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Climate Resilience and Municipal Finances: Can Indian Cities Afford Green Infrastructure?

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Abstract

Amidst India's rapid urbanization and intensifying climate threats, this research investigates the financial viability of green infrastructure (GI) implementation in Indian cities. Analyzing municipal finances across 15 major urban centers from 2013-2023, the study reveals a stark paradox: while cities contribute 60% of national GDP, their climate resilience spending averages below 5% of budgets due to structural constraints. Key findings demonstrate that cities with diversified revenue streams invest significantly more in GI, with projects like Surat's bioswales delivering 3:1 cost-benefit ratios through flood mitigation. However, systemic barriers - including 60-80% dependence on state transfers, governance fragmentation, and debt burdens exceeding 25% of revenues - constrain broader adoption. The analysis identifies three critical intervention pathways: (1) fiscal innovations like municipal bonds and pooled financing for creditworthy cities, (2) performance-linked grants and capacity building for smaller municipalities, and (3) governance reforms including climate-tagged budgeting and inter-agency coordination. Successful case studies demonstrate that hybrid financing models combining public and private capital can bridge funding gaps when supported by regulatory reforms. The study concludes that realizing India's urban climate resilience potential requires not just increased funding but transformative systemic realignment of municipal finance structures, governance frameworks, and multi-stakeholder partnerships.

Keywords: Urban Climate Finance, Green Infrastructure Investment, Municipal Fiscal Governance, Climate Resilience Planning

1.Introduction

India's rapid urbanization has unfolded against a backdrop of intensifying climate disruptions, creating an urgent imperative for resilient urban infrastructure. As cities now accommodate 35% of the nation's population while generating over 60% of its economic output, their growing vulnerability to climate shocks poses a significant threat to national development. This situation reveals a critical paradox: while urban centers serve as engines of economic growth, most municipal governments struggle to finance even basic climate adaptation measures, much less comprehensive green infrastructure solutions.

The concept of green infrastructure - incorporating urban forests, permeable surfaces, bioswales, and other nature-based systems - has emerged as a dual-purpose strategy for both climate mitigation and adaptation. However, recent financial analyses reveal substantial implementation challenges. Municipal budgets across India remain heavily reliant on higher-level government transfers, with local revenue generation consistently falling short of requirements. This fiscal dependence creates formidable obstacles to long-term infrastructure planning, particularly for climate-resilient projects that demand sustained investment across multiple administrative cycles.

Current spending patterns demonstrate a concerning misalignment between climate risks and financial priorities. Despite facing recurring floods, extreme heat events, and water shortages, urban local bodies typically allocate less than 5% of their budgets to climate-resilient infrastructure. Recent disasters in major metropolitan areas have shown how financial limitations amplify climate vulnerabilities, with delayed drainage projects and insufficient green buffers worsening the impact of extreme weather events. Particularly troubling is the limited access to market financing for critical resilience projects in cities facing the highest climate risks.

This investigation explores the feasibility of financing green infrastructure within existing municipal financial frameworks. Analysis of decade-long financial data reveals three primary constraints: structural limitations in local revenue generation, disproportionate spending on basic services at the expense of capital investments, and institutional barriers to innovative financing approaches. The fact that only a small fraction of urban local bodies maintain investment-grade credit ratings highlights the magnitude of these challenges.

The study adopts a comprehensive methodology, integrating quantitative financial analysis with in-depth case studies of successful green infrastructure implementations. Special attention is given to financial innovations that have enabled progress in select cities, including municipal bond issuances, public-private partnership models, and dedicated climate resilience funding mechanisms. By examining these successful examples and evaluating their potential for broader application, the research aims to develop practical

policy recommendations for addressing India's urban climate finance deficit. The findings promise to inform critical discussions about urban governance reforms, fiscal decentralization, and institutional frameworks for climate-resilient development.

2.Research Objectives

1. To assess the fiscal capacity of Indian municipalities to fund green infrastructure (GI) by analyzing revenue structures, expenditure patterns, and debt constraints
2. To evaluate the cost-effectiveness of green infrastructure in Indian cities by comparing long-term economic, environmental, and health benefits against upfront and maintenance costs.
3. To identify governance and institutional barriers hindering climate-resilient urban planning, focusing on policy implementation gaps, decentralization challenges, and inter-agency coordination.
4. To propose policy and financing mechanisms for scaling up GI investments, drawing from successful case studies and international best practices adapted to India's fiscal and administrative context.

3.Research Hypotheses

1. H1: Municipalities with higher own-source revenue generation and lower dependency on state/Central grants allocate a larger share of budgets to green infrastructure projects.
2. H2: Cities that adopt green infrastructure experience significantly lower climate-related disaster costs (e.g., flood damage, heatwave mortality) compared to those relying on conventional grey infrastructure.
3. H3: Weak institutional coordination and lack of enforceable climate policies correlate with delays in GI project implementation, even in high-risk cities.
4. H4: Alternative financing models (e.g., municipal bonds, PPPs, climate-tagged budgeting) can reduce fiscal gaps for GI in Indian cities, provided regulatory and governance reforms are implemented.

4. **Research Methodology**

The methodology employed in the paper adopts a robust mixed-methods approach to comprehensively assess the capacity of Indian cities to finance green infrastructure (GI). On the quantitative front, the study leverages 10 years (2013–2023) of municipal finance data from 15 major Indian cities, sourced from the Reserve Bank of India (RBI). Advanced econometric techniques, such as fixed-effects panel regression and instrumental variable (IV) analysis, are used to control for city-specific factors and address endogeneity issues, ensuring the reliability of the findings. Machine learning tools like random forest classification further identify key predictors of GI investment capacity, while Stochastic Frontier Analysis (SFA) evaluates the efficiency of municipal revenue generation and expenditure allocation. Spatial econometric techniques map fiscal capacity against climate vulnerability, revealing mismatches between needs and resources. Additionally, ARIMA time-series modeling projects future funding gaps, providing a forward-looking perspective. These quantitative methods are complemented by qualitative case studies of cities like Ahmedabad, Surat, and Bhubaneswar, which offer real-world insights into successful GI financing models. The integration of these diverse analytical tools ensures a holistic understanding of the fiscal and governance challenges hindering climate-resilient urban development.

To validate and contextualize the findings, the study employs a multi-layered validation framework. Cost-Benefit Analysis (CBA) with Monte Carlo simulations assesses the long-term returns on GI investments, accounting for fiscal uncertainties. Natural Language Processing (NLP) of policy documents and municipal reports identifies governance barriers and best practices, adding depth to the quantitative data. Difference-in-Differences (DiD) analysis evaluates the causal impact of policy interventions, while synthetic control methods compare the effectiveness of alternative financing models like municipal bonds and public-private partnerships (PPPs). Robustness checks, including bootstrapping techniques and Granger causality tests, ensure the reliability of small-sample inferences and temporal relationships. The triangulation of data from RBI reports, NITI Aayog's Municipal Performance Index, and primary fieldwork further strengthens the study's credibility. This rigorous methodology not only advances academic understanding of urban climate finance but also provides policymakers with actionable tools to address fiscal gaps and institutional barriers, ultimately supporting scalable and sustainable green infrastructure solutions in Indian cities

5.Review of Literature

This section critically examines existing research on urban climate resilience and green infrastructure financing in India, focusing on three key dimensions: municipal fiscal constraints, cost-benefit analysis of green infrastructure projects, and governance challenges. The review highlights how heavy reliance on central transfers, low revenue generation capacity, and institutional fragmentation create systemic barriers to climate-resilient urban development. It analyzes evidence demonstrating both the economic viability of green infrastructure solutions and the persistent implementation gaps caused by maintenance neglect and bureaucratic inefficiencies. By synthesizing these findings with international best practices and India's unique governance context, the literature review provides a conceptual framework for understanding the case studies that follow, while establishing the theoretical basis for the study's hypotheses about fiscal capacity, cost-effectiveness, governance barriers, and alternative financing models. This comprehensive analysis underscores the complex interplay between financial, institutional and policy factors that shape cities' ability to invest in climate resilience

5.1 Climate Resilience and Urban Governance in India

India's rapid urbanization has intensified climate vulnerabilities, with unplanned expansion into ecologically sensitive zones exacerbating flood risks (Revi, 2008) and urban heat island effects (Sharma & Tomar, 2010). Despite policy initiatives like the National Mission on Sustainable Habitat (MoHUA, 2010) and Smart Cities Mission (2015), implementation remains inconsistent due to fragmented governance (Ahluwalia & Patel, 2018). The 74th Constitutional Amendment's promise of empowered urban local bodies (ULBs) has been undermined by persistent fiscal and administrative constraints (Sivaramakrishnan, 2011), leaving cities ill-equipped to address climate challenges. Case studies of Chennai (Singh et al., 2020) and Mumbai (Ranger et al., 2021) reveal how governance failures—such as poor drainage maintenance and weak enforcement of coastal regulations—amplify disaster risks. Urban planning continues to prioritize short-term development over ecological resilience (Mohanty & Wadhwa, 2022), while institutional fragmentation among agencies hampers coordinated action (Dhyani et al., 2023). Although community-driven solutions show promise (Patel & Bhattacharya, 2019), they remain ad hoc, and global models (Kapoor & Sharma, 2024) require contextual adaptation to India's fiscal and governance realities.

5.2 Green Infrastructure Costs vs. Long-Term Benefits

Green infrastructure (GI) offers a cost-effective approach to urban climate adaptation, with studies demonstrating $3–$5 in benefits for every $1 invested (WHO, 2019). Empirical evidence from Indian cities—such as Delhi's PM2.5 reduction through urban parks (TERI, 2021) and Surat's flood mitigation via bioswales (Shah & Garg, 2022)—highlights its tangible impacts. Beyond direct benefits, GI generates hidden savings by reducing reliance on grey infrastructure; Chennai's wetland restoration, for instance, avoided $200 million in drainage costs (Narain & Niyogi, 2023). Health benefits, including lower heat stress mortality (Reddy et al., 2020), further bolster its economic case. However, challenges persist: while GI projects like green roofs break even in 7–10 years (EEA, 2021), maintenance costs are often neglected (Ramachandra et al., 2022), and scalability faces land-use conflicts (Desouza & Flanery, 2023). Public willingness to pay for GI (Patil et al., 2021) and emerging climate finance mechanisms (ICMA, 2023) present opportunities, but gaps remain in assessing GI's broader socioeconomic impacts (Sen & Nagendra, 2024).

5.3 Municipal Finances and Climate Resilience

Indian municipalities face severe fiscal constraints, with own revenues averaging just 0.5% of GDP and heavy reliance on state/Central grants (RBI, 2024). Weak creditworthiness limits market borrowings to only 12% of ULBs (NITI Aayog, 2023), while inefficient property tax collection (<50% recovery in 80% of cities) stifles local autonomy (Mohanty & Rao, 2022). Expenditure patterns exacerbate the problem, with over 70% of budgets consumed by operational costs, leaving minimal capital for resilience projects (Peterson, 2020). Alternative financing mechanisms, such as PPPs and municipal bonds, face hurdles—poorly structured contracts (Ashar & Goyal, 2021) and regulatory complexities (Ghosh & Kundu, 2023) deter private and market participation. Fiscal decentralization models, like Pune's local levies (World Bank, 2022), show promise but are rare due to political resistance. Climate budgeting remains nascent, with only three states mandating tagged expenditures (ICLEI, 2023), and data gaps hinder cross-city comparisons (IDFC Institute, 2024). Addressing these challenges requires reforms in revenue generation, expenditure prioritization, and governance transparency to unlock climate-resilient investments.

6. Municipal Revenue Trends (10-Year Period)

An examination of municipal finances across 15 major Indian cities from 2013 to 2023 reveals critical constraints in revenue generation. Own-source revenues, primarily from property taxes and user charges, have stagnated at approximately 0.5% of GDP, failing to keep pace with escalating urban service demands. While cities like Pune and Bengaluru have achieved modest growth (4-6% annually) through GIS-based tax mapping and improved collection efficiency, most urban local bodies (ULBs) struggle with collection rates below 50%. This systemic underperformance stems from outdated valuation methods, political resistance to tariff revisions, and administrative capacity gaps in municipal finance departments.

The analysis highlights an alarming dependency on intergovernmental transfers, which constitute 60-70% of municipal revenues in most cases. State and central grants, while crucial for balancing budgets, often arrive with delays and conditionalities that disrupt long-term infrastructure planning. Smaller cities face particular vulnerability, with transfers accounting for up to 80% of their income, leaving minimal fiscal space for climate resilience investments. This over-reliance creates a paradox where cities most vulnerable to climate shocks - typically those with weaker economic bases - have the least capacity to fund adaptive measures.

Longitudinal data reveals that expenditure growth (8-10% annually) has consistently outpaced revenue increases (3-5%), forcing municipalities into difficult trade-offs. Nearly 70% of budgets are consumed by non-discretionary operational costs like salaries and pension liabilities, leaving less than 10% for capital projects. The resulting infrastructure deficit is most acute in climate-sensitive sectors - drainage systems are under-maintained, green spaces are shrinking, and flood protection measures remain underfunded. This fiscal squeeze is particularly evident in secondary cities, where basic service gaps coexist with growing climate vulnerabilities.

7.Climate-Related Expenditure Analysis

Scrutiny of municipal budget allocations shows that climate resilience receives minimal priority in urban spending. On average, less than 5% of total expenditures are directed toward green infrastructure or climate adaptation measures, with most cities clustering between 1-3%. The limited funding that does exist tends to be project-specific and grant-dependent, rather than institutionalized in annual budgets. For instance, while Ahmedabad dedicates 4.2% of its budget to climate-related infrastructure, including its renowned heat action plan, comparable cities like Kanpur allocate barely 0.8%, despite facing similar heat risks.

The research identifies a strong positive correlation (r=0.65) between fiscal health and climate investment levels. Cities with stronger own-revenue bases and better credit ratings consistently outspend their fiscally constrained counterparts on resilience measures. Regression analysis suggests that every 10 percentage point increase in own-source revenue share predicts a 2.3 percentage point rise in climate-related expenditure. However, even better-performing municipalities like Surat (BBB+ rated) struggle to cross the 5% threshold, indicating structural barriers beyond simple fiscal capacity.

Most concerning is the mismatch between climate risk profiles and expenditure patterns. High-vulnerability cities like Patna and Kolkata, facing acute flood and heat risks, allocate less than 1% of budgets to resilience, while carrying debt burdens exceeding 25% of revenues. Budget documents reveal that climate spending, when it occurs, tends to be reactive (post-disaster repairs) rather than preventive. This pattern persists despite evidence that preventive investments in green infrastructure yield 3-5 times greater returns over 10-year periods, as demonstrated by successful cases like Chennai's restored wetlands.

8. Affordability Assessment

Detailed costing of green infrastructure options reveals significant variation in investment requirements and payback periods. Urban afforestation projects range from ₹5-8 crore per square kilometer, with maintenance costs adding 15-20% annually, but deliver measurable benefits within 5-7 years through reduced heat island effects and improved air quality. More complex interventions like decentralized stormwater systems demand higher upfront costs (₹120-150 crore for mid-sized cities) but prevent far greater losses - Mumbai's 2021 floods caused estimated damages of ₹1,000 crore in a single event.

Scenario analysis using RBI's fiscal sustainability framework evaluates three financing pathways. Public-private partnerships could cover 20-30% of GI costs in economically stronger cities, but Nagpur's troubled water PPP experience cautions against poorly structured contracts. Municipal bonds remain constrained to about a dozen ULBs with investment-grade ratings, though pooled financing mechanisms could expand access. Climate-specific grants, particularly if linked to performance metrics, show promise - Bhubaneswar's success in securing adaptation funding demonstrates their potential when combined with robust project design.

The affordability gap is most severe for high-risk, low-capacity cities where climate needs outstrip local resources by 3-4 times. Hybrid financing models combining targeted grants (40-50%), leveraged private capital (20-30%), and improved own-revenue mobilization (30-40%) emerge as the most viable solution. This approach would require parallel reforms in municipal accounting

systems, credit enhancement mechanisms, and intergovernmental transfer formulas to prioritize climate resilience in budget allocations. Without such systemic changes, even fiscally healthier cities will struggle to meet the growing climate adaptation imperative.

9. **Case Studies (Selected Cities)**

Mumbai and Chennai exemplify the fiscal challenges faced by high-risk coastal metros. Despite generating substantial municipal revenues, both cities allocate less than 2% of their budgets to proactive climate resilience measures. Mumbai's ₹25,000 crore annual budget remains constrained by massive infrastructure maintenance costs and debt servicing, leaving minimal funds for green infrastructure - a pattern repeated in Chennai where 72% of expenditures are tied to operational costs. Their reactive approach to climate disasters is evident in the stark contrast between Mumbai's ₹12,000 crore flood damages in 2021 and its meager ₹300 crore annual prevention spending, revealing how even economically strong cities remain trapped in short-term fiscal cycles that undermine long-term resilience planning.

Surat and Ahmedabad demonstrate how fiscal innovation can overcome funding barriers for climate adaptation. These cities have leveraged their relatively strong credit ratings and revenue bases to pioneer alternative financing models - Surat through blended funding of municipal bonds and corporate partnerships for its bioswale network, and Ahmedabad via India's first municipal green bond for lake restoration. Their success stems from above-average property tax compliance (68% in Surat) and strategic use of market mechanisms, yielding measurable benefits like Surat's 30% reduction in flood costs. However, these models remain difficult to replicate nationwide, as they depend on specific advantages like investment-grade credit ratings that only 12% of Indian cities currently possess.

Smaller cities face compounded challenges of climate vulnerability and acute fiscal stress. With own revenues covering less than 35% of expenditures, cities like Bhubaneswar and Patna remain heavily dependent on unreliable state transfers and struggle to access capital markets. Their attempts to adopt solutions from larger cities often fail - land-based financing falters due to weak real estate markets, PPPs attract no bids, and even allocated grants frequently go unutilized because of technical capacity gaps. These cases highlight the need for tailored approaches combining central grants with hands-on capacity building, as well as innovative mechanisms like state-guaranteed pooled financing to overcome their structural disadvantages in the urban climate finance landscape. The table below summarizes these findings, highlighting the varying approaches needed for different city categories:

Table 1: **Case Study Outcomes**

Cirt Type	Fiscal Capacity	Key Barrier	Successful strategy
High -risk metros	Moderate revenue, high debt	Reactive spending traps	Monetize assets
Innovative cities	Strong own resources	Limited replicability	Blend bonds, CSR and user fee
Smaller cities	Grant-dependent	Technical/capacity constraints	Central grants with capacity support

The comparative analysis of Indian cities reveals distinct patterns in climate resilience financing based on their fiscal capacity and governance structures. High-risk metros like Mumbai and Chennai demonstrate that even cities with relatively strong revenue bases struggle to allocate adequate funds for climate adaptation, as competing priorities and debt burdens constrain long-term investments. In contrast, cities like Surat and Ahmedabad showcase how fiscal innovation—through municipal bonds, public-private partnerships, and improved revenue collection—can unlock funding for green infrastructure. However, their success remains difficult to replicate widely due to dependence on city-specific advantages such as creditworthiness and administrative efficiency. Smaller cities, meanwhile, face the most acute challenges, with limited own-source revenues and technical capacity gaps preventing effective utilization of available funding mechanisms. These insights underscore the need for differentiated policy interventions tailored to each city's fiscal reality. While high-risk metros require mechanisms to break free from short-term spending cycles, smaller cities need targeted support to build technical and financial capacity. The RBI's proposal for "resilience-linked fiscal transfers" could serve as a unifying framework, incentivizing all cities to prioritize climate adaptation while accounting for their unique constraints.

10.Eco-Finance Alchemy: Transforming Data into Climate Resilience

The study employed an innovative hybrid econometric framework to rigorously test four key hypotheses about green infrastructure (GI) financing in Indian cities, yielding nuanced insights with significant policy implications. For Hypothesis 1 (H1), researchers combined fixed-effects panel regression with machine learning techniques to analyze the municipal revenue-GI investment relationship. The instrumental variable approach, using state fiscal devolution indices as exogenous shocks, revealed a robust positive relationship ($\beta=0.23$, $p<0.01$) while controlling for endogeneity. The random forest algorithm further identified that cities with diversified revenue streams (≥3 sources) invested 2.3 times more in GI than tax-dependent peers, highlighting how fiscal architecture matters more than simple revenue volume. However, the gradient boosting model uncovered a critical non-linearity - the positive effect disappeared when debt-to-revenue ratios exceeded 25%, explaining why high-debt cities like Kolkata struggle despite revenue potential.

For Hypothesis 2 (H2), the research team integrated Stochastic Frontier Analysis with system dynamics modeling to capture GI's cost-effectiveness. The SFA quantified GI's 28% efficiency advantage over grey infrastructure (0.82 vs. 0.64, $p<0.05$), while Monte Carlo simulations projected risk-adjusted returns across climate scenarios. This hybrid approach revealed that while Surat's bioswales delivered consistent 3:1 returns, the probability of maintaining benefits dropped to 40% without proper maintenance funding. The system dynamics model traced how deteriorating GI assets create vicious cycles - Bengaluru's lakes showed how 15% maintenance budget cuts led to 40% effectiveness loss within five years, ultimately requiring 2.3 times more rehabilitation costs.

The examination of Hypothesis 3 (H3) blended Natural Language Processing with spatial econometrics to map governance barriers. The BERT-based NLP model analyzed 150 policy documents, finding that 72% lacked enforceability clauses ($r=0.58$ with fund underutilization). Simultaneously, spatial lag models visualized how bureaucratic fragmentation creates "governance deserts" - Mumbai's 12-agency system generated 2.3-year delays that spatially correlated with flood vulnerability hotspots. The vector autoregression framework showed election cycles induce 35% approval drops, with effects persisting for 18 months post-election. These hybrid techniques revealed governance failures are both systemic and spatially concentrated.

For Hypothesis 4 (H4), researchers applied Difference-in-Differences analysis enhanced by synthetic control methods to evaluate financing models. The DiD showed bonds increase GI spending by 1.8% ($p<0.05$), while the synthetic control approach revealed that Surat's hybrid model (bonds + CSR + user fees) achieved 78% completion rates versus 42% for conventional financing. The multinomial probit model identified technical capacity (ME=0.35) as the strongest PPP success predictor, explaining why 50% of contracts fail in low-capacity cities. This hybrid econometric suite demonstrated that financing solutions must be as diversified as the challenges they address.

The hybrid modeling framework generated three transformative insights: First, structural equation modeling confirmed that the 25% debt and 50% revenue thresholds represent tipping points, not linear transitions. Second, agent-based modeling simulated how maintenance underfunding triggers non-linear collapse in GI benefits. Third, network analysis revealed that bureaucratic silos create "implementation black holes" that persist across political cycles. Together, these findings demonstrate that India's GI financing challenge requires not just more resources but smarter systems - where fiscal instruments, governance structures, and technical capacities are holistically aligned through evidence-based policymaking.

11.Pioneering Pathways for Urban Climate Resilience

The study's findings reveal critical gaps in municipal financing and governance that hinder the adoption of green infrastructure (GI) in Indian cities. A key constraint identified is the over-reliance on state and central transfers, which account for 60–80% of municipal revenues in many cities. To build fiscal autonomy, urban local bodies (ULBs) must modernize property tax systems by adopting GIS-based tax mapping and digital payment platforms, as successfully implemented in Pune and Bengaluru. These measures can improve collection efficiency, which currently languishes below 50% in most cities. Additionally, diversifying revenue streams through local levies—such as congestion pricing, climate resilience fees, and monetization of municipal assets (e.g., land leasing, advertising rights)—can reduce dependency on unstable intergovernmental transfers. Fiscal decentralization must also be prioritized, with ULBs granted greater taxation autonomy, supported by capacity-building programs to strengthen financial management at the local level.

The study highlights that cities with diversified revenue sources invest significantly more in GI. To replicate this success, performance-linked grants should be introduced, where central and state funding is tied to measurable climate resilience outcomes, such as reduced flood damages or lower urban heat island effects. Municipal bond markets must also be expanded through pooled financing mechanisms and credit enhancement tools (e.g., state guarantees) to enable smaller and fiscally weaker cities to access capital. Public-private partnerships (PPPs) can play a pivotal role, but standardized contract frameworks and viability gap funding are needed to attract private investment in projects like bioswales, urban forests, and stormwater management systems.

Fragmented governance remains a major barrier, with cities like Mumbai facing delays due to bureaucratic silos. To address this, unified climate budgeting should be mandated, ensuring that a fixed percentage of municipal expenditures is tagged for resilience projects, as demonstrated in Bhubaneswar. Inter-agency task forces must be established to streamline approvals and accelerate project implementation. Additionally, community engagement through participatory budgeting and awareness campaigns can foster public support for GI initiatives, ensuring long-term sustainability. The study underscores how neglect of maintenance—as seen in Bengaluru's deteriorating lakes—erodes the benefits of GI investments. To prevent this, ULBs should allocate 15–20% of GI budgets exclusively for upkeep. Furthermore, the RBI's proposal for resilience-linked fiscal transfers should be adopted, rewarding cities that achieve predefined climate adaptation targets, such as reduced flood risks or improved air quality.

12.Conclusin

This study highlights the critical need for Indian cities to address the growing disconnect between their economic importance and climate risks through comprehensive reforms in green infrastructure financing and governance. The research demonstrates that while urban centers contribute significantly to national GDP, their ability to fund climate resilience measures remains severely constrained by structural financial limitations and short-term planning approaches. Successful examples from select cities prove that innovative funding mechanisms, when properly implemented, can deliver substantial returns on green infrastructure investments. However, widespread adoption requires fundamental systemic changes across revenue generation, expenditure prioritization, and institutional frameworks. The findings emphasize that overcoming current barriers will necessitate coordinated policy interventions tailored to different city contexts, with particular attention to governance integration and long-term maintenance strategies. Ultimately, the research calls for a fundamental reorientation of urban development priorities to embed climate resilience at the core of municipal planning and finance systems, ensuring cities can sustainably manage growing environmental challenges while maintaining their economic vitality.

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