal of Knowledge Management, and Automation in Construction. The source distribution shows that the topic is positioned at the intersection of construction engineering, project management, knowledge management, and digital construction research. This cross-disciplinary publication pattern reflects both the practical relevance and conceptual diversity of knowledge-sharing studies in construction contexts. To strengthen the quantitative profile beyond keyword co-occurrence, additional bibliometric indicators were calculated, including source title distribution, leading countries/regions, productive authors, citation-related indicators, and source concentration. The results are summarized in Table 2.

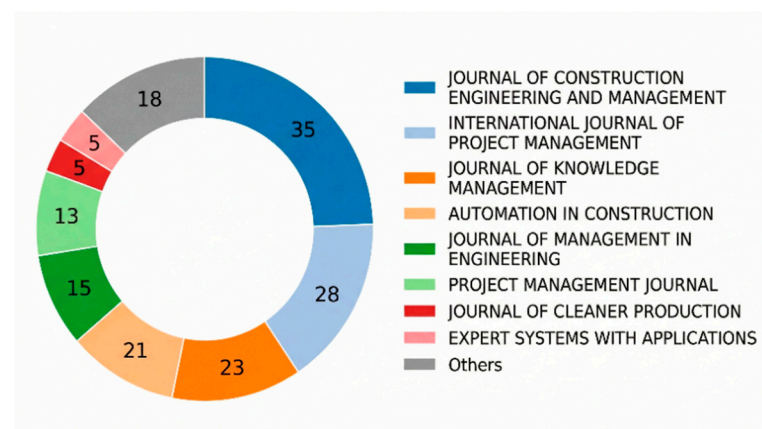


Figure 5. Source Title Distribution Analysis Chart.**Table 2.** Additional bibliometric indicators of the reviewed literature.

Indicator	Main Result	Interpretation
Top source titles	Journal of Construction Engineering and Management; Automation in Construction; International Journal of Project Management; Journal of Knowledge Management; Journal of Building Engineering	The topic is positioned at the intersection of construction engineering, project management, knowledge management, and digital construction.
Leading countries/regions	China; United Kingdom; United States; Australia;	Shows the geographical concentration and international distribution of KS research in construction project management.
Productive authors	Wang, Guangbin; Antwi-Afari, M.F.; Darko, A.	Identifies recurrent contributors and active research groups in this field.
Highly cited papers	Digital twins in the built environment: definition, applications, and challenges Construction and maintenance of urban underground infrastructure with digital technologies Conversational system to improve construction safety training of migrant workers	Indicates influential conceptual, empirical, or methodological contributions.
Journal distribution	The reviewed articles were distributed across construction, project management, digital construction, and journals.	The distribution confirms the interdisciplinary nature of the research topic.

3.2. Qualitative Analysis: Structured Content Analysis and Narrative Synthesis

Based on the quantitative profiling above, this study further applies structured content analysis and narrative synthesis to systematically review the included literature, so as to clarify the themes indicated by the keyword network. The qualitative synthesis followed a structured thematic coding process. First, two authors independently reviewed the included studies and extracted information on research focus, application context, methodological approach, theoretical perspective, and key findings. Second, recurring topics and patterns were identified and iteratively grouped into broader thematic categories. Third, the initial coding results were compared between the two coders. Disagreements were discussed until consensus was reached; when disagreement remained, a third author reviewed the relevant paper and made the final decision. Through repeated comparison and refinement, five major themes were developed to represent the main streams of knowledge-sharing research in construction project management. The resulting thematic distribution is shown in Figure 6.

Existing studies can be grouped into five themes. Among them, “Organizational and Behavioral Mechanisms” accounts for the largest share. Work in this area mainly examines factors such as trust, leadership, communication quality, and collaboration arrangements, with the goal of clarifying when knowledge-sharing intentions and behaviors emerge and where their effects are likely to stop. The second theme, “Performance–Innovation–Sustainable Value,” usually treats knowledge sharing as a core route to improve project performance and accelerate the spread of innovation, and then extends the discussion to sustainable construction and long-term value creation. Notably, “Digital Technology Empowerment (BIM/AI/Platforms)” shows a clearer upward trend, suggesting that technology-oriented studies have become one of the most active directions in this area. In this stream, the focus of knowledge-sharing research is gradually moving from “how organizations share” toward “how technology reshapes sharing mechanisms.” By contrast,

“Knowledge Mechanisms and Organizational Learning” pays greater attention to process-level pathways—such as lessons-learned management, knowledge capture, codification, and reuse—and emphasizes converting tacit experience into knowledge assets that can be stored, transferred, and applied. Finally, “Risk–Supply Chain–Governance and Security” represents the smallest share of the literature, which may indicate that this theme remains underdeveloped and warrants further study. The relatively small share of the “Risk–Supply Chain–Governance and Security” theme should not be interpreted as evidence that knowledge sharing is less relevant in this area. Rather, it may reflect several research barriers. First, risk- and security-related knowledge often involves commercially sensitive data, contractual responsibilities, accident records, and liability concerns, making empirical access difficult. Second, supply-chain knowledge is distributed across multiple firms and project tiers, which increases the difficulty of collecting comparable data across organizational boundaries. Third, digital-age issues such as data ownership, platform accountability, algorithmic opacity, and cybersecurity have only recently become prominent in construction knowledge-sharing research. Therefore, this relatively small theme may indicate an emerging and methodologically challenging research frontier rather than a marginal topic.

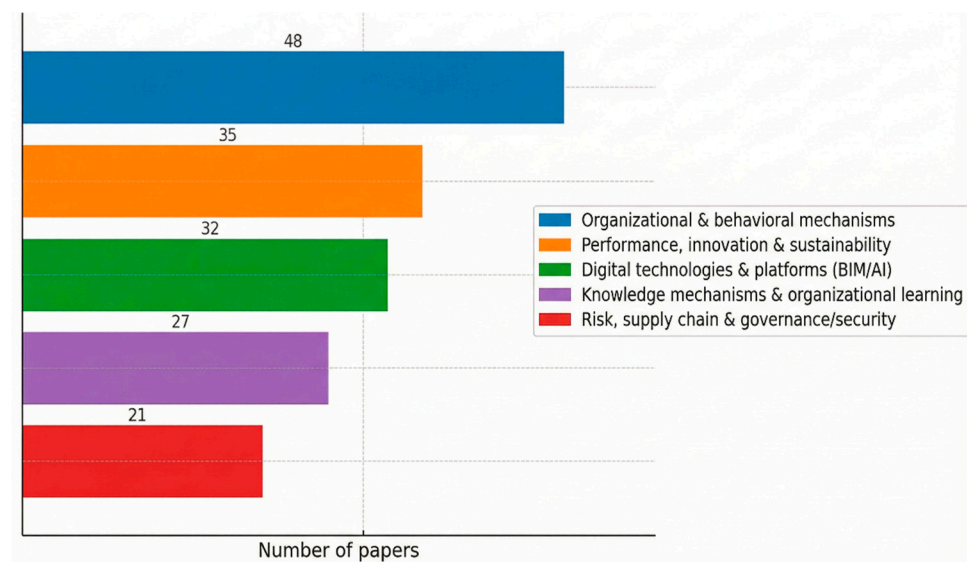


Figure 6. Thematic Distribution Map.

To improve the interpretability of the qualitative synthesis, this study combined the thematic distribution map with the structured evidence-extraction outcomes, as summarized in Table 3. Table 3 presents selected representative studies for thematic illustration, whereas the detailed characteristics and main findings of all 163 studies included in the systematic review are provided in Supplementary Table S1. Table 3 does not aim to list all 163 studies included in the review. Instead, it reports representative studies selected to illustrate the main evidence patterns within each theme. The selection was based on five criteria: thematic relevance to the research questions, methodological clarity, recency, diversity of application contexts, and ability to represent different knowledge-sharing mechanisms or outcomes. This linked reading suggests that the five themes form a relatively clear hierarchy, both in terms of research focus and proposed solutions. In particular, studies under “Organizational and Behavioral Mechanisms” mainly rely on empirical designs—most often questionnaire surveys paired with statistical modeling—to test how factors such as trust, organizational culture, and leadership behavior shape knowledge-sharing intentions and behaviors, and how these, in turn, relate to performance outcomes. Within “Digital Technology Empowerment,” an increasing number of studies highlight

BIM or intelligent platforms as basic infrastructure for knowledge capture, storage, and retrieval. Using case analyses or prototype systems, this line of work commonly examines whether such tools can improve collaboration efficiency, limit information silos, and reduce repeated rework. In parallel, under “Performance–Innovation–Sustainable Value,” knowledge sharing is frequently framed around outcomes such as quality, safety, innovation, or green construction performance. The main claim is that, in complex project settings, the value of knowledge sharing is less about isolated efficiency gains and more about improvements at the system level. Taken together, the literature appears to have formed a prevailing trajectory: it is anchored in organizational and behavioral explanations, strengthened by digital platforms, and evaluated through performance and sustainable value outcomes while gradually expanding toward intelligent systems, platform-based solutions, and cross-organizational governance.

It should be noted that the reviewed evidence is methodologically heterogeneous. Many studies rely on cross-sectional surveys, case analyses, conceptual frameworks, or review-based synthesis, while comparatively fewer studies provide longitudinal, quasi-experimental, or strongly causal evidence. As a result, existing findings are useful for identifying recurring associations between knowledge sharing and project outcomes, but they are less able to establish causal direction. For instance, it remains difficult to determine whether knowledge sharing improves project performance or whether high-performing project teams are simply more willing and able to share knowledge. Cross-sectional designs may also be affected by common method bias, respondent perception bias, and contextual heterogeneity across project types. Future research should therefore employ longitudinal project tracking, multi-project comparative designs, social network analysis, platform-log analysis, and mixed-method approaches to test how knowledge-sharing mechanisms evolve over time and influence project outcomes.

Table 3. Key Information Extraction from Representative Studies.

First Author	Theme	Focus Area	Evaluation Method
Jia [172]	Organizational behavioral mechanisms	Team/leadership/trust	Empirical analysis
Kunkcu [77]	Organizational behavioral mechanisms	Safety/risk; Team/leadership/trust	SEM/regression; Bibliometric/review
Dowson [173]	Organizational behavioral mechanisms	Team/leadership/trust	Interview
Elnagar [174]	Performance, innovation sustainability	Safety/risk; Sustainability/green construction	Bibliometric/review; Framework/conceptual
Zhou [166]	Performance, innovation sustainability	Sustainability/green construction	Framework/conceptual
Kim [75]	Performance, innovation sustainability	Safety/risk	Comparative risk analysis
Amaechi [175]	Digital technologies platforms (BIM/AI)	BIM/digital collaboration; Safety/risk; Supply chain/procurement	Bibliometric/review
Zhang [176]	Digital technologies platforms (BIM/AI)	BIM/digital collaboration; AI/data-driven KM; Off-site/modular construction	Bibliometric/review; Framework/conceptual
Jin [177]	Digital technologies platforms (BIM/AI)	AI/data-driven KM	Bibliometric/review

Xu [144]	Knowledge mechanisms organizational learning	AI/data-driven KM	ML/AI model; Framework/conceptual
Okudan [178]	Knowledge mechanisms organizational learning	AI/data-driven KM; Lessons learned/knowledge capture; Safety/risk	Bibliometric/review; ML/AI model
Eken [179]	Knowledge mechanisms organizational learning	Lessons learned/knowledge capture	Interview; Bibliometric/review

Note: Table 3 presents representative studies rather than the full corpus of 163 reviewed articles. The selected studies were chosen based on thematic relevance, methodological clarity, recency, contextual diversity, and their ability to illustrate key knowledge-sharing mechanisms or outcomes.

Taken together, the literature appears to have formed a prevailing trajectory: it is anchored in organizational and behavioral explanations, strengthened by digital platforms, and evaluated through performance and sustainable value outcomes, while gradually expanding toward intelligent systems, platform-based solutions, and cross-organizational governance. However, the reviewed studies do not suggest that knowledge sharing produces uniformly positive outcomes in all contexts. Its effectiveness appears to be moderated by project type, team size, cultural background, contractual arrangement, digital maturity, and task complexity. For example, cross-cultural and international projects may require stronger trust-building mechanisms before knowledge transfer becomes effective, while digitally mature projects may benefit more from BIM-enabled or platform-based knowledge repositories. Conversely, in highly competitive or risk-sensitive settings, excessive openness may increase concerns about knowledge leakage, liability, or data ownership. These differences suggest that knowledge-sharing mechanisms should be interpreted as context-dependent rather than universally effective.

4. Discussion

4.1. Benefits and Advantages of Knowledge Sharing in Project Management

Construction project management has long encountered persistent knowledge-governance problems. Common examples include information silos created when knowledge is split across organizations and job roles, the challenge of capturing and reusing tacit expertise, the high coordination and communication costs of cross-disciplinary collaboration, the weak transfer of lessons learned between projects and organizations, and unstable decision quality that can lead to repeated mistakes under uncertainty and complexity. In this context, knowledge sharing offers a basic route to strengthen project governance by enabling critical knowledge to move and be reused across teams, organizations, and wider project networks. Drawing on the reviewed studies, the main benefits of knowledge sharing in construction project management can be grouped into four areas: improved project performance, stronger innovation outcomes, greater sustainable value, and better safety and quality results.

4.1.1. From Information-Rich to Knowledge-Poor: Where the Chain Breaks Down

The reviewed literature suggests that the problem of being “information-rich but knowledge-poor” is not caused by a lack of project data but by the weak transformation of data into reusable knowledge. In construction projects, the data–information–knowledge chain may break down at four points. First, data are captured in fragmented formats across BIM models, documents, reports, schedules, and platform logs. Second, information is often interpreted within separate professional or contractual boundaries,

which may produce inconsistent meanings among designers, contractors, owners, consultants, and suppliers. Third, the contextual reasoning behind decisions is rarely codified, especially when decisions are made under time pressure or site uncertainty. Fourth, lessons learned are often not systematically transferred across project phases or reused in later projects because temporary teams dissolve after project completion. These mechanisms explain why large volumes of project information do not necessarily lead to organizational learning or improved decision quality.

4.1.2. Enhance Project Performance

Previous research frequently characterizes information sharing as a pivotal mediating mechanism for enhancing project performance, with its beneficial correlation consistently documented in relation to outcomes such as cost management, adherence to schedules, and quality enhancement [45,143]. One useful way to do this is to collect the high-frequency operational data that is generated during construction and turn it into “knowledge assets” that can be saved, searched, and utilized again. Some studies have built on this step by combining knowledge-transfer frameworks with methods like deep reinforcement learning to help guide decision-making in multi-stage construction settings. The goal is to improve schedule control, resource allocation, and the overall performance of the project [143].

In addition, sharing experience from both successful and unsuccessful projects can help employees coordinate overall progress, support smoother handoffs between phases, and reduce the risk of schedule delays [180]. At the early stages of strategic planning and design, repeated information and knowledge exchanges among the client, designers, and contractors can surface user preferences, functional constraints, and potential risks sooner, which may lower the probability of late changes and rework [153]. In complex infrastructure and prefabricated projects, the literature highlights the close relationship between information sharing and knowledge development, both of which jointly influence performance outcomes. Frequent knowledge exchange among cross-disciplinary teams facilitates better alignment of design details, construction methods, and operational requirements. This improved coordination often results in higher delivered quality and stronger operational performance [79].

4.1.3. Promoting Innovation

A number of studies suggest that knowledge management and knowledge sharing play central roles in shaping contractors’ innovation capability and project-level innovation outcomes. At the project level, some work uses agent-based models to describe how repeated, individual knowledge-sharing actions can accumulate and evolve into organizational capabilities. Model results indicate that when knowledge sharing levels are sustained within a high range, contractors experience significantly enhanced capabilities in both innovation exploration and innovation utilization within project contexts [50]. In studies of creativity during project delivery, knowledge sharing and information exchange are also treated as enabling conditions for project managers to develop innovative solutions, especially in complex and high-uncertainty situations [13]. Empirical studies report that information-technology innovations, both within and outside organizations (for example, collaborative systems, cloud platforms, and mobile tools), can enhance project team creativity by improving the efficiency of information sharing and the circulation of knowledge. In many of these analyses, knowledge sharing is treated as a mediating or amplifying factor that helps translate technology use into creativity outcomes [181]. In practice, organizations may build a case repository, an experience database, or a cross-organizational BIM platform to consolidate project-based innovative solutions into

knowledge assets that are searchable, comparable, and reusable, thereby supplying more accessible innovation resources for later projects [70].

4.1.4. Sustainable Value Enhancement

As green building practices continue to expand, the green technology systems and evaluation standards that support sustainable construction are often complex and strongly shaped by local conditions. In such settings, it is difficult for a single organization to hold all the knowledge needed to meet green targets, so knowledge transfer among project stakeholders is frequently described as a decisive mechanism. The literature reports that well-designed knowledge-transfer arrangements can improve the environmental performance of green projects and strengthen overall project outcomes [166]. In parallel, some green building projects have adopted blockchain-based smart contracts to increase information transparency, enable accountability tracking, and improve the credibility of incentive arrangements. Because shared ledgers are designed to be tamper-resistant, blockchain platforms are described as strengthening the reliability and traceability of green performance data and related knowledge exchanges among stakeholders, which can support progress toward sustainability objectives [35]. The key role of technology lies not in “replacing governance” but in enhancing the institutional foundation for cross-entity collaboration by improving data verifiability and accountability. This makes knowledge sharing more reliable. In complex infrastructure projects, these mechanisms become particularly prominent. In decision-making scenarios involving trade-offs between ecological and environmental impacts, social effects, and economic benefits, information sharing can enhance the completeness and consistency of decision evidence. This, in turn, supports project teams in making more balanced choices [79].

4.1.5. Safety and Quality Improvement

In complex engineering projects, the effectiveness of both deterministic and probabilistic risk management depends strongly on how complete the mechanisms are for knowledge sharing and dissemination. When risk-related knowledge does not circulate adequately within teams or cannot be exchanged in a timely way across organizational boundaries, even advanced risk assessment models may miss real-world risk conditions because their inputs arrive late or remain incomplete. This, in turn, weakens the timeliness and accuracy of early warnings and corrective actions [74]. At the same time, as digital technologies are increasingly deployed on construction sites for safety monitoring and decision support, the risk landscape is also becoming more complicated.

Identifying and mitigating emerging risks—such as algorithmic bias and opaque (“black-box”) decision-making—often depends on multi-stakeholder knowledge sharing to build shared understanding, reach agreement, and develop standardized protocols [137]. At construction sites, the timely exchange of information about near-miss events, latent hazards, and non-standard operations can strengthen frontline teams’ risk awareness and early-warning capacity, which in turn helps reduce recurring errors [35]. In addition, some studies propose an integrated framework spanning healthy-building design, construction, and operation, arguing that safety and health goals can only be embedded across the full project lifecycle when multidisciplinary knowledge is continuously shared and aligned. This includes, for example, coordination among structural engineering, HVAC, environmental psychology, and medical expertise at each project stage [174].

4.2. Challenges Facing Knowledge Sharing

Despite the significant advantages of knowledge sharing in construction project management, its implementation still faces multiple obstacles. Although some of these barriers

resemble general knowledge-management problems, they are intensified by the distinctive features of construction projects. Construction projects are temporary, multi-organizational, contract-bound, and strongly dependent on site-specific conditions. Project teams are often dissolved after completion, stakeholders may have different commercial interests, and knowledge is frequently distributed across owners, designers, contractors, subcontractors, suppliers, consultants, and platform providers. Therefore, the central challenge is not simply whether knowledge can be shared but whether it can be trusted, contextualized, protected, and reused across organizational and lifecycle boundaries. These obstacles can be categorized as insufficient trust and incentives, inadequate contractual and collaborative governance arrangements, the difficulty of externalizing tacit knowledge, and the lack of unified platforms/standards.

4.2.1. Lack of Trust and Motivation

In cross-organizational and cross-cultural engineering projects, trust is often treated as a basic precondition for knowledge sharing [162]. This is partly because complex collaboration networks—such as international projects and multi-organization delivery arrangements—may carry prior disputes, conflicting interests, or unequal bargaining power. These conditions can heighten concerns that shared knowledge will be misused, misattributed, or turned into a competitive disadvantage. Evidence from studies on international engineering and cross-cultural projects further suggests that large cultural distance and temporary, ad hoc team structures can intensify distrust between partners. As a result, key experiences and lessons may be selectively retained and shared only within formal settings, rather than being openly exchanged across organizational boundaries [17].

Similar dynamics are discussed in green building and other innovation-oriented projects, where contractors may fear that owners or competitors could replicate their technical know-how. This perceived risk can encourage a defensive posture and lead to “limited disclosure” instead of full knowledge exchange [131]. In addition to these inter-organizational concerns, at the individual level, Employees often spend substantial time and effort structuring knowledge and explaining it to others, yet may not receive matching recognition or rewards. At the same time, when others apply that knowledge, the benefits are frequently realized at the project or organizational level rather than directly by the individual contributor. Under these conditions, some employees may become less willing to share [182]. This tendency can be stronger in high-risk and highly competitive contexts, where team members may worry that extensive sharing reduces their perceived irreplaceability and weakens their personal value, prompting more strategic withholding behaviors [88].

4.2.2. Inadequate Contractual and Cooperative Governance Arrangements

Engineering projects are characterized by cross-organizational collaboration, multiple stakeholders, and strong contractual constraints. Multiple studies indicate that contracts and governance arrangements serve as both the foundation for cooperation and knowledge sharing, yet may also become barriers to knowledge flow [183]. Under the traditional Design Bid Build (DBB) model, contracts typically emphasize responsibility allocation and risk transfer rather than knowledge collaboration and co-learning, resulting in knowledge being strictly confined within contractual boundaries [163]. Knowledge management practices are often viewed as “additional costs” when introduced into projects. If contracts do not clearly specify knowledge-related deliverables and sharing responsibilities, contractors and suppliers often have little incentive to allocate time and resources to these activities, because the associated work can be viewed as optional and cost-

increasing rather than value-protecting [132]. To address this problem, some studies recommend collaborative governance arrangements—such as partnerships, framework agreements, or collaborative contracting—arguing that these models can loosen organizational boundaries and create stronger conditions for routine knowledge exchange.

4.2.3. Tacit Knowledge Is Difficult to Externalize and Is Highly Context-Dependent

One of the most challenging issues in managing project knowledge is the difficulty in externalizing tacit knowledge and its severe context dependency. Particularly, complex knowledge heavily reliant on practical contexts is often difficult to codify. Even when documented, it struggles to fully convey the “sense of operation” and “logic of judgment” [162]. In studies examining knowledge capture and retrieval during decision-making processes between owners and contractors, existing methods often only capture decision outcomes without reconstructing the underlying trade-offs and contextual judgments. This limitation hinders knowledge sharing across new projects. Moreover, stakeholders urgently seek to enhance team creativity to accelerate the achievement of project objectives. However, boosting team creativity depends not only on the volume of knowledge shared but also on the diversity and relevance of that knowledge. Currently, many knowledge repositories lack annotations for “contextual applicability,” which can easily lead to information overload or retrieval results that fail to match task requirements. This results in information asymmetry and information silos, running counter to stakeholders’ initial objectives [127]. This challenge is particularly distinctive in construction projects because tacit knowledge is strongly tied to temporary teams and site-specific. Many critical judgments are made during design coordination meetings, site inspections, emergency responses, or informal interactions among experienced professionals. Once the project team is dissolved, the individuals who hold such experience may move to other projects or organizations, while the contextual logic behind their decisions remains undocumented. Project temporality therefore makes tacit knowledge externalization more difficult than in stable organizational settings.

4.2.4. Platform/Standard Non-Uniformity Issue

With the application of digital technologies and intelligent construction platforms in the field of building engineering, they demonstrate the immense potential of technology for knowledge sharing while simultaneously revealing new barriers: frameworks for information exchange and interoperability during project implementation phases. Research indicates that inconsistent standards and incompatible interfaces between different systems result in high data-sharing costs and significant semantic loss [184]. Furthermore, if data within the platform is incomplete, delayed, or erroneous, knowledge recommendations and decision support will exhibit systemic biases [143]. At a broader level, inconsistent industry standards and heterogeneous data formats further complicate knowledge exchange across organizations, because information must be repeatedly converted, re-labeled, or manually checked before it can be reused in another firm’s workflow [177]. Similar issues appear in smart-building implementation: without unified data specifications across sensing, control, and management systems, cross-system knowledge integration becomes difficult, limiting the ability to build coherent, end-to-end “learning loops” from operations back to design and construction [185]. Currently, many intelligent systems and recommendation algorithms lack governance and transparency, making it difficult for users to assess the origin and reliability of knowledge suggestions. This uncertainty can weaken trust and reduce willingness to adopt platform-based knowledge suggestions in practice [186]. Digital transformation also introduces new knowledge-sharing challenges that are not fully captured by traditional KM barriers. For example, algorithmic black boxes may make it difficult for users to understand how knowledge recommendations are

generated, while data sovereignty concerns may limit whether owners, contractors, or platform providers are willing to share project data across organizational boundaries. In addition, when knowledge is mediated by BIM platforms, digital twins, blockchain systems, or AI-based tools, responsibility for data quality, model errors, privacy protection, and decision accountability becomes more complex. These digital-age challenges indicate that future knowledge-sharing research should address not only platform adoption but also transparency, explainability, data governance, and accountability.

4.3. Future Research Directions and Emerging Trends

Despite continuous evidence linking knowledge sharing to project performance, innovation, and collaborative improvement in project management research, existing findings exhibit a characteristic “rapid growth—fragmented accumulation” pattern. On one hand, studies continually introduce new technologies such as BIM, knowledge graphs, and collaborative platforms to enhance knowledge capture and sharing efficiency. On the other hand, hard constraints of project contexts—such as the tension between sharing and protection in cross-organizational collaboration, trust deficits under time pressure, and the difficulty of stably externalizing and reusing tacit knowledge—prevent technological availability from automatically translating into effective sharing and replicable performance.

Therefore, future research should shift from treating knowledge sharing as an isolated behavioral variable to viewing it as a project capability system that is designable, governable, and verifiable. This capability system can be preliminarily operationalized through five linked processes: knowledge capture, contextual interpretation, cross-organizational sharing, project-level reuse, and feedback-based learning. Each process can be empirically examined through measurable indicators, such as the completeness of captured knowledge, the clarity of contextual annotations, the density of knowledge-sharing networks, the frequency of knowledge reuse, the speed of decision response, and changes in project performance. This shift should advance along four main lines: the dynamic mechanisms linking behavior to capability, the combined design of governance and incentives, digital and intelligent Knowledge Sharing 2.0, and task-oriented knowledge sharing. Based on this logic, Table 4 provides a preliminary research agenda for empirically examining knowledge sharing as a project capability system.

Table 4. Preliminary research agenda for examining knowledge sharing as a project capability system.

Capability Process	What Should Be Examined	Possible Indicators	Suggested Methods
Knowledge capture	Whether project experience, decisions, and lessons are systematically recorded	Completeness of records; number of lessons learned; richness of contextual notes	Document analysis; platform-log analysis
Contextual interpretation	Whether shared information includes decision context and applicability conditions	Clarity of annotations; presence of project phase, stakeholder, and risk context	Content analysis; expert review
Cross-organizational sharing	Whether knowledge moves across firms, roles, and project boundaries	Network density; sharing frequency; stakeholder participation	Social network analysis; survey

Project-level reuse	Whether captured knowledge is reused in later decisions or projects	Reuse frequency; retrieval success; reduction in repeated errors	Longitudinal case study; comparative project analysis
Feedback-based learning	Whether reused knowledge is updated after application	Feedback loops; revision frequency; learning outcomes	Mixed-method tracking; action research

Note: This table provides a preliminary research agenda rather than a validated model. Future studies can adapt these indicators according to project type, delivery method, digital maturity, and data availability.

4.3.1. Closed-Loop Mechanism for Knowledge Sharing and Project Learning Capability

Existing research has drawn a series of relatively consistent conclusions regarding the “learning-sharing-performance” relationship based on different chains of evidence. For instance, experience management systems and knowledge repositories enable cross-organizational knowledge capture and retrieval, enhancing organizational learning efficiency; lean practices improve project learning quality and reduce “experience loss” by enhancing interactions, leadership support, and action triggers. Simultaneously, time pressure significantly reduces the effectiveness of knowledge transfer by undermining team trust, suggesting that knowledge-sharing behaviors are highly constrained by project pace and relational conditions [89]. However, most studies remain confined to static descriptions of “sharing intensity → performance,” lacking a dynamic explanation of how sharing accumulates into project learning capacity—namely, the closed-loop process of knowledge capture, meaning construction, and reuse. Future research will increasingly need to view “sharing” as part of the learning process rather than an isolated behavior. Especially in complex engineering projects, knowledge must not only be shared but also correctly understood and translated into decisions and actions. If all members remain perpetually busy with no time for communication, sharing becomes difficult, and performance improvements can only stem from individual learning rather than team learning [63]. Such evidence suggests that the key to project learning capability lies not merely in the “willingness to share” but rather in the existence of a sustainable learning feedback mechanism. Future studies may examine how knowledge capture, interpretation, reuse, and feedback interact across project stages, and whether this dynamic process can be measured through longitudinal case studies, social network analysis, or mixed-method project tracking.

4.3.2. Cross-Organizational Knowledge Governance and Incentive Mechanisms

Knowledge sharing in cross-organizational collaboration is never merely a matter of “willingness to share” but is shaped by contracts, institutional frameworks, relationships, and platform rules. In open collaboration projects, contracts/formal controls can reduce the risk of knowledge leakage, yet their impact on project performance is not simply linear; different types of controls also exert significantly different effects on performance [89]. Moreover, in the digital era, the owner contractor collaboration exhibits organizational tension between “open sharing” and “protective logic.” Merely emphasizing open sharing may overlook the practical need for boundary management. Future research could conceptualize the effectiveness of cross-organizational knowledge sharing as the outcome of multiple factors—institutional arrangements, contracts, relationships, and technology—with multiple equivalent pathways existing between them, rather than the marginal effect of a single variable. In other words, “the same sharing performance” may stem from different

governance combinations. Future research may compare different governance configurations, such as contractual controls, relational trust, and platform-based rules, to examine which combinations are most effective under different project conditions.

4.3.3. Knowledge Sharing 2.0 in the Era of Digitalization and Intelligence

Although recent studies repeatedly emphasize digital technology as a driver of stronger knowledge-sharing mechanisms, for example, natural language processing (NLP)-commonly regarded as a core area of artificial intelligence-can automate the extraction and semantic structuring of information from unstructured text. When integrated with BIM environments, project records such as documentation, meeting minutes, and other textual materials can be more readily transformed into searchable, reusable knowledge entries. This can strengthen knowledge capture and retrieval and, to some extent, reduce the risk of knowledge loss during project closeout, when teams disperse and project knowledge is most likely to fragment. In parallel, by using immersive or augmented visualization to build shared scenarios and present project information in a spatially intuitive way, multiple stakeholders can discuss issues and assess options within a more realistic environment. This approach can improve communication quality and support more effective decision-making, particularly when project information is complex and hard to interpret using conventional drawings or text-based reports. The integrated framework of blockchain and digital twins, along with blockchain-supported information sharing and collaboration, has also become a key focus area for scholars [31]. Although the core review window of this study ends in December 2025, recent early-2026 evidence further supports the continued integration of knowledge management, project management, human resource management, digital capability, and organizational resilience in construction research [187]. These recent works are not included in the bibliometric corpus because they fall outside the predefined 2015–2025 search window, but they provide useful contextual support for the future-oriented discussion of Knowledge Sharing 2.0.

However, the rapid expansion of technological approaches has been accompanied by a widespread research deficiency: while technological development advances swiftly, evaluation standards have failed to keep pace. This has resulted in a lack of unified assessment frameworks and compelling evidence of effectiveness. Consequently, the greatest challenge for “Knowledge Sharing 2.0” lies not in platform usage frequency but in enabling platforms and algorithms to function synergistically in collaborative decision-making while ensuring system transparency, auditability, and accountability. Future research should focus on “system governance”-specifically, the rules and accountability frameworks necessary to ensure stable and sustainable system operation, rather than merely enhancing efficiency and performance. More importantly, future work should move beyond technology adoption to evaluate transparency, accountability, explainability, and decision usefulness in intelligent knowledge-sharing systems.

4.3.4. Task-Oriented Embedded Knowledge Sharing Mechanism

As security and sustainability become more pressing concerns, knowledge-sharing research has increasingly moved beyond theory-heavy discussions of “enhancing organizational capability” and toward applied studies that are anchored in particular project contexts and guided by clearly defined, goal-oriented constraints. Future research trends may evolve knowledge sharing from a “generic capability” toward a “task-oriented system,” embedding sharing within specific management nodes to serve explicit objectives rather than remaining confined to static knowledge base development. For instance, research on knowledge transfer among green building stakeholders provides direct empirical evidence for “cross-subject knowledge integration driven by sustainability objectives”

. Studies analyzing and visualizing sustainable construction project management underscore the importance of interdisciplinary knowledge alignment, while highlighting that future research must develop more “actionable” shared processes and tools. These tools should enable sustainable measures to be structured, tracked, evaluated, and embedded within daily management practices [70]. Moreover, achieving accountability tracking and incentive alignment through trusted mechanisms may constitute a crucial pathway for green knowledge sharing to evolve from “initiative-based practices” to “institutionalized arrangements” [35]. In the realm of security and risk governance, integrating “structured knowledge sharing” with “risk front-loading” signifies that knowledge sharing research no longer focuses on generalized experience exchange. Instead, it targets knowledge encoding, retrieval, and collaborative interpretation mechanisms oriented toward risk identification tasks. This provides future research with more testable task boundaries and evaluation benchmarks [140]. This suggests the need for task-specific studies focusing on design review, safety risk identification, green target coordination, and project closeout learning, where knowledge sharing can be assessed against clearly defined management outcomes.

Overall, the reviewed evidence suggests that the value of knowledge sharing should be interpreted through specific project contexts rather than as a universally linear relationship. Its effects on performance, innovation, sustainability, and safety depend on governance arrangements, stakeholder trust, digital maturity, and the ability to convert shared information into reusable project knowledge.

5. Conclusions

This study offers a comprehensive review of knowledge-sharing applications in construction project management and examines how knowledge sharing may improve project performance, support innovation, and contribute to sustainable development. Based on the reviewed literature, the study identifies five major domains for knowledge-sharing implementation: organizational and behavioral mechanisms, performance innovation sustainable value, digital technology enablement, knowledge mechanisms and organizational learning, and risk and supply chain management. Overall, the findings indicate that knowledge sharing is associated with better project performance and safety and may also contribute to the achievement of sustainability objectives. Methodologically, the quantitative analysis traces the growth and development of knowledge-sharing research in the construction field, while the qualitative synthesis structures the evidence on existing applications, key barriers, and priority directions for future research. Although these contributions are noteworthy, the study has several limitations. First, the literature sample was limited to English-language peer-reviewed journal articles, which may have excluded relevant regional studies published in non-English outlets. Given the global nature of construction research, future reviews should incorporate multilingual databases and regional publications to improve coverage of evidence from Asia, Europe, and other non-English-speaking contexts. Second, the review focused on construction project management, meaning that the findings may not be directly transferable to other sectors. Third, much of the reviewed evidence is based on cross-sectional surveys, case studies, conceptual frameworks, or review-based synthesis. Therefore, the reported relationships between knowledge sharing and project outcomes should be interpreted mainly as associative rather than causal. Future research should strengthen causal explanation through longitudinal project tracking, quasi-experimental designs, multi-project comparison, platform-log analysis, social network analysis, and mixed-method studies. Such designs would help clarify whether knowledge sharing improves project performance or whether high-performing projects are more likely to develop stronger knowledge-sharing practices.

Supplementary Materials: The following supporting information can be downloaded at: <https://www.mdpi.com/article/10.3390/systems14080896/s1>. Supplementary File S1: Completed PRISMA 2020 checklist; Supplementary Table S2: Main characteristics and findings of the 163 studies included in the systematic review [8–170].

Author Contributions: Conceptualization, X.L. and J.Z.; Methodology, X.L.; Data curation, S.Z.; Software, X.L., J.Z. and S.Z.; Formal analysis, S.Z.; Investigation, X.L.; Resources, X.L.; Data curation, X.L.; Writing—original draft preparation, X.L. and J.Z.; Writing—review and editing, S.Z. and L.L.; Visualization, X.L.; Supervision, X.L.; Project administration, X.L. All authors have read and agreed to the published version of the manuscript.

Funding: This research was funded by the Major Project of Philosophy and Social Science Research in Colleges and Universities of Jiangsu Province [Grant Number 2025SJYB1055], Suzhou Science and Technology Plan (Basic Research) Project [grant number SJC2023002], and the National Natural Science Foundation of China [grant number 72201188].

Data Availability Statement: The data presented in this study are available on request from the corresponding author.

Conflicts of Interest: The authors declare no conflicts of interest.

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