

REVIEW ARTICLE

Research trends in megaprojects: A systematic review

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Abstract

Megaprojects have become one of the top topics of construction management literature for the last two decades. Conducting a structured and systematic literature review enables the investigation of research trends in megaprojects. This study aims to identify and categorize key research trends, analyze their evolution over 2013–2023, and review applied methodologies. The first step of the literature review showed that megaprojects had caught the attention of researchers by the early 1990s. However, this topic gained popularity after 2000 and received significant attention by 2016. Therefore, this study focused on the articles and reviews published between 2013 and 2023 in selected leading construction journals using the SCOPUS database. According to the comprehensive literature review; organizational management, project management, strategic management, the performance of megaprojects, risk management, and innovation were identified as the main research topics. Within the context of this study, research methods and techniques used in articles concerning megaprojects were also reviewed. Case studies, questionnaire surveys, interviews, and literature reviews/analyses were identified as the research methodologies that were applied in megaproject studies. Structural equation modeling (SEM), content analysis, regression analysis, and factor analysis were used as research techniques in studies related to megaprojects. The results of this study indicate that performance, strategic management, innovation, and risk management remain promising for future research. This review provides a structured synthesis of the existing literature and identifies emerging areas for future academic research on megaprojects in construction management. Also, findings of the study offer insights for practitioners and policymakers to better align governance and innovation in megaprojects.

1. Introduction

Megaprojects are mainly defined as large-scale, complex, and long-period construction projects having at least a US billion-dollar budget [1, 2]. Flyvbjerg [3] stated that investments in mega projects ranging from US&6 to US&9 trillion per year, or approximately 8% of global GDP after

2000. The term “mega” is a scientific and technical unit of measurement, denoting one million [3]. Besides, “mega” connotes greatness, largeness, vastness, significance, height, mighty, and importance. Examples of current megaprojects include nuclear and hydropower plants, offshore oil and gas platforms, airports, motorways, bridges, tunnels, and canals, which have shown an

increasing trend in the construction industry. Thus, megaprojects have become one of the main research topics in construction management (CM) literature over the past two decades.

According to Sheng [4] construction megaprojects are one of the main types of megaprojects aiming improvement in people's lives and facilitate social development. Morris [5] has defined megaprojects as invariably changing systems. Large scales and long durations of these projects lead to increased complexity and enormous investment, as well as great social and environmental impacts. Due to high investment costs and high level of risks, megaprojects are usually financed by governments and are characterized by complexity, innovation and enormous resource consumption [3, 6-9].

The most commonly accepted definition of megaprojects was provided by Flyvbjerg [3]. Flyvbjerg [3] defined megaprojects as "large-scale complex ventures that typically cost US\$1bn or more, take many years to develop, involves multiple public and private stakeholders, are transformational and impacts millions of people".

Selznick's first book [10] on megaproject management within the Tennessee Valley Authority in the USA is considered to be the first study in megaproject literature by researchers [11]. Prominent examples of megaprojects in construction include large transportation projects like London's cross-rail and the Edinburgh Tram Link project, bridges such as the Oresund link between Denmark and Sweden, and energy projects, along with iconic public architecture like the Burj-Al-Arab Hotel in Dubai and the Guggenheim Museum in Bilbao. By 1990, megaprojects had become important tools in the global political and economic competition among many countries [12].

Megaprojects in construction involve substantial investments aimed at generating significant social and environmental impacts. However, the failures of megaprojects can lead to severe economic and social damages. Moreover, socio-economic, economic, and political risks that contribute to uncertainty are closely intertwined

with the overall performance of construction megaprojects [13]. Managing these risks is crucial for professionals dealing with the complexity of construction megaprojects. Researchers have highlighted the necessity of innovative approaches to manage this complexity in construction management projects [14]. It is also very important to realize that megaprojects are not just exaggerated versions of smaller projects [3]. This point of view makes it clear why managing megaprojects is challenging due to their complexity, stakeholder involvement, and advanced technological levels required. Effective project management that deals with these complexities appears to be vital for achieving overarching goals of megaprojects with high performance overall.

Since complexity is the main challenge of megaprojects, management issues such as contractor and supplier selection, supply chain management, interface management, program management and cost management have been key research topics of megaprojects in (CM) literature. Megaprojects in construction emerged as a significant area in the field of construction engineering and management in the early 2000s and have gained popularity over the following two decades. It is obvious that megaprojects of increasing scale are being undertaken worldwide, and they continue to be on the agenda of researchers.

The study by Hu et al. [15] is the first attempt to systematically analyse the literature of megaprojects in construction. It covers a bibliographic analysis of megaprojects in construction from 2000 to 2010. Following Hu et al. [15], studies based on a systematic literature review focused on stakeholder management, organizational behavior, network perspective, performance measurement methods and megaproject management systems in megaprojects [16-22].

Despite these contributions, a comprehensive and current synthesis of research trends in megaproject literature—particularly within construction management—remains limited. Therefore, this study seeks to fill that gap through a

systematic literature review of scholarly articles published between 2013 and 2023 in selected construction management journals indexed in SCOPUS. In this context, research trends are defined as measurable developments in publication volume, thematic emphasis (research focus areas), and methodological approaches over time. Accordingly, this study aims to:

1. Identify and categorize the dominant research themes in construction megaproject studies;
2. Analyze how research focus areas have evolved over the past decade;
3. Examine the research methodologies and analytical techniques used in these studies;
4. Highlight emerging and underexplored areas to inform future research.

In addition to its academic contribution, this study offers practical insights for industry practitioners and policymakers, helping them align governance, risk, and innovation strategies in megaprojects. Megaprojects are large-scale, high-risk, and capital-intensive initiatives, and despite their significance, the construction management literature remains fragmented, with prior studies often focusing on isolated topics such as governance, risk, or performance. This study bridges this gap by systematically analyzing how megaproject research has evolved over the past decade (2013–2023), providing an integrated understanding of thematic and methodological developments. Through its clearly defined objectives, findings of the study provides a structured synthesis of existing knowledge and highlights where future megaproject research is heading.

2. Research Methodology

In accordance with the assertion that a systematic analysis of papers published in academic journals would help researchers in exploring the current status and future trend of a selected topic, this study applies a systematic literature review approach to identify research trends in construction megaprojects by analyzing peer-reviewed journal articles published between 2013 and 2023. The review period of 2013–2023 was chosen to capture

a complete and methodologically consistent decade of publications in peer-reviewed journals on August 2023. The review process was conducted using the SCOPUS database, selected for its wide disciplinary coverage and established use in prior construction management reviews [23–26]. To achieve a comprehensive review of megaproject-related literature, a three-stage filtering process was conducted, enabling detailed content analysis of articles published between 2013 and 2023. The conceptual framework of the study, adapted from Hong et al. [24], is presented in Fig. 1 and outlines the sequential steps of the literature review process commonly adopted in construction management research. In addition, to enhance methodological transparency and align with interdisciplinary review standards, a PRISMA-style flow diagram is included. Fig. 2 visually summarizes the article identification, screening, and selection process, thereby supporting the reproducibility of the study's search and inclusion criteria.

In the first stage, articles and reviews published between 2013 and 2023 were retrieved using a Boolean search—a logic-based query structure that combines keywords using operators such as AND, OR, and NOT to refine and control database results. The search was applied to the title, abstract, and keyword fields in SCOPUS to ensure comprehensive retrieval of relevant studies. A total number of 2251 of papers were identified in the first stage of this research (22 August 2023). The exact search was as follows: TITLE-ABS-KEY (megaprojects) OR ("mega projects") OR (mega-projects), AND PUBYEAR > 2012 AND PUBYEAR < 2024.

In the second stage, the results were refined by limiting the search using keywords “Megaprojects”, “Project Management”, “Mega Projects”, “Megaproject” and “Construction Industry”. The field of search was also refined to the areas including; business management and accounting and engineering, in articles or review by limiting the language to English. A total number of 429 papers were identified on 22 August 2023 after limiting the source type to journals. The refined Boolean query was:

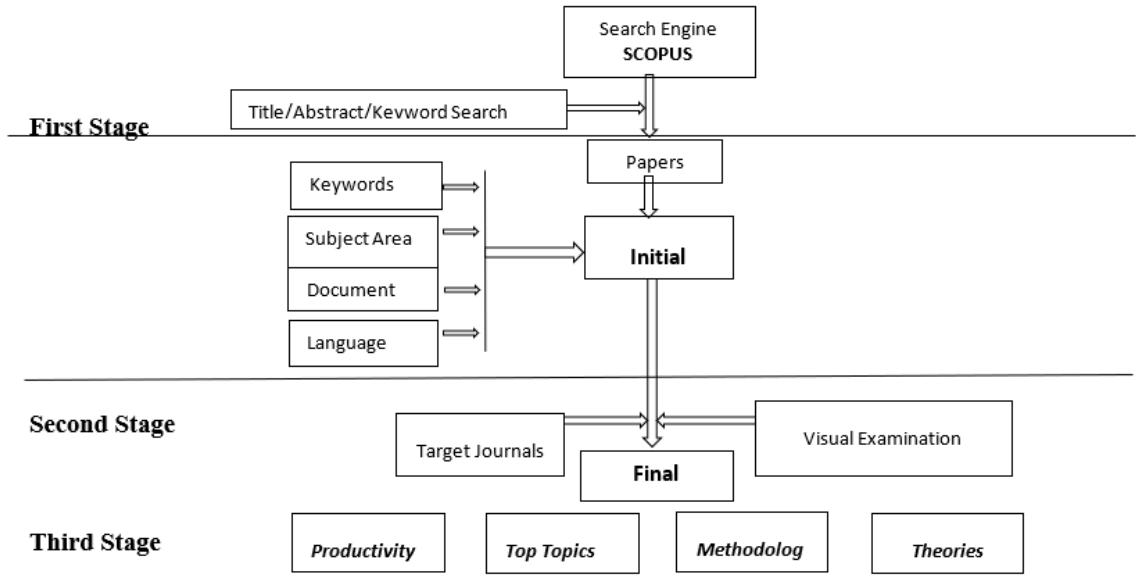


Fig. 1. Research methodological framework [24]

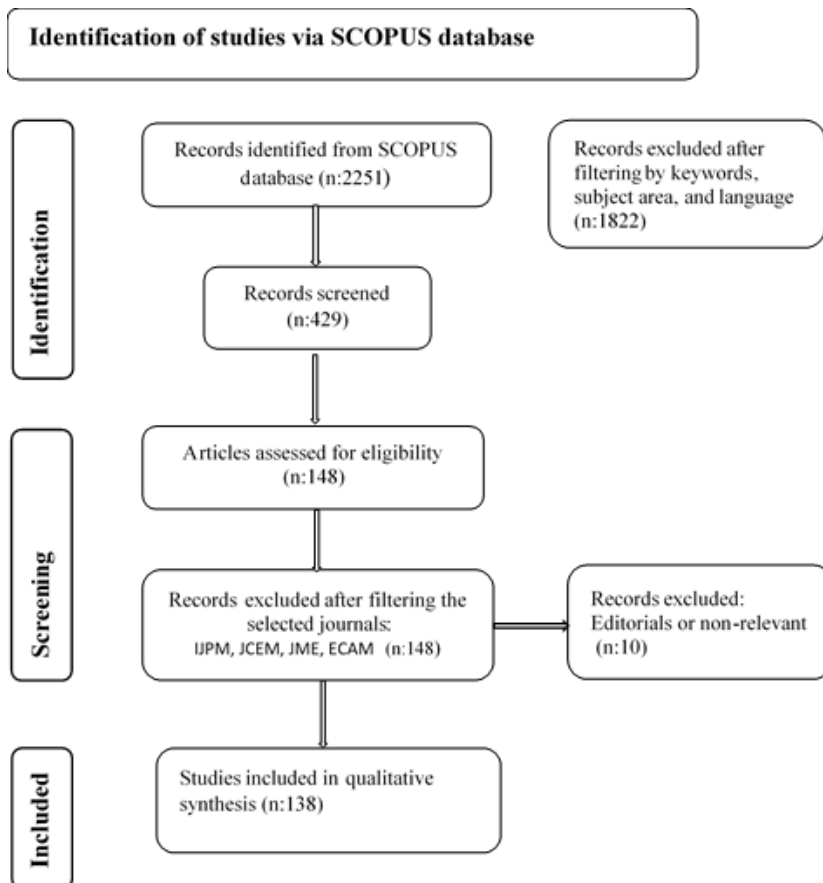


Fig. 2. The PRISMA diagram of the systematic review process

LIMIT-TO (EXACTKEYWORD, "Megaprojects") OR LIMIT-TO (EXACTKEYWORD, "Project Management") OR LIMIT-TO (EXACTKEYWORD, "Mega Projects") OR LIMIT-TO (EXACTKEYWORD, "Megaprojects") OR LIMIT-TO (EXACTKEYWORD, "Construction Industry") AND LIMIT-TO (SUBJAREA, "ENGINEERING") OR LIMIT-TO (SUBJAREA, "BUSINESS MANAGEMENT") AND LIMIT-TO (DOCTYPE, Article) OR LIMIT-TO (DOCTYPE, Review) AND LIMIT-TO (LANGUAGE, "English") AND LIMIT-TO (SRCTYPE, Journal).

In the third stage, four top-tier journals were selected based on the number of megaproject-related articles published between 2013 and 2023, ensuring both relevance and research depth. These journals were: International Journal of Project Management (IJPM), Journal of Construction Engineering and Management (JCEM), Journal of Management in Engineering (JME), Engineering, Construction and Architectural Management (ECAM). The selection was further supported by their current Scopus/SJR quartile rankings (Q1/Q2), confirming their academic impact and consistent coverage of construction megaproject topics. Finally, a total number of 148 papers were identified on 22 August 2023. The exact search was as follows:

LIMIT-TO (EXTRACTSRCTITLE, International Journal of Project Management) OR LIMIT-TO (EXTRACTSRCTITLE, Journal of Construction Engineering and Management) OR LIMIT-TO (EXTRACTSRCTITLE, Journal of Management in Engineering) OR LIMIT-TO (EXTRACTSRCTITLE, Engineering Construction and Architectural Management).

After a comprehensive review of each paper, ten were excluded; one was an editorial call for research papers on megaprojects, and the others were deemed irrelevant. Therefore, 138 papers were selected to be included in this study. Notably, articles labeled as 'in press' at the time of the search were also retained, even if their formal publication dates were later recorded as 2024 or 2025.

The initial stage of analysis focused on assessing the research productivity of the selected journals by identifying the total number of megaproject-related publications between 2013 and 2023. This was followed by an annual categorization of the articles to track publication trends over time. The final dataset of 138 papers was then systematically examined based on their research topics, methodologies, analytical tools, and underlying theoretical frameworks. The detailed findings and thematic analysis are presented in the following section.

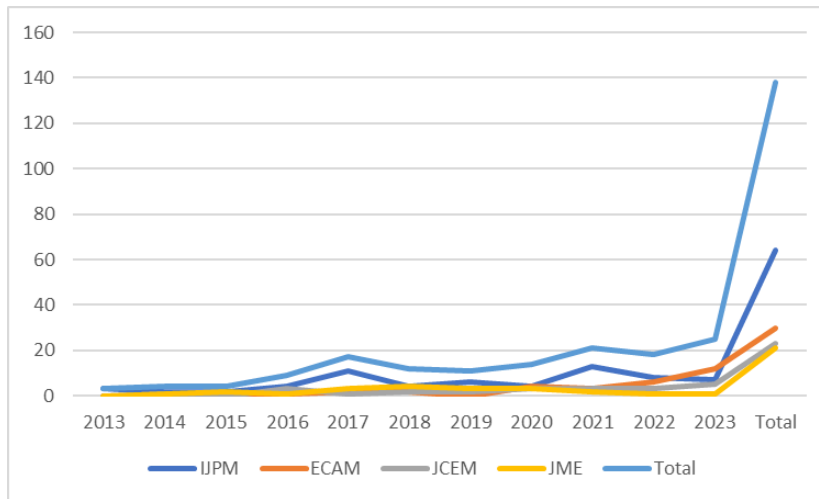
3. Findings and Analysis

This section presents the analytical results of the literature review, highlighting publication patterns, research trends, and methodological approaches in megaproject research over the last decade. The number of papers related to "megaprojects" identified from selected journals for the period 2013-2023 is presented in Table 1. Over the last decade, IJPM has proven to be the most productive journal among other construction journals, with 64 publications on megaprojects. Following IJPM, ECAM published 30 papers, JCEM published 23, and JME published 21. The most productive journal IJPM has published approximately 46% of all articles produced by the selected journals. Table 1 also illustrates the productivity of each selected journal, and the annual trends in paper output. It is evident from Table 1 that IJPM has consistently published articles on megaprojects every year. Furthermore, IJPM has shown an increasing trend in the number of articles published annually on this topic. JCEM and JME began publishing articles on megaprojects after 2014, whereas ECAM started after 2016, with the number of articles peaking in 2023. This growth indicates a sustained and increasing scholarly focus on megaproject complexity, governance, and delivery performance. Fig. 3 visualizes this temporal trend and reinforces the field's maturation over time.

Looking at the selected period, it can be observed that "megaprojects" got the attention of researchers by 2017, and this attention increased in subsequent years, reaching its peak in 2023.

Table 1. Number of megaprojects related papers published in selected top four journals by year

	IJPM	ECAM	JCEM	JME	Total
2013	3	-	-	-	3
2014	2	-	1	1	4
2015	2	-	-	2	4
2016	4	1	3	1	9
2017	11	2	1	3	17
2018	4	2	2	4	12
2019	6	-	2	3	11
2020	4	4	3	3	14
2021	13	3	3	2	21
2022	8	6	3	1	18
2023	7	12	5	1	25
Total	64	30	23	21	138

**Fig. 3.** Annual publication trend of megaproject-related articles (2013-2023)

4. Research Interests in Megaprojects Related Articles

This study analyzes published literature on megaprojects extracted from top-tier construction journals. Through a comprehensive review of publications from 2013-2023, major research interests in the field of megaprojects in construction were identified. Organizational management (1), project management (2), performance of megaprojects (3), strategic management (4), risk management (5), and innovation (6) were determined as the major research topics in (CM) literature related to megaprojects. The study further categorizes these research areas and sub-focuses

based on its findings. Table 2 presents details of the distribution of selected papers across each identified research area.

Organizational management, encompassing governance, stakeholder management, social responsibility, and organizational design, has been the most popular topic in megaprojects research over the past two decades. Since the main challenge of megaprojects is complexity, project and complexity management has also consistently ranked among the most popular topics across all years. Performance of megaprojects, strategic management, risk management, and innovation were identified as the other significant research areas.

Table 2. Major research interests of megaproject articles in the four selected journals

TOPICS	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	Total
Organizational management				3	9	6	7	4	12	4	11	57
Project management	3	3	3	4	3	1	2		4	7	6	36
Performance of megaprojects					3	1	2	2	2	4	2	16
Strategic management		1			1	2		3	1	2	1	11
Risk management			1	1	2			4	1		1	10
Innovation				1		2		1	1	1	2	8

Table 3 provides a summary of these six research topics and their respective subtopics as found in the selected construction journals. It also indicates the percentage representation of each research topic within the overall body of literature

reviewed. These findings from the literature review will be elaborated upon in the following section to highlight key research areas in megaprojects within the construction field, suggesting directions for further studies.

Table 3. Research areas and subfocus in megaprojects studies (2013-2023 end of August)

Research Area	Subtopics	Journals (Count)	(%) of Total
Organizational management	Organizational learning, organizational behaviour, organizational tensions, governance, stakeholder management; citizenship behaviour, relational behavior, effective communication, trust, social responsibility, environmental responsibility, public participation, leadership, social value	IJPM (30), ECAM (11), JCEM (6), JME (10),	41.3
Project management	Complexity management, decision making, supplier selection, change management, cost management, programme management, monitoring and control	IJPM (15), ECAM (8), JCEM (10), JME (3)	26
Performance	BIM implementation, contractor behaviour, success, Key Performance indicators (KPI), top management, corruption, critical success factors (CSF)	IJPM (5), ECAM (6), JCEM (3), JME (2)	11.5
Strategic management	Organizational strategy; Value co-creation, conflict resolution, supply chain management, crisis awareness, perspective taking, programme management	IJPM (6), ECAM (3), JME (2)	8
Risk management	Risk prioritisation, Supply chain risks, political risks, social risks, flexibility, bankability	IJPM (4), ECAM (1), JCEM (2), JME (3)	7.2
Innovation	Competition, technological innovation, open innovation, sustainable development, collaborative innovation, innovation ecosystems	IJPM (4), ECAM (2), JCEM (2)	6

4.1. Organizational management

Being a major indicator of economic and social development of regions, megaprojects are known to be carried out by multiple public and private stakeholders due to their highly technological needs and costs of US\$1bn or more [3]. Consequently, governance and stakeholder management appear to be the most popular topic among articles related to megaprojects in construction. Project governance delineates the interactions among project participants and the adopted mechanisms, significantly influencing mutual trust and relations between stakeholders. Based on this definition, the strong link between governance and stakeholders can be clearly seen [17, 27]. It is evident from the literature that organizational management in the context of megaprojects is predominantly shaped by these two mainstream topics: stakeholder management and governance.

According to the results of this study, organizational management has emerged as the most attractive topic in megaproject-related studies within the (CM) literature. Since 2016, there has been a significant focus on innovative approaches within organizations as a key aspect of organizational management [28-32]. Organizational management in megaprojects has been a core topic of literature by 2016 and be the top topic of megaproject related studies since then.

Interface management has been mentioned as an effective tool for enhancing communication among stakeholders [32]. Tensions between control and flexibility in the different organizational interfaces have been discussed by Szentes and Eriksson [33]. Regarding the importance of governing institutional complexity in megaprojects, Qiu et al. [34] conducted a case study of the Hong Kong-Zhuhai-Macao Bridge project in order to find out the effects of institutional complexity on the project outcomes. Their findings emphasize the significance of addressing institutional complexity to leverage comparative institutional advantages for sustainable organizational competitiveness.

Social responsibility and impact of megaprojects environmental responsibility has also

been discussed in literature [6, 35-37]. The study by Brookes, N. et al. [38] was the first attempt to examine organizational phenomena regarding long-term megaprojects. The temporalities of long-term infrastructure project organizing in relation to risk and knowledge management was the main issue of this research [38].

Innovative collaboration networks based on social network analysis within the architecture, engineering and construction (AEC) industry have been discussed by researchers such as Han, Y. et al. [31]. Additionally, organizational citizenship behavior appears to be another topic in the field of organizational management in megaprojects [6, 39]. A framework of megaproject citizenship behavior including contingent collaboration, compliance, harmonious relationship maintenance, initiative behavior and conscientiousness was developed within the context of the study by Yang, D. et al. [39]. Non-economic motivations driving organizational citizenship behavior in construction megaprojects have also been examined [40].

Although governance and stakeholder management have received considerable scholarly attention, relatively few studies appear to explicitly connect these structures to performance outcomes. This suggests an opportunity for further inquiry into how governance frameworks may shape measurable project success. In contrast, the domain of project management shifts the focus from organizational structures to the technical and procedural complexities involved in delivering megaprojects.

4.2. Project management

The second most attractive topic in construction management literature concerning megaprojects is project management. Given their extended durations and inherent complexity and uncertainty, effective project management approaches are crucial for managing megaprojects. Consequently, project management has become one of the most important research field for researchers. Subareas of project management in megaprojects including; complexity management, interface management, program management, cost management, safety

management, contractor and supplier selection have been in the agenda of researchers for the last two decades [13, 15, 32, 41-47].

Figuring out the need of innovative approaches in managing megaprojects, Gorod et al. [48] proposed a holonic approach in order to manage complexity. Biesenthal et al. [49] suggested applying institutional theory to megaprojects to address complexity, a notion further explored by Mahalingam [50]. Interface management has also emerged as a crucial practice in construction management for megaprojects [32]. Recently, Shen and Xue [41] developed management strategies based on interface independence and strategic influence for various categories of interfaces in megaprojects.

The keys to success in managing megaprojects have also been a focal point in project management research [15, 51, 52]. Zhu et al. [53] investigated the success DNA of the Hong Kong- Zhuhai-Macao Bridge through structured interviews based on interorganizational relationships. Regarding success in megaprojects, the contribution of project management offices towards overcoming complexities has also been investigated by researchers [54]. Furthermore, program management has been highlighted as a key approach for improving the performance of megaprojects in construction, since program management entails a more strategic focus [15, 43]. Adaptability, flexibility, and the design of the roles between clients and delivery partners were found to be the critical aspects of program management for megaprojects [55].

Providing a new direction for megaproject management, Liu et al. [56] investigated the impact of network positions on inter-team conflicts and project success. In addition, paradoxical organizational tensions in megaproject management have also got the attention of researchers [5]. Recently, Wiewiora and Desouza [57] have conducted a systematic literature review on paradoxical tensions in megaprojects and suggested approaches to manage these tensions.

Disruption events and causes of rework in megaprojects have been identified as another

research topic in the field of project management [58-60]. Ansari [58] developed a dynamic simulation model for project change-management policies.

While a variety of project delivery challenges are addressed in the literature, relatively limited work explores how these practices align with broader governance or stakeholder considerations. This opens potential for more integrative research across strategic and operational domains. Whereas project management literature is centered on delivery processes and execution strategies, the performance dimension shifts the focus toward how outcomes are measured and evaluated across the megaproject lifecycle.

4.3. Performance of megaprojects

Results of this study revealed that performance of megaprojects appeared to be another topic in literature [7, 56, 61-69]. It has been observed that researchers focused on the topic of performance in relation with organizational management and project management. Bourne et al. [69] stated that the performance of megaprojects is highly related to project governance and goals. The results of this study also revealed that uncertainty and need for flexibility appears as a result of long duration.

On the other hand, project success and project efficiency were figured out to be two different perspectives dealing with performance. Researchers stated the main differences and the integration between these two perspectives on the performance of megaprojects [63]. Project success has been mentioned as long-term-oriented perspective that considers the outcomes and benefits of the project for both the organization and environment [70]. Issues such as cost overruns, schedule delays, management failures, and organizational challenges contribute to poor performance in megaproject delivery. Addressing these issues is critical for improving the overall performance and success of megaprojects. On the other hand, the poor performance of megaprojects also has major impacts on the organization's reputation and revenue. Since the management of megaprojects faces many challenges due to

complexity, determining the factors that have effects on the performance of megaprojects becomes necessary. Thus, this issue has gained the attention of researchers. Critical success factors impacting the performance of megaprojects have been identified by Caldas and Gupta [61]. He et al. [64] defined key performance indicators to benchmark the success of construction megaprojects. Recently, Zhang et al. [68] determined critical success factors such as BIM implementation, stakeholder management and BIM project performance. From another point of view, the impact of corruption on performance of megaprojects has also been investigated [7]. The study by Locatelli et al. [7] appears to be the only one concerning corruption in megaproject literature.

Although interest in megaproject performance has expanded, there remains a need for more integrated models that consider long-term outcomes and context-specific definitions of success—particularly those that move beyond cost and time metrics. While performance research emphasizes outcome measurement, the theme of strategic management addresses how megaprojects are positioned, initiated, and governed to align with broader organizational or national objectives.

4.4. Strategic management

Strategic management has emerged as another research topic in megaproject literature. It is generally discussed in context of competition, organizational management, and project management issues. Aiming to provide effective and dynamic strategies to form relational contracts in megaprojects, Lu, et al. [71] conducted a case study to discover the mechanisms of collaboration and competition in megaprojects. Program management has been identified as more strategically oriented compared to project management [42]. Concerning concentration and competition, the study by Cheung and Shen [72] analyzed the competitive dynamics within the megaproject market. BIM has also received attention as an innovative tool for project management and strategic management. To identify

the strategic perception of BIM as a new way of working methodology for megaproject construction, a case study on the implementation of BIM in the Istanbul Grand Airport (IGA) construction project has been conducted by Koseoglu et al. [73].

Recently, Zhang, H.M., et al. [68] investigated the implementation of BIM with respect to stakeholder management and project performance, highlighting a strong relationship between BIM applications, stakeholder management and project outcomes.

Focusing on the tensions between project team and local community perspectives in infrastructure megaprojects Cuganesan and Floris [74] emphasized the specific cognitive attributes allowing project teams to be more effective in perspective-taking through balancing both local community and their own perspectives. Social responsibility in megaproject has emerged as a topic gaining attention in the literature, with research indicating that facilities focused on megaproject social responsibility have positive impacts on improving their sustainability [75].

On the other hand; value co-creation has been defined as new organizational strategy that provides solutions to the fragmented and complex practices in megaprojects [76]. Due to their complexity, megaprojects are often found to be vulnerable to crises. Highlighting the vulnerability of megaprojects to crises, Wang and Pitsis [77] identified antecedents of megaproject crises in China. Findings of this study reveals that; strategies concerning crisis orientation and crisis awareness will allow early detection and moderation of future crises. Researchers have also investigated strategies concerning supply chains in megaprojects through comprehensive literature reviews [22].

Strategic management studies have deepened understanding of megaproject initiation and institutional context, yet there remains scope for further integration with project-level decision-making and adaptive delivery mechanisms. As strategic alignment sets the foundation for megaproject direction, the next theme—innovation—examines how emerging technologies

and practices are leveraged to achieve these strategic aims.

4.5. Risk management

Complexity and risk are inherent characteristics of megaprojects. Thus, a growing body of literature has focused on risk management over the past decade. Poor performance in megaprojects often manifests as cost overruns, schedule delay and damage to organizational reputation. Identifying key performance indicators and managing risks are vital steps to improve the overall project. From this point of view, these two perspectives can be considered as the most appropriate tools for improving the performance of the project by identifying potential risks at the outset. Studies concerning risk management in megaprojects cover; risk management models and identification of risks in megaproject construction.

In line with researches focusing on performance management, risk management studies also aimed to improve the performance of the project by developing risk management models. Boateng et al. [78] proposed a risk prioritization model for megaprojects using Analytical Network Process (ANP), considering social, technical, economic, political and environmental risks. Following Boateng et al. [78], Liu et al. [79] developed a practical framework of social risk management in government-driven megaprojects. Shahtaberi et al. [80] investigated the impacts of unknown risks on megaprojects by applying reliability theory. Addressing the importance of complexity in megaprojects, Erol et al. [81] proposed an integrated risk assessment approach, considering complexity. Juarez et al. [82] described the interplay between the development of infrastructure megaprojects and political polarization, focusing on a single case with a longitudinal perspective; the Mexico City New International Airport (NAIM), an infrastructure megaproject that began on September 10, 2014, and was terminated on December 27, 2018, due to political reasons. Recently, Marandi et al. [83] investigated supply-chain risk factors in green construction of residential megaprojects.

While innovation is widely promoted as a performance enabler, empirical studies remain limited in demonstrating how specific innovations contribute to measurable improvements across megaproject phases—particularly in risk-intensive or resource-constrained environments. Closely related to innovation is the theme of risk management, which addresses how uncertainties are anticipated, evaluated, and mitigated throughout the megaproject lifecycle.

4.6. Innovation

Both complexity management and need for highly technological construction require innovative perspectives to enhance the performance of megaprojects. Consequently, innovation has emerged as another topic that has gained the attention in megaproject literature. Brockmann et al. [84] suggested that project complexity influences innovation more profoundly than other industry characteristics based on their research. Complexity has been highlighted as one of the most important challenges of megaprojects. However, it is precisely this complexity that drives the construction industry towards realizing its great potential for innovation. In Iran, Hosseini et al. [85] developed a conceptual model focusing on the contextual factors influencing sustainability in megaprojects across three stages of innovation. Sergeeva and Zanello [86] investigated how innovation is championed and promoted in megaprojects through a multi-case study approach. Proposing appropriate incentive and supervision mechanisms to reduce information asymmetry and improve the efficiency of incentives, Liu and Ma [87] made suggestions on megaproject management concerning technological innovation. Jin et al. [88] explored the relationship between input knowledge in innovation activities and the quality of output in megaproject innovation ecosystems, suggesting an inverted U-shaped relationship for optimal outcomes. Recently, Liu et al. [56] highlighted collaborative innovation among stakeholders as crucial for the successful implementation of megaprojects. The study emphasizes the necessity of collaborative

innovation to overcome the challenges of complexity in megaprojects.

Although risk management is well-represented in the literature, more integrated approaches are needed to connect risk planning with innovation, governance, and real-time project adaptation—especially in the face of escalating complexity and global uncertainty. Together, these six thematic clusters provide a structured lens for understanding how megaproject research has evolved over the past decade and highlight where future inquiry may yield the greatest impact.

4.7. Research methodologies and techniques in megaproject studies

In order to conduct a comprehensive literature review, research methodologies and the analytical tools applied in studies also reviewed in detail. Case study, interviewing and questionnaire survey are the three major categories of data collection techniques in megaproject studies that were reviewed within the context of this study (accounting for 88% of the articles). However, these research methodologies are common in the

area of construction management. Collecting data from the point of professionals and actual cases leads to a clear perspective on situations through in-depth investigation. On the other hand, many studies used these research techniques together [39, 61, 89, 90]. In an example; Xue et al. [91] investigated the impact of governance mechanisms in promoting cooperation and restraining opportunism in Chinese Joint Venture megaprojects by using questionnaire survey and case study as a research methodology. Based on this assumption, each research approach is counted, regardless of whether it was adopted with other methodologies. From this point of view, Fig. 4 depicts the distribution of publications according to research methodology. It is evident from Fig. 4 that the case study approach dominates with 73 out of 140 publications. Case studies are preferred due to their ability to provide detailed, real-world insights into the complexities of megaprojects through direct observation and in-depth investigation. The main reason of using case study as a data collection technique can also be defined with the nature of megaprojects.

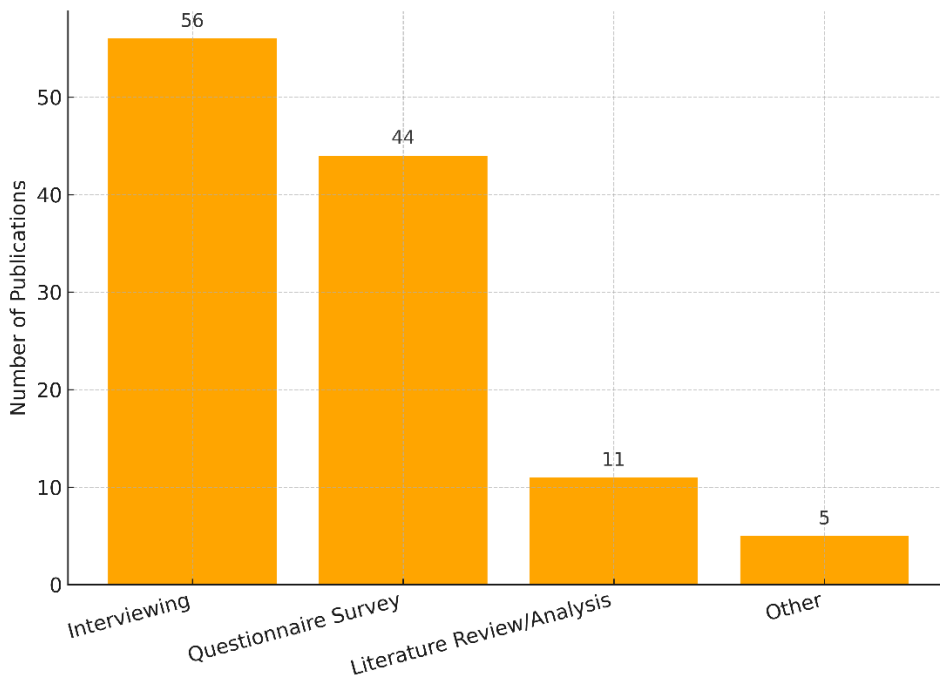


Fig. 4. Research methodologies

Obtaining actual through case studies and interviews based on questionnaires has allowed researchers to understand the nature of this highly complex organizations, since collecting data from professionals leads to acquiring proper knowledge. Interviewing and questionnaire survey are the following research methodologies, with the number of publications 53 and 43 among 140 publications.

According to the findings of the study, literature review/analysis, with the number of 11 publications, ranked as the fourth most favored research technique in megaprojects research. Literature review/analysis is considered as a valid research method when the review is used to develop a conceptual model, theory or highlight gaps in the literature [92, 93]. Publications covering a brief introduction of past studies without the aim of developing conceptual models, theories or suggestions are not considered as using literature review/analysis as a research method. Hu et al. [15] conducted a systematic literature review on megaproject studies for the period of 2000-2010 using bibliometric analysis. This study is noted as one of the most frequently cited papers (161 times) in the field of megaprojects. Following Hu et al. [15], Wiewiora and Desouza [57] conducted an in-depth analysis of 27 selected articles to identify types of paradoxes in megaprojects and approaches to deal with them. Recently, the Preferred Reporting Items for Systematic Review and Meta-Analyses (PRISMA) framework was used in a systematic literature review by Shi et al. [19].

Based on the findings of this study, several research methodologies and theoretical frameworks have been identified that contribute to the understanding of managing megaprojects. For example, Dyer [94] investigated the implementation of megaprojects and the risks associated with social responsibilities in megaprojects from the perspective of cultural sense-making. Institutional Theories used to address some questions that have not been adequately answered regarding megaprojects within the context of the study by Biesenthal et al. [49]. Since the complexity of megaprojects cannot be defined solely by technical issues, the study by

Biesenthal et al. [49] appears to be the first attempt to deal with institutional differences in the environment of megaprojects. Based on principal agent theory, Liu and Ma [87] established an incentive model considering supervision under information asymmetry. Bayesian theory was also adopted to verify the effectiveness of this new supervision method [87].

Recently, Floricel and Brunet [95] developed a process model aiming to disentangle the processes of shaping the symbolism of megaprojects and their influence on stakeholders' engagement. In another study, Liedtka and Locitelli [96] investigated the application of design thinking processes in megaproject management regarding stakeholder engagement. They explored how design thinking delivers value to project management beyond "project design.

Another look of this study is the variation and types of research techniques applied in megaproject studies. The findings of this study showed that out of 140 papers reviewed, 92 used research tools to analyze the data. The classification of research techniques applied in the sample papers is presented in Table 4.

Several papers applied more than one research technique in their studies. Consequently, the total number of observations counted is 97. Structural Equation modeling (SEM) was found to be the major data analysis tool (18 out of 92) among megaproject related papers. Content analysis was frequently used in megaproject papers to determine various aspects based on literature review. Regression analysis and factor analysis were also frequently adopted as a research tool. Additionally, Fuzzy Set Theory, AHP, ANP, DELPHI, qualitative and quantitative analysis, Social Network Analysis and Bibliometric Analysis were also used as a research technique in megaproject literature.

Despite growing methodological diversity, there remains an opportunity for more mixed-method and longitudinal research designs that integrate quantitative and qualitative insights—especially in tracking megaproject performance over time or across phases.

Table 4. Research tools applied megaprojects related studies in CM literature (2013-2023 end of August)

Research tool	Number of observations	Percentage of observations	Example papers
SEM, PLS-SEM, CB-SEM	18	18,56	Wang et al. [97], Zheng and Chang [98], Ma and Fu [99], Zhang et al. [100]
Content Analysis	15	15,5	Di Maddaloni and Davis [16], Yang et al. [39], Derakhshan et al. [17], Stefano et al. [22]
Regression Analysis, Hierarchical Regression Analysis	10	10,3	Brahm and Tarziján [44], Zhang et al. [68]
Factor Analysis	9	9,3	Wang et al. [101] Wang et al. [102], Yin et al. [103], Machiels et al. [104]
Fuzzy-TOPSIS, FUZZY-Delphi, Fuzzy-AHP, Fuzzy Set Qualitative	8	8,3	Liang et al. [105], Okudan et al. [59]
AHP, ANP, Delphi, Delphi-AHP	7	7,2	Semaan and Salem [46], Lin et al. [35], Li et al. [62]
Qualitative and quantitative analysis	6	6,2	Caldas and Gupta [61], Ben Abdallah et al. [66], Zheng et al. [89]
Social Network Analysis	4	4,11	Lu et al. [71], Xia and Xiang [106]
Bibliometric Analysis	3	3	Hu et al. [15], Li et al. [18], Xiao and Hao [107]
Other*	17	17,53	
Total	97	%100	

*Others are once observed research tools, covering Cluster Analysis, Atlas.ti Software, UML (unified modeling language), TOT (Topic over time), BERT "N" mining, system dynamics modeling, RACI Matrix, Nvivo, ANOVA, CI index, PRES (Project reputation evaluation system), Monte Carlo Simulation, Concentration Ratios (CR4), Herfindahl-Hershamann Index (HHI), Systematic Analysis, Thematic Analysis.

The variety of research approaches illustrates the richness of the field but also signals a need for methodological convergence to enhance comparability and cumulative knowledge-building.

4.8. Visualizing research trends through keyword mapping

To complement the thematic synthesis presented in previous sections, a co-occurrence keyword map was generated using VOSviewer software based on the SCOPUS dataset. This bibliometric visualization identifies clusters of frequently occurring keywords, offering a visual representation of how research themes in megaproject literature intersect and evolve. As shown in Fig. 5, distinct thematic clusters—including organizational governance, risk management, innovation, and performance—emerge, reinforcing the analytical categories identified in this review. The visualization also reflects the gradual integration of newer concepts such as stakeholder complexity, sustainability, and

innovation ecosystems, indicating potential directions for future inquiry.

5. Discussion: Limitations and Post-Review Trends (2023–2025)

While this review offers a structured and timely synthesis of megaproject research within construction management, several limitations warrant discussion. First, the scope of the literature search was limited to four high-impact journals indexed in SCOPUS—International Journal of Project Management, Journal of Construction Engineering and Management, Journal of Management in Engineering, and Engineering, Construction and Architectural Management. Although these journals represent leading scholarly outlets in the field, this selection may exclude relevant studies published in multidisciplinary, regional, or emerging journals. However, the choice was justified based on publication volume, topical relevance, and consistent placement in SCOPUS Q1/Q2 quartiles.

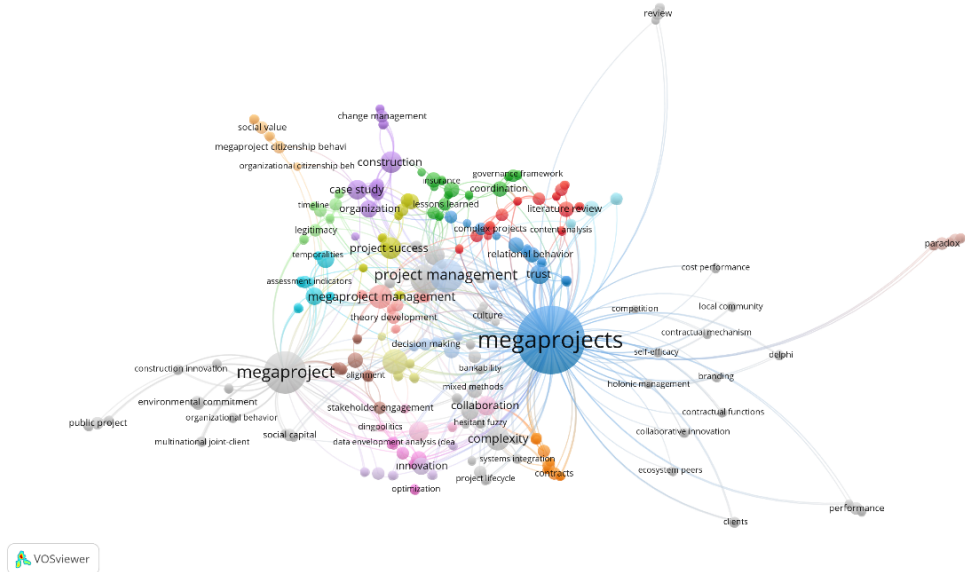


Fig. 5. Keyword co-occurrence map of megaproject research (2013-2023)*

*Generated using VOSviewer based on SCOPUS-indexed publications. Node size indicates keyword frequency; colors indicate thematic clusters.

Second, the review focused on publications from 2013 to August 2023. While this timeframe captures a decade of key developments—especially amid growing infrastructure investment and digital transformation—it may omit earlier foundational contributions or the most recent studies published beyond the initial cutoff. Third, study identification relied on keyword searches in titles, abstracts, and keywords. Despite the use of a structured protocol and PRISMA guidelines, this approach can introduce some subjectivity. The varied use of terms like “megaprojects” across disciplines, as well as SCOPUS indexing limitations, may have influenced inclusion. Fourth, this review prioritized thematic and methodological categorization over meta-analysis or theoretical synthesis. As such, it provides a descriptive overview rather than explanatory or predictive conclusions. This presents an opportunity for future research to pursue more theory-driven or quantitative analyses.

To ensure the inclusion of the most current research, a supplementary SCOPUS search was conducted covering the period from August 2023 to July 2025, using the same protocol as the original review. This update identified 35 additional articles across the four target journals. Upon closer examination, eight had already been included as

“articles in press” in the original review, and one was found irrelevant, resulting in 26 genuinely new contributions.

Analysis of these recent studies confirms that organizational management remains the dominant theme in megaproject research. Simultaneously, innovation—particularly in the form of management innovation—is gaining attention as a promising yet still underexplored topic. For instance, Ma and Lu [108] investigated how management innovation influences megaproject performance, incorporating the moderating effects of top management teams’ regulatory focus and project-level uncertainties. This shift underscores a growing interest in understanding the strategic and behavioral dimensions of megaproject delivery. Additionally, the importance of crises and dispute management in megaprojects is also concerned in recent studies [109, 110]. These post-2023 developments point to an emerging trend toward more integrative, adaptive, and networked approaches to megaproject management, particularly as these projects increasingly intersect with broader social, technological, and institutional dynamics. Future reviews could extend this work by incorporating additional databases, non-English language sources, and meta-analytical techniques to

enhance theoretical development and generalizability.

6. Conclusions

This study conducted a systematic literature review to identify research trends, methodologies, and techniques in megaproject studies published in leading construction management journals. A total of 138 articles from four SCOPUS Q1/Q2 journals between 2013 and 2023 were analyzed, providing a structured synthesis of the field. The review identified six main research themes:

- (1) Organizational management
- (2) Project management
- (3) Performance of Megaprojects
- (4) Strategic management
- (5) Risk management
- (6) Innovation

These categories offer a structured framework for understanding the diverse research priorities in megaproject management. Temporal analysis reveals that megaproject research gained significant momentum after 2017, with early studies focusing on governance and stakeholder management, and recent work increasingly emphasizing innovation, risk management, and strategic integration. Fig. 6 illustrates the evolution of research topics across the

decade, highlighting the shift from traditional management concerns toward interdisciplinary and innovation driven approaches.

The review also analyzed research methodologies and techniques, finding that case studies, surveys, interviews, and literature analyses are the predominant methods, while structural equation modeling (SEM), content analysis, regression analysis, and factor analysis are the most frequently used analytical techniques. This reflects a methodological trend toward both qualitative depth and quantitative rigor in megaproject research.

Critically, megaproject research is evolving from reactive project control to proactive, system level thinking. Key gaps remain in connecting governance strategies with innovation outcomes, linking stakeholder engagement to long term performance, and integrating risk management with digital transformation. Based on this synthesis, future research directions include:

- 1. Integrating risk management and digital innovation within megaproject governance.
- 2. Exploring social and environmental value creation in megaprojects.
- 3. Advancing interdisciplinary research bridging engineering, management, and policy perspectives.

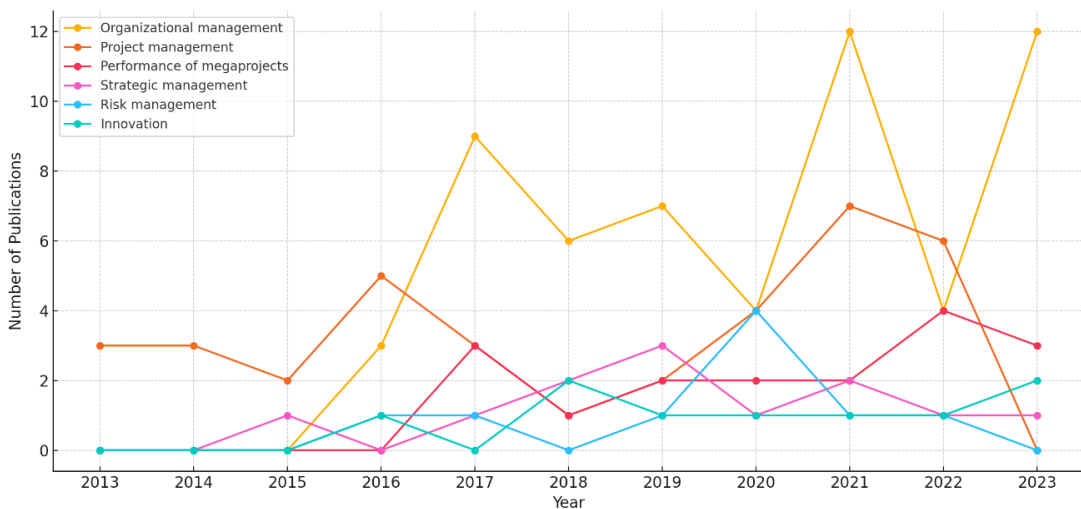


Fig. 6. Trends in megaproject research topics (2013-2023)

4. Empirically validating emerging frameworks, such as innovation ecosystems and sustainability driven models, to enhance both academic and practical impact.

Overall, the findings reveal a progressive shift from governance and stakeholder focused research toward innovation driven and interdisciplinary

approaches. These insights not only enrich the academic understanding of megaprojects but also offer practical guidance for policymakers and project managers to align governance, risk management, and innovation strategies to improve megaproject performance.

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Author Contributions

G. Aydoğan: Conceptualization, Methodology, Investigation, Writing- Original draft preparation, Visualization, Writing- Reviewing and Editing.

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Data Availability Statement

No new data were created or analyzed in this study.

Ethics Committee Permission

Not applicable.

Conflict of Interests

The author declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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