



Development of Civil Engineering Management Models Based on Community Participation: A Scoping Review in Timor Leste

Francisco Da Conceição Neves De Sousa¹, Lalu Mulyadi², Foury Handoko³,
Nanta Sigit⁴

^{1,2,3,4} Doctoral Program in Engineering Management, National Institute of Technology,
Malang, Indonesia

Corresponding Author: nantasigit1991@gmail.com

Abstract

Infrastructure development plays a crucial role in promoting economic growth and social welfare, particularly in developing countries such as Timor Leste. However, infrastructure projects in such contexts often face technical, managerial, and social challenges that limit their effectiveness and sustainability. One of the key issues identified is the limited integration of community participation within civil engineering management practices. This study aims to systematically map and analyze existing literature on participatory-based civil engineering management models for infrastructure development through a scoping review approach.

This research adopts a qualitative scoping review methodology following established review frameworks to identify, select, and synthesize relevant peer-reviewed studies published over the past decade. Academic databases including Google Scholar, Scopus, and ScienceDirect were used to retrieve literature focusing on civil engineering management, community participation, and infrastructure development in developing countries. The selected studies were analyzed thematically to identify key trends, model components, and research gaps.

The findings indicate that although community participation is widely recognized as an important factor in enhancing project relevance, sustainability, and social acceptance, its implementation within civil engineering management remains fragmented and largely confined to the planning stage. Moreover, existing models tend to emphasize technical and managerial efficiency while insufficiently integrating participatory and social dimensions. In the context of Timor Leste, these limitations are further compounded by institutional capacity constraints and post-conflict governance challenges.





This study concludes that there is a critical need for a comprehensive and context-sensitive civil engineering management model that integrates technical rigor with meaningful community participation across all stages of infrastructure development. The results of this scoping review provide a conceptual foundation for future empirical research and offer practical insights for policymakers and practitioners aiming to achieve inclusive and sustainable infrastructure development in Timor Leste and similar developing country contexts.

Keywords: civil engineering management, community participation, infrastructure development, scoping review, Timor Leste

INTRODUCTION

Infrastructure development is a fundamental foundation for accelerating economic growth and improving overall social welfare. Infrastructure such as roads, electricity networks, sanitation systems, and public facilities plays a crucial role in supporting social connectivity and economic activities (Kompas Atta, 2024). In addition, adequate infrastructure is closely associated with increased productivity, job creation, and equitable access to basic public services (Budiman, 2024). In many developing countries, the demand for high-quality infrastructure continues to rise as part of efforts to achieve the Sustainable Development Goals (SDGs). When infrastructure development effectively addresses these needs, economic growth and social equity can be achieved simultaneously.

Despite its strategic importance, infrastructure development in developing countries still faces various fundamental challenges, including limited financial resources and shortages of skilled human capital in project planning and implementation (Kompas Atta, 2024). Weak project management systems often result in project delays or outputs that fail to meet technical specifications, thereby reducing the effectiveness of development spending. Furthermore, disparities in infrastructure quality between urban and rural areas continue to widen gaps in public service provision. These challenges indicate that the availability of funding alone is insufficient without effective and context-sensitive project management.

Timor Leste, as a relatively young nation, continues to face significant challenges in infrastructure development. Reports indicate that basic infrastructure development, such as roads and public utilities, remains a national priority, with many facilities still underdeveloped or poorly maintained (Tatoli Agência Noticiosa, 2024; ANTARA News, 2024). Geographic challenges, including mountainous terrain and dispersed rural settlements, further complicate infrastructure construction and maintenance. These



conditions highlight the urgent need for development planning and management approaches that are contextualized and responsive to local needs.

Technical and managerial problems remain major obstacles to optimizing infrastructure development outcomes in many developing countries, including Timor Leste. Project delays, substandard construction quality, and limited sustainability frequently occur due to weak coordination among stakeholders. These issues result in inefficient use of public funds and reduce the long-term benefits that infrastructure projects are intended to deliver. Insufficient integration between strategic planning and technical implementation underscores the need for innovative and adaptive engineering management models.

Conventional infrastructure project management approaches, which are predominantly top-down in nature, have demonstrated significant limitations in addressing local social dynamics and community needs. Such approaches often lead to mismatches between project outcomes and community expectations because planning decisions are made without meaningful public involvement. Moreover, limited adaptation to local contexts frequently results in infrastructure designs that are technically sound but socially inappropriate. Technocratic management practices that overlook community perspectives contribute to weak public ownership of infrastructure assets.

Community participation in infrastructure development is essential because local residents are not only beneficiaries but also key stakeholders who possess in-depth knowledge of local conditions. Previous studies indicate that meaningful community involvement in planning and implementation processes enhances project sustainability, relevance, and a strong sense of ownership over public facilities (Perdana, 2025). Active participation also helps reduce social conflict, strengthen trust between communities and governing institutions, and improve transparency in project governance.

Integrating community participation into civil engineering management frameworks represents an effort to combine technical expertise with local social knowledge, enabling more inclusive and context-sensitive planning, implementation, and evaluation processes. Several studies have shown that community involvement improves project quality and ensures that infrastructure designs better align with local needs (Perdana, 2025). Participation should therefore be viewed not as a symbolic gesture but as an active and continuous role throughout all stages of infrastructure projects, from problem identification to post-construction evaluation.

Existing literature on community participation and infrastructure project management demonstrates growing academic interest in participatory approaches. However, most studies remain partial in scope and fail to comprehensively integrate engineering management principles with participatory dimensions. Furthermore, limited

attention has been given to developing country contexts, particularly Timor Leste. As a result, existing studies often lack systematic synthesis and fail to provide transferable models that can be adapted across different socio-political and institutional settings.

Although numerous studies have examined community participation in infrastructure development, there remains a lack of systematic mapping of civil engineering management models that explicitly integrate participatory approaches. The absence of cross-study synthesis makes it difficult to identify best practices and core components applicable to diverse contexts, especially in developing countries such as Timor Leste. Therefore, a scoping review approach is required to comprehensively identify, categorize, and synthesize existing literature to address this research gap.

This study employs a scoping review methodology to systematically map existing literature on civil engineering management models based on community participation and to identify key components relevant to infrastructure development in Timor Leste. The findings are expected to contribute theoretically by enriching the body of knowledge on engineering management and participatory development, and practically by providing insights for policymakers and infrastructure practitioners in developing countries. By synthesizing evidence across multiple studies, this research aims to propose a conceptual framework that supports inclusive, effective, and sustainable infrastructure development.

METHODOLOGY

This study adopts a qualitative research design using a scoping review approach to systematically map and synthesize existing literature on civil engineering management models that incorporate community participation in infrastructure development. The scoping review method is considered appropriate because the research topic is broad, multidisciplinary, and has not yet been comprehensively mapped, particularly in the context of developing countries such as Timor Leste. The review follows established scoping review frameworks, including the stages of identifying research questions, identifying relevant studies, selecting eligible studies, charting the data, and collating, summarizing, and reporting the results. This approach enables the identification of key concepts, theoretical perspectives, and research trends related to participatory-based engineering management.

The literature search was conducted using several academic databases, including Google Scholar, Scopus, and ScienceDirect, by applying predefined keywords such as *civil engineering management*, *community participation*, *infrastructure development*, and *developing countries*. Inclusion criteria consisted of peer-reviewed journal articles published within the last ten years, written in English, and focusing on infrastructure development and participatory approaches. Exclusion criteria included non-academic publications, opinion

papers, and studies unrelated to infrastructure or engineering management. The selected studies were analyzed using a thematic analysis technique to identify recurring patterns, key dimensions, and model components. The findings were then synthesized narratively to develop a conceptual understanding of participatory-based civil engineering management models relevant to infrastructure development in Timor Leste.

RESEARCH AND RESULTS

The results of this scoping review indicate that infrastructure development in developing countries increasingly recognizes civil engineering management as a key determinant of project success. Numerous studies emphasize that infrastructure performance is influenced not only by technical design quality but also by effective project management and alignment with community needs. This finding reinforces the view that purely technical approaches are insufficient to address the complexity of infrastructure development within dynamic social environments.

This review also reveals a growing body of research over the past decade focusing on community participation in infrastructure projects. Community participation is widely regarded as a strategic approach to enhancing project legitimacy, social acceptance, and long-term sustainability. However, despite its conceptual importance, the practical implementation of participation within civil engineering management remains inconsistent and often normative in nature.

Most of the reviewed literature indicates that community participation is predominantly concentrated during the early planning stages of infrastructure projects, such as needs assessment and public consultation. In contrast, community involvement during implementation, monitoring, and post-construction evaluation phases remains limited. This pattern suggests that participation has not yet been fully integrated throughout the entire infrastructure project management lifecycle.

These limitations reflect the continued dominance of conventional top-down management approaches in infrastructure development. Under such approaches, communities are often positioned as passive beneficiaries rather than strategic partners in decision-making processes. As a result, many infrastructure projects are technically completed but fail to achieve optimal utilization and long-term maintenance outcomes.

From a civil engineering management perspective, the review highlights persistent challenges in integrating technical, managerial, and social dimensions. Many management models prioritize technical efficiency and cost control while providing limited space for social dynamics and local knowledge. This imbalance may reduce project effectiveness, particularly in contexts characterized by strong social and cultural influences.

From a theoretical standpoint, the findings reveal a clear gap between participatory development theory and its application in civil engineering management practices. Although participatory theories emphasize empowerment and collaboration, their translation into operational project management frameworks remains limited. This gap underscores the need for interdisciplinary and implementable management models.

In the context of Timor Leste, the review indicates that infrastructure development challenges are exacerbated by institutional capacity constraints, post-conflict governance structures, and complex geographical and socio-cultural conditions. These factors necessitate a more adaptive and context-sensitive civil engineering management approach. Community participation emerges as a critical element in bridging institutional limitations and enhancing project acceptance.

The reviewed literature suggests that local community involvement provides valuable contextual information for technical decision-making processes. Local knowledge related to environmental conditions, social practices, and infrastructure usage patterns can improve planning accuracy and design effectiveness. Therefore, integrating community participation into civil engineering management is not only socially valuable but also strategically important from a technical perspective.

This scoping review also identifies the absence of well-structured and widely tested participatory-based civil engineering management models, particularly within developing country contexts such as Timor Leste. Most existing studies remain case-specific or conceptual, lacking cross-context synthesis. This gap highlights the importance of systematic mapping to identify core model components that can be contextually adapted.

Overall, this discussion emphasizes that the development of participatory-based civil engineering management models is essential to support inclusive and sustainable infrastructure development. Through a scoping review approach, this study contributes academically by synthesizing existing evidence and practically by providing a foundation for conceptual model development relevant to Timor Leste. These findings are expected to inform future research and infrastructure policy formulation in developing countries.

CONCLUSION AND RECOMMENDATIONS

Conclusion

This scoping review highlights the growing importance of integrating community participation into civil engineering management for infrastructure development, particularly in developing country contexts such as Timor Leste. The findings indicate that while community participation is increasingly acknowledged in the literature as a key factor for enhancing project relevance, sustainability, and social acceptance, its implementation

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within civil engineering management frameworks remains fragmented and uneven. Participation is most commonly applied during the planning stage, with limited involvement during implementation, monitoring, and post-construction phases.

Furthermore, the review reveals a significant gap between participatory development theory and its operationalization in civil engineering management models. Existing models often emphasize technical and managerial efficiency but fail to systematically integrate social and participatory dimensions. In the context of Timor Leste, institutional capacity constraints, post-conflict governance structures, and complex socio-cultural conditions further underscore the need for a context-sensitive and adaptive management approach. Overall, this study concludes that there is a clear need for a comprehensive civil engineering management model that integrates technical rigor with meaningful community participation to support inclusive and sustainable infrastructure development.

Recommendations

Based on the findings of this scoping review, several recommendations are proposed. From an academic perspective, future research should focus on developing and empirically testing integrated civil engineering management models that explicitly incorporate community participation across all stages of the infrastructure project lifecycle. Comparative studies across different developing countries are also recommended to strengthen the generalizability and adaptability of participatory-based management frameworks.

From a practical perspective, policymakers and infrastructure practitioners in Timor Leste should institutionalize community participation as a core component of infrastructure governance rather than treating it as an auxiliary activity. This includes establishing formal mechanisms for stakeholder engagement, strengthening local capacity through training and knowledge transfer, and ensuring that community feedback is systematically integrated into technical and managerial decision-making processes. By adopting these recommendations, infrastructure development in Timor Leste can become more inclusive, effective, and sustainable in the long term.

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