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A BIBLIOMETRIC ANALYSIS OF PROJECT COMPLEXITY ON IMPLEMENTATION OF HYBRID PROJECT MANAGEMENT METHODOLOGY FOR PROJECT SUCCESS IN CONSTRUCTION SECTOR

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ABSTRACT

The construction industry has growing challenges due to heightened project complexity, diverse stakeholders, and environmental unpredictability, which often compromise conventional project management methods. In response, Hybrid Project Management (HPM) methodologies that integrate predictive and agile practices have garnered recognition as an effective approach to improving project success. Nevertheless, empirical comprehension of how project complexity influences the efficacy of HPM is still constrained, especially in the context of developing countries. This study conducts a systematic evaluation of current literature to investigate the effect of project complexity on the link between HPM implementation and project success within the construction industry. This study conducts a comprehensive evaluation of current literature to investigate the effect of project complexity on the connection between HPM implementation and project success in construction industry. In accordance with the PRISMA framework, 146 peer-reviewed publications published from 2020 to 2025 were extracted from the Scopus database and examined utilizing bibliometric and thematic methodologies. The results indicate that project complexity, defined by technical, organizational, and environmental factors, substantially affects the appropriateness and performance results of hybrid approaches. HPM exhibits significant potential to enhance adaptability, stakeholder satisfaction, and performance in intricate projects; nonetheless, its efficacy depends on contextual alignment, the quality of collaboration, and managerial competence. The review emphasizes an increasing academic emphasis on complexity-driven, data-enabled, and hybrid methodologies, especially within megaproject and infrastructure domains. This study enhances theoretical understanding by integrating disparate information on complexity as a significant moderator and provides practical guidance for construction professionals to customize hybrid configurations based on project-specific complexity profiles.

KEYWORDS: Hybrid Project Management, Project Complexity, Construction Industry, PRISMA

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1. INTRODUCTION

The construction sector constitutes a fundamental element of economic development, acting as a crucial pillar for both social and economic progress (Elrayah & Mirzaliev, 2024; Ramanathan & Rathore, 2024; Su et al., 2025). Nonetheless, delivering projects in this field is intrinsically difficult because many team members and stakeholders are involved, which makes it hard to finish projects on time (Elrayah & Mirzaliev, 2024). Effective project management necessitates the utilization of comprehensive tools and methodologies to monitor progress and guarantee timely and budget-compliant delivery (Ünsal Altuncan & Vanhoucke, 2025). The creation of a baseline plan is an essential initial step; nevertheless, execution often encounters unforeseen disruptions that require pragmatic forecasting and flexible management approaches (Ünsal Altuncan & Vanhoucke, 2025).

Contemporary construction projects are encountering escalating levels of complexity, attributable to internal factors such as team interactions, fluctuating requirements, and external uncertainties (Álvarez-Espada et al., 2024). Conventional project management, reliant on predictability and control (the waterfall methodology), is effective solely when objectives and resources are consistent (Álvarez-Espada et al., 2024). In highly dynamic contexts, static management proves inefficient, frequently resulting in unrealistic planning, budget overruns, and schedule delays (Álvarez-Espada et al., 2024; Qianqianju, 2025; Son, 2022). The implementation of hybrid life cycles, which enable response to changes via a blend of predictive and agile approaches, has become essential to tackle these difficulties (Ünsal Altuncan & Vanhoucke, 2025).

In the construction sector, comprehending the role of project complexity is essential for the effective execution of hybrid project management approaches. Hybrid methodologies seek to optimise project delivery, although their efficacy may be profoundly affected by the level of interconnectedness and uncertainty intrinsic to the project system (Qianqianju, 2025). This study aims to assess how project complexity influences the relationship between the adoption of a hybrid methodology and overall project success.

2. LITERATURE REVIEW

The concept of project success is an often debated yet unclear subject in management literature (Azmat & Siddiqui, 2023). Traditionally, achievement in construction has been assessed using the "iron triangle" comprising the elements of scope, schedule, and cost (Azmat & Siddiqui, 2023; Elrayah & Mirzaliev, 2024). But the term has changed to incorporate safety standards, environmental compliance, and stakeholder and customer satisfaction (Azmat & Siddiqui, 2023; Qianqianju, 2025). Success is attained when a project fulfils established functional criteria while addressing the needs of all stakeholders involved (Qianqianju, 2025).

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In uncertain situations, a hybrid technique combines several life cycles, such iterative, incremental, and agile, to get better results on projects (Álvarez-Espada et al., 2024). These methodologies seek to integrate the framework of conventional software development or construction lifecycles with the adaptable nature of agile product development practices (Elrayah & Mirzaliev, 2024). The objective of such models is not solely to optimise scheduling but also to accurately forecast the project's future in order to enhance the likelihood of success (Ünsal Altuncan & Vanhoucke, 2025). Research indicates that systematic management approaches, such as process control and knowledge dissemination, are essential for successful execution in intricate sectors like construction (Elrayah & Mirzaliev, 2024).

Project complexity is characterised by a system of diverse interrelated components that continuously alter and evolve, influencing project objectives (Bakhshi et al., 2024; Lukhele et al., 2021). The literature frequently employs the TOE (Technical, Organisational, and Environmental) framework to classify complexity (Lukhele et al., 2021; Qianqianju, 2025; Ramanathan & Rathore, 2024). Technical Complexity pertains to technological challenges, task interdependence, and the organisation of construction activities (Lukhele et al., 2021; Qianqianju, 2025; Su et al., 2025). Organisational Complexity evident in extensive team sizes, several hierarchical tiers, and varied inter-organizational interdependencies (Qianqianju, 2025; Su et al., 2025). Environmental Complexity denotes the unpredictability within the environmental, political, or economic contexts of the endeavour. Alternative models, such as DEBACCS, delineate dimensions like Diversity, Emergence, Belonging, Autonomy, Connectivity, Context, and Size as major drivers of complexity (Azmat & Siddiqui, 2023; Bakhshi et al., 2024).

Complexity functions as a catalyst that influences the dynamic between management capabilities and project success (Elrayah & Mirzaliev, 2024). Evidence indicates that project complexity influences the efficacy of governance methods; for example, the beneficial effects of interface management on performance are more significant in high-complexity contexts compared to low-complexity ones (Sruthilaya et al., 2025). Conversely, in simple projects, basic management skills may suffice, but as complexity increases, the need for sophisticated, adaptable business practices becomes paramount to prevent "single point of failure" risks (Elrayah & Mirzaliev, 2024; Su et al., 2025).

Projects in developing countries face distinct obstacles, including the selection of subcontractors and the management of particular commercial building types (Ramanathan & Rathore, 2024). Studies demonstrate that the obstacles encountered by construction managers differ markedly across various geographical regions and cultural contexts (Ünsal Altuncan & Vanhoucke, 2025). Comprehending how local complexities spanning site layout planning to transdisciplinary participant expertise influence the adoption of hybrid techniques is crucial for improving the success rate of construction projects (Elrayah & Mirzaliev, 2024; Sing et al., 2022).

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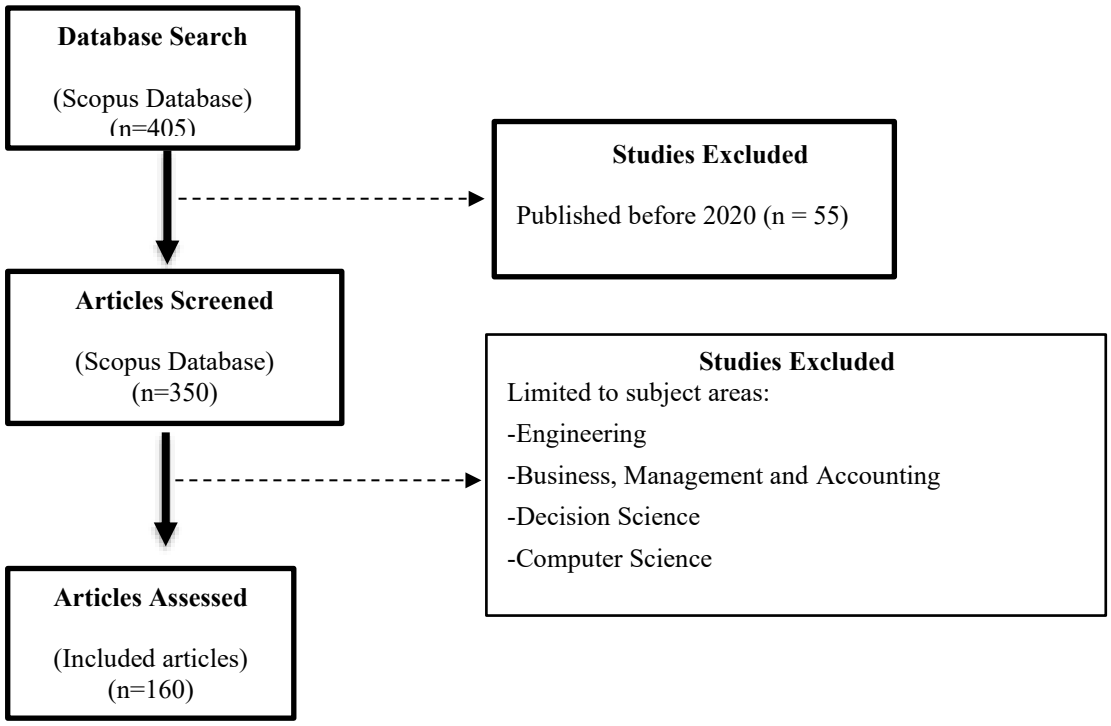
3. METHODOLOGY

This study provides a thorough examination of the literature review on aspect of project complexity on implementation of hybrid project management methodology for project success in construction sector. This review incorporates an extensive range of disciplines such as Technological, Environmental, and Social Perspectives. Regarding the systematic literature review, the process began by documenting the criteria used to include or exclude articles, as well as the methodology used for analysis. This mirrors the approach utilized in the preferred reporting items for systematic reviews and meta-analyses (PRISMA), which aids in the objective selection and analysis of papers (Liberati et al., 2009). Accordingly, identification, screening, ensuring eligibility and deciding on inclusion was followed in identifying the most relevant articles to be reviewed.

Scopus was identified as the optimal destination for identifying papers with significant effect (Tennakoon et al., 2024) . Hence, the search was performed in Scopus database using the search string as "Project Complexity" AND "Hybrid Project Management" OR "Implementation of Hybrid Project Management". The preliminary findings yielded a total of 405 articles. Stringent criteria for inclusion and exclusion were implemented to ensure the selection of the most relevant articles and 146 articles were selected as final sample.



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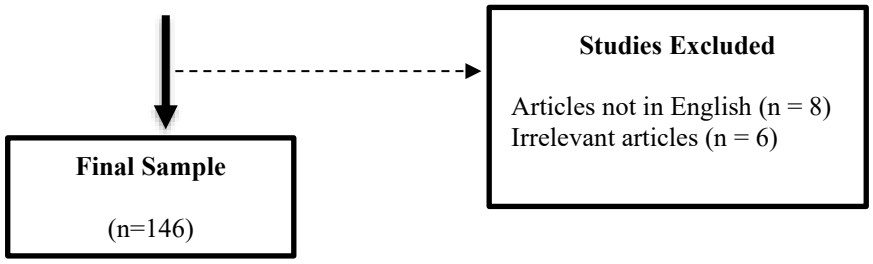

Figure 1: Articles selection strategy

4. KEY FINDINGS

4.1 Annual Scientific Production

Figure 1 shows a clear visual representation of the number of scientific articles published per year over a period from 2021 to 2025.The horizontal axis denotes the year, while the vertical axis depicts the number of articles, providing a straightforward comparison of publishing production across time. A solitary line links all data points, illustrating the overarching trend and the annual fluctuations in scientific productivity.

In 2021, with approximately 30 published articles, scientific production begins at a strongly level. Moving into 2022, there is a slight decline in the number of publications, dropping marginally to around 29 articles. Although this decline is minor, it indicates a slight deceleration in research productivity. This may result from alterations in funding, shifts in research goals, or external events. According to the chart, the lowest publications occurred in 2023, where the number of published articles falls to about 24 articles. It is the most notable change in the entire time period, which represents a clear disruption in scientific production. This decline may indicate wider issues, such as less research activity, publishing delays, or global or institutional limitations impacting academic productivity during that year.

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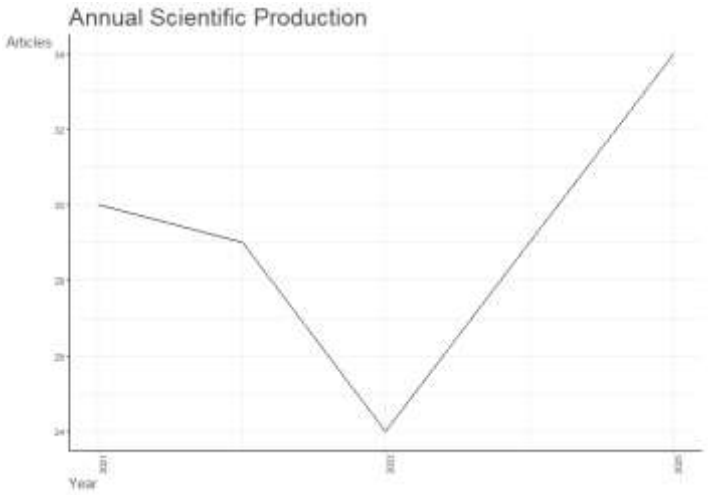

Figure 2: Annual Scientific Production

In the year 2024 the trend reverses strongly. Scientific production rebounds to 29 articles, nearly almost back to the levels seen in the first few years of the timeline. The revival indicates that research activities are resuming, potentially due to improved conditions, increased collaboration, or the recommencement of previously suspended programs. The increase proves that the scientific community is resilient and capable of adapting following a period of diminished productivity. The most prominent growth seen in 2025, where 34 articles have published which is the highest value across all five years. This peak reflects a significant increase in scientific production, suggesting that research effort is growing and results are being dispersed effectively. The pronounced upward trajectory from 2023 to 2025 indicates a rapid recovery and expansion of the economy.

The graph illustrates a U-shaped trend marked by an initial minor fall, a pronounced trough in the centre, and a subsequent robust increase, suggesting that obstacles in scientific output may foster substantial development and revitalized productivity.

4.2 Country Analysis

This bubble chart (figure 3) presents the most cited countries based on the total number of citations, highlighting the relative research impact of different nations. The horizontal axis shows the total citations while the vertical axis depicts the country name. The size of bubble represents the magnitude of citations, reinforcing visual emphasis on countries with higher academic influence.

As the figure depicts, China positioned far to the right with the largest bubble, indicating the highest citation count which is 194. This reflects its strong global leadership in research output and influence. Malaysia follows as the second most cited country, with around 137 citations, displaying the rapid emergence of their importance and effect on scientific research. Following are Australia and France,

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with citation counts of approximately 88 and 75, respectively. These figures indicate a significant yet moderate influence.

Some countries such as Germany, Turkey, the United Kingdom, Indonesia, Italy, Canada and Sweden cluster around 50 citations. Though their citation counts are lesser, their presence reflects their significant scientific contributions. The graphic illustrates that citations are unevenly distributed. Some countries influence global research, while others have a smaller but still significant impact.

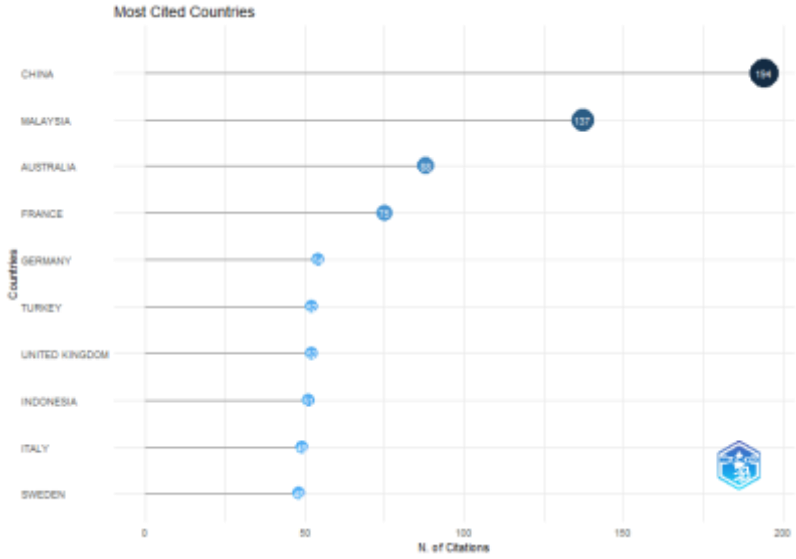

Figure 3: Most Cited Countries

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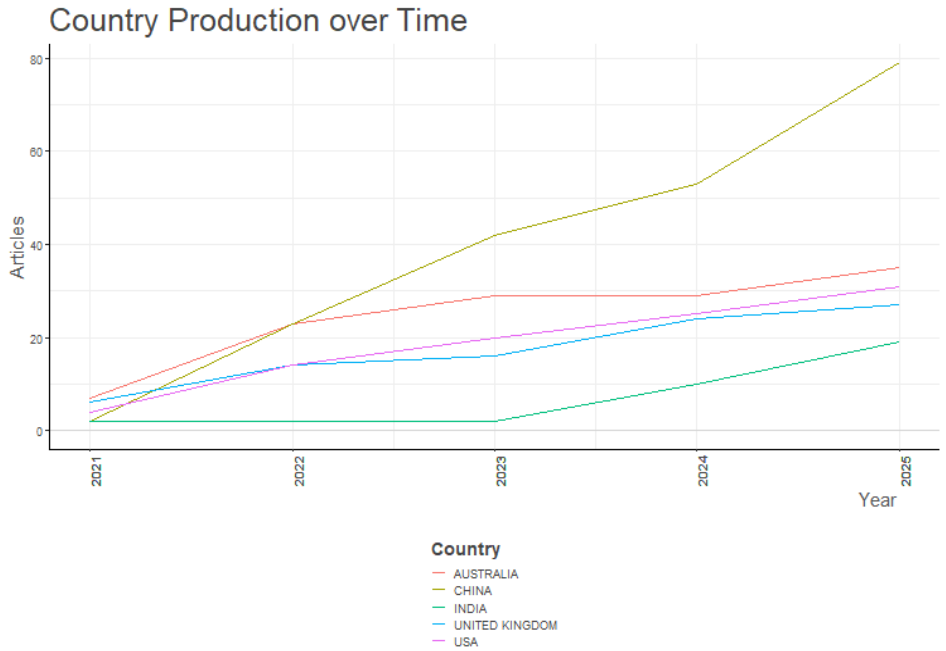

Figure 4: Country Production Over Time

The figure 4 shows he trend in scientific article production from 2021 to 2025 across Australia, China, India, The United Kingdom and USA. The horizontal axis represents the year, whilst the vertivl axis highlights the number of published articles providing a clear comparison of growth patterns among countries.

As the line graph depicts, all five countries demonstrate an upward trend in publications over time. China exhibits the fastest growth from a low beginning to the maximum output within this 5 years by reaching 79 publications in 2025. This shows that China is becoming more important in the creation of research around the world. Australia and The United Kingdom display steady and moderate growth during theis five years while USA exhibits consistent development, with the number of articles published consistently rising over the same time period. In contrast, India has published only 2 articles during first 3 years and highlights a surge after 2023.

In a nutshell, the figure shows that different countries are on different paths when it comes to research, with China leading in growth and other countries showing steady growth.

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4.3 Source Analysis

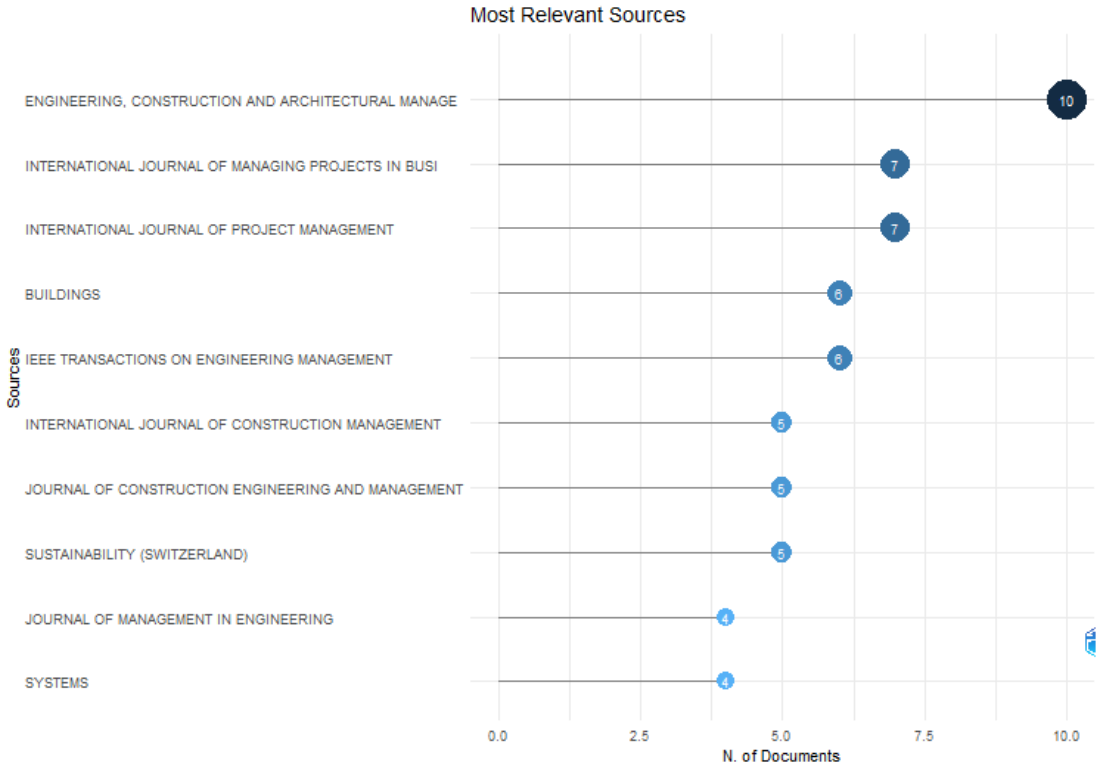

Figure 5: Most Relevant Sources

According to the figure 5, the distribution of research publications among prominent academic journals, determined by the published articles quantity and the horizontal and vertical axes denote the quantity of documents and the titles respectively. The visualization highlights Engineering, Construction and Architectural Management as the predominant source, yielding the greatest number of publications which is 10. There is a similar count of articles have published in the streams of International Journal of Managing Projects in Business and International Journal of Project Management each with 7 publications. Journal such as Buildings and IEEE Transactions on Engineering Management contribute 6 each pointing the significance of built environment research and engineering management perspectives. A slight impact of publications is found from the International Journal of Construction Management, Journal of Construction Engineering and Management, and Sustainability (Switzerland), that is 5 articles each. The lowest distributions are the Journal of Management in Engineering and Systems with 4 documents each. The publication environment is defined by a few predominant journals that lead the literature, along with several others that provide supplementary contributions, reflecting ongoing intellectual engagement and multidisciplinary diversity in the area.

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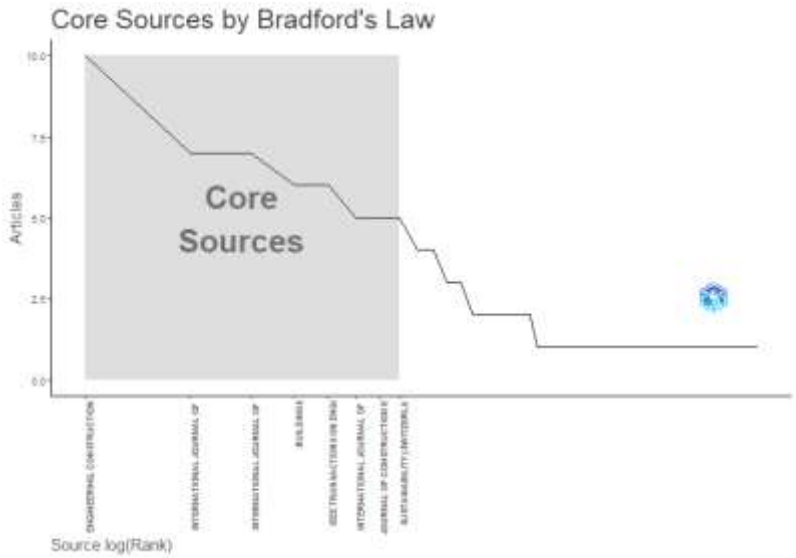

Figure 6: Core Sources by Bradford's Law

Bradford's Law states that a limited number of journals tend to comprise the majority of the publications in a specific study area. This trend is shown in the shaded core sources area, where the most articles are published in journals such as Engineering, Construction and Architectural Management, International Journal of Project Management, Buildings, and IEEE Transactions on Engineering Management. As the rank increases, the quantity of publications per source significantly decreases, resulting in a lengthy tail of journals that publish rarely. This pattern indicates that the majority of research is spread in a limited selection of reputable publications, whilst several additional sources publish only a few articles. The figure demonstrates that Bradford's Law remains significant in identifying the most pertinent journals related to the study area.

4.4 Keywords Analysis

Figure 7 provides a clear visualization of the most popular keywords related to project management research. Each keyword is represented by the vertical axis while the horizontal axis depicts the number of occurrences. At the top of the list, "Project Management" is the predominant theme in the dataset with 65 references. This is followed by "project complexity", which was mentioned 37 times. This indicates that both scholars and practitioners are increasingly interested in the impact of complexity on project outcomes. "Complexity" is the third highest keyword with 36 references proving that complexity is not only a general issue but also especially important in the construction industry while the "construction projects" and "decision making" appear 20 and 15 times respectively highlighting the significance of managerial decisions and sector-specific obstacles in project success.

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Figure 7: Word Cloud

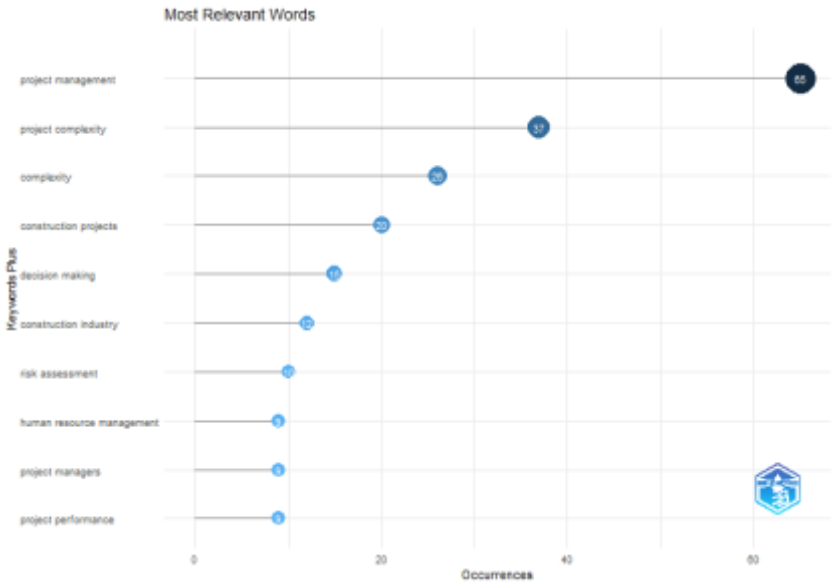

Figure 8: Most Relevant Words

Further, "construction industry" and "risk assessment" point out the complexity of project management, highlighting the critical roles of assessing uncertainties and managing personnel which are nearly 10 references. The lowest number of keywords used in publications are "Human Resource Management", "Project Managers" and "Project Performance" which is 9 references each. The chart shows that project management is both theoretical and practical, with a focus on ideas like complexity and decision-making. It shows a lot of concepts that are special to the construction business and stresses how important risk assessment and managing people are. In general, it talks about the main problems and things to think about when doing research on project management. It stresses how hard it is to deal with uncertainty and manage people to make a project successful.

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4.5 Keyword co-occurrences

Figure 9: Keyword co-occurrences

This diagram (figure 9) provides a conceptual map that highlights the interconnected themes of project management and project complexity positioning them as the central focus of the visualization. These two large nodes represent the most important areas and the smaller nodes that are spread out from larger ones denote distinct but related subtopics. The connections between nodes illustrate the interrelations, influences, and contributions to the broader discussion on project management across many contexts. Color coding and node sizes add further layers of meaning to this capture. The size of nodes vary with the importance of the themes and the colors group related topics into clusters, making it simpler to identify thematic categories. The web of links visually supports the idea that project management is not a straight line but a dynamic area shaped by many different aspects, including technical systems, people, and organizations.

At the center, the encompassing concepts like decision support systems, organizational complexity, forecasting, and project success are represented by the red cluster. These keywords emphasize managerial and organizational perspectives, concentrating on the impact of complexity on decisions, performance, and outcomes. The strong associations among these terms and the fundamental nodes illustrate their significance in transforming complexity theory into practical instruments for project management. The green cluster on the right emphasizes quantitative and analytical methodologies. The terminology employed includes structural equation models, cluster analysis, complex networks, uncertainty, and new product development initiatives. This implies a considerable methodological preference for modelling and quantitatively evaluating complexity and its effects on project performance.

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A purple cluster at the core pertains to risk management, risk assessment, machine learning, and infrastructure projects. This illustrates the increasing usage of modern data-driven methodologies and predictive analytics to manage the risks associated with complex projects, particularly within the realm of infrastructure. The occurrence of digital transformation in proximity illustrates how emerging technologies are altering project management methodologies. A blue cluster on the left illustrates themes related to construction, including the construction sector, architectural design, building projects, and information management. This demonstrates that construction remains a significant area of study for project complexity due to its integration with other disciplines and unpredictability.

Pink and orange smaller clusters indicate the topics such as megaprojects, developing countries, complexity management and complexity indicators. These themes show the new study directions that are relevant to the current scenario. The diagram shows a clear change in project management research towards approaches that are interdisciplinary, data-driven, and focused on complexity. It also shows how traditional management ideas are being combined more and more with advanced analytical methods and real-world application areas.

4.6 Trend Topics

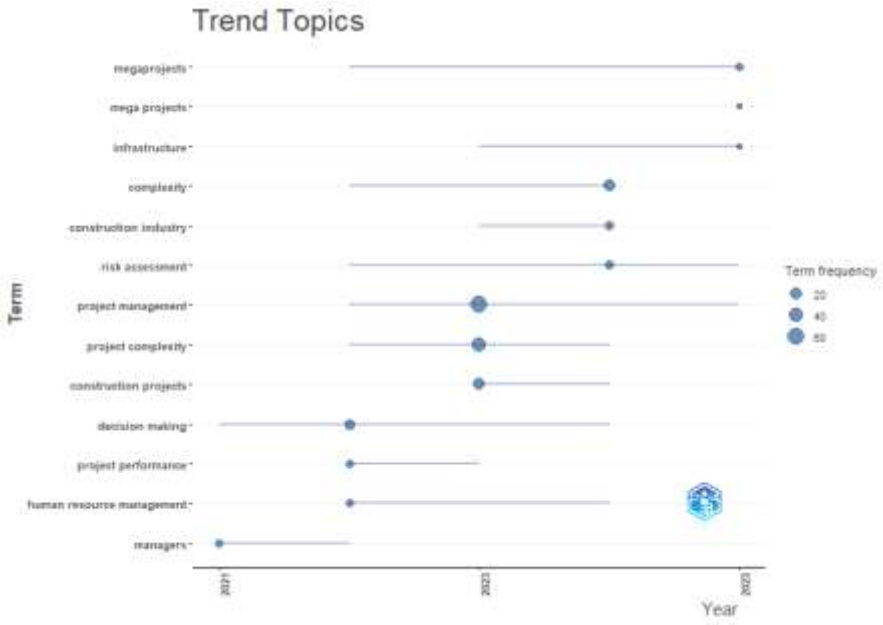

Figure 10: Trend Topics

This Graph (figure 10) shows the thematic maturity within research and industry discourse from 2021 to 2025. The Y and X axes represent the topic and the year respectively. Instead of looking at the topics one at a time, the data shows that there is a progressive shift from broad management underpinnings to more complicated, large-scale project contexts. The years 2021 and 2022, the focus

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is on broad ideas about organizations and people, like "managers" and "human resource management". This shows that initial focus was on leadership, workforce coordination and fundamental management structures that help projects get done.

By 2023, the field reached a massive peak in core operational themes. Project Management emerged as the most prominent topic with 60 term frequency, alongside project complexity and construction projects are the following themes with 40 and 20 term frequencies within this time period. This highlights a time when both academics and practitioners were very interested in figuring out how to plan, control, and deliver projects that were getting more and more complicated. This phase might be thought of as a time of consolidation, when basic management ideas are put to use in real-world situations.

As the timeline progresses toward 2025, the focus tends onto large-scale development significantly. Terms such as megaprojects, mega projects and infrastructure exhibit late-stage peaks and persistent importance. At the same time, risk assessment, construction industry and complexity that are cross-cutting analytical topics remain consistently evident, highlighting their significance across all project dimensions. In a nutshell, this visualization captures a transition from human-centric management toward the technical and logistical challenges of complex infrastructure systems.

4.7 Three- fields plot

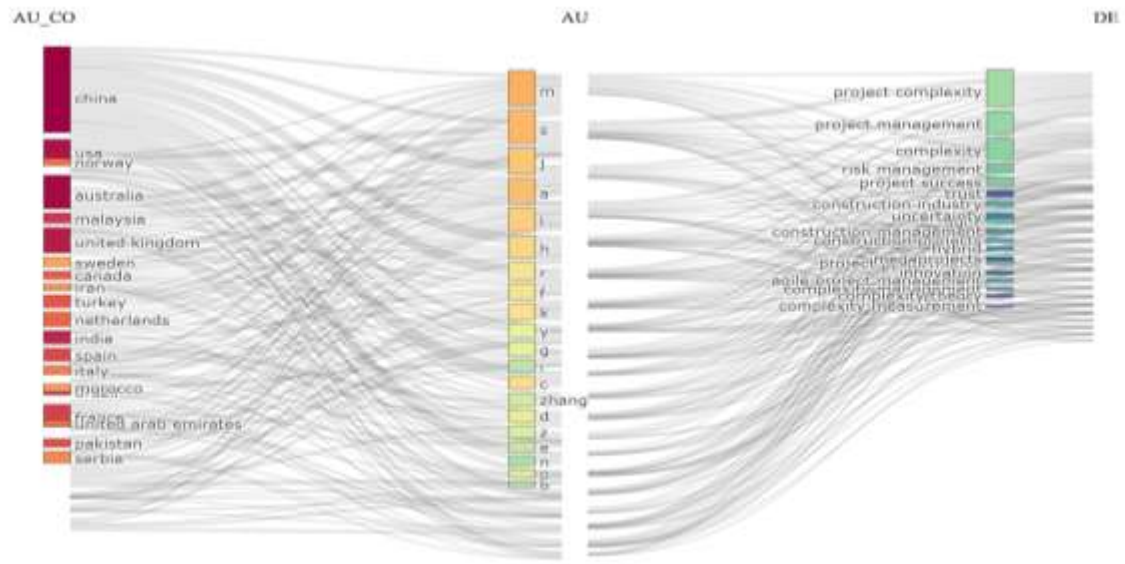

Figure 11: Three-fields plot

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The figure 11 captures the interconnected relationships between three primary categories: geographical regions (AU_CO), individual authors (AU), and key research themes or topics (DE). On the left, there are countries; in the center, author initials or names; and on the right, study domains or keywords. China plays a vital role in contribution to the research, as proven by its considerably thicker flow line relative to other nations such as Norway, USA, Australia, Malaysia, the United Kingdom and so on. This suggests an increased quantity of publications or enhanced academic engagement from Chinese researchers in this specific area of study. Canada, Iran, and Sweden are all big donors, but they don't have a lot of representatives.

In the core portion, each author acts as a link between their country and the domain of research. Certain author names are reiterated or more prominent, indicating their significance as key contributors or their considerable research presence. The color gradient transitioning from orange to green may signify the volume of research output or the impact factor linked to each author. Project complexity, project management and complexity are the most dominant research areas that stand out on the right side. Other notable themes are risk management, project success and trust while megaprojects, complexity theory and complexity measurement are the more niche topics that are visible at the bottom of the list. The figure serves as a network map linking global engagement to specific intellectual outcomes. The research is geographically broad yet mostly concentrated on the intricacies of management in the construction and project management industries.

4.8 Tree Map

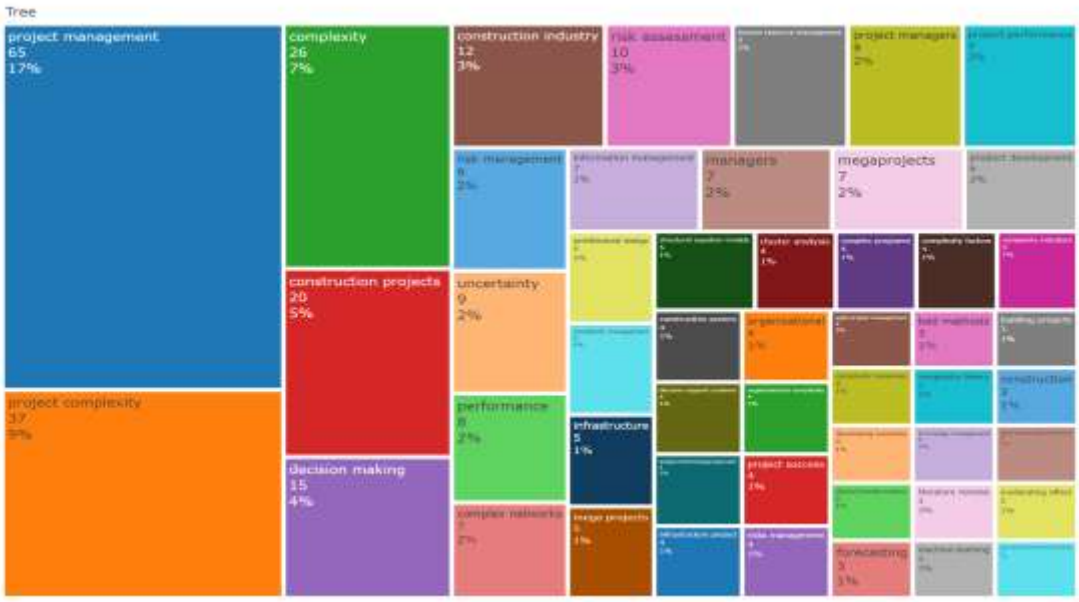

Figure 12: Tree Map

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The figure 12 provides a comprehensive overview of the principal study themes in project-related research. It accomplishes this by illustrating the frequency of each topic's occurrence and its relevance compared to other topics. The sizes of each rectangle represent the quantity of articles or mentions, while the percentage figures indicate the contribution of each theme to the overall dataset. As the figure depicts “project management” is the most salient theme accounting for 65 occurrences which is 17 as a percentage. Its predominant size shows the crucial role in study and practice, acting as an umbrella for the exploration of multiple subtopics. Project complexity is the theme that has second highest instances. It is 9% representing 37 occurrences while the next major topic is complexity that has 26 incidences.

Construction focused themes also occupy a prevalent portion of the capture. Construction projects and the construction industry recorded 20 and 12 instances in that order, highlighting the importance as the main implementation sector for project management studies. The analytical and managerial aspects including decision making, risk assessment and risk management that are 15, 10 and 9 occurrences respectively indicate a persistent commitment to enhancing project outcomes amid uncertainty. According to the tree map, all other themes have incidents quantity below 10 and we can classify them as human and organizational aspects, performance-oriented topics and emerging and specialized areas. Some of them are uncertainty, performance, product development, managers, mega projects with 2% of occurrences while the infrastructure, architectural design, project success and forecasting with 1% of incidents. Their presence indicates a diversification of research towards large-scale advancements and sophisticated analytical techniques, despite their current contribution being a minor fraction of overall publications.

Overall, this tree map illustrates the research landscape is mostly based on project management principles. However, it is becoming more complex, risky and challenging to constructions and further moving towards massive infrastructure and more advanced methods.

5. DISCUSSION

The adoption of Hybrid Project Management (HPM) methodology has arisen as a strategic reaction to the growing instability and technological constraints in the construction sector (Khan & Qaiser, 2025). HPM aims to improve project performance in financial, client, and quality aspects by combining the systematic planning and predictability of Traditional Project Management (TPM) with the adaptive flexibility of Agile Project Management (APM) (Khan & Qaiser, 2025). In the context of the developing countries construction sector, where projects frequently encounter substantial performance problems and diverse stakeholder demands, comprehending the influence of project complexity is crucial for attaining project success (Bhangale et al., 2025).

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Project complexity is characterized as a system's attribute that complicates the understanding, prediction, and regulation of its behavior, despite the availability of considerable information (Mata et al., 2023; Zheng et al., 2023). In the construction industry, this complexity is generally classified using the Technical, Organizational, and Environmental (TOE) framework (Lin et al., 2025; Zheng et al., 2023). In developing countries, complexity frequently arises from environmental and geographical issues, including difficulties in land acquisition, delays in utility relocation, and the management of many stakeholder interests. These elements generate a dynamic environment in which conventional, linear "waterfall" models frequently fail to adapt, resulting in cost overruns and timetable extensions (Bhangale et al., 2025; Sruthilaya et al., 2024).

HPM functions as a mechanism of organizational ambidexterity, enabling firms to maintain stability while fostering the agility required to address emerging risks (Khan & Qaiser, 2025; Patrucco et al., 2025). The sources indicate that the success of a project management approach depends on the alignment between the selected practices and the project context (Patrucco et al., 2025). For example, when customization or technological complexity is substantial, incorporating agile methodologies into a conventional framework enables more frequent decision-making processes and improved alignment with changing requirements. In the construction industry, where fluctuations are common, this hybridity facilitates a "best of both worlds" approach that offers a more robust response to technological advancements and market changes (Bhangale et al., 2025; Khan & Qaiser, 2025).

An essential observation from the sources is that project complexity serves as a substantial moderator that can either diminish or need specific management actions (Fazil et al., 2024; Lin et al., 2025). Elevated complexity can diminish the beneficial impacts of traditional performance metrics and control systems by presenting unexpected events that disrupt established strategies (Lin et al., 2025). Nevertheless, the sources suggest that complexity can be a "double-edged sword"; although it presents risks, its emergent characteristics may create new avenues and chances for innovation when managed by a proficient project team (Thuy & Anh, 2024).

In complicated settings, the association between management methods and project success is typically affected by things like collaboration quality (TWQ) (Khan & Qaiser, 2025). High TWQ, which means working together, talking to each other, and trusting each other, is the key that lets HPM lead to performance gains even when things are very complicated (Khan & Qaiser, 2025). Evidence indicates that in extremely complex construction projects, the likelihood of success increases when team members are incentivized to exhibit project citizenship behavior, transcending their formal duties to settle inter-organizational issues and enhance outcomes (Bibi et al., 2025).

These findings indicate that uniform project management strategies are inadequate for the

contemporary construction industry (Hu et al., 2023; Khan & Qaiser, 2025). Project managers must evaluate the structure of complexities such as the number of stakeholders and the level of technological innovation prior to project launch to ascertain the most effective hybrid configuration (Hu et al., 2023; Lin et al., 2025). The sources highlight that stakeholder integration is an essential element of this technique, since it mitigates distrust and information deficits in complicated projects (Ominde et al., 2024).

Ultimately, attaining project success in necessitates a transition from solely efficiency-oriented measures to a more comprehensive perspective that encompasses stakeholder satisfaction and sustainable value generation (Heredia-Rojas et al., 2022; Mata et al., 2023). By employing HPM and recognizing the influence of complexity, enterprises can formulate adaptive and adaptable strategies that guarantee the achievement of project objectives even under stormy circumstances (Khan & Qaiser, 2025). This entails cultivating an inclusive leadership approach that promotes involvement and accessibility, so augmenting the team's capacity to address the issues inherent in large-scale construction projects (Bibi et al., 2025).

6. CONCLUSION

This study aimed to investigate the effect of project complexity on the application of Hybrid Project Management approaches and their impact on project success in the construction industry. This research offers an integrated understanding of how complexity influences the efficacy of hybrid management systems by a thorough systematic literature review and bibliometric analysis of 146 peer-reviewed papers. The results unequivocally indicate that project complexity, which includes technical, organizational, and environmental aspects, is not simply a contextual obstacle but a critical determinant influencing the efficacy of project management approaches. Hybrid Project Management is an optimal strategy for intricate construction settings, integrating the systematic rigor of conventional methodologies with the flexibility and reactivity of agile techniques. Nevertheless, the review emphasizes that HPM is not universally efficacious; its effectiveness is significantly contingent upon the complexity and intensity of the project, the quality of team communication, stakeholder integration, and leadership proficiency.

In the developing countries context, where construction projects frequently involve regulatory ambiguity, resource limitations, and multiple stakeholders, the alignment between project complexity and management strategy is essential. The literature suggests that neglecting to identify and evaluate complexity during the project initiation phase can substantially diminish the advantages of hybrid methodologies. Conversely, when complexity is proactively addressed, HPM has the capacity to convert ambiguity into avenues for innovation, knowledge acquisition, and value generation. This study enhances the project management body of knowledge by integrating fragmented research on

complexity and hybrid techniques, establishing project complexity as a significant moderating variable instead of a mere background condition. The findings indicate that construction organizations ought to implement context-sensitive hybrid frameworks, enhance collaborative capacities, and bolster managerial competencies to efficiently navigate complicated project contexts. This review is constrained by its dependence on secondary data and a singular database, notwithstanding its contributions. Subsequent research ought to concentrate on empirical validation via case studies and quantitative modelling in the construction industry to evaluate the claimed correlations. This study emphasizes the need to transcend uniform project management solutions and promotes adaptive, complexity-conscious hybrid methodologies to attain sustainable project success.

REFERENCES

Álvarez-Espada, J. M., Fuentes-Bargues, J. L., Sánchez-Lite, A., & González-Gaya, C. (2024). Complexity assessment in projects using small-world networks for risk factor reduction. *Buildings, 14*(12), Article 4065. https://doi.org/10.3390/buildings14124065

Azmat, Z., & Siddiqui, M. A. (2023). Analyzing project complexity, its dimensions and their impact on project success. *Systems, 11*(8), Article 417. https://doi.org/10.3390/systems11080417

Bakhshi, J., Golzad, H., Martek, I., Hosseini, M. R., & Papadonikolaki, E. (2024). Unveiling the complexity code: Navigating BIM-enabled projects with a project management complexity index. *Engineering, Construction and Architectural Management*. https://doi.org/10.1108/ECAM-07-2023-0702

Bhangale, K., Joshi, K., Gupta, R., & Gardas, B. (2025). Assessing project complexity factors for railway megaprojects: A Delphi-BWM approach. *Journal of Engineering, Design and Technology, 23*(3), 973–997. https://doi.org/10.1108/JEDT-07-2022-0398

Bibi, H., Bhaumik, A., & Haider, S. A. (2025). Impact of inclusive leadership on project success through mediating role of project citizenship behavior: Project complexity as a moderator. *Journal of Project Management, 10*(4), 629–648. https://doi.org/10.5267/j.jpm.2025.8.006

Elrayah, M., & Mirzaliev, S. (2024). Project management capabilities and inventory control impact on project success: Does project complexity matter? *International Journal of Instructional Cases, 8*(2).

Fazil, M. W., Muhamad Tamyez, P. F., & Lee, C. K. (2024). Enhancing cost estimation performance through effective organizational control: The moderating role of project complexity in construction projects. *International Journal of Construction Management, 24*(15), 1630–1642. https://doi.org/10.1080/15623599.2023.2286048

Heredia-Rojas, B., Liu, L., Ramírez-Correa, P., & Mariano-Melo, A. (2022). Moderating effects of requirements uncertainty and project complexity on value creation processes and project value: A multigroup analysis via partial least squares structural equation modeling. *Mathematical Problems in Engineering, 2022*. https://doi.org/10.1155/2022/4106360

Hu, Z., Wu, G., Zheng, J., Zhao, X., & Zuo, J. (2023). Unravelling effect of project complexity on project success and project management success: A meta-analytic review. *Journal of Civil Engineering and Management, 29*(6), 542–560. https://doi.org/10.3846/jcem.2023.19553

Khan, U. A., & Qaiser, M. (2025). Hybrid project management and its effects on project performance. *International Journal of Organization Theory & Behavior*. https://doi.org/10.1108/IJOTB-09-2024-0166

Liberati, A., Altman, D. G., Tetzlaff, J., Mulrow, C., Gøtzsche, P. C., Ioannidis, J. P. A., Clarke, M., Devereaux, P. J., Kleijnen, J., & Moher, D. (2009). The PRISMA statement for reporting systematic reviews and meta-analyses of studies that evaluate healthcare interventions: Explanation and elaboration. *BMJ, 339*, b2700. https://doi.org/10.1136/bmj.b2700

Lin, W., Wang, G., Ning, Y., Ma, Q., & Dai, S. (2025). The effects of performance measurement on megaproject performance: The moderating effects of project complexity. *Engineering, Construction and Architectural Management, 32*(1), 172–193. https://doi.org/10.1108/ECAM-02-2023-0107

Lukhele, T., Botha, B., & Mbanga, S. (2021). Exploring project complexity relations to scope changes in construction projects: A case study of NEC projects in South Africa. *Construction Economics and Building, 21*(2), 18–33. https://doi.org/10.5130/AJCEB.v21i2.7518

Mata, M. N., Martins, J. M., & Inácio, P. L. (2023). Impact of absorptive capacity on project success through mediating role of strategic agility: Project complexity as a moderator. *Journal of Innovation & Knowledge, 8*(1). https://doi.org/10.1016/j.jik.2023.100327

Ominde, D., Ochieng, E. G., & Zuofa, T. (2024). Multilateral analysis of stakeholder integration, project complexity and project performance on information technology (IT) projects.

Patrucco, A. S., Selviaridis, K., & Ciccullo, F. (2025). Supply chain integration for collaborative innovation projects: Unraveling the role of project complexity and project management methods. *Journal of Business Logistics, 46*(4). https://doi.org/10.1111/jbl.70031

Qianqianju. (2025). Exploring the governance role of interface management in addressing project complexity of large-scale engineering projects. *Engineering, Construction and Architectural Management*. https://doi.org/10.1108/ECAM-12-2024-1754

Ramanathan, J. B., & Rathore, A. (2024). Identification of sources of complexity in various types of building projects in India based on design and performance attributes. *Buildings, 14*(8), Article 2331. https://doi.org/10.3390/buildings14082331

Sing, M. C. P., Edwards, D. J., Leung, A. W. T., Liu, H., & Roberts, C. J. (2022). A theoretical framework for classifying project complexity at the preconstruction stage using cluster analysis techniques. *Engineering, Construction and Architectural Management, 29*(9), 3754–3774. https://doi.org/10.1108/ECAM-09-2020-0726

Son, J. W. (2022). Complexity and dynamics in construction project organizations. *Sustainability, 14*(20), Article 13599. https://doi.org/10.3390/su142013599

Sruthilaya, D., Vilventhan, A., & Gopal, P. R. C. (2024). Analysis of project complexity factors and

their interdependencies in metro rail projects. *Built Environment Project and Asset Management, 14*(2), 260–277. https://doi.org/10.1108/BEPAM-09-2023-0159

Sruthilaya, D., Vilventhan, A., & Gopal, P. R. C. (2025). Development of a project complexity measurement model for metro rail projects. *Engineering, Construction and Architectural Management, 32*(4), 2728–2744. https://doi.org/10.1108/ECAM-08-2023-0845

Su, Y., Liu, J., & Zheng, Z. (2025). Enhancing the green construction performance resilience in infrastructure projects: A complexity perspective. *Buildings, 15*(15), Article 2594. https://doi.org/10.3390/buildings15152594

Tennakoon, W. D. N. M. S., Janadari, M. P. N., & Wattuhewa, I. D. (2024). Environmental sustainability practices: A systematic literature review. *European Journal of Sustainable Development Research, 8*(3). https://doi.org/10.29333/ejosdr/14604

Thuy, D. T. T., & Anh, T. T. (2024). Linking transformational leadership and project success: Role of work engagement and project complexity. *Journal of Eastern European and Central Asian Research, 11*(2), 320–331. https://doi.org/10.15549/jeecar.v11i2.1619

Ünsal Altuncan, I., & Vanhoucke, M. (2025). Duration forecasting in resource-constrained projects: A hybrid risk model combining complexity indicators with sensitivity measures. *European Journal of Operational Research, 325*(2), 329–343. https://doi.org/10.1016/j.ejor.2025.03.012

Zheng, J., Gu, Y., Luo, L., Zhang, Y., Xie, H., & Chang, K. (2023). Identifying the definition, measurement, research focuses, and prospects of project complexity: A systematic literature review. *Engineering, Construction and Architectural Management, 30*(7), 3043–3072. https://doi.org/10.1108/ECAM-05-2021-0425