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Project Cost and Financial Management Challenges in Greening Gauteng Metropolitan Cities

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Abstract

Urban greening is increasingly promoted as a pathway to sustainable and climate-resilient cities; however, its implementation in metropolitan municipalities is often constrained by persistent challenges in project costs and financial management. This qualitative study examines the institutional, fiscal, and financial factors shaping the costing and financing of urban greening initiatives in Gauteng's metropolitan municipalities: Johannesburg, Tshwane and Ekurhuleni. Semi-structured interviews were conducted with municipal officials, project managers, and environmental planners involved in green infrastructure planning and delivery, complemented by document analysis of municipal planning and financial reports. Thematic analysis reveals six interrelated challenges: institutional fragmentation, constrained fiscal capacity, weak cost estimation and project appraisal practices, limited access to innovative financing instruments, insufficient technical and monitoring capacity, and misalignment between environmental ambitions and financial accountability frameworks. The findings show that greening initiatives are often treated as discretionary expenditures rather than long-term investments, leading to underbudgeting, cost overruns, and reliance on short-term grants. The study argues that improving the financial sustainability of urban greening requires integrated green budgeting, strengthened project appraisal, life-cycle costing and investment appraisal, targeted capacity building, and reforms to municipal fiscal and audit frameworks. This paper contributes to debates on sustainable urban finance and offers policy-relevant insights for metropolitan municipalities in the Global South.

Keywords: urban greening; sustainable urban development; municipal finance; green infrastructure governance; metropolitan municipalities

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1. Introduction

Urban greening has become a central pillar of sustainable urban development, offering multiple co-benefits including climate change mitigation and adaptation, enhanced ecosystem services, improved public health, and social well-being [1]. Cities across the globe are increasingly investing in green infrastructure such as urban parks, ecological corridors, nature-based stormwater systems, and urban tree canopies to enhance resilience and liveability [2]. These interventions are particularly important in rapidly urbanising regions, where climate risks intersect with socio-economic inequality and infrastructure deficits.

Despite growing policy commitment, the implementation of urban greening initiatives remains uneven, especially in cities of the Global South. In South Africa, metropolitan mu-

nicipalities operate within constrained fiscal environments characterised by declining revenue collection, rising debt burdens, ageing infrastructure, and increasing service-delivery pressures [3–5]. These fiscal conditions complicate the planning, costing, procurement, and long-term maintenance of green infrastructure projects. As a result, greening initiatives are frequently marginalised in municipal budgets, treated as discretionary or "nice-to-have" expenditures rather than as long-term public investments.

The existing literature on urban greening has predominantly focused on environmental benefits, spatial distribution, and planning outcomes, including issues of equity and access [6,7]. While these contributions are critical, comparatively less attention has been paid to the project cost and financial management dimensions of urban greening, particularly at the metropolitan scale in developing-country contexts. Where finance is addressed, studies tend to emphasise funding availability or financing instruments rather than the institutional and managerial processes by which project costs are estimated, budgets are allocated, and financial risks are managed throughout the project life cycle [8,9].

In South African metropolitan municipalities, these challenges are especially pronounced. Gauteng Province, the country's economic hub, comprises three major metropolitan municipalities, Johannesburg, Tshwane, and Ekurhuleni, that have adopted climate action plans and green city strategies to expand green infrastructure investment [10–14]. However, implementation outcomes remain mixed. Persistent cost overruns, dependence on short-term grants, limited use of innovative financing instruments such as green bonds and blended finance, and weak integration of green assets into municipal financial and asset-management systems are widely reported [15,16].

Recent studies suggest that these challenges are not merely technical but deeply institutional. Fragmented governance arrangements, rigid budget structures, limited technical capacity, and conservative accountability frameworks constrain municipalities' ability to plan and finance greening initiatives effectively [17,18]. Furthermore, prevailing audit and regulatory regimes often struggle to accommodate the intangible and long-term value of green infrastructure, discouraging financial innovation and reinforcing short-termism in municipal investment decisions [9,19].

Against this backdrop, there is a clear gap in empirical research examining how project costs and financial management practices shape the implementation of urban greening initiatives in metropolitan municipalities. In particular, there is limited qualitative evidence linking institutional arrangements, fiscal capacity, cost estimation practices, and accountability frameworks to the financial sustainability of greening projects in the Global South.

This study addresses this gap by investigating the project cost and financial management challenges associated with urban greening initiatives in Gauteng's metropolitan municipalities. Using a qualitative approach based on semi-structured interviews with municipal officials, project managers, and environmental planners, complemented by document analysis, the study explores how budgeting practices, procurement systems, institutional coordination, and evolving climate-finance mechanisms influence project delivery. By foregrounding the financial and governance dimensions of sustainability transitions, this paper contributes to the literature on sustainable urban finance and provides policy-relevant insights for metropolitan municipalities seeking to align environmental ambitions with fiscal realities.

2. Literature Review

Urban greening and green infrastructure have received increasing attention as key instruments for sustainable city development. Yet the literature consistently indicates that costs, financial management, and institutional readiness are significant constraints. Studies

focusing on South Africa and the Global South offer important lessons for metropolitan-scale greening in the Gauteng City Region.

2.1. Value and Cost of Green Infrastructure

The Water Research Commission (WRC) [9] notes that research in South African contexts indicates that, while value is recognised, its incorporation into municipal finance systems remains weak. For example, the WRC's 2025 report highlights the need to treat green infrastructure as a municipal asset, with appropriate asset registers, condition assessments, and life-cycle costing, aligned with the Municipal Finance Management Act (MFMA) and asset-management frameworks [9]. The WRC 2025 framework for integrating green infrastructure into municipal asset-management systems underscores that although the benefits (e.g., stormwater regulation, increased property values) are precise, municipalities lack the technical, financial, and institutional capacity to fully monetise them [9].

In another South African study, the economic valuation of urban green spaces based on proximity to amenities showed that while greener areas were generally associated with higher property values, this relationship was weaker in middle-income neighbourhoods, suggesting that maintenance levels, amenity quality, and socio-economic differences mediate the value of green space [20]. The implication is that when greening projects are implemented, the cost–benefit calculus is uneven, posing a risk to municipalities that expect predictable returns.

2.2. Financing Models and Barriers in Metropolitan Municipalities

In the context of South African metros, recent work shows that current financing structures for greening are insufficient and poorly aligned with long-term cost and project delivery requirements. A qualitative study covering all eight South African metropolitan municipalities found financial constraints, inadequate staff training, political interference, and procurement process issues to be key barriers to scaling greening initiatives [17]. Similarly, the 2022 development of the national green finance taxonomy by the National Treasury indicates an attempt to categorise "green" activities for investments. However, the translation into municipal-level pipelines and bankable projects remains nascent [15].

Furthermore, frameworks for financing resilient and green urban solutions for the City of Tshwane highlighted that, while municipalities recognise the need to mobilise innovative finance (blended finance, public–private partnerships), the practical capacity to structure, transaction-manage and service these instruments is limited [11]. The financing challenge is amplified by declines in municipal operating margins, increasing service-delivery backlogs, and competing priorities, which push greening down the capital-investment queue [2].

2.3. Cost and Project Management Challenges

While greening often focuses on benefits and financing, a related strand addresses cost and procurement pressures in municipal infrastructure more broadly, a relevant analogue for greening projects [3]. One recent case study of a South African municipality found that unrealistic inflation assumptions led to significant cost overruns, underestimation of project complexity, political interference, and inadequate risk management [21]. Although not greening-specific, this shows the commonality of cost-control issues in metro infrastructure projects, which also greening interventions must anticipate.

On the spatial equity side, research shows that urban green infrastructure is often unevenly distributed: high-income areas receive more and higher-quality greening, while low-income neighbourhoods lag [6]. This structural inequity has cost implications, as municipal budgets may regularly prioritise service delivery over the incremental maintenance burdens of green assets.

2.4. Institutional and Governance Issues

Institutional readiness is repeatedly identified as a key enabler (or barrier) for green infrastructure cost-efficiency and financial viability [8]. The 2025 framework for integrating green infrastructure into formal municipal asset-management systems found that, although policy tools and delineation methods exist, municipalities frequently lack specialist economic-valuation capacity, budget allocation for maintenance, and formal audit trails for green-asset investments [9]. The literature on urban planning in African cities similarly underscores that, although many plans exist, their implementation is hampered by a weak alignment between fiscal capacity and plan ambitions [22].

Additionally, a recent environmental-justice review of urban green infrastructure in South Africa points out that financing and asset-management models insufficiently account for social and spatial justice concerns, and that failing to embed justice dimensions can undermine community buy-in and the sustainability of greening assets [7].

2.5. Synthesis and Gaps

Taken together, the literature establishes several persistent themes relevant to the cost and financial management of urban greening in South African metropolitan cities:

- Municipal asset management for green infrastructure is underdeveloped, making cost-and-benefit rationales weak and maintenance burdens uncertain;
- Financing models exist conceptually (such as blended finance, green bonds, PPPs), but municipalities struggle to assemble them into bankable pipelines, especially given fiscal constraints and competing service demands;
- Infrastructure project cost-control challenges (under-estimation, inflation, procurement risks) apply equally to green infrastructure, but fewer studies focus specifically on greening projects;
- Governance, institutional capacity, maintenance budgeting, and spatial equity issues are under-theorised in the greening–finance literature.

There is thus a clear gap in qualitative research exploring how metropolitan municipalities manage project costs and finances specifically for greening initiatives, linking budget practices, procurement, asset register integration, financing instruments, and institutional arrangements. This study seeks to fill that gap by qualitatively investigating these dynamics in Gauteng metropolitan cities.

3. Research Methodology

This study adopts a qualitative research design to explore project cost and financial management challenges in the greening metropolitan cities in the Gauteng Province of South Africa. The qualitative approach is appropriate because it enables an in-depth understanding of the complex financial, institutional, and managerial dynamics that shape the implementation of urban greening initiatives [23]. The study focuses on three South African key metropolitan municipalities, Johannesburg, Tshwane, and Ekurhuleni, given their shared yet distinct fiscal structures and environmental commitments within Gauteng [14].

The selection of the City of Johannesburg, City of Tshwane, and City of Ekurhuleni was driven by a theoretical sampling strategy designed to maximise analytical generalisability within the Gauteng City Region. While all three share the same macro-fiscal environment, they offer distinct variations in governance and greening portfolios, making cross-case comparison analytically meaningful.

1. Shared Macro-Institutional Context (Control Variables): All three municipalities operate under identical legislative frameworks (MFMA) and fiscal constraints (declining

revenue collection and rising debt service costs). This shared baseline enables the study to control for external economic shocks and isolate the effects of internal institutional arrangements on green finance outcomes.

2. Divergent Institutional and Greening Profiles (Comparative Variables): Despite their similarities, the metros present unique analytical angles:
    - City of Johannesburg: As the economic hub, it represents a "mature" green finance case, having previously issued a Green Bond (the first in the region) and established a Green City Action Plan. It serves as a test case for why financial innovation stalls even after initial success.
    - City of Tshwane: As the administrative capital, Tshwane faces unique governance pressures and has recently focused on climate action planning under severe liquidity constraints. It provides a lens into how "fiscal distress" specifically impacts greening ambitions.
    - City of Ekurhuleni: Historically an industrial and manufacturing hub, Ekurhuleni's greening portfolio focuses heavily on wetland rehabilitation and energy strategy. This offers insight into the challenges of the "industrial-to-green" transition, distinct from the corporate/administrative focus of the other two.

By selecting these three cases, the study captures a spectrum of "financial readiness" from early adopters of green bonds (Johannesburg) to those grappling with foundational green asset management (Ekurhuleni and Tshwane), enhancing the transferability of findings to other developing metropolitan contexts.

However, for ethical reasons (confidentiality and anonymity) the metropolitan cities are coded as Metro A, B and C in the following sections.

3.1. Research Design and Data Collection

3.1.1. Research Design

The study tries to facilitate comparative insights across all the selected metros [23]. It adopts a qualitative research approach for data collection, as this uniquely enables an in-depth exploration of the complex financial, institutional, and managerial dynamics shaping urban greening. Different from a quantitative approach that tries to test theories and relationships between variables using empirical evidence (thus, needs bigger samples) and is deductive and confirmatory in nature, the employed qualitative methodology is inductive and allows researchers to capture detailed, context-rich accounts (therefore, being exploratory, works with smaller samples) and then triangulates subjective experiences with municipal documentary sources [24].

3.1.2. Interview Protocol Designs

Data collection was guided by a semi-structured interview protocol designed to elicit specific technical and institutional insights. The instrument was structured around three thematic pillars derived from the literature review:

- Project Costing and Appraisal: Officials were asked to describe the methodologies used for estimating green infrastructure costs (e.g., "How are life-cycle maintenance costs factored into initial capital budget requests?" and "What benchmarks are used to appraise green versus grey infrastructure projects?").
- Financial Management Processes: Questions probed the mechanics of budget allocation and execution (e.g., "What specific regulatory or internal barriers prevent the utilisation of available green bonds?" and "How do grant conditions influence your project design?").
- Institutional Interactions: The protocol examined the governance workflows between technical and financial departments (e.g., "At what stage does the Treasury department

engage with Environmental Planning during the project cycle?"). This structure allowed for flexibility to explore emerging themes while ensuring that all interviews systematically addressed the core research questions regarding cost, finance, and governance.

3.1.3. *Selection and Integration of Documentary Sources*

Documentary sources were purposively selected to triangulate interview findings and assess the alignment between strategic policy intent and actual fiscal allocation. The document selection criteria prioritised statutory reports that hold legal and financial weight in municipal governance. Key sources included:

- Integrated Development Plans (IDPs) and Service Delivery and Budget Implementation Plans (SDBIPs): Analysed to trace the strategic prioritisation of green projects against competing infrastructure demands.
- Annual Financial Statements (2019–2023): Reviewed to quantify trends in Capital Expenditure (CAPEX) versus Operating Expenditure (OPEX) for environmental departments, specifically looking for evidence of the "underbudgeting" mentioned by interviewees.
- Climate Action Plans: Evaluated to measure the coherence between long-term environmental targets and the medium-term revenue frameworks.

Data Integration: A triangulation approach was employed to integrate these sources. Themes emerging from the interviews (e.g., the claim of "budget rigidity") were cross-referenced with financial statements to verify the extent of fiscal variance. Where interviewees described "institutional fragmentation," organograms and process maps in the IDPs were analysed to visualise these structural disconnects. This iterative process ensured that subjective perceptions of municipal officials were substantiated by objective financial and planning data, enhancing the credibility and dependability of the findings.

3.2. Sampling and Analysis

After initially targeting eight participants using purposive sampling within each municipality, a total of 15 interviews were conducted, as saturation was reached at five participants per municipality (i.e., further interviews no longer yielded additional knowledge). The sample included a cross-section of financial and technical expertise to ensure balanced perspectives. Table 1 presents the distribution of roles, including [six] financial officers, [three] environmental planners, and [three] project managers across the three metropolitan cases. Data were analysed using thematic analysis, following the six-step process outlined in [25] to identify recurring patterns, relationships, and institutional bottlenecks that influence cost and financial management. NVivo software (version 14), a qualitative data analysis software, assisted in coding and theme development.

Table 1. Distribution of Interviewees by Role and Municipality (Authors' Own Compilation).

Role/Designation	City of Johannesburg	City of Tshwane	City of Ekurhuleni	Total
Financial Officers (Treasury)	2	2	2	6
Environmental Planners	1	1	1	3
Project Managers (Infrastructure)	1	1	1	3
Municipal Officials (Policy/Admin)	1	1	1	3
Total Participants	5	5	5	15

Compared to quantitative research, a sample of 15 may appear numerically small, but it is consistent with methodological norms for expert-based surveys in highly specialised domains. Being qualitative in nature, this research is not deductive or confirmatory but exploratory/inductive, eliciting specific technical and institutional insights. It prioritised

the information power of the participants' key decision-makers with direct fiduciary and planning responsibility over mere volume. Accordingly, recent literature also confirms that for expert elicitation on emerging or technical topics such as green finance or supply chain performance, smaller, purposive samples are sufficient to generate high-validity insights. For instance, studies on emerging policy priorities in the low-carbon hydrogen sector have successfully relied on similar expert panel sizes to derive robust conclusions [26,27]. Furthermore, systematic reviews in fields like Supply Chain 4.0 performance measurement indicate that the depth of expert knowledge often outweighs the breadth of the sample in qualitative inquiry [28]. And indeed, the consistency of findings across the three metropolitan cases further strengthens the reliability of this sample.

3.3. Limitations of the Study

This study uses a qualitative, census design involving 15 in-depth interviews. While this sample allowed for deep engagement with key decision-makers, it may not capture the full diversity of views across all municipal departments. However, the consistency of findings across three distinct metros, Johannesburg, Tshwane, and Ekurhuleni, suggests a high degree of transferability regarding the structural and financial challenges faced by South African cities. Future research could expand on these findings by conducting quantitative surveys to assess the prevalence of these barriers across a wider range of secondary cities.

3.4. Ethical Considerations

Ethical clearance was obtained from the Tshwane University of Technology Research Ethics Committee. Participants' confidentiality, informed consent, and voluntary participation were strictly maintained in accordance with research ethics standards [29].

4. Results

4.1. Overview of the Results

The analysis of 15 semi-structured interviews across the Johannesburg, Tshwane, and Ekurhuleni Metropolitan Municipalities revealed six interrelated themes shaping project costs and financial management challenges in urban greening, as depicted in Figure 1: (1) institutional fragmentation and governance complexity; (2) constrained fiscal capacity and budget rigidity; (3) weaknesses in cost estimation and project appraisal; (4) limited access to innovative financing instruments; (5) insufficient technical capacity and monitoring systems; (6) misalignment between environmental ambitions and financial accountability frameworks. Furthermore, Table 2 shares the typology of challenges encountered by the metropolitan cities of Gauteng.

Table 2. Typology of Challenges: Shared Constraints vs. Metro-Specific Nuances (Authors' Own Compilation).

Theme	Shared Challenge	Metro-Specific Example
Institutional Fragmentation	Siloed departments (e.g., Environment vs. Finance) lead to a lack of project ownership.	Metro C: Projects are described as "floating" between departments due to administrative instability.
Fiscal Capacity	Declining revenue and rigid grant conditions (MIG/USDG) limit flexibility.	Metro B: Cash-flow management crises push greening down the priority list despite high political will.
Cost Estimation	Lack of standard benchmarks for "green" maintenance vs. "grey" infrastructure.	Metro A: Specific struggle with the cost of long-term maintenance for wetland rehabilitation compared to roads.
Innovative Finance	High perceived risk and audit anxiety regarding new instruments.	Metro B: "Green Bond Fatigue"—inability to replicate previous success due to credit rating slides. Metro A and C: Total lack of uptake; viewed as theoretically possible but practically unreachable.

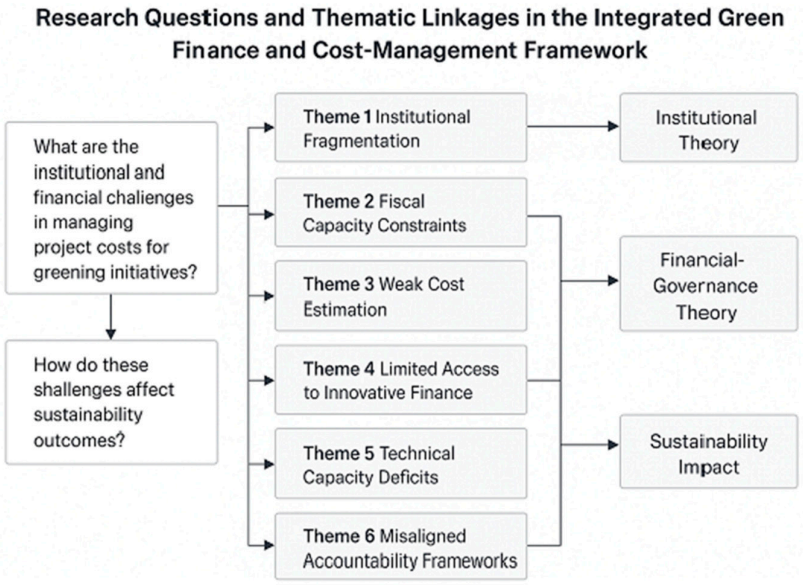


Figure 1. Linkage of emerging themes and research questions (Authors' Own Compilation).

These themes reflect shared institutional and fiscal constraints across the three metros, despite differences in organisational structures and project portfolios.

4.2. Institutional Fragmentation and Governance Complexity

All metros consistently highlighted fragmented governance arrangements as a major barrier to effective cost management in greening projects. Responsibilities for planning, environmental management, and financial oversight are distributed across multiple departments, often with limited coordination. An official from Metro C noted that "green projects don't sit neatly anywhere; they float between departments depending on who's driving the agenda."

This fragmentation results in unclear cost ownership, duplication of planning efforts, and delays in budget approvals. Officials across all three metros reported that green initiatives are frequently introduced through environmental or planning units without early involvement of treasury departments, leading to under-provisioning and subsequent budget adjustments during implementation.

4.3. Constrained Fiscal Capacity and Budget Rigidity

Fiscal constraints emerged as a pervasive theme affecting the financing of urban greening initiatives. Officials cited declining revenue collection, increasing debt obligations, and arrears to bulk service providers as factors limiting fiscal flexibility. A Metro B official explained that "even when there is political support for greening, cash-flow pressures push these projects down the priority list."

Officials also pointed to the rigidity of conditional grants, such as the Municipal Infrastructure Grant and Urban Settlements Development Grant, which restrict the use of funds for ecosystem-based or non-traditional infrastructure projects. As a result, greening initiatives are often funded through short-term allocations or donor grants, undermining continuity and long-term planning.

4.4. Weaknesses in Cost Estimation and Project Appraisal

Officials reported significant challenges in estimating costs and appraising green infrastructure projects. Unlike conventional infrastructure, green projects such as wetland restoration or green corridors lack standardised costing and investment appraisal models.

An official of Metro A stated that "we can cost a bridge or a road, but not the long-term maintenance of a wetland."

The absence of baseline data and life-cycle costing tools, as well as gaps in knowledge regarding the financial valuation of green investments [30], frequently leads to underestimation during project planning and cost overruns during implementation. Officials indicated that appraisal committees often prioritise short-term affordability over long-term value, disadvantaging greening projects in capital budget decisions.

4.5. Limited Access to Innovative Financing Instruments

Although national policy frameworks promote innovative financing mechanisms, officials reported limited practical uptake at the municipal level. Green bonds, blended finance, and public–private partnerships were perceived as difficult to implement due to concerns about creditworthiness, regulatory complexity, and limited internal capacity.

Officials noted that deteriorating balance sheets and risk-averse political environments constrain experimentation with new financing instruments. In Metro B, officials referenced the city's earlier green bond issuance [31] but indicated that replication has been stalled by declining credit ratings and audit concerns.

4.6. Insufficient Technical Capacity and Monitoring Systems

Across the three metros, officials highlighted capacity gaps in linking environmental outcomes to financial metrics. While technical expertise exists in environmental planning and engineering, officials reported limited financial modelling skills specific to green infrastructure.

Monitoring systems were also described as fragmented and largely manual, with environmental project expenditures tracked separately from core financial management systems. This disconnect limits real-time oversight and reduces the ability to detect underperformance early.

4.7. Misalignment Between Environmental Ambitions and Financial Accountability Frameworks

Finally, officials identified a misalignment between environmental policy ambitions and prevailing financial accountability frameworks. Green infrastructure expenditures often either fail to meet capitalisation criteria under existing accounting standards or lack guidance on how to treat them correctly, resulting in their classification as operational costs. Officials indicated that this treatment discourages long-term investment and limits access to borrowing or depreciation-based funding mechanisms.

Several officials described audit requirements as discouraging financial innovation, noting that uncertainty around compliance creates reluctance to pilot new financing approaches for greening initiatives.

5. Discussion

The findings demonstrate that project cost and financial management challenges in urban greening are not isolated technical failures but reflect deeper institutional and fiscal dynamics; these results align with institutional theory [18].

5.1. Re-Interpreting Cost and Financial Management Through Institutional Lenses

In Gauteng's metros, cost overruns and budget rigidity are symptoms of deeper structural inertia within municipal financial systems. These systems, designed for conventional infrastructure and often cost-based, struggle to accommodate the fluid, cross-sectoral, and often long-term nature of green investments, which require tailor-made investment appraisal approaches.

Most institutional theory on green finance comes from the Global North, where institutions are stable and well-resourced. The study shows that in the Global South (Gauteng), institutional fragmentation is not just an annoyance; it is a critical survival mechanism for under-resourced departments that hoard power/budget. Formally, municipalities require green budgeting instruments, cost-based pricing and, in particular, investment appraisal standards [30], as well as performance-based intergovernmental transfers. Informally, they must cultivate organisational cultures that reward experimentation, learning, and cross-departmental collaboration.

5.2. Bridging Fiscal and Environmental Rationalities

The discussion reveals the necessity of reconciling fiscal prudence with ecological rationality. Current cost-management frameworks privilege measurable outputs, such as kilometres of road or litres of water delivered, over intangible ecosystem services, and they do not account for the often long-term nature of green investments [30]. Integrating natural-capital accounting into financial statements and employing tailored investment appraisals could bridge this divide, aligning with the 2025 WRC framework and international sustainability reporting standards.

5.3. Building Financial Readiness

The data affirm that financial readiness, the institutional ability to plan, appraise, and manage green investments, is the critical missing link. Developing readiness requires:

- Dedicated budget lines for climate and green infrastructure;
- Training in environmental-economic valuation and financial modelling;
- Strengthened project-preparation facilities and partnerships with DFIs;
- Alignment of audit criteria with sustainability outcomes.

5.4. Policy and Practice Implications

For policymakers, these findings suggest a four-tiered reform agenda:

- Institutional Integration: establish inter-departmental "Green Finance Task Teams" linking treasury, planning, and environmental units;
- Fiscal Innovation: implement conditional-grant reforms allowing ecosystem-based spending and pilot revolving green funds;
- Implementation of green budgeting instruments and appropriate investment appraisal standards;
- Capacity and Governance: invest in training, digital cost-monitoring systems, and adaptive audit frameworks.

These reforms could position Gauteng metros as leaders in green fiscal governance, aligning municipal finance with national climate goals and SDG 11.

5.5. Future Research

Integrating institutional coherence, fiscal flexibility, long-term valuations, and the long-term (not only monetary) "costs" and benefits of green investments, along with technical capacity within a unified green-finance framework, is essential. Without such systemic reforms, the aspiration to build climate-resilient, inclusive, and ecologically vibrant Gauteng cities will remain just that: an aspiration rather than an achievable goal.

Building on insights from these discussions, the following section explicitly outlines the study's contributions to sustainability and urban finance scholarship.

5.6. Contribution to the Literature

This study advances sustainability scholarship by reframing urban greening not merely as an ecological intervention, but as a socio-institutional process deeply embedded in public financial management. By foregrounding project cost and financial governance as core enablers, the research extends institutional theory to demonstrate that sustainability outcomes are shaped more by organisational norms and compliance-driven accountability regimes than by technical capacity. This integration of behavioural insights into municipal finance challenges the assumption that funding availability alone drives green infrastructure; instead, it highlights how "financial institutional lock-in" and audit anxiety act as structural constraints. Consequently, the study responds to the call for systems-thinking research that bridges the gap between environmental objectives and economic feasibility.

The research contributes a critical Global South perspective to the discourse on sustainable cities. Drawing on evidence from Gauteng's Metropolitan cities, it illustrates how sustainability challenges manifest uniquely under conditions of fiscal rigidity and fragmented intergovernmental systems. Building on these contextual insights, the study offers a practical governance framework that links institutional coordination, project appraisal, and audit reform. This contribution moves beyond abstract policy prescriptions to provide a tangible roadmap for metropolitan municipalities seeking to embed green infrastructure within mainstream financial systems, ensuring that environmental ambition is matched by institutional readiness.

6. Policy Recommendation

Figure 2 illustrates the multi-level interactions among institutional and fiscal inputs, process mechanisms, and sustainability outcomes in Gauteng's Metropolitan cities. The model highlights the cyclical nature of financial readiness, innovation, and accountability in driving cost-efficient greening.

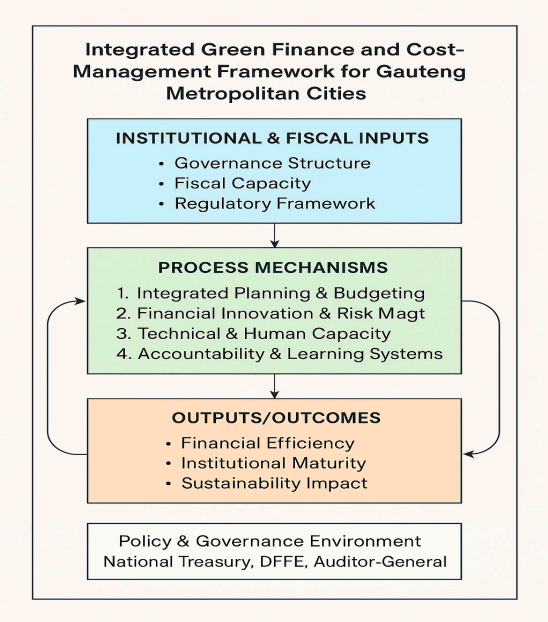


Figure 2. Integrated Green Finance and Investment-Management Framework for Gauteng Metropolitan cities (Authors' Own Compilation).

6.1. Nature and Empirical Derivation of the Framework

This framework functions as a prescriptive policy model designed to operationalise the findings of this study. Rather than serving as a purely abstract theoretical construct,

it represents a synthesis of the observed practice gaps identified in Section 4, effectively inverting the empirical barriers into structural enablers.

The framework's logic is grounded directly in the study's six thematic findings:

- Inputs: The focus on Governance Structure and Regulatory Frameworks is a direct response to the institutional fragmentation (Section 4.2) and misaligned accountability (Section 4.7) that officials cited as primary constraints.
- Process Mechanisms: The inclusion of Integrated Planning and Technical Capacity specifically targets the observed weaknesses in cost estimation/investment appraisal (Section 4.4) and the lack of internal skills to model green finance (Section 4.6).
- Outcomes: The shift toward Financial Efficiency addresses the pervasive issue of fiscal rigidity and cost overruns (Section 4.3).

Thus, the framework serves as a roadmap for converting the "financial institutional lock-in" identified in the discussion into a virtuous cycle of financial readiness.

6.2. Institutional and Fiscal Inputs

Governance Structure: Addressing the siloed working culture observed from Metro B and C, this input requires the formalisation of cross-departmental mandates. It moves beyond ad hoc cooperation to establish the "Green Finance Task Teams" necessary to resolve the cost-ownership disputes highlighted in the interviews.

Fiscal Capacity: Recognising the declining revenue bases reported by all three metros, this component does not assume abundant resources. Instead, it focuses on optimising existing grant dependence (e.g., USDG/MIG) while building the creditworthiness required for future bond issuances.

6.3. Process Mechanisms

Integrated Planning and Budgeting: This mechanism directly counters the "discretionary" nature of green spending found in the results. It requires adopting Green Budget Tagging to prevent the reallocation of environmental funds during cash-flow crises.

Accountability and Learning Systems: To mitigate the "audit anxiety" and risk aversion identified as a barrier to innovation (Section 4.5), this mechanism proposes a shift from compliance-based auditing to performance-based oversight that rewards long-term value creation.

6.4. Evidence-Based Operational Reforms

Institutionalisation of Cross-Departmental Task Teams: To directly address the finding of "institutional fragmentation", municipalities may formalise Green Finance Task Teams. Unlike ad-hoc committees, these teams require a specific mandate to bridge the "cost ownership" gap between Environmental Planning and Treasury. Interview evidence suggests that without this formal structure, green projects will continue to "float" between departments without a budgetary home.

Adoption of Green Budget Tagging (GBT): To counter the finding that green spending is treated as "discretionary", GBT should be implemented within the existing financial system. This recommendation flows directly from officials' inability to track green expenditure against competing priorities. GBT serves as an internal control mechanism to prevent the reallocation of green funds during cash-flow crises, a recurring practice identified in Metro B.

Internal Capacity Building for Life-Cycle Costing: Officials from Metro B and C explicitly cited a lack of skills to cost "non-traditional" assets, such as wetlands. Therefore, capacity building should not be generic but focus specifically on life-cycle costing (LCC) and appropriate green investment appraisal methodologies. This is an operational necessity to

ensure that budget submissions meet the rigorous technical standards required by Budget Steering Committees.

6.5. Broader Policy Implications and Aspirational Reforms

Reform of Intergovernmental Grant Frameworks: While interviewees highlighted the rigidity of grants such as the USDG, reforming these frameworks is a national competency. Consequently, this study supports the broader policy debate calling for "ecosystem-based" grant conditions. As an aspirational goal, the National Treasury should consider introducing a dedicated "Climate-Resilience Window" within existing infrastructure grants to mitigate bias toward grey infrastructure.

Development of Regional Green Investment Facilities: Drawing on the need for "innovative financing", there is a strategic case for pooling projects across the Gauteng Metropolitan cities. While not immediately actionable for a single municipality, a pooled facility could overcome the "ticket size" barriers that currently prevent smaller green projects from accessing the bond market and would also enable better bond terms. Besides this, it gives the participating municipalities much more flexibility in realising green investments, as it would allow for temporary shifting between projects, thus contributing to overall success. This aligns with global debates on scaling sub-national climate finance but requires significant inter-municipal political will.

6.6. Implementation Constraints and Feasibility

While the proposed framework offers a pathway to financial readiness, its feasibility is conditioned by significant implementation constraints inherent to the South African local government context.

Political Cycles and Short-termism: The effectiveness of the proposed "long-term value creation" is frequently undermined by the five-year political cycle. As noted in the results, political instability can lead to the sudden defunding of long-term projects. There is a risk that the "Green Finance Task Teams" proposed above could be dismantled during coalition changes, disrupting institutional memory. Therefore, reforms must be embedded in administrative regulations (which are stickier) rather than political manifestos.

Intergovernmental Tensions: The recommendation to reform grant conditions is constrained by intergovernmental friction. Metropolitan municipalities often seek greater fiscal autonomy, while the National Treasury maintains strict oversight to prevent fiscal mismanagement. This tension may delay the adoption of flexible, ecosystem-based grant windows, making municipalities dependent on their own revenue sources, which are already under strain.

The "Audit Anxiety" Barrier: Finally, the shift toward "performance-based accountability" faces the practical constraint of the Auditor-General's current rigorous focus on clean audits (compliance). Until the definition of "irregular expenditure" is officially adjusted to accommodate the experimental nature of green innovation, officials are likely to remain risk-averse, rendering the "innovative financing" component of the framework theoretically sound but practically difficult to execute.

Transforming Gauteng's metros into truly green, climate-resilient urban systems will require a paradigm shift from short-term expenditure control to long-term value creation. The study's findings confirm that sustainable urban finance is as much about institutional imagination as it is about fiscal discipline. Building this imagination demands political commitment, professional courage, and collaborative innovation. If Gauteng can align its financial governance with its environmental ambitions, it will not only green its skylines but also redefine the fiscal architecture of urban sustainability across South Africa.

7. Conclusions

This study has illuminated the complex intersection of institutional design, fiscal structure, and financial management practices that shapes the implementation of greening initiatives in Gauteng's metropolitan cities. Drawing on qualitative insights from Gauteng's Metropolitan cities, the research revealed that project-cost inefficiencies and financial bottlenecks stem less from technical incompetence than from a systemic misalignment between environmental ambition and financial architecture.

At the heart of these challenges lies a fragmented governance landscape. This fragmentation increases transaction costs and delays, reinforcing what may be termed a financial institutional lock-in.

Weak cost-estimation systems further exacerbate these fiscal stresses. The lack of credible cost baselines, in turn, deters private and development finance institutions from participating, creating a vicious cycle of underinvestment.

Moreover, limited access to innovative financing such as green bonds, blended-finance structures, and public–private partnerships reflects both institutional risk aversion and the rigidity of public finance regulations. The analysis shows that municipal officials often equate financial innovation with audit risk, reinforcing a culture of compliance rather than creativity. This observation aligns with global evidence that traditional fiscal rules in developing economies inhibit climate-compatible investment [19].

Finally, technical-capacity deficits and misaligned accountability frameworks weaken implementation. Municipalities lack specialised expertise to translate ecological outcomes into fiscal indicators, and prevailing audit standards fail to recognise environmental assets as capital investments. The combined effect is a disjuncture between what cities *aspire* to achieve in sustainability terms and what their financial systems are *designed* to deliver.

Thus, the greening challenge in Gauteng's metros is ultimately a governance and finance problem, not simply an environmental one. Addressing it demands systemic transformation of financial governance, institutional culture, and regulatory design to align fiscal responsibility with environmental sustainability.

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