



Advancing infrastructure investments in South Africa: The centrality of off-take negotiations

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Abstract

Expanding economic and social infrastructure in South Africa is at the heart of the National Infrastructure Plan 2050, or NIP-2050, designed in strategic pursuit of the national vision of inclusive growth, and aligning key development objectives with actionable investments and their outcomes. The urgency for the development of water infrastructure is underlined in NIP-2050, requiring investments of about ZAR 1 trillion, or US\$ 60 billion, over ten years. This paper zeroes into one of those planned investments, the mega-scale uMkhomazi water infrastructure project in the southeastern region of the country, an inter-basin scheme for improving supplies to more than six million people and industries in the third-largest regional economic hub. The study examines the delayed process of off-taker negotiation of the project funding model and affordability levels, drawing on the direct experiences and perspectives of key project stakeholders, in a participatory manner. Lessons point to the need for project sponsoring and implementing agents to create ample room for negotiation processes to be fully inclusive and robust; enable early and transparent deliberation on project feasibility, funding options and implications for affordability; and take sensitive cognizance of the requirements of local approval structures for recurring capacity building.

Keywords: Infrastructure Development Challenges; Multi-Partner Decision-Making; Stakeholder Negotiations; Water Investments; South Africa

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1. Introduction

Robust infrastructure drives socio-economic development. During the 1960s and 1970s, South Africa directed substantial investments across various sectors to build reliable and effective infrastructure (Watermeyer and Philips, 2020). However, inadequate and inefficient infrastructure has recently emerged as a hindrance to socio-economic advancement (Chakamera and Alagidede, 2018). Many government-funded projects are plagued by significant delays and cost escalations, due to a variety of factors, including fiscal constraints and inadequate financial allocations, extended decision-making timelines and drawn-out off-take negotiations, with escalations in project costs worsened by inflationary pressures. The long-term perspective for advancing infrastructure development in South Africa, the National Infrastructure Plan 2050 (NIP-2050), seeks to deploy better strategies for future investments, mapping out a path that aligns the core development objectives of the country with actionable projects and their outcomes.

Water infrastructure, considered broadly as encompassing water supply, treatment, distribution, and wastewater management, is a critical component of vital networked infrastructure that faces significant challenges in several countries. Ageing infrastructure, population growth, and climate change are increasingly burdening these systems, which are essential for public health, economic development, and environmental sustainability. Delays in the maintenance, upgrades, and expansion of water infrastructure have become a pressing concern for municipalities and governments worldwide. These postponements not only compromise the reliability and efficiency of water services, but also increase the risk of system failures, water quality deterioration, and environmental degradation (Taha et al., 2016).

Consequently, there is growing consensus among policymakers, engineers, and environmental experts that water infrastructure requires urgent attention and substantial investment, to the tune of about ZAR 1 trillion, or US\$ 60 billion over ten years. Addressing these challenges promptly is crucial for ensuring safe, accessible, and sustainable water supply for future generations, as well as for supporting economic growth and resilience, in the face of evolving environmental conditions (Watermeyer and Philips, 2020). At the macroeconomic level, South Africa's inflexible fiscal policies and long-running budget deficits posed significant obstacles to infrastructure development (Aiyetan and Das, 2021). These interrelated factors limit the government's ability to allocate sufficient resources to critical infrastructure projects, ultimately impeding national progress and economic growth.

This lack of flexibility often results in the suboptimal allocation of funds, with infrastructure development receiving inadequate attention and resources. Consequently, many essential projects are frequently underfunded or delayed, hampering the country's development trajectory. A high debt burden, with gross debt stock at 73.9 per cent of GDP in the 2023-24 fiscal year expected to reach 74.7 per cent of GDP in 2026-27, exacerbates the situation by constraining the government's financial capacity for infrastructure investments. When a significant portion of the national budget is allocated for debt servicing and other immediate obligations, limited fiscal space remains for long-term infrastructure investments. This shortage of funds, and the difficulty of structuring projects for bankability, in collaboration with critical project partners, has led to a backlog of infrastructure projects across various sectors, including energy, telecommunications, transportation, water supply and sanitation.

Extensive research has been conducted on the factors contributing to project delays on a global scale, including in South Africa (Ruiters and Matji, 2015; Gaetsewe et al., 2015; Taha et al., 2016; Hyder and Saja,

2020; Ekwuno, 2022). Such studies demonstrate that delays prevalent in the planning and design phases of construction projects can significantly impact overall project timelines. In particular, Aiyetan and Das (2021) find that delays in the front-end engineering design phase are strongly correlated with overall project delays. Ruiters and Matji (2015) believe that the complex interaction between the government's budget deficits and debt servicing, together with troublesome political factors, creates a seemingly insurmountable barrier to addressing South Africa's water infrastructure backlog.

This paper is focused on ongoing efforts to address the backlog of water services in the Kwa-Zulu Natal province of South Africa, in the southeastern region of the country (Figure 1), specifically relating to the implementation of the mega-scale uMkhomazi water infrastructure project, seeking to transfer water from the uMkhomazi River catchment to augment the Mngeni River catchment. The latter catchment supplies water to more than six million people and industries in the third-largest regional economic hub in South Africa, incorporating the strategic cities of Durban and Pietermaritzburg. The Mngeni catchment is already experiencing a water resource deficit, necessitating augmentation to enhance water security in the region, in a manner that should last until about the year 2040, at the earliest.

More specifically, the paper examines the delayed process of off-taker negotiation of the project funding model and affordability levels among several contracting parties – on the one hand, a group of off-take municipalities, and on the other, the sponsoring government department and the funding/implementing agency – with a view to understanding the drivers of the drawn-out negotiations.



Figure 1. Location of the project area in Kwa-Zulu Natal province, South Africa

The remainder of the paper is organised as follows. The succeeding section provides a brief description of the project context. Next, the review of previous work explores several factors influencing project delays and cost escalations, highlighting the limitations of the extant literature. The section on study methodology outlines the manner

in which the principles of participatory research were deployed, underscoring stakeholder ownership of process and outcomes. In the last two parts, study findings, conclusions and recommendations are summarized.

2. Infrastructure project context

In the project area, in the southeastern region of South Africa (Figure 1), the primary source of water for the communities, commercial centres and industrial hub is the Mngeni water supply system, incorporating the Mngeni River. While there are currently four storage reservoirs on the Mngeni River, with a combined yield of 334 million cubic metres per annum, the Mngeni supply system is in a state of deficit, requiring an in-flow augmentation to improve regional water security until about the year 2040. The water deficit has raised concerns about the ability of the Mngeni system to provide adequate and reliable water supply to the region's growing population and expanding economic activities, especially around the two largest cities in the Kwa-Zulu Natal province, Durban and Pietermaritzburg. Urban and industrial development in the centres is extensive and has a major impact on water demand.

The infrastructure project for addressing the deficit is the mega-scale uMkhomazi water project, planned to increase the yield of the Mngeni supply system by 214 million cubic metres per annum. The project is configured as an inter-basin water transfer scheme, with raw water stored in the uMkhomazi River catchment and transferred to the Mngeni River catchment. The infrastructure elements are as follows:

- Storage dam: 81 m high Smithfield Dam and associated infrastructure in the uMkhomazi River, with a gross storage capacity of 251 million cubic metre.
- Conveyance infrastructure: 32 km, 3.5 m diameter tunnel, and 5 km, 2.6 m diameter pipeline, from the Smithfield Dam to a new water treatment plant (TCTA, 2021).

Project sponsor and owner is the national Department of Water and Sanitation (DWS); and a ministerial directive was issued in 2019 to its special purpose vehicle, the Trans-Caledon Tunnel Authority (TCTA), to fund and implement the raw water component of the project as a government waterworks. At the downstream end of the broader infrastructure, the potable water supply component is expected to be implemented by a state-owned water services provider, the uMngeni-uThukela Water Board, enhancing the assurance of the supply of treated water to six municipalities in the region.

The implementation of the foregoing water augmentation measures, and the mobilization of the requisite substantial investment, call for careful front-end planning and collaboration among several stakeholders, to ensure a common understanding of project objectives, outcomes and bankability, as well as the long-term sustainability of the river catchments and their ecosystem. In addition to DWS and TCTA, the other strategic institutional stakeholders directly involved in the collective mapping of project arrangements – including water-use agreements – are the uMngeni-uThukela Water Board and the six municipal off-takers. On as-required basis, there are also ongoing interactions with the national department for the environment, the provincial government, civil society organizations, community structures, potential lenders to the project and the National Treasury, the latter of which holds the authority for the approval of borrowing limits and associated matters.

Following the issuance of the directive for the uMkhomazi raw water infrastructure project, it was estimated to be completed in 2026, at the total cost of ZAR 23.2 billion, or US\$ 1.3 billion. The current forecast date of completion

of the project is March 2032, at an anticipated cost of ZAR 28 billion, or US\$ 1.6 billion: a delay of well over six years, and minimum cost escalation of more than 20 percent.

3. Literature review

The global community recognises that the advancement of a nation's infrastructure plays a pivotal role in social and economic development. Well-developed infrastructure not only enhances productivity and efficiency but also improves the overall quality of life for a nation's population (Tshidavhu and Khatleli, 2020). More importantly, robust water and sanitation systems contribute to public health and environmental sustainability. As nations strive for sustainable development and economic competitiveness, there is increasing recognition that prioritising infrastructure development is essential to achieving long-term growth, reducing poverty, and improving overall societal well-being (Ruiters and Matji, 2015; Aiyetan and Das, 2021).

In examining the challenges of implementing two mega-scale energy projects in South Africa – the Medupi and Kusile power plants – Tshidavhu and Khatleli ascertained that delayed client decision-making precipitated the majority of the challenges that emerged (Tshidavhu and Khatleli, 2020). Aiyetan and Das (2021) posited that insufficient investment laws and inadequate revenues from taxes and tariffs influence the delay and suboptimal delivery of infrastructure projects.

In addition to delayed client decision-making, the extant literature has established that inadequate planning, design deficiencies, suboptimal information flow, ineffective stakeholder engagement, and poor communication contribute to project delays and cost overruns (Ekwuno, 2022). These challenges not only impede project timelines and budgets, but also have far-reaching consequences on economic growth and social development. Citing several findings, Ekwuno (2022) asserts that delays have adverse effects on stakeholders, resulting in diminished trustworthiness, cash flow issues, litigation, arbitration, and deterioration of future relationships.

Effective coordination among project organisations and their key stakeholders is crucial for successful project delivery, because it ensures the alignment of goals, efficient resource allocation, and timely decision-making. This coordination involves clear communication channels, well-defined roles and responsibilities, and a shared understanding of project objectives. By establishing robust coordination mechanisms such as regular level-ground stakeholder meetings, integrated project management systems, and cross-functional teams, organisations can enhance their capacity to navigate complex project environments and deliver outcomes that meet or exceed expectations (Aiyetan and Das, 2021).

Existing research on the water investment value-chain and supportive governance models has provided valuable insights into various aspects of water infrastructure development. However, a significant gap remains in our understanding of the critical pre-funding phase of the development of the infrastructure, and the intricate processes involved in negotiating off-take arrangements and water supply agreements. This gap is particularly noteworthy because the pre-funding period, seeking to confirm bankability, often sets the foundation for the success or failure of water infrastructure projects.

Expanding this area of study could reveal crucial factors influencing the development and implementation of water infrastructure initiatives. For instance, an in-depth examination of the negotiation processes with direct off-takers, prior to firming up the funding model and securing funds, can reveal the power dynamics, stakeholder interests, and potential conflicts that shape the final agreements between implementing agents and off-takers. In

addition, exploring the pre-funding phase could shed light on how different institutional models can be selected, adapted, or created to suit specific local contexts.

4. Methodological approach

Participatory research, the approach underpinning this study, is a research-to-action approach that emphasises the direct engagement of local priorities and perspectives (Cargo and Mercer, 2008). Participatory research is an umbrella term that encompasses research design, methods, and frameworks that employ systematic inquiry in direct collaboration with stakeholders affected by the issue under investigation to facilitate action or change (Cargo and Mercer, 2008).

The foundational premise of participatory research methods is the value placed on genuine and meaningful participation. This means valuing “the ability to speak up, to participate, to experience oneself and be experienced as a person with the right to express themselves and to have their expression valued by others” (Cargo and Mercer, 2008). Building upon the participatory research approach, this methodology cultivates a collaborative environment in which researchers and community members collaborate to identify, analyse, and address local challenges.

In this study, participatory assessment of the project negotiation process not only enhances the relevance and applicability of the findings, but also empowers project stakeholders to assume ownership of the study process and its outcomes. Through the integration of project experiences and perspectives, the participatory approach herein is considered to yield more sustainable and context-appropriate solutions to the complex dynamics of the mega infrastructure project, as well as the associated social and environmental dimensions. A coding tree methodology was employed to elucidate themes based on the participants' insights. This approach facilitated the examination of their viewpoints and culminated in a feedback session that served to authenticate the collected data.

Participants in this study include interviewees from the following partnering institutions:

- Off-take Municipality of Msunduzi, encompassing the city of Pietermaritzburg, the administrative capital of the province of KwaZulu-Natal;
- The intermediary water services provider, uMngeni-uThukela Water Board mandated to supply treated bulk water to the off-takers;
- The project sponsoring government department responsible for water resources management across the country, Department of Water and Sanitation; and
- The state-owned enterprise directed to fund and implement the project, Trans-Caledon Tunnel Authority.

Some of the participants were senior officials from key institutions involved in the development of the project, and had direct experiences of the front-end planning delays from 2019 to 2024. Delays affect different stakeholders, such as municipal off-takers and end users, in varied ways. For off-takers, specifically, this means delayed realisation of project objectives, resulting in revenue loss, cost escalation, and failure to receive value for money (Ogbeifun and Pretorius, 2022 p. 94).

The information obtained from project stakeholders was supplemented by a review of extant memos, letters and meeting records. Essentially, the approach involved prudently mapping out the study with key

stakeholders, conducting semi-structured interviews as agreed upfront, carrying out systematic reflective sessions and informal discussions to establish what seemed to have worked or not worked, and why, as well as critically appraising the available information and data.

5. Elements of the negotiation process

At the point of the 2019 government directive to implement the uMkhomazi water project, the sponsoring department and implementing agent were both confident about project readiness for implementation, including the strategic rationale and urgency, socio-economic soundness, risk profile, cost-effectiveness and affordability, as well as overall value for money. Earlier in 2009, the system reconciliation assessment indicated that the project had the highest potential to meet the long-term water requirements of the region, with the ensuing technical feasibility concluded in 2014.

In the negotiation process post-directive, with the aim to agree water user agreement as a major project milestone, the sponsor and implementing agent sought to engage off-take municipalities on the cost-effectiveness and affordability of the project to off-takers, mapping out their perception of the level of reasonableness and firmness associated with the estimates, and the proposed funding model. The back-and-forth negotiations provided room for off-takers and their user communities to gauge their own understanding of the value for money, assess the costs of debt service and intermediary agency administration, and their impact on water tariffs, as well as, especially, explore alternative implementation arrangements and the possibility for fiscal support and concessional financing. At times, some dimensions of the negotiations required that assistance be sought from a political steering committee involving elected officials and political appointees, chaired by the national Minister of Water and Sanitation.

The front-end negotiations were delayed, first, by the critical matter of affordability raised by the municipalities, and later because of noncompliance, by one municipality, with the public participation process outlined in the Municipal Finance Management Act of South Africa. In particular, negotiations stalled several times on the level of raw water tariffs acceptable to municipal off-takers, with a resolution requiring the procurement of an independent consultant to conduct a detailed socio-economic impact assessment, incorporating a cost-benefit analysis. Ultimately, the national government intervened to make the project more affordable to water users, picking up 25 percent of the costs through fiscal allocations, and providing additional 25 percent as interest-free loan, such that the implementing agent was only required to mobilize the remaining 50 percent from the financial market, as cost-effectively as possible.

Once the affordability hurdle was crossed, and supportive feedback was received from the public participation process conducted by each off-take municipality, inputs reflected from the relevant provincial and national authorities, and approval-to-proceed obtained from all municipal councils, the six water user agreements were concluded and signed in April 2024.

While the agreements were meant to establish the legal basis for water supply and revenue flows in support of infrastructure development and water management, ideally resulting in increased assurance of water supply and superior service delivery, the negotiations were long-drawn-out, perhaps pointing to gaps in certain modules of project feasibility. Ultimately, the extended timespan of back-and-forth negotiations, together with other project challenges, has resulted in a shift in the timeline for water delivery by more than six years, and a cost escalation of over 20 percent.

With the Mngeni supply system remaining in a state of water deficit, the long delay of an urgent augmentation of 214 million cubic metres per annum impacts on regional water security, affecting the assurance of water supply to six million people, as well as planned significant commercial and industrial development. Also, the impact of an increase of 20 percent in project cost will be felt in new tariff projections, raising further affordability concerns. The implications of these drawn-out negotiations and cost escalations have been factored into the collective review and updating of the risk matrix for the entire project, as it evolves into full implementation.

6. Findings

Drawing on participatory engagement with a wide spectrum of project stakeholders, this section underscores that stakeholders expect the negotiation process for mega-scale infrastructure investments, such as the uMkhomazi project, to be fully inclusive and robust, enable early and transparent deliberation on project feasibility, funding model and affordability, and take cognizance of the requirements of local approval structures for recurring capacity building.

6.1. Active participation in decision-making

The perspective from water users emphasises the critical importance of transparent communication and adaptability in project planning. Early and open engagement with project stakeholders could have mitigated some of the concerns that unfolded, particularly those relating to funding mechanisms and tariff levels, and would have allowed a better understanding of stakeholder expectations, paving the way for timely problem-solving and risk mitigation. Clear lines of communication and decision-making, among both external stakeholders and internal team members and partners, could have enabled more rapid responses to emerging issues, as well as internal alignment of the sponsoring and implementing agents.

Greater flexibility in project design and implementation strategies would allow the ability to adapt and modify plans quickly, as unforeseen challenges arose. It was suggested by study participants that such adaptability should be built into the project framework from the outset, enabling contingency plans and alternative approaches to be readily available when needed. The integration of these two crucial aspects of project development would enable a more holistic approach to risk assessment and management, ensuring that local water-user considerations are adequately factored into financial projections and timelines.

6.2. Stakeholder understanding of the funding model

Study participants expressed the view that earlier unpacking of the project funding model, funding option analysis and tariff determination would have mitigated the challenges faced during the negotiation process.

Water off-takers considered themselves capable of interrogating any funding model, irrespective of its complexity, and reckoned that prompt engagement on financial aspects might have allowed for a more collaborative approach to addressing their concerns, potentially preventing the prolonged negotiation impasse. They also believed that such engagement could have provided valuable insights into the preferences and

constraints of various strategic stakeholders, enabling the sponsoring and implementing agents to refine their approaches before reaching a deadlock.

This experience underlines the importance of mainstreaming financial planning into stakeholder consultation upfront in the project lifecycle, particularly for infrastructure investments with significant economic implications for end users. In this project, the late stakeholder engagement on the funding model and tariff structures may be highlighting some gap in the (inclusive) evaluation of financial feasibility.

6.3. Patient, cyclic engagement with councillors

Investment in water infrastructure of the project scale requires a long-term perspective, which contrasts with the brevity of the political tenure of approving structures of local government for such projects. It stands to reason that stakeholders expect that all efforts be made to get elected councillors to understand water infrastructure and its funding mechanisms.

When equipped with knowledge of potential funding arrangements, associated water tariff implications, and their impact on project delivery, councillors can become effective decision-makers and accountability keepers. However, the frequent change in councillors requires an on-going process of education and capacity building. In the absence of understanding, misinformation and suspicion tend to proliferate, hence the need for continuous and patient engagement with downstream approval structures.

6.4. Transparency and trust

Whether in timely taking water users through active engagement, or in especially unpacking the funding model and its implication for affordability, or in specifically targeting councillors iteratively, study participants commonly emphasised the importance of transparency, trust, and mutual respect in project negotiations amongst stakeholders.

One instance was cited by study participants, occurring during an engagement to address project negotiation delays, when senior officials of municipal off-takers felt disrespected by political leadership from the national government, because they perceived the latter as ordering them to immediately sign off-take agreements, even as they considered their concerns far from fully resolved. Municipal officials also pointed to a pre-existing dispute on a similar infrastructure project, sponsored and implemented at the national level, where they believed that their concerns about the potential for overpayment to settle project debt turned out to be valid. The old dispute fueled perceived mistrust and lack of transparency, such that the new negotiations were fraught with tension.

7. Conclusions

Although multi-institutional projects face significant challenges in terms of authentic multi-level negotiation, coordination, alignment, and resource management, they also offer a wealth of opportunities for innovation, impact and institutional growth, provided they take cognizance of the significance of transparency, trust and mutual respect among partners and stakeholders. By carefully navigating these challenges and strategically leveraging opportunities, sponsoring and implementing agents are able to harness the power of robust

negotiations to address complex project and societal issues, advance knowledge, move the planned investment forward, and create lasting value for all parties.

A significant lesson from the study is the value of adaptive management strategies in the governance of mega-scale infrastructure investments. Given the complex and often unpredictable nature of such projects, particularly in developing countries, the ability to respond flexibly to changing circumstances and emerging challenges is crucial. This may involve regularly reassessing project goals, adjusting timelines, or modifying implementation strategies based on the feedback from strategic stakeholders. By embracing such adaptive approaches in governance, project planners and managers can enhance the resilience of infrastructure investments and increase their chances of long-term success, even in the face of unforeseen obstacles or shifting socio-economic conditions. Furthermore, the study highlights the importance of transparent communication and information sharing throughout the project lifecycle, which are essential for fostering trust and support among project stakeholders. In a bid to assist to positively influence the outcomes of similar project negotiation processes, and empower project stakeholders to better deal with the complex front-end dynamics of mega infrastructure investments, a few recommendations are summarized below.

7.1. Ensuring inclusive level-field negotiation process

Full and robust participation by all key stakeholders in project preparation and design is essential to achieving optimal outcomes and maximising benefits for all parties involved. This inclusive level-ground approach ensures that diverse perspectives, expertise, and concerns are incorporated from the outset, leading to more comprehensive and well-rounded project decisions.

Through such early engagement, project sponsors and implementers can identify potential challenges, mitigate risks, and utilise collective knowledge to develop innovative solutions. Moreover, this collaborative approach fosters a sense of ownership and commitment among stakeholders, thereby increasing the likelihood of successful project implementation and long-term sustainability. Ultimately, when stakeholders are actively involved in decision-making processes, they are more likely to support project objectives and contribute resources effectively.

7.2. Opening-up on project funding and modelling

Implementing mega-scale infrastructure projects requires careful planning and stakeholder engagement, particularly with regard to funding models and tariff structures. The early unpacking of project funding options is crucial for carrying-along stakeholders, as it offers transparency where it is considered to matter most, and builds trust among all parties.

By clearly outlining the financial aspects of a project, stakeholders can better understand the available resources, fund allocation, and potential risks and benefits associated with their involvement. The transparency helps alleviate concerns and encourages more active participation from stakeholders, as they are able to see how their contributions, and the quantum of such contributions, fit into the larger financial picture. Additionally, a thorough breakdown of project funding can be a powerful tool to attract and retain off-takers and other stakeholders. Such openness demonstrates financial accountability and responsible management, which are crucial factors in building long-term relationships with strategic stakeholders and other interested parties.

7.3. Recognising the power of local approval structures

The tenure of those in downstream political leadership structures, required in many cases for the approval of off-take decisions at the local level, may be out-of-sync with the timeframe for progressing front-end project negotiations into the phases of funding and implementation. In the context of local government, the turnover of councillors may present a significant challenge for project planners and managers, who find themselves in a perpetual cycle of education and re-education. The constant need to explain the principles and intricacies of huge infrastructure systems can be time-consuming and potentially hinder progress in advancing investments.

It would pay to exercise patience in ensuring the continuity in knowledge and understanding among those in local approval structures, to achieve consistent decision-making and policy implementation. While there may be potential knowledge gaps across political administrations, it is critical that project teams recognize the power of decision-makers and appreciate their crucial role in shaping policies and allocating resources.

References

- Aiyetan, A.O. and Das, D.K. (2021), "Evaluation of the factors and strategies for water infrastructure project delivery in South Africa", *Infrastructure*, Vol. 6 No. 65, pp. 1-19. <https://doi.org/10.3390/infrastructures6050065>
- Cargo, M. and Mercer, S. (2008), "The value and challenges of participatory research: strengthening its practice", *Annual Review of Public Health*, Vol. 29 No. 1, pp. 325-350. <https://doi.org/10.1146/annurev.publhealth.29.091307.083824>
- Chakamera, C. and Alagidede, P. (2018), "The nexus between infrastructure (quantity and quality) and economic growth in Sub-Saharan Africa", *International Review of Applied Economics*, Vol. 32, pp. 641-672. <https://doi.org/10.1080/02692171.2017.1355356>
- Ekwuno, A. (2022), "Analysing the project delays causes in the South African construction industry", *International Journal of Engineering Applied Sciences and Technology*, Vol. 7 No. 6, pp. 15-73. <https://doi.org/10.33564/IJEAST.2022.v07i06.002>
- Gaetsewe, R., Monyane, T. and Emuze, F. (2015), "Overruns again in public projects: a perspective from Northern Cape, South Africa", *6th International Conference on Engineering, Project, and Production Management*, Marriott Resort and Spa Hotel, Brisbane Queensland Australia, available at: https://www.researchgate.net/publication/281965567_Overruns_Again_in_Public_Projects_Perspective_from_Northern_Cape_South_Africa, pp. 37-46 (accessed 20 March 2024). <https://doi.org/10.32738/CEPPM.201509.0006>
- Hyder, K. and Saja, M. (2020), "The benefits of applying project management methodology on project delay: A study in construction projects in Iraq", *Montreal, IOP Conference Series: Materials Science and Engineering*. Vol. 745 No. 1. <https://doi.org/10.1088/1757-899X/745/1/012155>
- Ogbeifun, E. and Pretorius, J. (2022), "Investigation of factors responsible for delays in the execution of adequately funded construction projects", *Engineering Management in Production and Services*, Vol. 14 No. 1, pp. 93-102. <https://doi.org/10.2478/emj-2022-0008>

- Ruiters, C. and Matji, M. (2015), "Water institutions and governance models for funding, financing and governance of water infrastructure in South Africa", *Water SA*, Vol. 41 No. 5, pp. 660-676. <https://doi.org/10.4314/wsa.v41i5.9>
- Taha, G., Badawy, M. and El-Naway, O. (2016), "A model for evaluation of delays in construction projects", *International Journal of Innovation Research in Science, Engineering and Technology*, Vol. 5 No. 3, pp. 3021-3027.
- Trans-Caledon Tunnel Authority (2021), "2020-2021 Integrated Annual Report: Journey towards sustainable development", Centurion: Trans-Caledon Tunnel Authority, available at: https://www.tcta.co.za/wp-content/uploads/2022/06/TCTA_IAR_2021_Final.pdf (accessed 12 January 2023).
- Tshidavhu, F. and Khatleli, E. (2020), "An assessment of the causes schedule and cost overruns South African mega-projects: A case study of critical energy sector projects of Medupi and Kusile", *Acta Structilia*, Vol. 26 No. 2, pp. 119-143. <https://doi.org/10.18820/24150487/as27i1.5>
- Watermeyer, R. and Philips, S. (2020), "Public infrastructure delivery and construction sector dynamism in the South African economy", Discussion paper, National Planning Commission, University of the Witwatersrand, Johannesburg, 25 April. Available at: <https://www.wits.ac.za/ipdm/evidence-based-publications/discussion-papers> -(accessed 26 March 2024).