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A Literature Study on E-Procurement Technologies and Method Selection in Construction Projects

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A B S T R A C T

This collection presents a synthesis of research efforts in the realm of construction procurement and project management. The studies showcased employ diverse methodologies, including systematic literature reviews, analytical reviews, surveys, and content analyses. Themes explored encompass the adoption of e-procurement technologies, factors influencing procurement method selection, and the intricacies of stakeholder engagement. The studies span across geographical contexts, ranging from Australia to Nigeria, Thailand to Malaysia, providing a global perspective on the challenges and opportunities inherent in construction procurement. From identifying procurement selection factors to proposing integrated frameworks for risk management, the abstracts encapsulate a rich tapestry of insights that contribute to the existing body of knowledge in the field.

Keywords: procurement, project management, Systematic Literature Review, E-Procurement Technologies, Procurement Method Selection.

Introduction

The field of construction procurement and project management is dynamic, evolving, and critical to the success of infrastructure development. As industries progress, so do the methodologies and systems employed in procurement processes. This compilation represents a diverse range of studies and literature reviews undertaken in various contexts, aiming to provide a comprehensive understanding of the challenges, innovations, and best practices in construction procurement. The studies delve into topics such as the impact of procurement systems, the role of technology, stakeholder engagement, and the intricacies of project management.

The chosen methodological framework, employing SLRs, ensures a systematic and comprehensive survey of literature. This approach adds rigor to our examination, facilitating the identification of patterns and inconsistencies across diverse studies and providing readers with a reliable synthesis of insights.

The rationale for this review stems from the recognition of the pivotal role played by procurement systems in influencing construction project outcomes. Seeking to unravel complexities, address challenges, and illuminate opportunities within the dynamic landscape of construction procurement, this exploration is grounded in a commitment to inform practice and guide future research.

Literature Review

Farshid et al. (2018) Discuss about the detailed analysis of various construction procurement systems used in the past and present, specifically within the Australian construction industry. It delves into the historical development of procurement both globally and in the Australian context through existing literature. The review also highlights the evolution of procurement methods, from traditional methods to management-oriented methods and the emergence of collaborative methods. Furthermore, it discusses the dearth of study focusing on modern, purely relationship-based delivery systems and the lack of knowledge in the concept and evaluation of their effectiveness when used for a construction project. Additionally, the review emphasizes the significance of relationship-based procurement (RBP) systems and their potential benefits to project participants, while also addressing the challenges in demonstrating value for money (VfM) for public projects, which may influence a potential move away from RBP in the future. The literature review provides a valuable insight into the historical development, current landscape, and potential future trends of construction procurement methods in Australia, making it a valuable resource for understanding the complexities and dynamics of this industry.

Maria et al. (2018) Study about the criteria and methods used in the phases of selecting and evaluating suppliers in projects, as given in papers published from 1973 to 2015. It categorizes the papers based on the type of project and the phases of the project procurement process. The review also highlights the most relevant journals, the number and relevance of papers, and the distribution of papers in different phases of the project procurement process. The review reveals that the most widely used criteria and methods for selecting suppliers in projects are conceptual or theoretical publications, case studies, literature reviews, and surveys. It also indicates a significant increase in the number of papers published in this field, particularly since 2008. Furthermore,

the review identifies a greater interest from academics in the supplier selection phase and recommends further research on supplier evaluation, particularly in different industries. It also discusses the criteria for supplier selection and evaluation, highlighting the need to consider various factors and the importance of establishing and maintaining collaborative relations with suppliers.

Mohamed et al. (2018) Study on effectiveness of end-user engagement and alignment of objectives in the context of project management, specifically in the oil and gas industry. It discusses the measurement attributes, measurement instruments, and evaluation criteria for end-user engagement and alignment of objectives. Additionally, it provides information on the use of Structural Equation Modeling (SEM) as an analytical technique for inferring the existence of the concept of effectiveness. The literature review also references various studies and publications related to project management, user involvement, and reliability in the oil and gas industry. The document also includes a detailed discussion on the measurement models used for reflective and formative constructs, as well as the assessment results of end-user engagement and alignment of objectives constructs. It provides information on the evaluation criteria for both reflectively and formatively measured constructs, along with the assessment results for each. Overall, the literature review in the document provides a comprehensive overview of the research conducted on the effectiveness of engineering, procurement, and construction (EPC) major projects from an end-user's perspective, particularly in the context of the oil and gas industry.

Phuong et al. (2018) Discusses the traditional procurement procedures used in the construction industry, specifically focusing on LB (Lowest Bid), QBS (Qualifications-Based Selection), and BV (Best Value) procurement methods. It highlights the benefits and drawbacks of LB procurement, such as short-term monetary savings and simplicity in the selection process, but also the exclusion of quality considerations and inconsistent performance. The review also mentions the common perception that greater qualifications are correlated with higher costs and the need to investigate this in DBB (Design-Bid-Build) procurement scenarios. Overall, the literature review provides an overview of the different procurement methods and their implications for construction projects, setting the stage for the subsequent research methodology and findings.

Solomon et al. (2018) Provides an overview of previous studies and models developed for the selection of procurement systems in construction projects. It discusses various factors influencing the selection of procurement systems, such as project size, complexity, client's requirements, risk allocation, and financing ability. The review also summarizes the categorization of procurement systems into separated and cooperative systems, integrated systems, and management-oriented systems. Additionally, the document discusses the development of an expert system tool, ESCONPROCS, for the selection of procurement systems in large-scale construction projects. It outlines the methodology used to develop the system, including the design of heuristic IF/AND/THEN decision rules based on identified factors and the conduct of expert surveys to validate the system. The review also provides a comparison of the proposed system's recommendations with those of human experts, highlighting the need for revision and validation. It concludes with an analysis of the revised system's accuracy and error rates, indicating the suitability of the recommended procurement methods for large-scale construction projects.Overall, the literature review in the document presents a comprehensive overview of previous studies, factors influencing procurement system selection, and the development and validation of the ESCONPROCS expert system tool.

Wan et al. (2018) The study focuses on the relationship between the procurement system and the performance of construction projects. The authors argue that the adoption of the appropriate procurement system is critical to ensuring successful project delivery, a satisfied client, a successful service provider, and a reputable construction industry. The Transaction Cost Approach is used to analyze the procurement system and its impact on project outcomes. This approach considers the costs associated with transactions between parties, such as asset specificity, uncertainty, and frequency of transaction, as well as human behaviour, such as opportunism and bounded rationality. Several studies have explored the relationship between transaction costs and procurement systems in construction projects. For example, a study in the UK quantified the transaction costs involved in public/private partnership (PPP) projects. Other studies have compared traditional procurement projects to design and build procurement projects to capture transaction costs.

Dabarera et al. (2019) Discusses the need for research on public-private partnership (PPP) procurement in Sri Lanka. It highlights that many developing countries have used PPPs extensively for infrastructure development. The document also mentions that past studies have focused on the applicability and suitability of PPPs in various countries, but there is a literature gap on determining the suitability of different PPP models as procurement tools. Furthermore, the document outlines the research methodology used, which involved a mixed approach, literature synthesis, expert interviews, and a questionnaire survey. The study aimed to identify the most suitable PPP model for road construction in Sri Lanka. The literature review also discusses the characteristics of road construction, procurement selection factors, different types of PPP procurements available in the road construction industry, and the use of PPPs in Sri Lanka. It emphasizes the importance of identifying the PPP model that best suits Sri Lanka. Overall, the literature review provides a comprehensive overview of the need for research on PPP procurement in Sri Lanka and the methodology used to address this need.

Izhar et al. (2019) Provides an overview of various studies and research conducted on the factors affecting the selection of procurement methods in public sector construction projects. It includes references to studies from different countries such as Nigeria, Kenya, South Africa, and Gaza. The review highlights the importance of procurement methods in project performance and discusses the impact of factors such as cost, time, quality, risk, project characteristics, and external environment on the selection of procurement methods. The review also emphasizes the significance of considering client characteristics, time-related factors, cost-related factors, quality-related factors, risk-related factors, project characteristics, and external environment-related factors when selecting a procurement method. It further discusses the adoption of Rogers innovation diffusion theory for the classification of factors to clarify the degree of importance of identified factors. Overall, the literature review provides a comprehensive understanding of the factors influencing the selection of procurement methods in public sector construction projects, drawing on various research studies and industry experts' insights.

Sitsofe et al. (2019) A total of 68 papers were retrieved and thoroughly reviewed to identify the drivers for e-procurement. 61 drivers were identified and subsequently developed into a categorization framework for synthesized understanding, revealing existing interrelationships. Although literature has consensus on some selected drivers, few studies have identified drivers relating to sustainability. Gaps were identified from the existing literature and

directions for future research were proposed. 61 drivers for e-procurement adoption were identified and categorized into the following framework Organizational drivers, Technological drivers, Environmental drivers, Economic drivers, Social drivers, Legal and regulatory drivers. Investigating the impact of cultural differences on e-procurement adoption and usage. Examining the role of government policies and regulations in promoting e-procurement adoption. Exploring the relationship between e-procurement adoption and sustainability in the construction industry. Investigating the impact of e-procurement on supply chain management and collaboration.

Tang et al. (2019) Provides a literature review on the influence of procurement systems on the success of sustainable buildings. It includes references to various studies and authors who have contributed to the understanding of critical success factors for sustainable building success. Additionally, it mentions the use of a generic system dynamics (SD) model to analyze the influences of different procurement systems on sustainable building success. The literature review also covers the validation tests, sensitivity analysis, and the relationships between critical success factors, sustainable building success, and procurement systems. The literature review in the document includes references to several studies and authors, such as Pinto & Slevin (1988), Belassi & Tukel (1996), Chua et al. (1999), and others, who have contributed to the understanding of critical success factors for sustainable building success. It also discusses the use of a generic system dynamics (SD) model to analyze the influences of different procurement systems, such as Design-Bid-Build (DBB), Construction Management (CM), and partnering, on sustainable building success. Additionally, the review covers the validation tests, sensitivity analysis, and the relationships between critical success factors, sustainable building success, and procurement systems.

Timothy et al. (2019) The client or his representative needs to understand the advantages and disadvantages of each of the various procurement methods. This study examined the potential impact of ex-tent of use of construction procurement systems to integrate waste minimisation strategies based on professionals' perceptions. The extent of use and the magnitude of material waste generated by different procurement methods were examined and the relationship between the two was evaluated. The result obtained revealed that direct labour, labour only, lump sum and re-measurement procurement methods, are used in most building projects in the study area. The test carried out to determine variations in the extent of use of different procurement systems showed no statistically significant variation in the study area. Therefore, it was concluded that there is no significant variation in the use of construction procurement system among the States since no variation is observed in about 77%of them. It is concluded, therefore, that there is no locational effect in the extent of use of the CPS within the South-South geopolitical region of Nigeria. Comparison among the magnitude of material waste generated by different procurement methods revealed that there is the existence of variation resulting to the conclusion that contractor's profits and overheads may be directly affected by the magnitude of waste generated. A perceived relationship between construction procurement methods used and the level of material waste generated was obtained. Conclusively, it was affirmed that alternative procurement routes hold no significant advantages in terms of waste minimisation.

Yang et al. (2019) Discuss about the range of sources to explore the factors that impact project management efficiency in a centralized public procurement system. These sources include academic journals, books, and reports, and cover a range of topics related to project management, procurement, and organizational behaviour. One key area of focus is the role of organizational culture in project management efficiency. The authors draw on a range of studies to highlight the importance of a strong organizational culture in promoting effective project management, including studies on the impact of culture on employee commitment and job satisfaction, and the link between organizational learning and technical innovation. The authors also highlight the importance of employee quality and job analysis in promoting project management efficiency, drawing on studies that explore the impact of person-organization fit on job satisfaction and performance, and the benefits of job rotation in software organizations. Overall, the literature review highlights the complex range of factors that impact project management efficiency in a centralized public procurement system, and the need for a multifaceted approach to improving efficiency that takes into account organizational culture, employee quality, job analysis, and effective recruitment and selection processes.

Yap et al. (2019) Discusses the importance of selecting an appropriate procurement method for construction projects in Malaysia. It highlights the significance of procurement management in ensuring project success and the impact of procurement method on project performance. The review also emphasizes the factors that influence the selection of procurement methods, such as time, project complexity, quality level, price certainty, responsibility division, risk distribution, and flexibility for changes and variations. Furthermore, the literature review discusses the consequences of choosing an inappropriate procurement method, including project failure, cost and time overruns, compromised quality of work, and client dissatisfaction. It also addresses the challenges faced in the selection process, such as the lack of familiarity with alternative procurement methods and the tendency to prioritize the lowest initial project cost without considering long-term project outcomes. The review concludes by emphasizing the need for a systematic approach to the selection of procurement methods, considering decision criteria and factors pertinent to the selection of procurement approaches and their properties. It also highlights the importance of establishing project performance criteria and matching them against the outcomes of various procurement methods before making a selection. Overall, the literature review provides a comprehensive overview of the factors influencing the selection of procurement methods for construction projects in Malaysia and the implications of choosing an inappropriate method.

Adedeji et al. (2020) Study about the public procurement and e-Procurement technologies. The authors discuss the challenges faced by the Nigerian public procurement system, including corruption, lack of transparency, and inefficiency. They argue that e-Procurement technologies have the potential to address these challenges by improving transparency, reducing transaction costs, and increasing competition. The authors draw on a range of sources to support their argument, including academic articles, government reports, and case studies from other countries. For example, they cite a study by Gelderman et al. (2006) that explores the reasons why some organizations fail to comply with EU tendering directives. They also discuss the Ugandan experience with public procurement reform, as described by Agaba and Shipman (2007). The authors also provide a detailed overview of the different types of e-Procurement technologies that are available, including e-Tendering, e-Auctioning, and e-Cataloguing. They argue that these technologies can help to streamline the procurement process, reduce errors, and improve accountability.

Azeanita et al. (2020) Provides a comprehensive analysis of procurement methods in the construction industry, focusing on Design-Bid-Build, Design-Build, and Construction Management. The review incorporates various sources. The review also includes the use of the average index (AI) analysis based on Abdul Majid & McCaffer (1997), Suratkon, Chan, & Jusoh (2016), and Abdul Rahman & Al-Emad (2018) to gather the level of agreement on the importance of the three procurement methods' characteristics. Additionally, the literature review references the work of Turner (1995) on design and build contract practice and Wearne (1997) on innovations in procurement. This literature review provides a solid foundation for understanding the various aspects of procurement methods and their impact on construction project performance, leadership qualities, and project delivery. It also highlights the importance of further investigation into the factors contributing to the success of procurement methods and construction projects as a whole.

Perera et al. (2020) Discusses the valuable insights into the procurement systems and selection factors for steel building construction. It discusses the characteristics of steel building procurement and specifies the procurement method selection criteria for such projects. The review also highlights the main strands of procurement systems, including separated, integrated, and management-oriented procurement systems, along with various procurement methods such as traditional lump sum separated, design and build pure, turnkey, and others. Additionally, it synthesizes the factors that need to be considered when procuring buildings and identifies the factors specifically related to steel building procurement within the context of Sri Lanka. The literature review also references several relevant studies that contribute to the understanding of procurement systems and factors influencing construction project performance, such as labour productivity, project management consultancy (PMC) procurement approach, delays in the material procurement process, and the effects of procurement-related factors on construction project performance. These references provide a comprehensive background for the empirical study conducted in the document, offering a solid foundation for the research methodology and data analysis. Overall, the literature review serves as a comprehensive guide to understanding the procurement systems and selection factors relevant to steel building construction, laying the groundwork for the subsequent empirical investigation and analysis.

Suresh et al. (2020) Provides a comprehensive overview of the factors influencing lean procurement in construction projects. It draws on various scholarly sources to establish a theoretical framework for understanding the readiness factors for lean procurement. The review also incorporates expert opinions and industry insights to enrich the understanding of lean procurement in the context of construction projects. The review highlights the significance of factors such as supplier selection, reviewing of material specification/product evaluation, and the integration of lean procurement methodologies in the aviation industry. It also emphasizes the importance of understanding the interrelationships between these factors to facilitate successful implementation of lean procurement practices. Furthermore, the review discusses the use of interpretive structural modelling (ISM) as a methodology to analyse the interconnecting network of relationships between the identified factors. This approach provides a deeper understanding of the hierarchical relations among the readiness factors for lean procurement in construction projects. Overall, the literature review serves as a foundation for the subsequent analysis of readiness factors for lean procurement and provides valuable insights for both academia and industry practitioners in the field of construction project management.

Weerasekara et al. (2021) Study about the procurement management in foreign-funded construction projects, with a particular focus on Sri Lanka. The review highlights the challenges faced in such projects, including government bureaucracy, delays in hiring key personnel, political instability, and the complexity of loan payment processes. The document also provides strategies to overcome these challenges, such as introducing standard policies, conducting negotiations with donors, and increasing capacity building. The literature review also covers the adoption of project management practices in international development projects, the gaps in public procurement processes in the Sri Lankan construction industry, and the application of the Delphi method in construction engineering and management research. Overall, the literature review provides a comprehensive overview of the issues and complexities associated with procurement management in foreign-funded construction projects, particularly in the context of international development and the Sri Lankan construction industry. The document offers valuable insights and strategies for stakeholders involved in such projects.

Mathagul et al. (2022) Discusses about an evaluation of Green Road Incentive Procurement in road construction projects by using the AHP explores the use of eco-construction methods in road construction projects and evaluates the effectiveness of the Green Road Incentive Procurement program. The article notes that contractors have historically been hesitant to adopt eco-construction methods due to the extra costs involved, and public project owners have been reluctant to request more environmentally friendly construction due to fears of increased costs. The Green Road Incentive Procurement program was developed to incentivize contractors to adopt environmentally friendly construction methods by offering emission deductions applied to their proposed bid price. The program includes provisions for monitoring compliance and penalties for noncompliance. The study conducted a survey of contractors and public owners to evaluate their opinions on the program, using the Analytical Hierarchy Process (AHP) to evaluate options based on eight criteria. The results showed that both contractors and public owners gave the highest weighted scores for the full implementation of the Green Road Incentive Procurement program. The users' readiness was identified as the highest significance criterion for both parties. Overall, the article suggests that the Green Road Incentive Procurement program is a promising approach to incentivizing contractors to adopt environmentally friendly construction methods in road construction projects.

Nadeesha et al. (2022) The study focuses on the barriers and strategies for the successful implementation of Lean Integrated Project Delivery (LIPD) in the construction industry. It identifies various barriers to LIPD implementation, including problems with conventional procurement methods, organizational barriers, external barriers, and technology barriers. Additionally, the review highlights strategies for successful LIPD implementation, such as determining the best management team and structure, providing training and awareness, obtaining expert support, and encouraging professional skills. The review also emphasizes the significance of LIPD compared to existing procurement methods and the need for a new procurement system to improve the performance of construction industries in developing countries. It discusses the lack of preparedness in the construction sectors of Sri Lanka and India to embrace Integrated Project Delivery (IPD) and the need to explore LIPD through empirical studies for potential successful implementation. Furthermore, the literature review outlines the research methodology, which includes the use of a qualitative exploratory approach, semi-structured

interviews with construction industry experts in Sri Lanka, and qualitative content analysis to analyse the collected data. The study aims to develop a framework for the implementation of LIPD in the construction industry based on data collected from the Sri Lankan context. Overall, the literature review provides insights into the challenges and opportunities associated with implementing LIPD in the construction industry, particularly in the context of developing countries like Sri Lanka. It sets the stage for the subsequent research findings and the development of a framework for LIPD implementation.

Nan et al. (2022) The study focuses on procurement selection criteria (PSC) in the construction industry. The review employs a systematic literature review (SLR) method to answer specific research questions and consolidate the existing knowledge on PSC. The review identifies 256 PSC and analyses their evolution over time. It highlights the emergence of new PSC due to updated procurement systems and broader areas of procurement systems considered since the shifts in technologies and legislation. The review also identifies several emergent themes, including procurement systems, decision aid tools, and procurement selection process. It notes that most attention from earlier papers is at the micro-level, considering the contribution of PSC for individual project procurement selection. The review provides insights into the trends and core clusters of specific criteria at different time intervals, using citation network analysis and a Java program. It also highlights four possible areas for future research that emerged from the study of the corpus, indicating potential gaps and opportunities for further exploration in the field of construction procurement selection criteria.

Reuben et al. (2022) Provides an overview of traditional procurement in the construction sector and the impact of procurement methods on project performance. It discusses the structured and organized techniques and procedures by which clients obtain construction products and services. The review also highlights the development of different variants of procuring projects, including turnkey, partnering, joint ventures, and management contracting. Furthermore, the literature review outlines the research methodology adopted for the study, which involved the use of a structured questionnaire administered to construction experts in Owerri, Imo state, Nigeria. The questionnaire was designed based on information obtained from the literature review and was subjected to a pilot survey to ensure its suitability and completeness. The review also discusses the data analysis methods used, including frequency, percentages, and mean item scores, as well as the reliability tests conducted using Cronbach's alpha test. The results of the study are then presented and discussed, highlighting the impact of traditional procurement systems on construction project delivery and the factors responsible for poor project performance. In conclusion, the literature review emphasizes the need to move away from traditional procurement systems and adopt modern digital and smart technologies to improve project performance in the construction sector. It also recommends further research in other regions to compare results and adds to the existing body of knowledge on the impact of traditional procurement on construction project performance.

Windapo et al. (2022) Discusses about the role of client knowledge and procurement systems in construction project performance. It discusses the main procurement systems used in the construction industry, such as Traditional, Integrated, and Management Oriented systems, along with sub-classifications and strategies. Additionally, it outlines client project performance criteria, including cost, time, quality, health and safety, aesthetics, environmental considerations, sustainability, and technical performance. The study also presents the Analytical Hierarchy Process (AHP) to determine the rank of client project performance criteria and the relationship between the level of clients' knowledge and project performance using inferential statistics, specifically the Pearson Product Moment Correlation. The literature review references various studies and sources, including those related to construction quality in South Africa, critical success factors for different project objectives, multi-criteria contractor selection, infrastructure sustainability, and the role of knowledge management and incentives in improving the quality of transport infrastructure projects. Overall, the literature summary in the document focuses on the relationship between client knowledge, procurement systems, and project performance in the construction industry, particularly in the context of South Africa.

Conclusion

In conclusion, this compilation underscores the multifaceted nature of construction procurement and project management. The studies collectively illuminate critical aspects such as the impact of procurement systems, the role of technology in eradicating corruption, and the significance of organizational culture in enhancing project management efficiency. While some studies focus on specific geographical contexts, the overarching themes resonate globally, emphasizing the universal relevance of effective procurement practices. As the construction industry continues to evolve, these insights provide a foundation for informed decision-making, fostering innovation and improvement in procurement processes. The collective knowledge presented in these studies contributes to the ongoing discourse in construction management, offering valuable perspectives for researchers, practitioners, and policymakers alike.

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