

MANAGING TIME DELAYS ACROSS THE PUBLIC INFRASTRUCTURE PROJECT LIFECYCLE IN SOUTH AFRICA: A CRITICAL REVIEW

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Abstract

Time delays in public infrastructure projects remain a pervasive challenge in South Africa, undermining socio-economic development objectives and straining limited government resources. This critical review synthesizes recent research on the causes and management of time delays across all stages of the public infrastructure project lifecycle, from initiation and procurement to execution and handover. Drawing on both qualitative and quantitative studies, as well as comparative analyses, the review identifies key factors contributing to delays, including payment bottlenecks, inadequate project planning, sub-contractor performance issues, political interference, and deficiencies in governance and procurement frameworks. The paper systematically assesses best practices and emerging strategies for delay mitigation, such as implementing transparent procurement processes, strengthening contract management, enhancing stakeholder engagement, and promoting the adoption of public-private partnership models. Special attention is given to the role of capacity building within the public sector and the development of robust risk management protocols tailored to the South African context. The review also explores the broader economic and social consequences of persistent project delays, such as cost overruns, reduced public trust, and hindered service delivery. By integrating insights from South African case studies and relevant international experiences, this paper provides actionable guidelines and policy recommendations aimed at improving the timely delivery of public infrastructure. The findings highlight the need for systemic reforms, multi-stakeholder collaboration, and continuous monitoring to address underlying inefficiencies. Ultimately, the review not only advances the academic discourse on infrastructure project management but also offers a practical foundation for future research and policymaking in the sector.

Keywords: Governance, Project delays, Procurement, Public infrastructure, Risk management, South Africa.

1. INTRODUCTION

Public infrastructure plays a pivotal role in South Africa's socio-economic development, facilitating access to essential services, enhancing the quality of life, and fostering economic growth (Shivambu & Thwala, 2019). Efficient infrastructure delivery is fundamental for achieving government objectives, reducing inequality, and ensuring sustainable progress. However, the public sector frequently encounters persistent challenges in executing infrastructure projects, with time delays emerging as one of the most critical obstacles (Alinaitwe & Ayesiga, 2013). These delays not only impede service delivery but also contribute to escalating costs, resource wastage, and diminished public trust in government institutions (Tamosaitiene et al., 2021).

Time delays in public infrastructure projects are a pervasive issue in South Africa, affecting nearly every stage of the project lifecycle from initiation to handover (Shivambu & Thwala, 2019). The consequences of such delays are profound: they undermine the government's ability

to meet development targets, disrupt economic activities, and exacerbate social disparities (Alinaitwe & Ayesiga, 2013). Factors including payment bottlenecks, inadequate planning, sub-contractor inefficiencies, political interference, and deficiencies in governance and procurement frameworks contribute to these delays (Shivambu & Thwala, 2019). Addressing these root causes is essential for improving project outcomes and achieving timely infrastructure delivery.

This review paper aims to critically examine the causes and management of time delays across the public infrastructure project lifecycle in South Africa. The primary objectives are to synthesize recent research findings, evaluate governance and procurement frameworks, analyze risk management strategies, and identify best practices for delay mitigation (Alinaitwe & Ayesiga, 2013). The scope of the review encompasses literature published in the past decade, comparative international studies, and case analyses relevant to the South African context.

The purpose of this paper is to provide a comprehensive critical review of the factors contributing to time delays in public infrastructure projects in South Africa and to evaluate strategies for managing and mitigating these delays. By synthesizing current research and practical experiences, the paper aims to highlight the most significant challenges and best practices throughout the project lifecycle.

The review seeks to inform policymakers, project managers, and other stakeholders about effective approaches for ensuring timely and successful delivery of public infrastructure projects, thereby supporting broader development objectives in South Africa.

2. METHODOLOGY

2.1 Literature Search Strategy

This review employed a systematic literature search to identify scholarly articles, review papers, and relevant case studies addressing time delays in public infrastructure projects in South Africa.

The primary database utilized was Web of Science, selected for its comprehensive indexing of multidisciplinary, peer-reviewed research. Additional sources included Scopus and Google Scholar to supplement coverage and ensure the inclusion of seminal works and grey literature.

The search was conducted using a combination of keywords, including:

“Public infrastructure”, “project delays”, “governance”, “procurement”, “risk management”, “South Africa” and “public-private partnerships”

Boolean operators (AND, OR) were used to refine search results and capture articles addressing intersections of these themes. The search also incorporated synonyms and related terms such as “construction delays,” “policy frameworks,” and “capacity building.”. The below table shows the inclusion and exclusion criteria.

Table 1: Inclusion and Exclusion Criteria

Criterion	Inclusion criteria	Exclusion criteria
Geographic and sectoral focus	Studies focused on public infrastructure projects in South Africa, or comparative studies providing findings relevant to the South African public-infrastructure context	Studies focused exclusively on private-sector projects without clear relevance to public infrastructure delivery or the South African context
Topical relevance	Studies that examined the causes, impacts, management, mitigation, or prevention of time delays in infrastructure projects	Studies that did not provide substantive discussion of project delays, delay management, procurement, governance, or related delivery challenges
Publication source	Articles published in peer-reviewed academic journals and papers published in reputable, peer-reviewed conference proceedings	Non-peer-reviewed sources, unpublished materials, opinion pieces, news articles, and sources of uncertain academic or professional credibility
Type of contribution	Studies presenting empirical evidence, theoretical or conceptual frameworks, systematic or critical literature reviews, and evidence-based management strategies	Studies offering only general descriptions of infrastructure delivery without evidence, analytical depth, or a meaningful connection to project-delay issues
Language	Studies available in English	Studies not available in English

2.2 Time Frame Covered

The review primarily considered literature published within the past ten years (2016–2026) to ensure relevance to current practices and policy debates. Earlier seminal works were included where necessary to provide historical context and foundational perspectives.

2.3 Selection and Analysis Methods

Titles and abstracts were screened for relevance, followed by full-text review of eligible articles. The selected literature was analyzed using thematic synthesis, grouping findings according to recurring causes of delays, governance and procurement challenges, risk management approaches, and best practice recommendations. Comparative studies and case analyses were highlighted to draw lessons applicable to the South African context. The synthesis aimed to identify research gaps, areas of consensus, and emerging strategies for delay mitigation.

3. THEMATIC REVIEW OF LITERATURE

3.1 Public Infrastructure in South Africa: Historical Context, Importance, and Challenges

The evolution of South Africa's infrastructure policy has been shaped by the need to address inherited service-delivery backlogs, reduce spatial inequality, and support inclusive economic development. The apartheid legacy produced uneven patterns of infrastructure investment, leaving many rural areas, townships, and informal settlements with inadequate access to

reliable basic services and economic infrastructure (Matimolane, 2026; Sithole, 2025). Public infrastructure investment is therefore central not only to economic growth and private-sector activity, but also to social inclusion, employment creation, climate resilience, and improved quality of life. Since the adoption of democratic governance, national policy frameworks have sought to strengthen infrastructure provision across key sectors, including transport, energy, water, sanitation, housing, and digital infrastructure. The National Development Plan and the National Infrastructure Plan 2050 position infrastructure as a mechanism for inclusive growth, spatial transformation, stronger service delivery, and improved long-term economic competitiveness (Watermeyer & Phillips, 2020; Thwala et al., 2022). However, population growth, rapid urbanisation, deteriorating assets, and constrained municipal capacity continue to intensify demand for infrastructure services and maintenance.

Despite these policy commitments, public infrastructure delivery remains constrained by weaknesses in planning, procurement, implementation, coordination, monitoring, and asset management. Research identifies weak intergovernmental coordination, fragmented institutional responsibilities, poor consultation processes, political-administrative tensions, inadequate life-cycle planning, and limited technical capacity as major barriers to effective municipal infrastructure delivery (Mafuna et al., 2024). These weaknesses can obscure accountability, delay decision-making, disrupt project implementation, and contribute to cost escalation, incomplete projects, and the diversion of resources from new infrastructure development to remedial maintenance and rehabilitation.

The effective delivery and maintenance of public infrastructure have implications beyond immediate service provision. Reliable infrastructure can support local economic activity, crowd in private investment, facilitate employment, and improve community resilience to climate-related and environmental risks. Conversely, infrastructure deterioration and weak governance tend to reproduce inequalities, with historically marginalised communities often experiencing the most severe service interruptions and infrastructure deficits (Matimolane, 2026; Sithole, 2025). Strengthening public infrastructure delivery in South Africa therefore requires integrated planning, clearer institutional roles, improved technical and project-management capacity, transparent procurement, stronger monitoring systems, and a life-cycle approach that gives equal attention to planning, construction, operation, maintenance, and renewal (Mafuna et al., 2024).

3.2 Causes of Project Delays: Payment, Planning, Procurement, Political, Capacity, etc.

Recent South African research shows that infrastructure-project delays often originate during planning and design, particularly where stakeholder engagement is inadequate, project scope is poorly defined, or land, community, and site-related issues are not resolved before implementation. These shortcomings can generate disputes, scope changes, legal challenges, and work interruptions during construction (Faku & Lukman, 2025). Delays may also arise from permitting, regulatory, and contractual processes, especially where implementing institutions lack the capacity to coordinate approvals, manage compliance requirements, and resolve contractual matters timeously (Faku & Lukman, 2025). In addition, inflation, price escalation, exchange-rate variability, and broader economic uncertainty can affect material

costs, contractor cash flow, and contractual affordability, potentially requiring variations, revised budgets, or renegotiation of project terms. A major source of delay in public infrastructure delivery is the late payment of contractors and suppliers. Payment delays constrain contractors' cash flow, limit their ability to procure materials, pay labour, and maintain site operations, and may ultimately result in work suspension, extended contract periods, disputes, and increased project costs (Odeyinka & Kaka, 2018). These problems are particularly severe for smaller contractors with limited financial reserves. In public-sector projects, payment bottlenecks may be aggravated by inefficient invoice-processing systems, delayed certification, inadequate budget management, fragmented approval processes, and weak coordination among implementing departments (Mabaso, 2021).

Political and administrative interference can further undermine project continuity, particularly where changes in political leadership, competing institutional priorities, or inappropriate involvement in the appointment of service providers disrupt established project-governance arrangements. Research on Municipal Infrastructure Grant projects identifies political interference, inadequate project-management skills, and limited institutional capacity within municipalities and project-management units as significant impediments to effective project implementation (Mofokeng, 2020). A shortage of experienced project managers, engineers, quantity surveyors, and technical monitoring personnel can weaken planning, scheduling, risk management, quality assurance, contract administration, and construction supervision. These constraints increase the likelihood that delays will remain unidentified or unmanaged until they become costly and difficult to reverse (Mofokeng, 2020; Faku & Lukman, 2025).

3.3 Governance and Procurement Frameworks: Policies, Best Practices, and Pitfalls

Literature highlights the value of leveraging digital procurement platforms, which can streamline processes, enhance transparency, and reduce corruption risks (Tamosaitiene et al., 2021). The establishment of procurement performance indicators and benchmarking against international standards has proven effective in identifying inefficiencies and driving continuous improvement (Wibowo & Kochendoerfer, 2011). However, it is noted that inconsistent application of governance guidelines across jurisdictions can foster ambiguity and undermine accountability (Alinaitwe & Ayesiga, 2013).

3.4 Risk Management Approaches: Identification, Assessment, and Mitigation Strategies

Advanced risk modeling techniques, such as Monte Carlo simulations and sensitivity analysis, are increasingly used in infrastructure projects to anticipate potential disruptions and optimize resource allocation (Tamosaitiene et al., 2021). Literature also points to the necessity of integrating risk management into project culture, with regular training and awareness workshops for all stakeholders involved (Wibowo & Kochendoerfer, 2011). The adoption of flexible contract clauses, allowing for adjustments in response to unforeseen events, is recommended as a mitigation strategy (Alinaitwe & Ayesiga, 2013). Effective risk identification in public infrastructure projects often relies on collaborative workshops and stakeholder consultations, ensuring that diverse perspectives and potential vulnerabilities are considered early in the project lifecycle (Shivambu & Thwala, 2019). This participatory

approach helps capture risks related to technical, financial, environmental, and socio-political factors, which can otherwise be overlooked if risk management is confined to a narrow group of decision-makers (Tamosaitiene et al., 2021). Regularly updated risk registers and scenario planning exercises further strengthen preparedness for unexpected disruptions.

In addition, continuous monitoring and evaluation systems are essential for the timely detection of emerging risks and for the implementation of corrective actions before minor issues escalate into major delays (Wibowo & Kochendoerfer, 2011). Integrating digital tools for real-time progress tracking and risk reporting enhances transparency and accountability, supporting evidence-based decision-making throughout the project lifecycle (Alinaitwe & Ayesiga, 2013) 4. Ultimately, embedding a proactive and adaptive risk management culture across all project stakeholders is vital for reducing delays and achieving successful infrastructure delivery.

3.5 Public-Private Partnerships (PPPs): Role, Success Factors, and Barriers

Studies on PPPs underscore the importance of pre-implementation feasibility assessments to ensure project viability and alignment of expectations between partners (Tamosaitiene et al., 2021). Effective communication and trust-building activities are highlighted as essential for overcoming cultural and operational differences between public and private entities (Wibowo & Kochendoerfer, 2011). Appropriate risk transfer mechanisms, such as insurance and guarantees, are shown to enhance confidence and reduce the likelihood of disputes (Alinaitwe & Ayesiga, 2013).

The structuring of PPP contracts is a critical factor in determining project outcomes, with clear allocation of roles, responsibilities, and risks necessary to maintain balance between public interests and private sector incentives (Shivambu & Thwala, 2019). Well-defined performance indicators and payment mechanisms help align partner objectives and ensure that both parties remain committed to delivering on project milestones (Tamosaitiene et al., 2021). When these contractual elements are ambiguous or inadequately enforced, disputes and delays become more likely, undermining the effectiveness of the partnership. Capacity constraints within the public sector often hinder the successful implementation of PPPs, as government agencies may lack the specialized expertise needed to negotiate, monitor, and manage complex contractual arrangements (Wibowo & Kochendoerfer, 2011). Literature suggests that targeted training and the involvement of independent advisors can help bridge these capacity gaps and enhance the government's ability to protect the public interest (Alinaitwe & Ayesiga, 2013). Moreover, sustained stakeholder engagement throughout the PPP lifecycle including community consultation and transparent disclosure of project information can build public trust and support, further contributing to project success (Shivambu & Thwala, 2019). Barriers to broader adoption of PPPs in South Africa include political uncertainty, regulatory complexity, and market perceptions of risk, which can deter private investment (Tamosaitiene et al., 2021). Addressing these challenges requires stable policy environments, streamlined approval processes, and the development of standardized PPP frameworks to reduce transaction costs and promote greater participation from both domestic and international partners (Wibowo & Kochendoerfer, 2011)

3.6 Comparative International Insights: Lessons from Other Countries/Regions

Comparative literature indicates that infrastructure delivery is more likely to achieve favourable time, cost, quality, and value-for-money outcomes when project-selection and procurement decisions are transparent, criteria-based, and aligned with project complexity, risk allocation, market conditions, technical capacity, and stakeholder requirements. The choice of an appropriate project-delivery method should therefore be guided by clearly specified criteria rather than a uniform procurement approach, as different delivery models allocate responsibility, risk, collaboration, and performance incentives differently (Alves, Reis and Rodrigues, 2023). Research on infrastructure-delivery method selection similarly identifies regulation, project scope, risk, cost, time, innovation requirements, contractor capacity, community support, and political conditions as factors requiring systematic consideration. Investment in human capital is also fundamental to improving infrastructure performance. The availability of competent project managers, procurement practitioners, engineers, contract administrators, and monitoring personnel supports better project planning, bid evaluation, scheduling, financial control, risk management, contract administration, and quality assurance. Evidence from Uganda demonstrates that bureaucracy, design delays, compensation processes, delayed contractor payments, and weak institutional arrangements can adversely affect road-infrastructure performance, reinforcing the need for stronger project and procurement capability within implementing agencies (Kagoro-Rugunda, 2018).

International procurement approaches may offer useful lessons for South Africa, but they should be adapted to local legal, institutional, and market conditions rather than adopted uncritically. Joint ventures can potentially combine complementary financial, technical, managerial, and local-market capabilities, although their effectiveness depends on appropriate partner selection, transparent governance, equitable risk allocation, and strong contractual arrangements (Aigbavboa *et al.*, 2023). Performance-based procurement and contracting can also strengthen accountability by linking remuneration to specified outcomes, such as timely delivery, quality performance, asset functionality, and sustainability requirements. However, South African procurement law and practice have not always provided explicit mechanisms for embedding innovation-oriented performance conditions in public contracts, making regulatory reform and procurement-capacity development important prerequisites for implementation (Ramakrishna, 2017).

3.7 Impact of Delays: Economic, Social, and Political Consequences

The economic ramifications of delays extend beyond direct costs, affecting regional competitiveness and the attractiveness of South Africa for foreign investment (Tamosaitiene *et al.*, 2021). Socially, delayed infrastructure perpetuates disparities in access to services such as water, healthcare, and education, particularly in rural areas (Alinaitwe & Ayesiga, 2013). Politically, these delays can serve as rallying points for opposition parties and civil society organizations, intensifying pressure for reform and accountability (Wibowo & Kochendoerfer, 2011).

4. SYNTHESIS AND DISCUSSION

The review demonstrates that the persistent challenge of time delays in South African public infrastructure projects arises from a complex interplay of historical, institutional, and operational factors. Across the literature, there is consensus that while significant investments have been made to improve access and quality of infrastructure, the legacies of apartheid manifested in spatial inequality and systemic backlogs still influence project prioritization and resource allocation (Shivambu & Thwala, 2019); (Tamosaitiene et al., 2021). Institutional challenges, notably misalignment between national and provincial government priorities, fragmented responsibilities, and limited technical capacity, consistently emerge as root causes of delays (Wibowo & Kochendoerfer, 2011).

A recurring theme is the multifaceted nature of delays, with studies highlighting payment bottlenecks, inadequate project planning, evolving regulatory frameworks, political interference, and capacity constraints as critical contributors. There is broad agreement in the literature that payment delays and bureaucratic inefficiencies disrupt cash flow and stall progress, while weak integration of stakeholder interests during project design increases the likelihood of disputes and interruptions (Alinaitwe & Ayesiga, 2013). The growing complexity of regulatory requirements, particularly around environmental compliance, underscores the need for greater capacity and flexibility within implementing agencies. The literature further reveals that governance and procurement reforms are essential for reducing delays, with best practices including digital procurement systems, independent oversight, and standardized procedures. However, there is a notable gap in the consistent application of these reforms across different jurisdictions, suggesting a need for stronger institutional coordination and continuous training. While risk management strategies are increasingly sophisticated incorporating advanced modeling, participatory risk identification, and real-time monitoring there is a lack of empirical studies evaluating their effectiveness in the South African context. This points to a crucial area for future research: the assessment and adaptation of international risk management frameworks to local realities.

Public-private partnerships (PPPs) are presented as a promising approach for mobilizing resources and enhancing efficiency, yet their success depends on rigorous feasibility assessments, clear contractual frameworks, and ongoing capacity building within the public sector. Barriers such as political uncertainty, regulatory complexity, and capacity deficits remain significant hurdles to broader PPP adoption. The literature calls for more systematic evaluation of PPP models, especially in terms of risk sharing and long-term value for money.

A key controversy identified is the tension between speed and quality in project delivery. While expedited processes can address urgent infrastructure needs, they may compromise stakeholder engagement, risk assessment, and long-term sustainability. There is also debate over the most effective allocation of roles and risks between public and private partners, with some studies advocating for greater government oversight and others highlighting the efficiency gains of private sector leadership. For theory, these findings reinforce the importance of multi-level governance and complex systems perspectives in understanding infrastructure delivery. Practically, the synthesis underscores that solutions must be context-specific,

addressing not only technical and managerial aspects but also the socio-political environment in which projects are implemented. Policy recommendations emerging from the review include institutionalizing robust procurement and risk management protocols, investing in human capital, fostering intergovernmental collaboration, and promoting transparent stakeholder engagement. In sum, while the literature offers a robust foundation for understanding the causes and consequences of delays, further empirical research is needed to refine best practices and adapt international innovations to the South African context. Bridging these gaps will be essential for achieving timely, equitable, and sustainable infrastructure delivery.

5. RECOMMENDATIONS

To address persistent time delays and improve the successful delivery of public infrastructure projects in South Africa, the following recommendations are proposed:

- **Strengthen Institutional Capacity and Coordination:**

Government agencies should invest in ongoing training and professional development for project managers, procurement officials, and technical staff to enhance project planning, execution, and oversight. Improved coordination between national, provincial, and local authorities will reduce fragmentation and clarify accountability throughout the project lifecycle.

- **Enhance Stakeholder Engagement:**

Early and continuous involvement of all key stakeholders including communities, contractors, and financiers should be institutionalized to ensure that project objectives, risks, and expectations are clearly communicated and aligned from inception to completion.

- **Modernize Procurement Practices:**

Adoption of digital procurement platforms and standardized documentation will increase transparency, reduce corruption risks, and streamline contract award and management processes. Regular benchmarking against international best practices should be implemented to identify areas for improvement.

- **Embed Robust Risk Management:**

Risk assessment and mitigation should be integrated into every stage of the project lifecycle. The use of advanced modeling techniques, regularly updated risk registers, and contingency planning will help anticipate and address potential disruptions proactively.

- **Promote Effective Public-Private Partnerships:**

PPP frameworks should be standardized, with clear guidelines for risk sharing, performance measurement, and dispute resolution. Capacity-building efforts are needed to strengthen government negotiation and monitoring skills, and independent advisory services should be engaged where necessary.

- **Foster a Culture of Accountability and Learning:**

Establish independent oversight mechanisms and regular project audits to ensure compliance with governance and procurement standards. Lessons learned from completed projects should be systematically captured and used to inform future initiatives.

Delays in public infrastructure delivery remain a significant barrier to South Africa's development aspirations, impacting economic growth, social equity, and public trust in government institutions. This review has shown that time delays are driven by a combination of historical legacies, institutional weaknesses, capacity constraints, and evolving political and economic conditions. While notable progress has been made in policy formulation and investment, persistent challenges in payment systems, stakeholder integration, procurement, and risk management continue to undermine project outcomes.

The synthesis of literature highlights the need for comprehensive, context-sensitive solutions that address both technical and socio-political dimensions of infrastructure delivery. Strengthening institutional capacity, modernizing procurement and risk management, and promoting transparent stakeholder engagement are all essential steps toward more timely and effective project completion. Furthermore, adapting and rigorously evaluating international best practices, particularly around PPPs and risk frameworks, will be critical for sustained improvement. Ultimately, overcoming these challenges will require sustained commitment, cross-sector collaboration, and a willingness to learn and adapt. By implementing the recommendations outlined above, South Africa can move closer to realizing the full potential of its infrastructure investments driving inclusive growth, improving service delivery, and enhancing the quality of life for all its citizens.

6. CONCLUSION

Delays in public infrastructure delivery remain a significant barrier to South Africa's development aspirations, impacting economic growth, social equity, and public trust in government institutions. This review has shown that time delays are driven by a combination of historical legacies, institutional weaknesses, capacity constraints, and evolving political and economic conditions. While notable progress has been made in policy formulation and investment, persistent challenges in payment systems, stakeholder integration, procurement, and risk management continue to undermine project outcomes.

The synthesis of literature highlights the need for comprehensive, context-sensitive solutions that address both technical and socio-political dimensions of infrastructure delivery. Strengthening institutional capacity, modernizing procurement and risk management, and promoting transparent stakeholder engagement are all essential steps toward more timely and effective project completion. Furthermore, adapting and rigorously evaluating international best practices, particularly around PPPs and risk frameworks, will be critical for sustained improvement. Ultimately, overcoming these challenges will require sustained commitment, cross-sector collaboration, and a willingness to learn and adapt. By implementing the recommendations outlined above, South Africa can move closer to realizing the full potential

of its infrastructure investments driving inclusive growth, improving service delivery, and enhancing the quality of life for all its citizens.

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