INTERNATIONAL CONFERENCE

New Approaches to Governance & Resilience (NAGAR)

ABSTRACTS

ARCS 10.0

ANNUAL RESEARCH ON CITIES SUMMIT 10.0

5-7 February 2026

SCHOOL OF HUMAN SETTLEMENTS
XIM UNIVERSITY

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International Conference on New Approaches to Governance & Resilience (NAGAR)

5-7 February 2026

School of Human Settlements, XIM University, Bhubaneswar

Edited by:
Jublee Mazumdar, Arpan Paul, Annam Sai Kiran and Tiyali Bose

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MESSAGE FROM THE VICE-CHANCELLOR'S DESK

On behalf of XIM University, I extend a warm welcome to all the delegates who have come from around the world to participate in the ARCS 10.0, the Tenth Annual Research on Cities Summit.

The theme of this year's summit, 'New Approaches to Governance & Resilience (NAGAR)', could not be more timely or relevant.

As the world's population continues to urbanize at an unprecedented rate, it is crucial that we invest in education and research in the fields of urban management, governance, and planning. By working together, we can develop new and innovative solutions to the complex challenges facing our cities, from climate change and inequality to the need for affordable housing, access to clean water, sanitation, and sustainable transportation.

XIM University's identity is distinguished by its philosophy of 'Inspiring Futures' by not just walking the well-trodden path but striking out and exploring new paths. To address various developmental challenges confronting our cities and regions, the School of Human Settlements at XIM University has pioneered innovative courses in the areas of Urban Management, Urban Governance, and Planning. By providing students with a comprehensive education in these areas, we equip them with the knowledge and skills necessary to address complex challenges and create sustainable, liveable cities for all.

I believe that the insights and knowledge shared at this summit will be instrumental in helping us to create more

sustainable, humane, and just cities for all. I urge you to engage in robust and productive discussions and to make the most of the opportunity to connect with your peers and colleagues from around the world.

Once again, welcome to XIM University, and I look forward to a successful summit.

Dr. Fr. K.S. Casimir, SJ
Vice Chancellor, XIM University

FOREWORD

As the world strives to meet the challenges of climate change and its consequences, the ways in which we organise our urban development and renewal efforts will be key to addressing them. For it is clear that global sustainability and adaptation to climate change depends greatly on how we reinvent and develop our cities and other settlements. However, adapting to changed realities with new technologies, designs and the necessary lifestyle and behavioural changes hinges on supportive shifts in governance – enabling policies, appropriate institutional and organizational structures and suitable processes.

Central to crafting a sustainable urban development trajectory is building the extensive knowledge, capabilities and capacities for the necessary adaptations. Insights and experiences are developing rapidly as policymakers, academics, researchers, consultants, communities and civic organizations engage with emerging issues and look for solutions. But the necessary ecosystem of knowledge and talent is currently scattered at present. To foster knowledge sharing and learning, the School of Human Settlements (SHS) of XIM University organises the Annual Research on Cities (ARCS) Conferences as a platform for multidisciplinary exchange and learning.

The first Annual Research on Cities conference also marked the launch of Urban Management as a new professional field in India, with the start of the MBA-Urban Management and Governance (MBA-UMG) programme of this School. With the conviction that sustainable urban development requires a range of professional expertise for the unique policy, planning, management and governance tasks posed by rapid urbanization, Urban Management complements

the existing field of Urban and Regional Planning and adds sorely needed implementation capacities for emerging systems and protocols.

The ARCS 10.0 focuses on the new approaches and innovations in governance, including policy, planning and management – and the application of emerging technologies and processes. While developing suitable policy and making plans is relatively easier, changing the existing organizational and institutional ecosystem is arguably more intricate and complex. Experience of crafting such changes and emerging insights is thus crucial, but the limited opportunities and platforms for sharing the understandings leaves valuable insights and learnings buried – and perhaps eventually lost, as they remain in individual and sometimes, organizational memories. An immense loss, for as the country rapidly urbanizes towards having almost 30% of the global urban population in 2035, context-relevant knowledge and its appropriate application become critical. In this regard, the ARCS Conferences provide a rich learning opportunity for all and increase the extent of documentation and reflection on urban policy and interventions. To encourage research, case study, and documentation of urban initiatives, the Annual Urban Research Awards (AURA) are given to the best papers and presentations.

I welcome the delegates, panellists and guest speakers to the ARCS 10.0. This Book of Conference Abstracts illustrates the range of new technologies, policy and governance adaptations that have emerged in recent years and insights of the wide range of academics and practitioners engaging in the tasks of sustainable urbanization. We hope this provides insights and provokes reflection and further engagement.

Dr. Kajri Misra
Dean, School of Human Settlements
XIM University

XIM UNIVERSITY

XIM University, building on the long legacy of the high-quality development and management education of the Xavier Institute of Management Bhubaneswar (XIMB), was established under the Xavier University Odisha Act, 2013. The XIM Board of Governors comprises representatives of the Jesuit Society, the Government of India, the Government of Odisha, and eminent industrialists and educationists. Distinguished by its philosophy of 'Inspiring Futures'- of students, organizations, and communities- by enabling them to explore beyond well-trodden paths and serve as active agents of change in society, XIM carries forward the hallmark education for the creation of social value provided by XIMB.

SCHOOLS OF XIM UNIVERSITY

- Xavier Institute of Management
- School of Human Resource Management
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- Center of Excellence in Fiscal Policy and Taxation
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- Center for Humanities and Compassion Studies
- Center for Analytics and Digital Transformation

The University has also carried forward and strengthened the three decades of knowledge support provided to v

government, business, and national and international organizations to design and implement business, social, and economic development initiatives. This is extended through consulting and advisory services for local, state, and national governments, businesses and civil society organizations, and high-quality management research towards the overall urban, rural, and industrial development of the state and the country.

SCHOOL OF HUMAN SETTLEMENTS

The School of Human Settlements (SHS) houses all initiatives of XIM University for education, research, training and consulting in the fields of urban and regional development policy, planning, management and governance. SHS's mission is to create the expertise needed for sustainable, inclusive and just urban, rural, and regional development. At the core of its graduate degree and other programmes are modules for hands-on learning, including in live projects with faculty and organizations engaged in policy development and impact evaluation, technical support and advisory with government, corporate and civil society organizations. Currently, the School of Human Settlements offers a 2-year full-time Postgraduate programme in MBA in Urban Management and Governance (MBA UMG). Building on the long experience of management education at XIMB, the School's flagship MBA-Urban Management and Governance Programme extend the application of management expertise to human settlements at all scales with the understanding of spatiality, spatial transformations, and public systems in its programmes.

PROGRAMMES OFFERED AT SHS

- MBA in Urban Management and Governance (MBA UMG)
- Ph.D. in Urban Management and Governance
- Ph.D. in Planning

SHS also offers two Doctoral programmes, in Urban Management and Governance, and in Planning. In addition, it offers executive education and capacity building in public

systems, in the areas of economic development, education, health, water and sanitation, affordable housing, mobility, habitat resilience, and other aspects crucial for sustainable development. Graduates work with Consultants, Government, SPVs, NGOs and Foundations, and industry.

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ANNUAL RESEARCH ON CITIES SUMMIT (ARCS)

Current understandings of the conditions of cities, towns, and peripheries and their functioning and development processes are minimal and partial, presenting a key challenge for effective intervention. The ARCS is an annual conference organised by the School of Human Settlements, XIM University, to share research and experience of researchers, academicians, and industry professionals in the planning and management of human settlements and urbanisation in India. It aims to stimulate creation and facilitate the exchange of knowledge to develop safe, sustainable, and just settlements.

ANNUAL URBAN RESEARCH AWARDS (AURA)

The Annual Urban Research Award (AURA) is presented at the ARCS annually for the best paper presentation. Submissions are invited at the time of the Conference announcement every year from academicians, researchers, students, professionals, and policymakers. ARCS 10.0 AURA awards for best paper presentation are selected based on- overall delivery of the presentation, research content, communication skills, and time management.

ARCS 10.0

New Approaches to Governance & Resilience (NAGAR)

In today's world, cities are facing an urgent need for new ways of thinking about how they are run and how they grow. As urban areas expand rapidly, especially in the Global South, they are increasingly strained by the effects of climate change, widening social divides, and environmental decline. Existing governance systems often fall short when it comes to managing these overlapping challenges. International agendas like the Sustainable Development Goals (with SDG 11 at the core), the Paris Climate Agreement, and the Sendai Framework for Disaster Risk Reduction all stress on the importance of building cities that are inclusive, adaptable, and resilient. This means moving beyond outdated, fragmented approaches and toward planning that is coordinated, forward-looking, and grounded in community involvement. To make cities more liveable and just, especially for vulnerable populations, we must reshape how we govern and build urban spaces. It's not simply about policy—it's about ensuring a future that works for everyone.

The 10th ARCS, organised by the School of Human Settlements (SHS), XIM University, scheduled on 5-7 February 2026, is thus shaped as a global meeting ground for people who care deeply about the future of cities. From policymakers, urban managers, planners, to community organisers, researchers, and institutions, this gathering brings together a wide range of voices to reflect on how cities can become more resilient, inclusive, and sustainable. With particular focus on the Global South, where rapid urban growth often intersects with deep social and environmental challenges, the conference offers a space to share lessons, ideas, and new approaches.

Resilient cities are not built in isolation—they emerge when ecosystems are protected, governance is inclusive, and planning responds to real human needs. Good governance helps communities feel heard and included. Healthy ecosystems, both natural and built, help cities cope with shocks and recover more quickly. And when city centres are connected to their outer edges through thoughtful planning, everyone benefits. By bringing these elements together, we can create urban spaces that are not only efficient and functional but also sustainable to future uncertainties.

The aim of ARCS 10.0 is to build lasting partnerships and practical strategies that help cities become fairer, more adaptive, and better prepared for the future. Papers, case studies, project reports, and working paper were invited from researchers, academics, professionals, students, civic and policy actors across disciplines and fields of practice. The conference also features the Annual Urban Research Awards (AURA) for the best paper.

The ARCS 10.0 conference tracks are organised around key dimensions of real-world initiatives, research, and experiences related to urban and regional sustainability. Presentations from different perspectives and sectors were organised into seven tracks:

Track 1- SDGs, Governance and Policy: Institutions, Participation, and Evidence- based Frameworks

The Sustainable Development Goals (SDGs) offer a shared global vision for tackling some of the most urgent and complex environmental, social, and economic challenges facing humanity. But translating this vision into meaningful action requires more than just long-term planning. It depends on strong and inclusive governance, well-designed policies grounded in evidence, and institutions that are both accountable and adaptable. This conference theme invites participants to examine how national and local governance systems can work in concert with policy innovation and multi-stakeholder collaboration to advance

the SDGs. By fostering dialogue on coherent policy frameworks, participatory decision-making, and institutional resilience, the theme seeks to uncover pathways for accelerating equitable and sustainable development. It calls on practitioners, researchers, and policymakers to reflect on what it takes to create governance systems that not only deliver on global goals but also empower communities and build lasting capacity for change. The sub-themes include:

- Evidence- based policymaking
- Multi- level governance and institutional coordination
- Participatory governance and civic engagement
- Financing and regulatory mechanisms for the SDGs

Track 2- Urban Economy and Livelihoods: Circular Economy, Inclusive Growth, and Resilient Livelihoods

As cities continue to grow and reshape the global landscape, they are increasingly recognized as vital hubs of economic activity, innovation, and opportunity. Yet, the speed and scale of urbanization often deepen existing inequalities and strain natural resources. This theme focuses on reimagining urban economies in ways that not only drive growth but also ensure that such growth is inclusive, resilient, and environmentally responsible. It explores how principles of the circular economy—such as resource efficiency, reuse, and regenerative systems—can be embedded into urban development to support both economic vibrancy and sustainability. This theme will engage in interdisciplinary dialogue around resilient livelihoods that can withstand economic and environmental shocks, particularly in the context of the Global South. The theme emphasizes the need to diversify income sources, support informal and creative economies, and design policy frameworks that prioritize equity and adaptability. By rethinking how urban systems value work, waste, and wellbeing, this track aims to uncover practical pathways toward economic models that empower

communities while safeguarding the planet. The sub-themes are:

- Economic growth
- Circular economy
- Inclusive and resilient livelihoods
- Local economic development and urban- rural linkages

Track 3- Environmental Extremes and Adaptation Strategies: Attaining Resilience through Sustainable Approaches

Extreme weather events like heatwaves, floods, droughts, wildfires, and storms are becoming more frequent and intense, affecting our ecosystems, communities, health, and economies in serious ways. This conference brings together researchers, policymakers, practitioners, and community leaders to better understand these challenges and to share practical ways to adapt. It values approaches that combine scientific insights with local and traditional knowledge, recognizing that real resilience comes from communities working together. By encouraging open conversations across different fields and experiences, the conference hopes to inspire solutions that not only reduce risks but also help people and places become stronger and more prepared for whatever comes next.

- Natural hazards and society
- Nature- based solutions (NBS)
- Role of community in disaster risk reduction
- Adaptation and mitigation strategies
- Environment, Social and Governance (ESG)

Track 4- Inclusive Urban Transformation: Placemaking, Identity, and Equity Across Age and Gender

In an era marked by rapid urbanization and widening social inequalities, the concept of inclusive transformation calls for a fundamental rethinking of how cities are designed and governed to better reflect the diverse needs, identities, and

aspirations of all residents. This theme critically examines how inclusive placemaking can help address disparities across dimensions such as gender, age, culture, and identity, fostering urban environments that are equitable, diverse, and resilient. It invites thoughtful dialogue on the role of urban design, participatory governance, and meaningful community engagement in shaping public spaces that promote a sense of belonging, safety, accessibility, and cultural expression for everyone. By centering inclusivity in urban transformation, this approach aims to build cities where all individuals can thrive and participate fully in civic life. The sub-themes are:

- Inclusive and resilient placemaking
- Gender- responsive planning and management
- Role of culture and identity
- Age- sensitive planning and management
- Equity, belonging and urban justice

Track 5- Future of Urban Living: Trends in Housing and Real Estate

The housing and real estate sector is undergoing rapid transformation driven by urbanization, technological innovation, demographic shifts, and evolving economic dynamics. This theme addresses the question of how these changes are reshaping the way we plan, finance, and govern living spaces. It invites dialogue on building inclusive, resilient, and sustainable communities through innovative housing models, smart technologies, and equitable policy frameworks. As cities grow and diversify, the challenge lies in ensuring that housing is accessible, adaptable, and responsive to human needs. This theme encourages collaboration across disciplines to envision housing not just as infrastructure, but as a catalyst for social stability, dignity, and opportunity. The sub-themes are:

- Affordable housing and inclusive development
- Smart and sustainable housing
- Real estate investment and market dynamics

- Landuse planning and management
- Land markets, property rights, and governance

Track 6- Urban Network Services and Infrastructure: Innovation, Integration and Accessibility

As cities expand rapidly, the need for reliable, equitable, and resilient urban services like water, sanitation, hygiene (WASH), transportation, and education becomes more pressing than ever. These essential services form the foundation of inclusive, healthy, and sustainable urban life. This theme seeks to foster interdisciplinary conversations on overcoming challenges and driving innovation in these sectors. It emphasizes developing policies and practices that improve accessibility, affordability, and quality, while addressing social disparities and equipping cities to meet future growth and environmental pressures. The sub-themes are:

- WASH
- Sustainable urban transportation
- Education infrastructure and accessibility
- Infrastructure finance

Track 7- Digital Solutions and AI- driven Innovation: Smart Application, E- governance, and Ethical Tech

Digital solutions and AI-driven innovations are rapidly transforming how cities are managed, offering new tools to tackle complex urban challenges with greater efficiency and insight. This theme explores the potential of technologies such as artificial intelligence, big data analytics, and smart sensors to enhance urban governance, service delivery, and resilience. The theme will explore how these innovations can promote inclusive, transparent, and adaptive urban systems, while addressing ethical considerations and digital divides. By integrating technology with community needs, cities can become more responsive, equitable, and prepared for the future. The sub-themes are:

- Smart technologies and AI for urban solutions

- Digital governance in decision making
- Role of AI and digital infrastructure in urban management
- Ethical challenges in the implementation of AI

About UofT India Foundation

The UofT India Foundation was established to connect academia with India's entrepreneurship, government, and not for profit sectors in order to pave a sustainable pathway for a growing and thriving country. Together, using our collaborator-first approach to engagement, we work to address the sustainability challenges that Indian cities of all sizes face today.

CONTENTS

NEW APPROACHES TO GOVERNANCE & RESILIENCE (NAGAR)

ABSTRACTS

Analyzing Floor Space Index (FSI) for Economic Growth and Sustainable Urban Development: Global Lessons, Indian Context, and Kerala's Applicability

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FSI is the foremost planning standard used to control development density in a city, indirectly managing the burden on civic infrastructure, such as roads, water, sewage, and power, by limiting the total built-up area. The study highlights that the efficient and rational application of FSI is crucial for predicting the growth of urban centres and accommodating projected population growth, which is expected to require a 326% expansion of urban area in developing countries between 2000 and 2050.

Worldwide adaptable FSI/FAR policies have been effectively utilized to control density and boost growth. For instance, New York City's incentive zoning, introduced in 1961 granted developers additional if they incorporated public plazas leading to the development of more, than 500 privately owned public areas. São Paulo, Brazil presents an example where FAR transformed into a financial tool. Initially extra building capacity was allocated via grants obliging developers to fund infrastructure. In 2004 this system shifted to employing Certificates for Potential Additional Construction (CEPAC) which're monetary tools traded through electronic auctions. Acquiring a CEPAC provides the buyer, with building rights enabling local governments to dissociate public income from the schedule of private development and fund infrastructure promptly. In China extensive housing and construction growth has been utilized to form urban configurations that promote walkability and reduce commute times. This is achieved by allowing FAR variations through zoning granularity, permitting higher FARs in central business districts and

transit hubs, which decrease gradually away from these core uses

Although FSI has achieved recognition as a versatile tool for growth and Land Value Capture (LVC) its use in Kerala, India is clearly ineffective. The main issue is twofold: absence of a data-informed framework for FSI distribution and an excessive provision of development rights. Presently FSI in Kerala is established on basic physical limits, including road widths and setbacks while ignoring essential planning factors such, as urban density, available land and infrastructure capacity. Consequently, there is no established, data-driven formula for assigning FSI values

An essential initial conclusion, from a small-scale project evaluating the feasibility of LVC via Transferable Development Rights (TDR) in Kerala uncovered obstacles. The study indicated:

- **Absence of Zoning Hierarchy:** Urban areas such, as Kozhikode exhibit minimal. No spatial differentiation or established zoning hierarchy complicating the identification of clear TDR "Sending" or "Receiving" zones.
- **Underuse of FSI:** Developers frequently fail to maximize the permitted FSI, in areas beyond city centers suggesting that recent boosts, in permissible FSI have not translated into anticipated development projects or market demand.
- **Lenient Permissible FSI/FSRs:** Unlike controlled cities such as Mumbai, several cities in Kerala (for instance Kochi, Kozhikode) offer generous basic FSI values (2.5–3.0) and permit expansions up, to 5.0 via PREMIUM FSI without relying on TDRs.
- **Market Saturation and FSI Inflation:** This abundance of development rights or "FSI inflation" depresses the market value of TDRs, rendering them ineffective as an LVC tool. TDR's fundamental concept of transferring a restrictive encumbrance is negated when an abundance of FSI is already available via PREMIUM FSIs

This research thus highlights the need to streamline the FSI system to open up opportunities, for development and establish methods to transform low-density urban zones into dense mixed-use compact communities. The study aims to create a data-informed framework that combines spatial factors with FSI distribution.

The initial objectives include a theoretical review of FSI implementation in other countries and Indian states, a review of LVC tools, and the identification of significant spatial parameters that influence FSI decision-making. These critical parameters include population density, infrastructure capacity, access to public transportation, hazard zones, and land use mixes

The initial findings of the research support a Zone-Based FSI Optimization method. This strategy suggests assigning FSI values (up to 3.0) to Transit Corridors and Central Business Districts equipped with robust infrastructure while keeping reduced FSI values (1.0 or less) in outer and environmentally sensitive areas, which would function as TDR "sending zones". This systematic approach aims to support evidence-based decision-making and municipal revenue enhancement for ULBs in Kerala, ensuring that FSI allocation is conditioned on urban morphology and is accompanied by regulations on setbacks and mandatory public amenities to prevent density from degrading the quality of urban spaces. The ultimate goal is to design a dynamic FSI allocation system with both base and adaptive FSI components, validated by real-world data, and presented via an interactive dashboard for ULB decision support.

Keywords: Floor Space Index, Land Value Capture, Sustainable Urban Development

Sustainable Heritage Corridor for Memorable Pilgrimage Experience and Heritage City Image

Sandeep Kumar Mohanty[1], Prakash Chandra Dash[2]

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With the developments of Sustainable Heritage Corridors some of the developing countries have restructured their cultural and religious significance of their heritage cities. These heritage cities have gone through tremendous changes with raising expensive and elaborate heritage sites aligning with the SDGs. These heritage corridors are endorsing the chances of deeper academic investigation in heritage tourism (Li et al., 2023). Unique problems are emerging in this new phase of heritage tourism, particularly investigating how it creates a memorable pilgrimage experience (Wani et al., 2025). As heritage corridors are becoming the focal point of academic research, developing countries are curious to acknowledge and critical to comprehend their effects on tourists' cultural exposures and local socio-economic transformations in these places of historical significances (Ries and Schwan, 2023). So Sustainable Heritage Corridor and its effects on multi-stakeholders bring a fresh investigation, and more support is sought within the broad area of heritage city image research today.

A Sustainable Heritage Corridor is defined as a designated area enriched with historical/cultural heritage aspects that has been earmarked for the purposes of sustainability (Singh et al., 2023). This heritage corridor serves as vital cultural and historical pathway that not only preserves the city's legacy but enhance its image and attractiveness as a major pilgrim/tourist destination. This corridor concept intermingles a city's past with its present and claim to control its future by encompassing its historical sites, traditional markets, and cultural landmarks, contribute

significantly to the overall pilgrimage experience and influence their perception (Bose and Mukherjee, 2022).

The question arise how far these sustainable heritage corridors fulfil the objectives and create positive heritage city image. The present study focuses on this research gap by reviewing the theoretical arguments and concepts important to sustainable heritage corridors and then testing a new conceptual model that defines the elements of a memorable pilgrimage experience. This study aims to propose and test an integrative theoretical model of memorable pilgrimage experience based on stimulus-organism-response (S-O-R) theory.

This study adopts a quantitative, cross-sectional research design, appropriate for examining the causal relationships between Pilgrimage Experience and Heritage City Image. Quantitative design is justified because the constructs are latent, multidimensional, and require numerical measurement through scale items. A structured questionnaire survey approach was applied, allowing methodical data collection from a heritage corridor visitors in a realistic setting. Data for this study were collected from the heritage corridor site using the convivence sampling method during the period of February-April 2025.A convenience sampling method was utilized, with notable benefits including low cost, ease of implementation, and efficiency (Jager, Putnick, & Bornstein, 2017).

The sustainable heritage project in Puri, which was inaugurated in January 2024, has aligned few SDGs. The project encompasses various amenities such as parking spaces, Shree Setu (a bridge), pilgrimage centres, a new road for pilgrim movement, toilets, clock rooms, electrical work, and more. The project's alignment with specific SDGs can be broken down to SDG 11 that focuses on Sustainable Cities and Communities where focus is Safeguarding heritage by Preserving the cultural and historical integrity of the 12th-century Jagannath Temple and its surroundings. Its also focusing on Urban Planning by Creating a

structured, nine-zone corridor with green spaces, pedestrian paths, and organised public areas to manage the high volume of visitors. It is also focusing on Resilience by integrating heritage conservation with urban planning helps build community resilience.

This research focuses on a developing country like India and specifically a city like Puri to explore the effect of a newly developed sustainable heritage corridor in creating a memorable pilgrimage experience and extending that effect to heritage city image building and reshaping revisit intentions, keeping in mind that the city has the potential to express unity in diversity and carrying Indian culture to a great height (Chandan et al, 2023).

The results of the study are relevant because they indicate various means by which the pilgrimage /tourism service provider, sustainable heritage corridor developer and local administration can facilitate more memorable pilgrimage experience.

Keywords: SDGs for City, Sustainable Heritage Corridor, Memorable Pilgrimage Experience, Heritage City Image

Urban Management and Finance: Evolving Scope and Contemporary Challenges

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Urban governance has undergone a profound conceptual and operational transformation over the past five decades, shifting from a narrow administrative function to a multidimensional, finance-centred practice shaped by rapid urbanisation, institutional reforms and evolving sustainability mandates (Tribillon, 1985; Rakodi, 1991; McGill, 1998; Behbood, 2024; He & Tan, 2025). This paper traces this evolution with particular focus on the rising

centrality of urban finance as both the analytical lens and operational fulcrum of city management. Early understandings of urban management emphasised planning implementation, basic coordination, and administrative efficiency (Tribillon, 1985; Mattingly, 1994). More recent perspectives prioritise fiscal resilience, resource mobilisation, inter-sectoral coordination, and the strategic leveraging of land and infrastructure assets (Davidson, 1991; Van Dijk, 2000, 2006; Arefi, 2012; Zucaro et al., 2022; Mashhadi et al., 2023). Drawing together foundational and contemporary scholarship (Da Cruz et al., 2019; Engin et al., 2020; Lai, 2020; Gogoi & Debbarma, 2025), the paper argues that financial governance now fundamentally structures how cities plan, implement and sustain development trajectories.

The theoretical framework integrates three complementary perspectives: decentralisation, urban competitiveness, and New Public Management (NPM). Decentralisation theory highlights gaps between constitutional devolution and effective fiscal autonomy, especially in developing contexts where revenue assignments, intergovernmental transfers and budgeting authority remain weak or inconsistent (Dick-Sagoe, 2020; Febriandiela et al., 2024; Ibrahim, 2024). India's post-74th Amendment experience reflects these tensions, with persistent dependence on state transfers and limited enhancement of local financial capacity (Prasad & Pardhasaradhi, 2020; Sonkar & Ojha, 2024). Urban competitiveness frameworks, derived from Porter's (1990) competitive advantage and expanded into multidimensional assessment models, underscore the role of innovation, institutional coordination, sustainability and long-term financial strategy in shaping urban performance (Chiu & Liu, 2021; Komasi et al., 2022; Nasi et al., 2023). NPM provides a third pillar, emphasising managerial efficiency, accountability, performance measurement, and market-oriented tools—each carrying major fiscal implications for service delivery, PPP structuring and

contract governance (Indahsari & Raharja, 2020; Lapuente & Van de Walle, 2020; Dan et al., 2024; Dadzie et al., 2022). In combination, these theories reveal that institutional design, financial autonomy and governance capacity are decisive in enabling cities to respond to infrastructure needs, climate shocks and technological transitions.

Methodologically, the study uses a semi-systematic literature review, applying a PRISMA-informed approach (Moher et al., 2009; Pickering & Byrne, 2014) to map conceptual and historical shifts in urban governance and finance. Searches across six databases (JSTOR, ProQuest, Google Scholar, EBSCOhost, ScienceDirect, Emerald Insight) using terms related to "urban management," "urban finance," "municipal finance," "infrastructure financing," and "urban governance" produced 1,042 results, from which 20 met rigorous two-tier inclusion criteria. These comprised works offering conceptual contributions on governance-finance linkages, institutional reform, financial innovation or infrastructure management (e.g., Ahluwalia, 2019; Tan & Taeihagh, 2020; Allam et al., 2022). Selected articles were coded using a comparative matrix capturing geography, conceptual focus, financing tools and governance inflection points (Petrakovska & Mykhalova, 2018; Sitzenfrei et al., 2020; Noring, 2019; De Risi et al., 2018; Rincón et al., 2021).

The review identifies three broad phases of financial-governance evolution. First, the 1980s–1990s were shaped by structural adjustment and fiscal austerity, which decentralised responsibilities without matching resources and encouraged private participation and cost-recovery strategies (Mattingly, 1994; Van Dijk, 2000). Second, the 2000s saw partial decentralisation, expanded local mandates and intensified service obligations, though with inconsistent revenue empowerment (Ahluwalia, 2019). Third, post-2010 transformations combined financial innovation, digital governance and sustainability imperatives. Cities experimented with PPPs, municipal

bonds, land-value capture and lifecycle costing, while global agendas such as the SDGs pushed climate resilience and green investment to the foreground (Vaidya & Chatterji, 2019; Ni'mah et al., 2021). Simultaneously, "smart city" programmes and digital twins introduced new governance possibilities but also new demands for institutional capacity and stable financing (Tan & Taeihagh, 2020; Rana et al., 2019; Allam et al., 2022).

Four thematic patterns emerge. First, land-based finance—through LVC, development charges and asset corporatisation—has become a central revenue strategy, though raising important equity considerations (Petrakovska & Mykhalova, 2018; Noring, 2019). Second, climate resilience and environmental quality have become core budget priorities, with cities increasingly adopting green infrastructure valuation, lifecycle costing and blended finance frameworks (Sitzenfrei et al., 2020; De Risi et al., 2018; Chaudhuri & Kumar, 2022). Third, infrastructure budgeting is shifting from short-term capital expenditure to lifecycle management, reflecting concerns over ageing assets, deferred maintenance and emergency cost spirals (Denis & Florentin, 2024; Subramanian et al., 2019). Fourth, institutional fragmentation remains a persistent constraint: despite advances in tools and models, many cities lack the capacity, regulatory coherence or fiscal autonomy needed to deploy financial innovations effectively (Ahluwalia, 2019; Rincón et al., 2021; Cheela et al., 2021).

The paper concludes that urban finance has moved from a technical subdomain to the defining arena of urban governance. Decisions about revenue generation, investment priorities, maintenance cycles, PPP design, creditworthiness and climate budgeting now shape not only infrastructure outcomes but the governance architecture itself (Da Cruz et al., 2019; Zeng et al., 2022). However, the embrace of market-based instruments risks deepening disparities between fiscally strong and weak

cities, and between affluent and marginalised neighbourhoods (Ni'mah et al., 2021; Aly & Dimitrijevic, 2022). An integrated reframing of urban management is therefore required—one in which financial strategies are directly aligned with institutional reform, social equity and long-term resilience. Strengthening own-source revenues, improving intergovernmental fiscal design, expanding participatory budgeting and building professional financial capacity emerge as central priorities (Tan & Taeihagh, 2020; Van Oijstaeijen et al., 2020). For scholars, the review highlights a growing research frontier at the intersection of finance, governance and sustainability, particularly in rapidly urbanising contexts where institutional change is ongoing. For practitioners, it underscores that the future of urban governance will depend not only on planning vision but on the fiscal systems that underpin and enable it.

Keywords: Urban Management, Urban Finance, Municipal Finance, Urban Development, Urban Governance

Assessment of the GARIMA Scheme for Core Sanitation Workers in Odisha

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India's pursuit of rapid economic growth under the broader vision of Viksit Bharat has been accompanied by accelerated urbanisation, infrastructure expansion, and increased access to sanitation facilities. While these developments have contributed to improved public health outcomes and urban liveability, they have simultaneously intensified pressures on urban sanitation systems. The expansion of sewer networks, septic tanks, community toilets, and faecal sludge management infrastructure has led to a substantial rise in sanitation-related labour demand. At the centre of this expanding system are sanitation workers, whose labour ensures the safe

management of human waste and the functioning of urban environments. Despite their critical contribution, sanitation workers in India continue to remain socially invisible, occupationally vulnerable, and structurally marginalised.

Sanitation workers operate across the sanitation value chain, performing tasks such as cleaning public and community toilets, sweeping streets, maintaining drains, operating sewer networks, emptying septic tanks, handling faecal sludge, and managing waste treatment facilities. National estimates suggest that India has approximately five million sanitation workers, of whom nearly two million are engaged in high-risk sanitation activities involving direct contact with untreated human waste. These workers face persistent exposure to confined spaces, toxic gases, pathogens, and unsafe working conditions, resulting in high occupational morbidity and mortality rates. The vulnerabilities of sanitation workers are further compounded by caste-based stigma, informal employment arrangements, low wages, and limited access to social security. These challenges persist despite the existence of legal frameworks such as the Prohibition of Employment as Manual Scavengers and their Rehabilitation Act, 2013, highlighting enduring gaps between policy intent and implementation.

Within this broader workforce, core sanitation workers constitute the most vulnerable group. Core sanitation workers are directly engaged in sewer cleaning, septic tank emptying, drain cleaning, and faecal sludge handling—tasks that involve the highest levels of occupational hazard. Their work often takes place in confined and poorly ventilated environments and is frequently carried out using rudimentary tools and inadequate protective equipment. Fatal accidents caused by toxic gas inhalation, asphyxiation, and falls into open sewers remain recurrent. Additionally, the predominance of contractual and informal employment arrangements limits access to labour protections, health

insurance, compensation mechanisms, and grievance redress systems.

Against this national context, the state of Odisha has emerged as a significant case in sanitation governance and worker welfare reform. Odisha was among the first states in India to adopt a comprehensive Urban Sanitation Policy in 2011, signalling early recognition of sanitation as a governance priority. More importantly, Odisha became the first state to formally acknowledge the continued existence of unsafe sewer and septic tank cleaning practices and to accept institutional responsibility for addressing the safety and dignity of sanitation workers. This acknowledgement marked a departure from widespread administrative denial observed in many other states and created the foundation for targeted welfare interventions.

In September 2020, the Government of Odisha launched the GARIMA Scheme, a dedicated initiative aimed at ensuring safety, dignity, and social security for core sanitation workers. GARIMA was conceptualised as a comprehensive welfare programme addressing multiple dimensions of sanitation work. Its design includes digital identification and enumeration of core sanitation workers, issuance of Garima ID cards, provision of personal protective equipment, institutionalisation of safe cleaning systems, occupational safety training, establishment of emergency response mechanisms, financial protections through minimum wages and risk and hardship allowances, and access to social security entitlements such as health insurance, housing support, and educational benefits for workers' families. The scheme has been positioned as a pioneering model for sanitation worker welfare and has received national and international attention.

However, evidence from existing literature and independent studies suggests that welfare schemes for sanitation workers often encounter significant challenges during implementation. Research from Odisha and other states highlights issues such as uneven coverage, limited

awareness among workers, disparities between permanent and contractual employment arrangements, inconsistent provision of safety equipment, and weak grievance redress mechanisms. These findings raise important questions about whether progressive scheme designs translate into tangible improvements in workers lived experiences. Despite GARIMA's prominence, systematic academic assessments examining its implementation effectiveness at the urban local body level remain limited.

This paper addresses this gap by evaluating the implementation effectiveness of the GARIMA Scheme for core sanitation workers in selected urban local bodies of Odisha. The study adopts an assessment-focused approach, examining whether the scheme's intended provisions are being realised on the ground, rather than proposing solutions or policy recommendations. The evaluation framework is structured around key dimensions of the scheme, including worker identification and coverage, occupational safety measures, financial protections, access to social security benefits, and perceived changes in dignity and working conditions.

The study employs a mixed-methods approach, combining primary and secondary data sources. Primary data are drawn from structured interactions with core sanitation workers and key stakeholders at the urban local body level, enabling an assessment of scheme coverage, benefit access, and occupational conditions. Secondary data include a review of official scheme documents, government reports, and existing academic and policy literature on sanitation workers and welfare interventions. An indicator-based assessment framework is used to compare scheme design provisions with observed implementation outcomes.

The findings of the study indicate that the GARIMA Scheme has made measurable progress in certain areas, particularly in the identification and formal recognition of core sanitation workers. Digital enumeration and the issuance of

Garima IDs have contributed to improved visibility of workers within the sanitation system. However, the implementation of occupational safety measures shows variability across locations and categories of employment. While the provision of personal protective equipment and safety training is reported, consistent usage and enforcement remain uneven. Financial protections, including minimum wages and risk allowances, demonstrate partial realisation, with disparities observed between permanent and contractual workers. Access to social security benefits such as insurance, housing, and education support is also found to be uneven, influenced by factors such as awareness, administrative capacity, and employment status.

In terms of dignity and workplace recognition, the study finds that improvements are perceptible but not universal. Formal identification, uniforms, and official recognition contribute positively to workers' self-perception and sense of inclusion. However, entrenched social stigma and discriminatory practices persist, particularly in informal and contract-based work settings. These findings underscore the complexity of translating welfare schemes into holistic improvements in safety, security, and dignity for sanitation workers.

By providing an evidence-based assessment of the GARIMA Scheme's implementation, this paper contributes to the limited empirical literature on sanitation worker welfare in India. It offers insights into the extent to which a state-led, rights-oriented welfare initiative delivers on its stated objectives within the context of rapid urbanisation and increasing sanitation burdens. The study situates GARIMA within broader discussions on urban governance, labour welfare, and social justice, highlighting the importance of assessing implementation outcomes alongside policy design. While the paper does not advance recommendations, its findings provide a grounded understanding of the successes and limitations of the

GARIMA Scheme in practice, informing future research and discourse on sanitation worker welfare and urban development in India.

Keywords: Core Sanitation Workers, GARIMA Scheme, Occupational Safety, Social Protection, Welfare Schemes, Dignity of Labour

Hybrid Governance after Reform: Evidence from Urban Water Provision in Odisha

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Urban service delivery reforms in the Global South increasingly rely on hybrid governance arrangements that combine state authority, market mechanisms, and community participation. These arrangements are often evaluated in terms of innovation, efficiency, or access expansion. Far less attention is paid to what follows once hybridisation stabilises and the reform moment passes. This paper examines the outcomes of governance after WATCO, a corporatized entity that replaced the state engineering department, PHEO, in Odisha for domestic water provision in Bhubaneswar. Instead of exploring why hybrid governance was implemented, this article investigates the ongoing impact of the system and how it will develop over time.

This research connects with the ongoing discussions regarding hybrid governance, networked authority, and resilience. Previous research has shown that hybrid models can create opportunities for experimentation with service delivery options, thereby facilitating innovation within municipalities that lack capacity (Jaglin, 2016; Gopakumar, 2014). There have also been empirical studies showing that hybrid governance models may lead to varying degrees of accountability, ambiguity in decision-making authority, and

varying levels of citizen involvement, especially when change is contingent upon political opportunities or elite coordination (Bakker, 2010; Pierre & Peters, 2000). This paper contributes to this literature by shifting the analytical focus from hybridisation as a reform strategy to hybrid governance as a settled mode of governing.

The case examines Odisha's urban water sector following the establishment of the Water Corporation of Odisha in 2015 and the launch of the 'Drink from Tap' initiative in 2019. The reform combined corporatised utility management, large-scale infrastructure investment, digital monitoring systems, and the engagement of women's self-help groups, known as Jal Sathis, for last-mile interface functions. Through its implementation, this initiative led to rapid network expansion, resulting in claims of near-universal coverage for all households in Bhubaneswar and Puri, and is viewed as an exemplar by many other states in India.

The analysis draws on qualitative data collected between 2024 and 2025. Methods include an overview of policy documents, project reports, and utility records, and semi-structured interviews with state officials, engineers, consultants, Jal Sathi members, and urban households. The research describes the evolution of roles, authority, and practices that resulted from the implementation of hybrid governance in Odisha, rather than those developed during the agenda-setting or policy design phases.

The findings indicate that hybrid governance in Odisha produced three distinct post-reform outcomes. First, hybrid practices stabilised selectively. Technological and organisational elements, such as digital monitoring systems and corporatised operations and maintenance, became embedded in routine governance. Participatory elements, by contrast, remained weakly institutionalised. Jal Sathis functioned primarily as intermediaries for billing and communication, with limited influence over operational decisions or feedback loops. Participation existed as task

execution rather than shared authority, echoing concerns raised in earlier studies on co-production in service delivery (Joshi and Moore, 2004).

Second, hybrid governance led to a consolidation of authority rather than its dispersion. While multiple actors were involved in planning and rollout, post-implementation governance became increasingly centralised under the state-owned utility. Informal and alternative provisioning modes, which previously coexisted with state systems, declined in relevance. This reduced fragmentation and improved quality control but also narrowed user choice and local autonomy. The case challenges the assumption that hybrid governance necessarily decentralises power or strengthens local control.

Third, the durability of hybrid governance proved uneven. Organisational hybridity, anchored in legal and administrative restructuring, remained stable despite leadership changes. Policy hybridity, however, was politically contingent. Informal coordination spaces, expert involvement, and adaptive decision-making weakened following changes in administrative leadership. Tacit knowledge and collaborative routines were lost, with limited mechanisms for institutional memory or learning. This created a governance system that continued to deliver water but was less capable of adaptation and responsiveness.

From the user perspective, the reform produced tangible gains in access and public health protection. At the same time, household practices such as water storage and filtration persisted, indicating unresolved trust deficits. Monitoring focused on technical performance, while community perceptions and satisfaction were not systematically tracked. The governance system prioritised standardisation and measurable outputs, with limited attention to experiential dimensions of service delivery.

The paper argues that hybrid governance should not be assessed only by its ability to enable reform. Its longer-term governing effects matter equally. In the Odisha case, hybridisation facilitated rapid service expansion and quality control but also resulted in a state–corporate monopoly with thin participation and fragile adaptive capacity. Hybridity functioned as a transitional governing arrangement rather than a stable institutional equilibrium.

The findings have implications for governance debates linked to the SDGs and urban resilience. They suggest that hybrid governance can strengthen service delivery while simultaneously narrowing spaces for participation and contestation. For essential urban services, stability and equity gains may come at the cost of pluralism and user agency. The paper calls for greater attention to post-reform governance dynamics and the institutionalisation of participation, learning, and accountability beyond the reform moment.

Keywords: Hybrid Governance, Urban Water Reform, Institutional Durability, Global South

Governance of Urban Commons: The Case of Open Livestock Grazing in Bhubaneswar, Odisha

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The rapid expansion of cities into their surrounding rural hinterlands creates unique governance challenges, particularly with regard to the management of common resources or 'urban commons.' A prime example of this phenomenon is Bhubaneswar, the capital city of Odisha, India. As its boundaries are extending, traditional agriculture and pastoral practices, such as open livestock grazing, come into direct conflict with modern urban planning ideals, infrastructure, and sensibilities. This article

explores the specific case of open livestock grazing on the peri-urban fringes of Bhubaneswar, examining how this age-old practice is perceived, regulated, and contested in a context of accelerated urban transformation. The practice is not merely a relic of the past but an active site of negotiation, reflecting broader tensions between development, equity, and sustainability.

The foundation of this research is a systematic review and synthesis of secondary sources. A wide range of documents was collated and critically analysed in order to build a comprehensive understanding of the issue.

These sources included:

- **Policy and Planning Documents:** State-level livestock policies, Bhubaneswar's Master Plans, and municipal corporation regulations.
- **Legal Documents:** Relevant High Court and National Green Tribunal orders related to cattle on the roads, public nuisance, and environmental degradation.
- **Academic Literature:** Journal publications from relevant fields such as urban studies, environmental management, sociology, and agricultural economics.
- **Grey Literature:** Reports and briefs from NGOs, research institutes, and media coverage from local and national newspapers.

The analytical process thus involved extracting and comparing the narratives, assumptions, and evidence presented in these sources to identify dominant frames, points of conflict and consensus, and serious gaps in the prevailing discourse. Analysis of secondary data presents three dominant and sometimes competing narratives on open grazing.

The Urban Nuisance and Safety Frame: From the perspective of the urban planners, municipal authorities, and a large section of residents, open grazing is primarily framed as an issue related to urban management. Various

policy documents and the literature on urban development often cite its contribution to traffic congestion and road accidents, destruction of public infrastructure like footpaths and green spaces, and public health nuisances in terms of animal excreta. In this frame, free-roaming cattle are seen as symbols of disorder, incompatible with the vision of a "smart," modern, and globally competitive city.

The Socio-Economic Livelihood Frame: This is countered by a narrative in a range of socio-economic studies and reports emanating from civil society organizations. This frame positions open grazing as an essential economic activity for poor pastoralists or *Gwalas* and small farmers. It is a livelihood sustaining practice through a low-cost mode of feeding livestock that sustains the extensive informal dairy economy of the city. The ban on grazing, without viable alternatives, is framed as directly impacting the food security and economic survival of these poor communities, increasing urban poverty and inequality.

The Environmental Paradox Frame: Environmental assessments give a more mixed picture, hence posing a kind of paradox. On one hand, the practice is linked to the degradation of peri-urban ecosystems, including soil compaction, loss of biodiversity in green areas, and pollution of water bodies. The same reports often note its undesired ecosystem service: waste management in an informal way. Large amounts of agricultural residue and organic waste are consumed by cattle on the urban fringes, thereby reducing the burden on municipal solid waste management systems. This duality makes for a less clear environmental case against-or for-the practice.

The dominance of any single frame in the policy discussion has led to a governance impasse. If the "urban nuisance" frame prevails, the response is generally a call for restrictive bans-which are socially disruptive and hard to enforce. As the "livelihood" frame gains ground, it often leads to policy paralysis or ineffective regulations that fail to address valid urban concerns. Thus, the absence of an integrated view

recognizing the validity of all three frames has led to a vicious circle of contention and ineffectiveness in governance. Moving beyond this stalemate requires a holistic governance approach, synthesizing these competing concerns. The evidence synthesized in this review suggests that solutions must be as multi-dimensional as the problem itself.

The literature points to several promising, integrated policy directions:

- **Designated Grazing Zones:** At the least, there could be a formal designation of certain less-sensitive peri-urban land for grazing, through participatory mapping exercises involving grazers, residents, and planners to determine mutually agreeable locations that could balance the needs for space to graze and urban safety and order.
- **Fodder Development Programs:** Municipal or state agencies could incentivize the production of high-nutrient fodder on empty urban plots or through farmer cooperatives to minimize dependence on open grazing. This would support the dairy economy with minimal negative externalities due to free-range grazing.
- **Waste Management Integration:** Formal recognition of the informal waste management service provided by cattle and were safe, integration in a regulated manner into the city's organic waste strategy could turn a perceived problem into a collaborative solution. Stakeholder Collaboration Platforms: The establishment of formal, continuous dialogue platforms involving herder communities, residents' welfare associations, municipal corporations, and environmental groups is needed to build trust and to create context-specific, legitimate rules concerning the shared use of space.

The case of open livestock grazing in Bhubaneswar serves as a microcosm for more general challenges of governance of urban commons in the Global South. At the policy level, the impasse is less about lack of awareness but rather about

a failure to integrate urban, socio-economic, and environmental dimensions into a coherent governance strategy. This secondary research synthesizes disparate viewpoints into constructing a more holistic understanding. It calls for a shift from fragmented, single-objective policies to integrated, participatory, and adaptive management models. Nevertheless, the feasibility and exact design of certain proposed interventions, such as site-specific demarcation for assigned grazing zones and fodder programs, remain purely theoretical without necessarily being validated at the grassroots level. Hence, this article concludes with a strong plea for empirical research in the future, including spatial analysis for zone identification, socio-economic surveys of pastoralist communities, and action-research pilots to test and refine these proposed solutions in the unique and dynamic context of ongoing urban growth in Bhubaneswar.

Keywords: Urban Commons, Open Grazing, Policy Dilemma, Livelihoods, Integrated Governance

Capacity Development in Urban Governance: An Institutional Analysis

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Capacity Development (CD), often used interchangeably with Capacity Building (CB), has emerged as a central concern in contemporary urban governance discourse, particularly in the context of rapidly urbanizing developing countries. Over the past few decades, urban development policy has evolved from a narrow focus on infrastructure provision and institutional creation towards a more nuanced emphasis on strengthening the capacities of municipal institutions to plan, implement, regulate, and govern complex urban systems. Despite this growing policy emphasis, persistent concerns regarding weak municipal

capacities, uneven institutional performance, and limited governance outcomes continue to surface across urban contexts. This paradox of sustained investments in capacity building alongside persistently constrained municipal performance raises fundamental questions about how capacity development is conceptualized, institutionalized, and operationalized within urban governance systems.

This paper addresses this puzzle by focusing on the institutional arrangements for municipal capacity building, drawing from broader doctoral research. This paper concentrates on the foundational theme the institutional ecosystem underpinning municipal capacity development as it constitutes the structural and normative basis upon which all other capacity interventions are designed and executed. By isolating this theme, the paper seeks to contribute to a deeper understanding of how institutional frameworks shape the coherence, effectiveness, and sustainability of capacity development efforts in urban governance.

The paper is grounded in a comprehensive review of the evolution of capacity development as a concept, tracing its historical roots, dominant schools of thought, and its adaptation within urban governance scholarship. The review highlights that capacity development is inherently multidimensional, encompassing human, organizational, institutional, and systemic dimensions. However, much of the existing literature remains normative and prescriptive, offering idealized models and standards of municipal capacity while paying limited attention to the actual institutional design, governance arrangements, and inter-governmental processes through which capacity building is pursued. A critical gap persists in linking the design and institutionalization of capacity building interventions to their observed outcomes on the ground. Addressing this gap, the paper adopts a qualitative case study approach, focusing on the Indian state of Odisha as an illustrative case of municipal capacity building efforts. Although local government is constitutionally a state subject in India,

municipal capacity building interventions are largely driven by national missions, centrally sponsored schemes, and apex institutions, with common expectations regarding governance outcomes across states. Odisha presents a particularly instructive case, having been recognized for its innovations in urban governance and administrative reforms, while simultaneously grappling with long-standing concerns regarding municipal capacity constraints. This duality allows for a nuanced examination of the institutional arrangements that frame capacity development efforts and their implications for urban governance effectiveness.

The findings reveal that municipal capacity building in Odisha operates within a multi-layered institutional ecosystem, shaped by national frameworks, state-level policies, regulatory and legislative provisions, and inter-governmental coordination mechanisms. At the national level, flagship urban missions and schemes provide the conceptual and operational foundation for municipal capacity building. These frameworks articulate capacity development as an enabling mechanism for service delivery, urban reforms, and governance modernization. However, the conceptualization of capacity within national missions often remains broad and instrumental, emphasizing technical assistance, training, and institutional strengthening without sufficiently addressing contextual diversity or long-term institutional learning. At the state level, these national frameworks are localized through policy directives, institutional mechanisms, and dedicated organizational arrangements. The study finds that state-level agencies play a critical mediating role in translating national capacity building objectives into operational strategies for municipalities. This process of localization, however, is not merely administrative; it involves reinterpretation, prioritization, and adaptation of national norms to fit state-specific political, administrative, and fiscal contexts. Variations in institutional commitment, administrative leadership, and organizational capacity at

the state level significantly influence the depth and quality of municipal capacity building interventions.

A key contribution of the paper lies in its analysis of inter-governmental alignment and integration in municipal capacity building. The findings demonstrate that the effectiveness of capacity development is closely tied to the degree of coherence between central and state frameworks. Where alignment is strong characterized by complementary objectives, clear role delineation, and coordinated implementation mechanisms capacity building efforts tend to be more structured and sustained. Conversely, misalignment between central mandates and state priorities often leads to fragmented interventions, duplication of efforts, and diluted outcomes. Mechanisms for coordination, negotiation, and conflict resolution thus emerge as critical determinants of institutional coherence in capacity development.

The paper further examines the regulatory and legislative underpinnings of municipal capacity building, highlighting the role of legal frameworks in shaping municipal autonomy, accountability, and institutional behaviour. Legislative provisions define the formal authority of municipalities, the scope of their functions, and their relationship with higher tiers of government. The study finds that while recent reforms have sought to strengthen accountability and standardization, they have also introduced new layers of regulation that can constrain municipal discretion and innovation. This tension between control and autonomy has significant implications for how capacity development is internalized and sustained within municipal institutions.

Overall, the findings underscore that municipal capacity building cannot be understood merely as a technical or managerial exercise. Rather, it is deeply embedded within a broader institutional architecture that shapes incentives, power relations, and governance outcomes. The paper argues that inadequate attention to institutional

arrangements particularly inter-governmental integration, regulatory coherence, and the localization of national frameworks undermines the effectiveness of capacity development interventions, regardless of the scale of investments or the sophistication of program design. By foregrounding the institutional foundations of municipal capacity building, this paper contributes to urban governance scholarship in three ways. First, it advances a more nuanced understanding of capacity development as an institutionally embedded process rather than a standalone intervention. Second, it provides empirically grounded insights into the design and functioning of capacity building frameworks in a multi-level governance system. Third, it offers analytically transferable lessons for other urban contexts where centrally driven capacity development initiatives interact with diverse state and local governance realities.

In doing so, the paper invites policymakers, practitioners, and scholars to rethink capacity development strategies beyond narrow programmatic interventions and to engage more deeply with the institutional ecosystems that enable or constrain effective urban governance.

Keywords: Urban Governance, Municipal Capacity Development, Institutional Arrangements, Urban Policy Frameworks, Institutional Capacity

Balancing Ecology and Livelihoods: A Sustainable Strategy for the Loktak Lake Region, Manipur

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Loktak Lake is considered as the lifeline of the people of Manipur due to its importance in their socio-economic and

cultural life. It is the largest natural freshwater lake in the northeastern region and plays an important role in providing ecological and economic security to the region. Around 12% of the State's Population rely directly on its resources for daily sustenance and livelihood. There are mainly two types of settlements in this region, Communities living directly on the lake atop Phumdi (floating biomass) and in the town and villages around the lake. The Phumdi dwellers depend entirely on the lake for fishing and other resources while the lakeshore communities are engaged in various occupations such as agriculture, fisheries, wage labour, and small enterprises. In recent years due to the change in ecology, migration also plays a large role in livelihood in this region as the people move out of the village seasonally due to low earning period in fishing; They migrate for higher wages or switch to urban-sector jobs, leaving fishing and agricultural farming.

Ecologically, Loktak Lake is highly valuable. It harbours rich biodiversity and was recognized as a Wetland of International Importance under the Ramsar Convention in 1990 and was subsequently placed on the Montreux Record in 1993 due to increasing ecological degradation and hydrological alteration. Situated in its southern zone is the Keibul Lamjao National Park, the world's only floating national park, which serves as the last natural habitat of the critically endangered brow-antlered deer, or Sangai (Rucervus eldii eldii). The lake also functions as an important breeding ground for various riverine fish species and remains a major fisheries resource for Manipur.

However, the ecological balance of the Lake has been increasingly disrupted by anthropogenic pressures, infrastructural interventions, and changing landscape of the lake but still there continue to be multiple tourism-oriented proposals around the lake without proper consultation with the local communities. These ecological stressors ranging from altered hydrological regimes due to the Loktak Hydro-electric Project, proliferation of invasive

species, reduction in open water areas, thinning of phumdis, and degradation of fish habitats have collectively reshaped the resource base on which local communities depend. The construction of the Ithai Barrage in 1983 has had one of the most profound and long-lasting impacts on livelihoods around Loktak Lake. As a result, the overall water level of the lake has risen and permanently submerged a large tract of agricultural land and blocked the seasonal migration route of fish leading to decrease in varieties and volume. The altered water levels have disrupted the grounding of the floating phumdis, which traditionally provided nutrients to the ecosystem. This has led to the unchecked proliferation of these floating mats in some areas, choking water channels and reducing the lake's open water surface

There has been a long history of conflict and conservation of the lake between Loktak Development Authority (LDA) and local communities. In November 2011, under the provisions of the Manipur Loktak Lake (Protection) Act, 2006, the LDA, assisted by state forces, launched a large-scale clearance operation in which approximately 777 floating huts were burnt and dismantled. While the state justified the action as part of ecological restoration, the eviction resulted in the displacement of hundreds of households, with many families losing not just their homes but their primary livelihood base. Although the LDA announced a compensation package of ₹40,000 per affected household, the amount was widely criticised as inadequate and failed to provide meaningful rehabilitation.

This study focuses on understanding how key ecological stressors such as hydrological alterations, siltation, weed proliferation, pollution, flooding and habitat degradation have shaped the dynamics of Loktak Lake over the past decades, and how these changes affect the livelihoods of communities dependent on fishing, phumdi based practices, agriculture, and lake related resources use. The methodology for this study involves a combined ecological

and livelihood assessment method to understand the linkage and influence between them. Ecologically, the study evaluates the vulnerability of wetland ecosystem services due to major stressors through a structured scoring system. The process includes identifying and categorising the lake's ecological, economic, hydrological and social values, assessing threats based on their severity and likelihood, and developing an impact matrix that links each value to the corresponding pressures., allowing a comparative understanding of which services are most at risk. At the same time, the livelihood analysis applies a sustainable livelihoods framework to determine how different livelihood assets such as human, physical, financial and social shape household livelihood strategies around the lake. This integrated approach enables the study to examine ecological vulnerability and socio-economic dependencies, thereby providing an approach for balancing conservation priorities with community. The data input for the study can be drawn from primary sources such as physical field surveys, household questionnaires, focus group discussions, and key informant interviews with fishermen, phumdi dwellers, lakeshore farmers, women's groups, and local institutional representatives.

Keywords: Livelihoods, Ecological Services, Loktak Lake, Local Communities, Anthropogenic Pressures

Beyond GDP: The Need for Recognising Natural Assets in Urban Development and Local Governance Systems

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Urbanisation in Indian cities has skyrocketed over the past few decades, accompanied by sustained economic expansion and rising investment in physical infrastructure.

While this trajectory is routinely interpreted as evidence of development success, it conceals a deeper imbalance in the growth pattern. Economic growth indicators, particularly Gross Domestic Product, accurately record constructed capital and market transactions, yet remain largely silent on the depletion, fragmentation, and degradation of ecosystems that underpin urban livelihoods. As cities densify and infrastructure demand intensifies, land, water, and energy systems experience cumulative stress. Lakes are filled, wetlands are encroached upon, urban forests are fragmented, and commons are transformed into developable parcels that cater to the needs of the growing population. These processes rarely register within municipal accounting systems, despite their significant ecological consequences, which shape long-term urban resilience, public health, and fiscal stability.

The study focuses on addressing one key fundamental governance question. If urban local bodies formally recognise only built infrastructure as assets under their jurisdiction, what institutional status is accorded to rivers, lakes, wetlands, open spaces, and vegetated lands that deliver essential ecosystem services to the city? Furthermore, when such natural assets are degraded or lost, is this ecological depreciation accounted for in any municipal framework, or does it remain invisible within official financial and performance assessments? The absence of systematic monitoring, valuation, and management of natural assets suggests that current urban accounting frameworks prefer short-term economic competitiveness over the ecological foundations that sustain urban life.

To evaluate this gap, the study undertakes a focused scoping review of the National Municipal Accounts Manual 2004 issued by the Ministry of Urban Development. The Manual continues to function as a reference framework for municipal accounting practices across Indian cities. Its asset classification system primarily categorises municipal

holdings as fixed assets, further subdivided into infrastructure assets and other assets. The synthesis reveals a conspicuous absence of any explicit recognition of natural assets or guidance on their management within the accounting framework prescribed for local governments. This omission is not merely semantic. It reflects an institutional gap where ecological systems are treated as external to municipal responsibility, despite being central to urban service provision, risk mitigation, and quality of life.

The identified gap frames the central theme of this study, the need for an integrated Natural Asset Management approach for Urban Local Bodies that extends beyond conventional infrastructure-focused accounting. To justify this argument within broader theoretical arguments, the paper undertakes a narrative literature review structured around four interrelated research questions. First, how can Natural Asset Management be effectively structured and implemented within urban governance frameworks? Second, how do existing governance mechanisms influence the integration of Natural Asset Management within municipal asset management practices? Third, what role can community participation play in strengthening Natural Asset Management for urban sustainability and resilience? Fourth, how can the valuation and integration of ecosystem services within Natural Asset Management contribute to sustainable urban investments?

Based on these questions, a systematic keyword-driven search was conducted across databases, resulting in the shortlisting of forty-nine peer-reviewed studies that spanned planning, environmental economics, public finance, governance, and urban ecology. Rather than reporting the findings descriptively, the study structures this literature to extract sensible analytical themes that discuss the municipal-scale decision-making. Four core thematic domains were extracted from the synthesis. The first concerns natural capital accounting, particularly efforts

to operationalise ecosystem services as measurable assets within economic and planning systems. The second addresses data infrastructure for natural assets, including the challenges of asset identification, spatial boundary definition, and integrating biophysical datasets into administrative frameworks. The third examines institutional governance mechanisms, focusing on the allocation of roles, mandates, and accountability across levels of government. The fourth explores value capture mechanisms through which ecological value can inform municipal finance, investment decisions, and long-term fiscal resilience.

The synthesis reveals that while international frameworks such as ecosystem accounting offer methodological clarity, their translation into municipal practice remains uneven, especially in the Global South. Data limitations, fragmented institutional mandates, and the absence of legally anchored frameworks for asset recognition restrict implementation. Importantly, several studies caution against treating valuation solely as a monetisation exercise, arguing instead for hybrid approaches that combine ecological indicators, service-based metrics, and fiscal instruments.

Building on these insights, the study argues that the absence of natural assets in the National Municipal Accounts Manual is not an isolated technical oversight but a structural governance gap. It leads to a model of urban growth where ecological costs are externalized, and long-term risks are nearly certain. Addressing this gap requires more than incremental accounting adjustments. It calls for a reorientation of municipal asset frameworks to recognise natural assets, define criteria for their classification, establish data infrastructures for continuous monitoring, and link ecological performance to urban finance and investment decisions.

The study concludes by outlining a way forward grounded in the extracted thematic domains. By aligning natural capital accounting with local asset management systems,

urban local bodies can move beyond GDP-centric performance assessment toward a more balanced representation of economic and ecological value. Such a shift is particularly relevant under conditions of rapid urbanisation, climate risk, and fiscal stress, where the sustainability of urban growth increasingly depends on the careful stewardship of natural assets rather than their unchecked conversion.

Keywords: Natural Asset Management, Urban Governance, Environmental Economics, Beyond GDP

Integrating Street Vending into Transit-Oriented Development: A Kiosk-based Approach to Revenue Generation and Public Space Management in Indore

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Transit-Oriented Development (TOD) has become an important planning strategy in Indian cities to improve accessibility, encourage compact urban growth, and intensify economic activity around major public transport nodes. While TOD improves mobility and land-use efficiency, it also intensifies pedestrian movement, commercial demand and raises land and property prices. This creates significant challenges for informal livelihoods, particularly street vendors who depend on high footfall for daily income but cannot afford to pay high rent. In Indore, Madhya Pradesh, more than 30,000 street vendors operate across major commercial and transit-linked locations such as Zinci, Foothi Kothi, Rajwada, and Sarwate Bus Stand. These areas experience continuous pedestrian movement due to bus terminals, railway stations, and mixed land-use patterns (provide details). However, Indore has very few formally notified vending zones, forcing vendors to operate

informally on footpaths and road edges. As a result, vendors face frequent eviction, lack of tenure security, and absence of basic infrastructure, creating persistent livelihood insecurity. Thus, the aim of this study is to design and assess a kiosk-based street vending model located within TOD areas that addresses both livelihood insecurity and municipal revenue constraints.

Field observations indicate that fewer than 15 percent of street vendors are formally registered with municipal authorities or integrated into structured urban systems. At locations like Sarwate Bus Stand (14,500–15,000 daily commuters), the Railway Junction, Rajiv Gandhi Square (1,500–2,000 daily commuters), Bengali Square, and Bada Junction where TOD has been implemented in Indore, and possess high commercial potential, the spaces remain underutilised in terms of planned vending infrastructure and organised revenue generation. Formal retail spaces in these areas command rents ranging from ₹50 to ₹85 per sq. ft, translating into monthly costs of ₹10,000–₹22,500 for standard units. However, such high rents are unaffordable for vendors whose average gross monthly earnings range between ₹15,000 and ₹25,000. This mismatch between high land values and low-income livelihoods leads to loss of potential municipal revenue.

A detailed study of the vendors highlights that a typical food vendor operating at Sarwate Bus Stand completes approximately 60–80 transactions per day with an average transaction value of ₹30–35. This results in a realistic daily revenue of around ₹2,300 and a monthly gross income of approximately ₹69,000. After accounting for cost of goods, utilities, licensing fees, and kiosk rent, the vendor earns a net monthly profit of nearly ₹25,000. Similar calculations for fruit and vegetable vendors indicate average monthly profits between ₹20,000 and ₹36,000.

The study thus develops a model that applies basic principles of urban economics, cost–benefit assessment, and revenue modelling to assess affordability, breakeven

feasibility, and long-term non-farebox revenue potential. It proposes for setting up of small-format kiosks of 8 sq. m, rented at a fixed rate of ₹4,000 per month. These kiosks proposed across eight high-footfall TOD locations in Indore can provide for an affordable and secure alternative to informal street vending while remaining financially viable for the municipal authority. At full scale, the model includes more than 100 kiosks supporting over 500 vendors.

Vendor-level financial modelling demonstrates that typical seasonal rent adjustments if incorporated to support single-commodity vendors during low-demand periods, then it would ensure continuity of operations throughout the year. Additionally, from a municipal perspective, the kiosk-based TOD model creates multiple structured non-farebox revenue streams. These include monthly kiosk rentals, advertising and branding partnerships placed on kiosk surfaces and nearby public assets, utility recovery charges, and premium floor space index development linked to TOD. Advertising partnerships are particularly significant, as TOD zones attract high commuter visibility, making them valuable locations for commercial branding. When fully implemented with 100 kiosks operating at an average occupancy of 85 percent, the model generates an estimated ₹66 lakh in annual non-farebox revenue by Year 5. This revenue is directly linked to pedestrian movement and transit activity rather than taxation, making it stable and scalable. Phased implementation allows the municipal authority to prioritise the highest footfall locations in the early stages, reducing location failure risk and enabling revenue stabilisation.

Beyond financial outcomes, the model addresses governance challenges associated with informal vending. Renewable lease agreements provide vendors with basic tenure security and reduce eviction risk. Provision of water supply, waste segregation, and sanitation improves hygiene standards and consumer confidence, leading to increased sales. The model bridges the gap between informal

economic activity and formal urban systems without increasing bureaucratic complexity.

Overall, the study demonstrates that a TOD-linked kiosk-based vending model can transform street vending from an informal survival activity into a regulated, productive, and revenue-generating urban asset, while simultaneously enhancing public transport usage, municipal finances, and the overall urban living experience.

Keywords: Transit-Oriented Development, Street Vending, Kiosk-Based Approach, Revenue Generation, Public Space Management

A Landscape Architecture Approach to Urban Flood Mitigation on a Neighbourhood Level: Case of Hyderabad

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Urban flooding is a growing global challenge, exacerbated by climate change, rapid urbanization, and the rapid increase of impervious surfaces. Traditional engineering solutions, often called grey infrastructure, have been shown to be inadequate and unsustainable because they merely relocate water away from urban areas, often displacing the flooding problem downstream. Most existing urban drainage infrastructure was designed based on historical rainfall records. intended to carry a fixed maximum volume of water. Hence exceeding of carrying capacity leads to the volume of water to exceed the engineered capacity of the pipes, thereby leading to surface flooding. This highlights the fundamental limitation of static, fixed-capacity Gray Infrastructure, underscoring the necessity of more resilient, adaptive, and decentralized systems like Green Infrastructure.

This paper proposes a landscape architectural strategy to enhance urban flood resilience to mitigate flooding at the neighbourhood city level taking 100ft Road (Ayyappa Society Road) in Madhapur, Hyderabad City, Telangana, as the specific site for design intervention. The criteria for selection being topographical vulnerability, high imperviousness of abutting land uses and recurrent flooding history. To quantify the extent of hydrological failure, a hydraulic model of the selected 100ft Road catchment was developed using EPA SWMM 5.2. The Baseline Model was subjected to three distinct design storm events- Normal Rainfall (2-Year Return Period), High Rainfall (10-Year Return Period), and Extreme Rainfall (100-Year Return Period) to evaluate system performance under stress. The simulation results showed instances of high velocity water runoff and low water percolation.

A comprehensive literature review was conducted, focusing on various Nature-Based Solutions and their application in urban settings. This was supplemented by an analysis of four international case studies which are the Copenhagen Cloudburst Plan (Denmark), Green Streets Program (Portland, USA), Sponge City Program (Wuhan, China) and the Water Square (Rotterdam, Netherlands) detailing successful urban flood mitigation strategies. The case studies demonstrated that the application of Nature Based Solutions had a positive and significant impact on reducing urban flooding.

Based on the studies, a NBS strategy was developed for 100ft Road. The proposed strategy prioritizes source control, where stormwater is captured, detained, and infiltrated close to the point of incidence thereby reducing the velocity and rate of runoff leaving the catchment. Based on the spatial constraints of the 100ft Road, three specific NBS typologies have been selected which are - Roadside Bioretention Cells (Existing impervious buffers and unutilized pavement strips along the footpath edge will be excavated and retrofitted with engineered soil media and

native vegetation and curb cuts will be introduced to bypass the hydraulic disconnect identified), Permeable Pavement Systems (Applied to the parking lanes and pedestrian footpaths. Unlike the main carriage way which requires rigid asphalt for heavy traffic, these auxiliary zones will be paved with porous concrete or interlocking pavers with aggregate joints to facilitate vertical infiltration.) and Infiltration Trenches (The existing concrete median strips will be converted into depressed, gravel-filled infiltration trenches. This allows the median to act as a linear recharge zone, capturing runoff from the inner lanes that typically flows toward the edges).

To evaluate the hydrological efficacy of the proposed Nature Based Solutions, the SWMM model of the 100ft Road catchment was modified to include the selected NBS strategies which are Bioretention Cells, Permeable Pavement and Infiltration Trenches. This Proposed Scenario was subjected to the same three rainfall boundary conditions utilized in the baseline analysis. The intervention achieved a 35% reduction in Total Runoff Volume across all three rainfall scenarios, decreasing the 100-year flood volume from 1.38 ML to 0.90 ML. total infiltration during the extreme (100-year) event rose from a negligible 0.47 mm in the baseline scenario to 23.04 mm in the proposed design, a nearly 50-fold increase in groundwater recharge. This data confirms that by treating just 30% of the road surface with landscape-based solutions, the peak runoff rate for the critical 10-year storm was attenuated from 0.982 CMS to 0.643 CMS, thereby significantly reducing the hydraulic load on the existing municipal drainage network and minimizing the risk of surface inundation.

The study concludes that the reliance on centralized conveyance systems alone is insufficient to handle the increasing intensity of monsoon rainfall. By retrofitting arterial roads with landscape elements that function as hydraulic sinks, the city can effectively restore a portion of its lost water storage capacity.

Keywords: Urban Flood Mitigation, Landscape Architectural Strategy, Nature Based Solutions (NBS)

Climate Extremes and Sustainable Adaptation Strategies for Water Quality Resilience in the Mahaweli River Basin Around Kandy

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Monsoon patterns and Global climate change affected the Sri Lankan environment. Increasing rainfall events, flooding, and prolonged drought affected Sri Lanka. This climate variation is a significant problem for the country's primary water sources, especially in the Mahaweli River basin. The Mahaweli River basin is the largest river basin in Sri Lanka and a vital water source in the hill country—the river system supports drinking water, agricultural practices, hydropower generation, and urban development. However, water quality changes in extreme hydrological weather conditions. This study focuses on how climate variation affects water quality in the Mahaweli River basin around Kandy and on how it strengthens long-term resilience.

This study combined field sampling, laboratory testing, rainfall data analysis, and hydrological observations at key points in the Kandy region. In water quality parameters like turbidity, pH, Electrical conductivity (EC), Total Dissolved solids (TDS), iron, nitrate, nitrite, phosphate, ammonia, sulfate, Chemical Oxygen Demand (COD), and microbiology parameters were tested according to the standard procedures for finding the variation of the climatic conditions. This study provides a clear, overall picture of the relationship between extreme weather conditions and variations in river water quality in the Mahaweli River basin.

During heavy rainfall events, such as the southwest and northwest monsoons and inter-monsoons, water quality was rapidly affected. Turbidity values typically range from 5 to 20 NTU under stable conditions. During the rainy season, values increase to 500-1000 NTU due to increased soil erosion and surface runoff. High rainfall washes sediments, agricultural chemicals, sewerage, toilet waste, and organic matter into the river. Nutrient levels, especially nitrate (1.0 – 30 mg/L), nitrite (1 – 10 mg/L), Phosphate (2 – 20 mg/L), Sulfate (20-200 mg/L), ammonia (0.5 – 5 mg/L), COD levels increased (300 – 1500 mg/L), Total Coliform colonies at least 1200 per 100ml sample, E-Coli colonies increase approximately 250 per 100ml sample also increase significantly during the extreme events. Increased iron concentration led to increased leaching from soils and to erosion of riverbanks and the upstream catchment. These affected the Kandy water supply system by requiring higher coagulant use and increased operational costs.

In prolonged drought conditions, mainly in inter-monsoon periods, several challenges have been faced. During this period, river flow and TDS concentration are reduced to 30–50 mg/L during drought periods. Ammonia, phosphate, Nitrate, and Nitrite levels rise due to dilution from upstream pollution sources, such as agricultural runoff, livestock farming, and poor wastewater discharge. A special case is a drought period, when water volume is low, and water temperature is high, then rises again because the water moves through the segments of the Mahaweli River and upstream reservoirs feeding the Kandy area. This algal growth affects water treatment due to the risk of cyanotoxins.

The study highlights that the Mahaweli River flows through the Kandy area, which is particularly vulnerable due to the steep upstream catchment, increased urbanization along the riverbank, and land-use change. High rainfall in steep areas increases erosion, while expanding urban settlements in untreated greywater and solid waste to the river during

storms. In drought conditions, a lack of vegetative cover reduces soil moisture retention, leading to lower baseflow and water-quality stress.

The study evaluates sustainable strategies to improve climate resilience in the Mahaweli River basin around Kandy. Long-term strategies include Reforestation of degraded slopes, riverbank vegetation, reducing sediment transport, and reducing stormwater runoff. Green buffer zones can filter the pollutants.

Land-use improvements are more critical. During extreme rainfall, it is necessary to control agricultural fertilizer use in upstream areas, regulate construction activities near riverbanks, and implement soil conservation techniques, such as contour farming, to reduce sediment and nutrient loads. Community-based programs, river cleaning, and monitoring further strengthen local resilience.

From this situation, it is recommended to upgrade water quality monitoring programs to include special measurements of pH, Turbidity, Conductivity, Solids, nutrients, and heavy metals. During this period, an early warning system is essential to prepare the operational processes in water treatment plants. Modelling also helps optimize reservoir operations and the treatment process during drought conditions.

Infrastructure development is a key part of sustainable management. Increase the number of raw water storage tanks and design food-resilient intake structures to reduce the direct impact of extreme weather on the water supply system. During the drought period, managing aquifer recharge, rainwater harvesting, and water storage systems can help maintain water availability in the Mahaweli River.

At the governance level, this study is essential for several agencies like the National Water Supply and Drainage Board (NWSDB), the Mahaweli Authority, the Central Environmental Authority (CEA), and local authorities. Integrated Water Resources Management (IWRM) hopes to

achieve climate-resilient policies, decision-making, and protection of the catchment around the Kandy area.

In conclusion, this study suggests that the Mahaweli River basin around the Kandy region has highly sensitive environmental conditions, with heavy rainfall and drought significantly affecting water quality. However, a combination of strengthened governance, improved water monitoring programs, and community participation can transition to sustainable water resources management. The finding provides essential details for policymakers, Engineers, scientists, and environmental specialists to safeguard river basins under future climate uncertainty.

Keywords: Climate Variation, Extreme Weather Events, Water Quality, Mahaweli River Basin, Resilience Strategies

Monitoring Peri-urban Wetland Transitions through Spatio-temporal Analysis

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Wetlands are critical components of global ecosystem health. They are vital natural infrastructure, acting as giant water filters, flood buffers, and immense carbon stores. They fight climate change and protect human settlements. Losing these ecosystems accelerates environmental degradation and amplifies community vulnerability. Unfortunately, wetlands are disappearing faster than any other ecosystem, especially in the peri-urban zones of rapidly expanding global cities. This transitional space between urban centres and natural environments is a battleground. Wetlands are frequently viewed as unproductive land and become prime targets for reclamation, draining, and paving. This relentless encroachment fragments habitats, disrupts vital natural water flow, and subjects the remaining systems to heavy

pollution loads from urban runoff. The ultimate consequence is devastating, increased urban flood proneness, loss of clean water sources, and a severe reduction in ecological capacity. Understanding and reversing this transition demands a highly specific, long-term analytical approach. This research addresses this urgent requirement by focusing on one of India's most vulnerable and ecologically significant systems.

This study focuses on the Vembanad Kol Wetland in Kerala, India. It is the largest Ramsar site on the country's Southwest coast. The site is an immense lagoon ecosystem, globally recognized for its biodiversity and its critical role in sustaining regional livelihoods. This wetland supports over 200,000 households through fishing, clam harvesting, and the indigenous Pokkali rice cultivation system. Geographically, it acts as a critical flood buffer for the rapidly expanding Kochi-Ernakulam metropolitan area. Despite its ecological and socio-economic importance, Vembanad Kol is in a state of severe, documented collapse. Historical studies confirm a massive physical shrinkage: the lake's water spread area has been significantly reduced by reclamation and sedimentation. Furthermore, a major structural intervention, the construction of the Thaneermukkom Barrage (TMB) in 1976, fundamentally altered the natural salinity and hydrological regimes. While intended to aid agriculture, the TMB tragically divided the lake, exacerbating siltation, eutrophication, and causing a catastrophic decline in brackish-water species. The wetland system is collapsing under the combined weight of unscientific structural intervention and accelerating urban expansion, demanding urgent, evidence-based quantification to inform policy.

To fully capture the dynamic, long-term nature of this transition, the research employs a robust spatio- temporal analysis using Geographic Information Systems (GIS) and remote sensing (RS). We utilized a multi-temporal time series of consistent, medium-resolution Landsat satellite

imagery (Landsat 5, 7, 8, and 9) spanning four decades (1985to 2025). This period allows us to map and quantify change across critical policy epochs and major infrastructure development cycles. To achieve high-accuracy, pixel-level classification and precisely chart land-use/land-cover (LULC) changes, we systematically applied five specific, crucial spectral indices. This combination is essential for differentiating subtle changes in a complex peri-urban environment: the Normalized Difference Vegetation Index (NDVI) tracks vegetation encroachment; the Normalized Difference Built-Up Index (NDBI) accurately identifies urban expansion; the Normalized Difference Water Index (NDWI) and Modified Normalized Difference Water Index (MNDWI) distinguish water bodies from shallow, turbid, and vegetated zones; and the Bare Soil Index (BSI) highlights areas vulnerable to new construction or severe erosion. This multi-index approach moves beyond simple LULC mapping to quantify the process of wetland transition itself.

The comparative analysis of the four LULC epochs delivers clear, alarming evidence of transition. The core aquatic character of the wetland has been catastrophically compromised: the area of Clear Open Water Bodies (MNDWI) plummeted from a significant 442.99 km2 in 2005 to a near-negligible 0.03 km by 2025. This shows a fundamental ecosystem shift towards a shallow, degraded state. Concurrently, the area classified as Shallow Water (NDWI) experienced a rapid surge of over 141 km2 between 2005 and 2015, confirming extensive infilling and sedimentation, which reduces water depth and capacity. This infilling has fuelled the process of Terrestrialisation, evidenced by the massive and concurrent growth in Thick/Heavy Vegetation (NDVI), which increased from 34.33% in 1988 to nearly 50% by 2025. This vegetation encroachment, coupled with the documented structural damage from the TMB, is rapidly converting open water into terrestrial land. Simultaneously, Urban Encroachment (NDBI) accelerated, particularly between 2015 and 2025,

consuming 23.63 km2 of the peripheral land for low-density infrastructure. The alarming surge in Bare Soil/Barren Land (BSI) to 312.84 km2 by 2025 suggests escalating, intense land-clearing and development pressure in the immediate vicinity.

The quantifiable findings confirm that the Vembanad Kol wetland is not merely shrinking; it is undergoing a profound and rapid ecological regime shift. The transition from a deep, clear water system to a shallow, turbid, and highly vegetated one severely compromises its capacity to provide essential ecosystem services. The continuous expansion of built-up areas and the structural interference from the TMB are identified as the primary, measurable drivers of this transition. This leaves the remaining wetland system critically fragile, increasing the regional risk of flooding (as the natural sponge is clogged) and weakening its capacity to filter water and support local livelihoods. These results establish clear, data-driven hotspots of vulnerability for planning action. The overall trajectory of change: massive hydrological alteration and direct habitat loss driven by peri-urbanization places: the Vembanad Kol ecosystem at the centre of the Environmental Extremes and Adaptation Strategies theme. Successful adaptation requires more than engineering; it requires policy based on measured ecosystem function.

This study successfully generated a precise, multi-decadal roadmap of wetland decline, fulfilling the goal of quantifying change and understanding its physical drivers. The resulting LULC classification data is now essential for future planning and governance. This analysis serves as the critical foundation for the succeeding study: Valuing Ecosystem Services of Peri-Urban Wetlands for Socio-Ecological Resilience and Sustainable Urban Planning. By linking the quantified spatial loss documented in this study (e.g., loss of clear water area, gain in built-up land) to the economic and social cost of lost services (flood control, water purification, livelihood sustenance), the forthcoming

thesis will equip policymakers with the necessary actionable data. The objective is to transition from simply monitoring decline to implementing policy interventions that promote socio-ecological resilience and secure the long-term, wise use of this internationally important wetland.

Keywords: Wetland Transition, Spatio-Temporal Analysis, Indices, Vembanad Kol

Spatial Assessment of Coastal Vulnerability and Urban Growth in Karaikal, India: A GIS-based Planning Support Framework for Resilient Governance

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The coastal urban areas of India are increasingly vulnerable to compounded risks related to climate variability, environmental degradation, and unregulated urban expansion. These issues are felt acutely in smaller coastal administrative units such as Union Territories, where institutional capacity, spatial data integration, and evidence-based planning support continue to be limited. Karaikal, an enclave coastal city of the Union Territory of Puducherry, offers a very unique planning context wherein high rates of growth intersect with ecological sensitivity, the risk of coastal hazards, and multi-scalar governance arrangements. Even though it is prone to flooding, cyclonic events, sea-level rise, and thermal stress, the systematic spatial assessments done toward resilience-oriented urban planning in Karaikal remain disjointed and underutilized in formal planning processes.

This study aims to develop a planning support framework in a GIS environment that analyses the spatial relationship

between urban growth patterns and environmental vulnerability in Karaikal, with the broader aim of informing adaptive urban governance and climate-resilient planning strategies. The study addresses two essential questions: (i) how does recent built-up growth interact spatially with environmentally sensitive and hazard-prone zones in Karaikal, and (ii) how can geospatial indicators be synthesised into actionable planning insights for coastal Union Territories working amidst constrained institutional frameworks?

The approach applied is a multi-layered geospatial methodology using remotely sensed data and secondary spatial datasets analysed within a Geographic Information System (GIS) environment. Satellite imagery was processed to derive indicators representing built-up intensity, vegetation cover, and land surface temperature, employing indices such as the Normalized Difference Built-up Index (NDBI) and Normalized Difference Vegetation Index (NDVI). These indicators were spatially overlaid with coastal proximity, low-lying terrain, and urban infrastructure layers to identify zones where development pressure coincides with environmental sensitivity. Spatial analysis techniques, including zonal statistics and hotspot identification, were used in order to examine intra-urban variations and emerging growth–risk patterns across the study area.

The analysis reveals that recent urban expansion in Karaikal has increasingly concentrated along transport corridors and peri-urban edges, which are environmentally sensitive and vulnerable to flooding and heat stress. Places with greater intensity of built-up demonstrated correspondence with reduced vegetation cover and higher surface temperatures, signalling the emergence of hotspots for urban heat in ecologically fragile coastal zones. Such spatial trends give cause for critical concern about the long-term sustainability of current development trajectories, especially in climate change and increasing vulnerability to extreme weather events. It also brings out that the existing land-use

regulations and development controls fall short of reflecting spatial variations in environmental risk and, thus, indicate a mismatch between statutory planning instruments and on-ground vulnerability patterns.

This study shows that, from a governance and planning perspective, it has the potential for operational decision support through the GIS-based analysis rather than merely as a technical exercise. Translating spatial indicators to planning-relevant information, this framework can assist in revising zoning boundaries, climate-responsive infrastructure planning, prioritization of adaptation interventions, and coordination between environmental regulation and urban development control. This is especially relevant to Union Territories and secondary coastal cities where constrained planning capacity calls for efficient and replicable analytical tools to steer resilient urban transformation. This research, aligned with the themes of environmental extremes, digital solutions, and resilient urban futures, further contributes to contemporary debates around spatial evidence integration within urban governance frameworks. It emphasizes geospatial planning support system institutionalization to enhance adaptive capacity toward informing ecologically sensitive coastal regions in sustainable urban development. This study, therefore, strongly calls for data-driven and resilience-oriented approaches toward planning as a significant pathway toward strengthened urban governance and environmental stewardship for coastal India.

Keywords: Coastal Resilience, Urban Governance, GIS-based Planning, Environmental Vulnerability, Union Territory Planning

Water Sensitive Campus Design: Strategies for Sustainability and Community Integration

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Educational campuses in rapidly urbanizing India face mounting pressures from climate change, water scarcity, and extreme weather events challenges that directly intersect with SDG 6 (Clean Water and Sanitation), SDG 11 (Sustainable Cities and Communities), and SDG 13 (Climate Action). As urban microcosms that consume substantial quantities of water for drinking, sanitation, landscaping, and recreation, campuses typically rely on centralized water supply and drainage systems that are increasingly inadequate for current and future environmental conditions. Water-Sensitive Design (WSD) offers a transformative, nature-based alternative by integrating water management into spatial and landscape planning, enabling improved stormwater management, groundwater recharge, ecological restoration, and enhanced user interaction with campus environments.

This research investigates how WSD principles can be adapted to the Indian educational context, where seasonality produces acute fluctuations between water abundance and scarcity. Through a comprehensive literature review and comparative case study analysis, this study synthesizes design strategies that strengthen campus sustainability while extending ecological and social benefits to adjacent communities. The research examines four precedents across diverse climatic contexts IIT Gandhinagar (semi-arid Gujarat), MS Swaminathan Wetland Eco-Park (coastal Chennai), Infosys Pocharam Campus (semi-arid Hyderabad), and Monash University Clayton Campus (temperate Melbourne) to derive adaptable lessons for climate-responsive spatial planning.

Water Sensitive Urban Design (WSUD), originating in Australia in the 1990s, provides the theoretical foundation for the study as an integrated framework for managing stormwater, wastewater, groundwater, and potable water within urban and landscape systems. Water-sensitive campus design extends WSUD principles to the unique conditions of educational institutions, recognizing them as multifunctional environments combining residential, academic, recreational, and ecological functions. Unlike purely engineering-focused systems, water-sensitive campuses emphasize spatial integration, ecological performance, and human experience.

A qualitative, analytical four-stage methodology structures the research:

i. Literature review establishing theoretical foundations and identifying core design strategies.
ii. Case study analysis of four diverse global and Indian projects
iii. Comparative analysis synthesizing common principles and climate-responsive variations; and
iv. Development of design recommendations tailored to Indian educational campuses.

The study emphasizes design and planning strategies rather than detailed engineering specifications, aiming to produce adaptable strategies suitable for varied institutional contexts.

The case studies demonstrate the breadth of possibilities for water-sensitive design in educational campuses. IIT Gandhinagar showcases integrated sustainability in a semi-arid region through contour-responsive planning and a spatial structure anchored by a river promenade, rehabilitated ravines, and a central vista. Its “Jal Mandaps” architectural pavilions built above underground tanks storing 628-1,413m³ of water transform functional infrastructure into cultural place-making elements referencing Gujarat’s stepwell heritage. Decentralized

wastewater treatment using root-zone systems achieves near-zero discharge while native planting reduces irrigation demand by 50%.

The MS Swaminathan Wetland Eco-Park exemplifies ecological restoration in a coastal monsoon environment. Developed on 15 acres of previously degraded land, the park employs a five-stage treatment train bioswale, sedimentation pond, aeration basin, phytoremediation pond, and a 6-acre retention lake with 30 million litres of storage to capture 90% of rainfall with zero direct discharge. Elevated boardwalks ensure hydrological continuity while providing public access, demonstrating how ecological infrastructure can simultaneously serve environmental and community functions.

Infosys Pocharam Campus, organised around nine interconnected artificial lakes, illustrates large-scale implementation of water-sensitive design within corporate settings. Its 3R strategy (Reduce–Reuse-Recharge) achieves near-complete wastewater recycling through membrane bioreactor (MBR) technology, while native landscapes reduce irrigation demand by approximately 40%. Smart metering and leak-detection systems support real-time monitoring, demonstrating how digital tools enhance water governance.

Monash University Clayton Campus demonstrates the potential of retrofitting existing institutional environments. Through rain gardens, bioswales, constructed wetlands, Aquifer Storage and Recovery (ASR), and IoT-enabled monitoring, the campus has achieved over 70% reduction in stormwater runoff relative to pre-development conditions, transforming the site into a “water-sensitive living laboratory.”

Synthesis across these varied contexts reveals essential principles for water-sensitive campus design in India. At the master plan scale, water-centric spatial organization, contour-responsive planning, pedestrian-oriented

permeable circulation, and decentralized yet interconnected water networks are foundational. At the system scale, multi-stage treatment trains, diversified storage typologies (underground tanks, surface lakes, aquifer storage), distributed infiltration, recharge wells, and near-zero discharge wastewater reuse are critical. Landscape integration must prioritize native climate-adapted species, biodiversity corridors, microclimate regulation, and cultural-educational landscapes that make hydrological processes visible and meaningful. Context-specific strategies are essential: semi-arid regions benefit from Jal Mandap-like underground storage and drought-tolerant landscapes, while high-rainfall monsoon regions require elevated walkways, multi-stage filtration, and flood-adaptive spaces capable of managing 3,000+ mm annual rainfall.

The findings demonstrate that educational campuses given their scale, multifunctionality, and public role offer unique opportunities for advancing water-sensitive, climate-adaptive planning in India. By positioning campuses as living laboratories and community demonstration sites, the research proposes a replicable model for climate-resilient institutional development across diverse ecological regions.

This study supports global agendas on environmental extremes, nature-based solutions, and climate adaptation. Water-sensitive campus design aligns with the Sendai Framework and Paris Agreement, and advances SDGs 6, 11, and 13 through closed-loop water systems, resilient campuses, and strategies for extreme rainfall.

Keywords: Water-Sensitive Design, Blue-Green Infrastructure, Educational Campus Planning, Climate Adaptation, Sustainable Development Goals

Urban Heat Resilience in Three Indian Coastal Cities: A Comparative Analysis Using MODIS and Landsat Data

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Accelerated urbanization and climate change are worsening heat stress in cities throughout the Global South, particularly in coastal metropolitan regions that face increased hazards from dense development, altered land cover, and climate-induced extremes. In many cities in emerging nations, surface heat buildup has increased due to rapid population growth, the expansion of hard surfaces, and the replacement of natural landscapes with built-up infrastructure. In India, Cities are conceptualized as centres of inclusive and resilient urban development; however, specific assessments of spatially clear urban heat patterns are scarce, especially in coastal cities where land-sea interactions, vegetation dynamics, and urban growth processes converge. Coastal cities are additionally influenced by complex land-sea interactions, high humidity, and exposure to extreme weather events, making them particularly sensitive to rising temperatures. These combined pressures have raised concerns about thermal comfort, public health, and the long-term sustainability of urban environments. This study presents a comparative spatiotemporal analysis of urban heat dynamics and vegetation alterations in three prominent coastal Cities of India: Visakhapatnam on the eastern coast, Mumbai on the western coast, and Kochi on the southern coast. The aim is to identify spatial patterns of heat concentration and guide context-sensitive cool-scape planning. These cities represent diverse climatic conditions, urban morphologies, and coastal configurations, providing an opportunity to examine urban heat behaviour across contrasting regional

contexts. A comparative perspective helps highlight both shared challenges and location-specific characteristics relevant to coastal urban heat management.

The present study covers a two-decade timeframe (2003-2023) to capture long-term trends and seasonal variability in urban surface temperatures, which are increasingly influenced by rapid urbanization and climate change pressures. Urban Heat Island (UHI) patterns are analysed using land surface temperature data derived from the Moderate Resolution Imaging Spectroradiometer (MODIS), which offers a consistent and long-duration observational record suitable for city-scale temporal analysis. This approach facilitates a comparative assessment of spatial and temporal variations in surface thermal conditions across coastal urban contexts, thereby helping to understand how differences in urban form and coastal settings may shape surface heating dynamics.

To examine the role of vegetation in moderating urban heat, the Normalized Difference Vegetation Index (NDVI) is derived from multi-temporal Landsat imagery. It is commonly acknowledged that vegetation in urban and suburban regions plays a crucial role in affecting surface temperature through evapotranspiration, shade, and landscape connectedness. Zones of vegetation loss or stability are identified by analysing temporal patterns in NDVI, and their geographic relationship with regions showing increasing surface temperatures is identified. Such relationships are important for understanding how changes in green cover may affect thermal conditions in rapidly urbanizing coastal environments. In order to place thermal changes within larger processes of urban development and landscape alteration, land use and land cover patterns are analysed,

To provide a consistent foundation for comparing surface temperatures and determining UHI severity, built-up extent data is used to define urban and non-urban zones. To facilitate both intra-city and inter-city comparisons, UHI is

defined as the difference between the mean surface temperatures of urban regions and those of surrounding non-urban reference zones. Population distribution is used to indicate regions of potential heat exposure by highlighting areas where high surface temperatures coincide with high population densities.

The aim of this study is to investigate how urban heat varies over time and space in each of the three coastal cities, as well as how these fluctuations connect to vegetation patterns, urban form, and coastal setting. The analysis aims to determine whether dense and continuous built-up areas are linked to persistent thermal concentrations and how elements such as topography, proximity to the coast, and the fragmentation of urban green spaces affect heat distribution by comparing long-term surface temperature trends with changes in vegetation cover. To emphasize the potential significance of urban and rural green areas in moderating thermal conditions, special attention is given to identifying sites where losses in vegetation correspond with increasing surface temperatures.

The study superimposes high human density, vegetation zones, and persistent heat hotspots to determine priority regions for cool-scape development. These are key regions where interventions such as planting trees at street level, improving small urban green spaces, protecting natural areas and coastal buffers, and promoting heat-sensitive urban design may have a significant impact. The study emphasizes the significance of geographical evidence in informing current urban planning and climate adaptation initiatives.

This study identifies both common issues and location-specific dynamics of urban heat by using a comparative approach across three geographically different coastal Cities. In terms of methodology, it demonstrates the utility of open-source technologies and publicly accessible satellite data in tracking urban heat trends where data is sparse. Notably, the study provides policy-relevant insights

for integrating green infrastructure and heat mitigation into government procedures, climate action plans, and City planning. In line with national and international sustainability objectives, the results encourage more extensive efforts toward inclusive, climate-resilient urban development.

Keywords: Urban Heat Island, MODIS, Landsat Data, Coastal City

Managing Festival Waste: Lessons from Nagpur City

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Urban solid waste management in Indian cities is commonly framed around routine municipal functions such as door-to-door collection, transportation, processing, and disposal of household and commercial waste. While this lens captures everyday urban sanitation, it often overlooks episodic but high-impact waste streams that put disproportionate stress on urban infrastructure and governance systems. Festival-generated waste represents one such category. Large religious and cultural events, deeply embedded in India's urban social life, generate sudden surges of organic, inorganic, and hazardous waste within short timeframes and spatially concentrated public spaces. These surges frequently exceed routine waste-handling capacities, leading to environmental degradation, sanitation failures, and public health risks if not managed through planning and governance mechanisms.

This paper explores festival waste as an integral part of solid waste management system in Nagpur city. Nagpur presents a particularly relevant case due to the scale, diversity, and frequency of its festivals, including Ganesh Visarjan, Dhamma Chakra Pravartan at Deekshabhoomi, Diwali and

related public activities. These events attract lakhs of participants annually and generate large volumes of *nirmalya* (organic ritual waste), idol debris, plastic packaging, decorative materials, and sanitation waste across roads, residential neighbourhoods, religious sites, and sensitive urban water bodies. Historically, inadequate planning for such waste in Nagpur resulted in pollution of lakes, deterioration of public spaces, reactive post-event clean-ups, and visible ecological stress. However, in recent years, the Nagpur Municipal Corporation (NMC) has shifted towards more proactive, decentralized, and collaborative approaches to festival waste management. This shift has been enabled by partnerships with civil society organizations, scientific institutions, volunteers, and community groups.

The primary objective of this paper is to examine how festival waste management in Nagpur has transitioned from reactive clearance to a more planned, preventive, and recovery-oriented framework. Specifically, the paper analyses the scale and frequency of festival waste generation in the city. The paper further assesses the role played by the community, NGOs, and scientific agencies in implementing and sustaining these approaches.

The study is informed by fieldwork conducted in the city, including unstructured observations, visits to immersion sites, artificial tanks, lakes, and high-footfall public spaces, and interactions with municipal officials, Reduce-Reuse-Recycle centre workers, sanitation workers, NGO representatives, volunteers, and local organisers. Secondary data such as municipal briefings, news reports, environmental monitoring data, and program documentation were also reviewed to triangulate field observations. Rather than a purely technical evaluation, the study adopts an urban governance perspective, focusing on how institutions respond to episodic waste shocks and how behavioural, cultural, and infrastructural dimensions intersect during festivals.

The findings indicate that festival waste in Nagpur has historically imposed considerable environmental stress while substantially adding to the city's routine solid waste burden. High volumes of idol immersion and organic offerings overwhelmed conventional waste systems, contributing to measurable declines in water quality in urban lakes, reduced dissolved oxygen levels, and accumulation of sludge and debris. Sanitation deficits at mass gatherings, particularly in earlier years, resulted in open defecation, littering, and strain on surrounding neighbourhoods. Waste handling practices were largely reactive, with minimal segregation and limited recovery or reuse.

In response, Nagpur has implemented a multi-layered institutional and operational strategy around 2013. The municipal corporation established hundreds of artificial immersion tanks to reduce pressure on natural water bodies, introduced systematic collection and composting of *nirmalya* at municipal processing facilities, deployed mobile sanitation infrastructure at scale during mass gatherings, and promoted reduce-reuse initiatives during Diwali and other seasonal events. Notably, Nagpur was the first city in India to formally implement a ban on the use, sale, and immersion of Plaster-of-Paris (PoP) idols, marking an early and nationally significant policy intervention in environmentally responsible festival governance. The involvement of scientific institutions such as NEERI has strengthened environmental safeguards and validated treatment practices, while grassroots organizations and volunteer networks have played a critical role in awareness, collection drives, and behavioural outreach. The adoption of Innovative practices such as incentive-based cloth bag systems, Reduce-Reuse-Recycle centres, eco-idol promotion, and youth-led waste reduction campaigns signals a gradual shift towards the integration of circular economy principles into festival management.

However, the study also identifies persistent challenges like post-immersion sludge handling which remains operationally demanding, behavioural compliance with segregation, eco-friendly practices that are uneven, and residual use of Plaster-of-Paris idols despite regulatory measures. Peak-day operational stress exposes limitations in manpower, coordination, and real-time monitoring, while community engagement often remains festival-centric rather than sustained year-round. These challenges highlight the mismatch between routine municipal systems and episodic waste surges characteristic of large urban festivals.

The paper contributes to urban waste management literature by foregrounding festival waste as a governance issue rather than a temporary inconvenience. It demonstrates that managing cultural events in cities requires permanent institutional arrangements, adaptive planning, and continuous behavioural engagement. Based on the findings, the paper recommends the establishment of a dedicated Festival Waste Task Force, deployment of digital waste tracking systems, introduction of on-site composting at major festival locations, strengthened eco-friendly idol promotion, and formal institutionalization of NGO partnerships. Taken together, these measures offer actionable policy directions for Indian cities to embed festival waste governance within municipal systems, enabling resilient, inclusive, and environmentally responsible management that safeguards urban ecosystems while supporting cultural practices.

Keywords: Festival Waste, Nagpur, Urban Governance, Solid Waste Management, Collaborative Governance

Enabling Factors for Solid Waste Management – A Tale of Two Cities of Odisha

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Access to a host of services including water, sanitation, solid waste management, transportation, education & fire protection etc. is central to a decent quality of life & an efficacious economic landscape in urban areas. These basic urban services, widely understood to be the responsibility of municipal bodies and/or parastatals, are often not provided very efficiently in developing countries.

The literature on Solid Waste Management (SWM) in developing countries surfaces a variety of issues which undercut efficiency and effectiveness. These vary from revenue constraints to governance issues & technological bottlenecks, and generally afflict all municipal and other service providers, especially in the Indian context. Despite these, however, some municipal bodies – or other organizations tasked with the responsibility - are better able to provide services than others. What enables better service provision performance by some service providing organizations than others, under similar resource and governance conditions? There is very limited understanding in the literature on this question, especially in the Indian context, where there is a diversity of institutional structures, governance mechanisms and resource levels across states, and even among cities within the same state. This paper examines the question empirically in Odisha, to identify the factors that enable some municipal bodies (service providers) to perform better.

Municipal functioning is a state subject and there are substantial differences across states in the degree of devolution of functions, and therefore the structure, functions, and resources of municipal bodies. Moreover, all services may not be devolved to municipal bodies, and

other organizations may be charged with that task, and this pattern also differs across states. Since the question is aimed at identifying better performers under similar policy, structural, functional and resource conditions, it was explored in the context of one state i.e. Odisha.

The study uses a two-stage approach. In the first stage, better service providers across the set of 115 urban areas in Odisha were identified using Data Envelope Analysis (DEA). Thereafter, a case study approach was adopted to comparatively study selected better performers and low performers to identify factors that enable better performance.

In the first stage, to study the efficacy of Solid Waste Management (SWM) by each Municipal Body (MB) of Odisha, different parameters in this regard for all the 115 MBs were collected. On the basis of factor analysis, 5 important input factors and 3 important output factors were identified. To arrive at the individual efficiency using Data Envelopment Analysis (DEA), required minimum 30 (i.e. 2x5x3) of Decision Making Units (DMUs); therefore, all municipal bodies of Odisha (114) were included.

The 114 MBs of Odisha were divided into two categories i.e. Category A (City population exceeding 1 lakh – 9 nos.) and Category B (city population between 25,000 to 1 lakh – 41 nos.). DEA was run with these 50 MBs as DMUs and individual efficiency in respect of SWM of these MBs was ascertained. For study of different factors affecting SWM services, 2 MBs in category A cities having Corporation status and comparable features were selected. These are Cuttack Municipal Corporation (CMC) and Berhampur Municipal Corporation (BMC), which emerged in the DEA as having efficiency of 1 and 0.9384 respectively.

Case studies of these two MBs regarding factors influencing SWM by these organizations were undertaken. For each case, the organizational features, and the logistics, manpower and the finances in relation to the provision of

SWM, were analysed. It was found that despite a uniform SOP (standard operating procedure) mandated by the state government for SWM by all municipal bodies, and similar availability of financial resources, specific organizational and managerial aspects of the two MBs affected SWM efficacy.

Keywords: Solid Waste Management, Data Envelope Analysis, Cuttack Municipal Corporation, Berhampur Municipal Corporation

Differential Placemaking in Delhi: A Comparative Case Study of a District Park and a Neighbourhood Park

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Placemaking refers to the process of creating high-quality public environments that foster a strong sense of place. In simple terms, a strong sense of place emerges when people feel connected to their surroundings and are motivated to live, work, socialize, and engage in everyday activities within them. Placemaking, therefore, is not merely a physical or design-driven outcome, but a socially produced process that evolves through continuous interactions between people and space. Since space itself is socially constructed, it is never neutral; rather, it reflects and often reproduces existing social relations, power structures, and inequalities. As a result, the embodied and affective experiences that individuals have within space—such as feelings of comfort, belonging, exclusion, or fear—play a decisive role in shaping the placemaking process.

When public spaces are designed or governed in ways that limit access or privilege certain groups over others, they can perpetuate isolation, exclusion, and unequal access to shared urban resources. Such outcomes point to the co-

construction of unjust spaces, where the right to the city and the right to equal access to public amenities are unevenly distributed. In this context, placemaking becomes deeply intertwined with questions of social justice, equity, and inclusion. This study situates itself within this critical framework and examines placemaking in a specific form of open public space: urban parks.

Public spaces encompass a wide range of environments, including streets, open public spaces such as parks, gardens, playgrounds, public beaches, riverbanks, and waterfronts, as well as public facilities and markets. Among these, parks occupy a particularly significant position, as they are often envisioned as inclusive, democratic spaces meant to serve diverse urban populations. From the perspective of physical structures, placemaking can be categorized into four distinct types: standard placemaking, strategic placemaking, creative placemaking, and tactical placemaking. This study focuses primarily on parks as a crucial element of standard placemaking in cities, while also acknowledging how other forms intersect with and influence park design and use.

The research adopts a case study methodology, focusing on two parks located in the Vasant Vihar area of Delhi. The first is a neighbourhood park in Munirka, commonly known as Rock Garden or Fakkarwada Mohalla Park, and the second is a district park in Vasant Vihar known as Basant Udyan or Bagh-e-Bahaar. Although both parks are situated within the same broader vicinity, they are embedded in a highly heterogeneous urban context characterized by stark socio-economic contrasts. The surrounding area includes informal settlements and slums, gated communities, and planned Delhi Development Authority (DDA) colonies, making it a compelling site to examine how placemaking unfolds across different social and spatial scales.

A comparative analysis of the two parks reveals distinctly different placemaking processes. The neighbourhood park functions as an “extended family” space, primarily catering

to a specific and relatively homogeneous group of users. It fosters strong social ties, familiarity, and a sense of ownership among regular visitors, but simultaneously limits access—implicitly or explicitly—for those perceived as outsiders. In contrast, the district park operates as a multipurpose public space that attracts a more diverse user base from across the city. While it appears more inclusive in terms of access, patterns of use within the park reveal subtle forms of spatial segregation and unequal participation among different social groups.

This study examines placemaking through the lens of physical structure, which forms a key component of the entanglement model of placemaking. The research employs a mixed-methodology approach that integrates network analysis, qualitative Geographic Information Systems (GIS), and traditional fieldwork. Network analysis is used to examine spatial connectivity, accessibility, and movement patterns at both neighbourhood and citywide scales. Qualitative GIS complements this approach by mapping social interactions, perceptions, and lived experiences that are often overlooked in purely quantitative analyses. Fieldwork, conducted on both weekdays and weekends, provides contextual depth and enables a comprehensive understanding of everyday practices and temporal variations in park use.

To systematically evaluate the placemaking process, the study employs a framework consisting of five dimensions and twenty-two parameters. These dimensions correspond to key aspects of public space evaluation: inclusiveness, pleasurability, meaningfulness, safety, and comfort. The parameters and indicators were modified and contextualized to suit the specific conditions of Delhi's parks, ensuring relevance to local socio-cultural and spatial dynamics.

The network analysis uncovers subtle, yet persistent forms of exclusion embedded within the city's spatial structure, shaped by class relations at both neighbourhood and

metropolitan scales. Exclusion manifests not only in differential access to parks, but also in unequal patterns of use within them. Certain areas of the parks become informally claimed by specific groups, while others remain underutilized or avoided altogether. Qualitative GIS further reveals fine-grained social dynamics—such as gendered use of space, age-based clustering, and class-based territoriality—that remain invisible in conventional spatial analyses.

Fieldwork observations enrich these findings by highlighting how park design can either aggravate or mitigate unjust uses of public space. Differences in seating arrangements, pathways, visibility, and entry points significantly influence who feels welcome, safe, and comfortable. Behaviours observed within the parks—such as individuals confidently interacting with others, engaging in casual conversations, leaving personal belongings unattended for short periods, or displaying relaxed body language—serve as indicators of ownership, familiarity, and belonging. Conversely, hesitant movement, limited duration of stay, and avoidance of certain zones reflect experiences of exclusion and discomfort.

By linking placemaking with urban design through an integrated spatial and qualitative approach, this study offers a nuanced framework for understanding public spaces in cities of the Global South. It demonstrates how everyday design decisions and spatial configurations can reinforce or challenge socio-spatial inequalities. Ultimately, the study proposes pathways toward more just, inclusive, and equitable urban environments by foregrounding the lived experiences of diverse users in the placemaking process.

Keywords: Placemaking, Open Public Space, Qualitative GIS, Network Analysis

Cities as Organizations: Exploring Urban Organizational Identification among Migrant Inhabitants in an Indian City

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Cities have for long received scholarly interest for being hubs of economic activities, laboratories of governance, nurseries of cultural spaces, and for infrastructural enquiries. Despite this multifarious focus, relatively limited attention has been paid to examining cities as organizational entities from the standpoint of organizational identification i.e. to understanding how cities, conceived as organizing entities shaped by segmented governance, infrastructure management, informational flows, and symbolic expressions, become sites through which inhabitants construct narratives of who they are. Much scholarly work has happened in environmental psychology and urban studies on place identity, place attachment, and civic identity. Organizational theorists too have comprehensively theorised on organizational identification within formal organizations. However, these studies are yet to be brought to convergence, to examine, if at all inhabitants identify with cities as organizing entities. Little is known about how an organizational identification view of city-inhabitation offers something that place-based approaches do not, particularly in the Indian context, where rapid urban transformation followed by mass internal migration could point to compelling questions around belongingness, identity, and urban adaptability.

This paper initiates studying cities from viewpoint of organizational identification, extending the concept of organizational identification to explore the construct of Urban Organizational Identification (UOID) conceived as a process through which inhabitants define themselves in relation to a city's perceived identity, experiencing the city

not merely as a physical location but as an organizing entity that shapes everyday life. Underpinned by the organizational identification theory, UOID conceives identification as a self-defining process in which the perceived identity of the city tends to become one with the individual inhabitant's self-concept. Towards this, the paper adopts an interpretive lens that recognises that such identification can be an emotional process at deep individual level: inhabitants may endow the city with a psychodynamic spectrum ranging from existential meanings-making, pridefulness, disenchantment, or ambivalence, relating to it as an organizing "container" that can stabilize or strain identification in everyday urban life.

Organizational identification theory presents a particularly unique lens for studying cities because it shifts the focus away from typical bounded institutions to processes of assigning-meanings, identity dynamics, and self-definition. In contrast to place-based approaches that often emphasize affective attachment or symbolic meaning, organizational identification focusses on how systems of organizing, shape who people believe themselves to be. When applied to cities, this perspective allows urban environment to be understood not simply as backdrop for social life, but as an active organizing entitative energy that through its structures of urban routines, embedded aspirations, offered opportunities, and manifested constraints, influences the trajectory of inhabitant's identification with the city. This theoretical move enables an examination of how identification with a city emerges through everyday encounters with its organizing logics, rather than through abstract notions of place alone.

The study is motivated by two interrelated questions – i) do inhabitants—particularly migrants—develop identification with cities in ways that resemble organizational identification? ii) how are such processes of identification or non-identification shaped by everyday urban experience in contemporary Indian cities? Addressing these questions

responds directly to calls within urban studies and governance scholarship to better understand how cities generate belonging and resilience, not only through policy and infrastructure but through lived experience and identity formation.

Empirically, the paper is based on an exploratory qualitative study proposed in Noida, a rapidly urbanising city in the National Capital Region of India, characterised by high in-migration and planned development, governed through segmented institutional arrangements common to contemporary Indian cities. The study proposes to conduct approximately 40–50 semi-structured interviews with adult inhabitants who have migrated to Noida from different regions of India and have lived in the city for varying lengths of time. Participants are expected to include inhabitants who are professionals, retired officials, service workers, and small business owners, allowing for variation in socio-economic positioning and urban expectations. Interviews will focus on participants' migration trajectories, everyday interactions with the city, perceptions of Noida's identity, and meanings they attach to living or working there.

Methodologically, the study adopts an interpretive qualitative approach. Interview data is analysed using an inductive thematic strategy informed by organizational identification theory, while remaining open to emergent meanings rather than imposing predefined categories. Particular attention is paid to how participants speak about the city as an entity—whether as enabling or constraining, aspirational or inert—and how these interpretations intersect with feelings of belonging, detachment, pride, frustration, or continuity. Rather than presupposing fixed patterns of identification, the analysis explores the varied ways in which Urban Organizational Identification is expressed, remaining attentive to the multiplicity and ambivalence that may characterise inhabitants' relationships with the city.

Theoretically, the paper contributes to urban studies and organizational research in three ways. First, it extends organizational identification theory beyond formal organizations by examining how similar processes of self-definition may operate in relation to cities conceived as organizing entities. Second, it reframes existing discussions of place identity by focussing on the organizational dimensions of urban life, rather than considering the city solely as a symbolic or affective place. Third, it opens space for a more nuanced understanding of urban resilience, suggesting that resilient urban living is not only infrastructural or economic but also psychodynamically determined, shaped by whether inhabitants can meaningfully relate to the city that organizes their everyday lives.

By grounding the concept of Urban Organizational Identification in an exploratory qualitative inquiry situated in an Indian city, the paper offers a novel lens for understanding identity, identification, migration, and urban experience in rapidly transforming contexts. In doing so, it responds to the conference theme of New Approaches to Governance and Resilience by aligning to its track 'Inclusive urban transformation: Placemaking, identity, and equity across age and gender' highlighting how cities function not only through policies and systems, but through the identities they enable—or struggle to enable—among those who inhabit them.

Keywords: Urban Organizational Identification, Organizational Identification, Cities as Organizations, Qualitative Research, Internal Migration

Understanding Affordable Housing Challenges and Potentials for Low Income Groups - Case Area Kukatpally, Hyderabad

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Affordable housing has become a critical priority in rapidly urbanizing regions, particularly in India, as the nation advances toward its Viksit Bharat 2047 vision amidst ever growing cities and expanding urban centres, where the gap between formal housing supply and the needs of low-income households continues to widen. This paper examines the evolving landscape of affordable housing within the framework of inclusive development, focusing on Low-Income Group (LIG) housing in Kukatpally, Hyderabad. Although national and state housing schemes such as VAMBAY, JNNURM, KPHB 630 LIG, and Rajiv Gruha Kalpa have aimed to address housing deficits over multiple decades, a significant gap persists between housing provision and user satisfaction. This research is guided by the core question on How effectively do existing affordable housing models serve the needs and lived realities of low-income communities, and what strategies are required to make housing development more inclusive, equitable, and sustainable?

The study is important because affordable housing is no longer limited to physical construction rather, it is deeply tied to questions of social equity, spatial justice, livelihood access, and urban inclusion. As cities expand and land values escalate, low-income households face displacement to peripheral locations, further intensifying socio-economic disparities. Understanding how current housing schemes perform both physically and socially is therefore essential to shaping future solutions that are sustainable and equitable.

The positional rationale for this research stems from the need to shift from supply driven to people cantered housing planning. While government programmes have successfully delivered units at scale, there is limited evidence on whether these solutions result in dignified living, long-term satisfaction and integration into the urban fabric. The study argues that affordable housing must be evaluated not solely on unit count or cost efficiency but on how well it supports residents' quality of life, tenure and socio-economic mobility.

The research employs a mixed-method approach combining field observation, primary survey data, policy review, and quantitative and spatial analysis. A total of four LIG housing projects developed under housing programmes by government and were evaluated across 23 indicators grouped into structural quality – Internal and External welling, Access to facilities and neighbourhood environment. Analytical tools such as Satisfaction Indexing, Importance-Performance Analysis, Proximity Mapping and ANOVA were applied to assess variations in perception across housing programmes. The study also examines constraints faced by government and private developers related to finance, regulations, market conditions, and infrastructure delivery. This multi-layered methodology allows for a comprehensive understanding of both user experience and systemic challenges in providing inclusive affordable housing.

The findings reveal that overall residential satisfaction across the four housing schemes remains below average, with over 20 of the 23 measured indicators scoring below the 50% satisfaction level. Dissatisfaction was highest in areas related to Internal and External welling, Access to facilities and neighbourhood environment long-term living costs. While some improvements were noted in the recently constructed 630-unit LIG, ANOVA results confirm statistically significant disparities between this project and older programmes, indicating inconsistent performance

across programme cycles. Additionally, spatial analysis shows that many except 630 LIG other housing developments are located in peripheral areas with limited access to employment hubs, public transport and essential services resulting in increased travel costs and detachment from existing livelihood networks.

These outcomes highlight a fundamental planning concern, the trade-off between housing provision and spatial inclusion. Beneficiaries gained shelter, often at the expense of accessibility, social cohesion, and economic stability. Thus, the study reinforces that affordable housing must align with broader planning instruments such as land management and inclusive zoning to ensure long-term sustainability.

The implications of this research underline the need to rethink housing delivery models from a purely supply-based approach to a participatory, need based and ecosystem aligned framework. Affordable housing must be viewed as an integral component of inclusive urban development where economic mobility, accessibility, and safety are equally prioritized as the physical dwelling.

Based on the findings, the paper recommends.

i. A shift toward location efficient housing aligned with Mixed development and livelihood nodes.
ii. Introduction of an inclusionary housing framework through land banks and partnerships with private developers.
iii. Adoption of DBMT–Annuity cum Capital Grant based Subsidized Housing Model (ACGSH) to ensure financial feasibility and affordability.
iv. Strengthening post occupancy monitoring systems to evaluate tenure ship and maintenance.

In conclusion the study demonstrates that affordable housing can advance inclusive development when it goes beyond the delivery of housing units and addresses social, spatial, and economic needs. The findings indicate that

although government housing programmes have increased access to shelter for low-income groups, gaps remain in residential satisfaction, accessibility, and neighbourhood quality. Peripheral locations, limited livelihood linkages, and weak post occupancy support reduce the long-term effectiveness of these schemes. The study highlights the need to shift from supply driven housing to people centered and location efficient approaches that integrate inclusive zoning, mixed use development, and public private partnerships. Collaboration through land banks, incentives, and innovative financing is essential to improve project viability and housing quality. Ensuring equitable, accessible, and human centered housing is key to creating resilient and liveable Indian cities.

Keywords: Affordable Housing, Low-Income Groups, Inclusive Housing, Housing Programme Evaluation, Residential Satisfaction

Exploring the Relationship between Transport Infrastructure, Land Use, and Land Value: The Case of Kolkata

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Rapid, unregulated land conversion is a defining characteristic of contemporary urbanism in developing nations like India. This is driven primarily by speculative real estate markets and state-led infrastructure expansion. In cities like Kolkata, the introduction of new transport networks like the metro corridors and arterial connector expansions has opened previously transitional zones and inaccessible peri-urban hinterlands to intense development pressures. This phenomenon results in the transformation of ecological assets such as wetlands and agricultural fields

into highly dense residential or commercial fabric. This transition may fuel economic growth, but the absence of a coherent framework linking the physical capacity of infrastructure to the intensity of land utilisation leads to unsustainable spatial outcomes, environmental degradation, and increasing socio-economic disparities.

A review of existing literature reveals the prior attempts at analysing urban dynamics through binary relationships: Transport Infrastructure (TP) vis-à-vis Land Use (LU), Transport Infrastructure vis-à-vis Land Value (LV), or Land Use (LU) vis-à-vis Land Value (LV). Established theories confirm that proximity to rail networks spurs residential densification, while road network expansion correlates strongly with commercial land conversion. Similarly, economic models consistently demonstrate a "value premium" of 2-12% for properties near transit corridors. However, these pair-wise analyses often fail to capture the complex, simultaneous feedback loops where land value speculation influences land use changes before infrastructure is operational, or where zoning regulations dampen the expected capitalisation of transport benefits. The purpose of this research is to address this theoretical gap by proposing a triadic assessment framework that treats TP, LU, and LV as an interdependent ecosystem rather than isolated variable parts.

The primary goal of this study is to assess the existing linkages among TP, LU, and LV in the urban context of Kolkata. The methodology adopts a mixed approach combining qualitative factor review with quantitative spatial econometrics.

- The study focuses on a transitional ward of the Kolkata Municipal Corporation along a major growth axis, specifically the Eastern Metropolitan Bypass (EM Bypass). This ward was selected due to its active "announcement effects" from the ongoing Metro Line (Orange line) construction.

- The study integrates spatial data on transport infrastructure and land use with economic data (market value for plots of land).
- A Binary Response Model was employed to understand the extent of the relationships between the spatial and economic datasets.

A pilot empirical study was conducted in Ward 106 of the Kolkata Municipal Corporation, also known as Kalikapur-Haltu. This provided initial validation for the triadic hypothesis. The ward represents a classic Kolkata blend of older mid-rise neighbourhoods of single-family homes, with some being redeveloped into mid to high-rise apartments, and emerging mixed-use and commercial high-rises along the Prince Anwar Shah (PAS) Connector and the EM Bypass.

The key empirical findings revealed:

- A non-linear relationship between road width and value. Land values remained relatively stable across land uses in narrow roads (ROW<25m), and a significant "value jump" was observed for properties on wider roads. This premium was not uniform, being heavily skewed towards commercial land, confirming the influence of high-capacity infrastructure towards land-use conversion.
- An inverse relationship between land value and distance from the PAS Connector. The rate of decay varied by use: Commercial and mixed-use properties showed a sharp, steep decline in value with increasing distance, indicating high sensitivity to accessibility. In contrast, Residential plots exhibit a gradual, flattened decay curve, suggesting the influence of factors beyond connectivity.
- While transport infrastructure enables access, land-use zoning determines the value ceiling. Widening the road does not uniformly increase value; it triggers a conversion where residential plots are converted to commercial use to capture the infrastructure rent.

An in-depth analysis using the Binary Response Models using data on- Land Use Typology, Road Hierarchy, Road Condition (on street parking, damaged roads, waste/construction material dumping on road etc.), Congestion, Presence of Footpath, Right-of-Way, Land Value per Square Feet, and Proximity of plots from the EM Bypass, PAS Connector, Healthcare Facilities, Schools, Parks, Markets, Bus Stops, Metro Stations, revealed which of these variables influences the possibility of the different land uses.

It was revealed that the likelihood of a plot of land being of residential use increases due to the presence of footpaths, healthcare facilities within 500 meters, and the plot being adjacent to non-secondary roads; the likelihood also increases with decreasing land value. The likelihood of commercial land use increases with higher land value, the presence of schools and metro stations within 500 meters. For mixed-use land, the likelihood increases with increasing land value, adjacency to tertiary roads, increasing distance from EM Bypass, and proximity to a metro station; however, it decreases with better road conditions. The likelihood of recreational land, meanwhile, has an inverse relation with proximity to healthcare, land value, and distance from the PAS Connector; the likelihood, however, increases with proximity to a school. It was also seen that no variable is statistically significant to public use land, thus signifying that such facilities are built wherever vacant land is found without specific considerations whatsoever.

This analysis reveals that the Land Value per square Foot is the single most important factor, having significant correlation to four of the five land uses. Higher land value positively drives Commercial and Mixed-Use development and negatively influences Residential and Recreational areas. Certain land use types are seen to favour accessibility to specific infrastructure. Commercial and Mixed-Use lands have a positive association with transit and tertiary roads, while Residential zones favour footpaths and are negatively

impacted by secondary roads. Overall, the results clearly delineate the high-value (Commercial/Mixed-Use) and low-value (Residential/Recreational) land-use types based on economic and infrastructural influences.

The findings demonstrate that transport infrastructure, land use and land value form a complex system in which economic pressure often outweighs planning intent. The triadic assessment reveals that infrastructure upgrades trigger value shifts which reshape land use patterns. Recognising these interdependencies is essential for guiding future growth. Without comprehensive frameworks, these loops risk accelerating ecological loss, uneven densification, and socio-economic inequality across rapidly transforming urban corridors.

Keywords: Transport Infrastructure, Land Use, Land Value, Spatial Econometrics, Binary Response Model

Determinants of Basic Service Delivery in the Cities of Metropolitan Peripheries of Kolkata

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The past few decades have witnessed significant growth across suburban cities in India, as reflected in the rising number of census and statutory towns. A growing body of literature has been advocating for the economic potential of these peripheries, where affordable land has catalysed real estate and industrial investments, in turn, spurring immigration flow. Although some of these cities have expanded through planned interventions, numerous others have evolved haphazardly. A substantial body of literature highlighted the inadequacy of infrastructure and basic amenities in these cities, while accusing the lack of administrative capacities, low citizen participation, substandard governance and absence of inter-jurisdictional

integrations. However, these studies seldom differentiate among peripheral cities while evaluating their specific infrastructural requirements. Despite decentralised frameworks, cities in the metropolitan periphery are governed by a uniform metropolitan apparatus that fails to acknowledge their heterogeneity, leading to the non-consideration of city-specific requirements. Based on empirical analysis of two distinct peripheral cities in the Kolkata Metropolitan Area, this study demonstrates the differing conditions of basic service delivery and the factors shaping them.

The study employed a mixed-methods approach, gathering primary data from 240 households using a structured questionnaire. Secondary information was gathered from the Census of India (2011) and the concerned urban local bodies. Furthermore, various qualitative information was derived from the interviews of elected leaders and civil organisations. The study evaluated the condition of five key basic amenities, i.e. water supply, drainage, solid waste management, roads and streetlights.

The study was conducted in two cities of the Kolkata Metropolitan Area, of which Kamarhati is located 14 Km North of Kolkata and is characterised by a dense transport network, concentration of industrial, commercial and real estate activities, and a population of 3,302,11. Conversely, Baruipur lies 29km south of Kolkata at the edge of KMA, characterised by a limited yet expanding commercial and real estate activities, with a population of 53128.

Based on the various indicators identified by the existing literature for assessing basic service quality, the study constructed two indices (coverage and effectiveness) to evaluate the quality of basic services in the cities. Additionally, these indices were averaged at the household level

Average coverage index= Value of Coverage index of water supply+ drains+ SWM+ Roads+ Streetlights,

Average effectiveness index= Value of Effectiveness index of water supply+ drains+ SWM+ Roads+ Streetlights

which is subsequently employed as a dependent variable in a regression model to determine the factors influencing basic service delivery.

The findings suggest that, in terms of coverage of various services, the city near Kolkata, i.e. Kamarhati, is outperforming Baruipur. However, when it comes to effectiveness, Baruipur have performed better in terms of roads, drains and waste management. Interestingly, due to a lack of piped water connection in Baruipur, citizens are predominantly dependent on public taps, which significantly affects the effectiveness of the water supplied. Similarly, although the coverage of streetlights is comparatively good in Baruipur, the quality of the lampposts has reduced their effectiveness. On the other hand, the poor maintenance of drains, roads and waste management has resulted in poor effectiveness of these services. Moreover, in both cities, slum areas lack coverage of effective services, whereas gated societies and non-slum areas have improved service delivery. These suggest that despite these cities being located at the periphery of the Kolkata metropolis, their requirement for basic services differs.

The study further tries to understand the factors influencing the basic service management and reveals that Kamarhati, being closer to Kolkata, has a higher agglomeration impact, resulting in better coverage of services and parastatal-led developments. However, such opportunities failed to improve the effectiveness of these services. Citizen participation in ward committee meetings has only a marginal effect on service delivery in both cities. However, interaction with elected leaders helped households in accessing some of these services in Kamarhati, where such interactions are irregular. Such interactions failed to significantly improve basic services in Baruipur, primarily due to a lack of funds and other

administrative issues. Slum areas continue to receive inadequate services despite repeated appeals. Larger households receive better services in both cities, with a stronger influence in Baruipur due to greater visibility and network reach. In Baruipur, capital expenses show a negative effect on service coverage, while operation and maintenance spending has a small but statistically insignificant positive influence. In Kamarhati, both types of expenditure display negative, though statistically insignificant, impacts on service delivery. Additionally, interviews with stakeholders highlight inadequate planning, with service delivery falling short of city needs, evident in the case of road construction and streetlights in both Kamarhati and Baruipur. State and central intervention and parastatal projects often overlook local priorities, further weakening service responsiveness. The citizens having higher incomes reported better services. Educated citizens in Baruipur report slightly better services, whereas in Kamarhati, education shows no effect.

Therefore, it can be asserted that the cities within the metropolitan apparatus are not homogeneous rather exhibit different requirements of service delivery and infrastructural developments. Cities having better agglomeration impact tend to exhibit higher coverage, while cities at the edge have better maintenance despite lagging in coverage. These findings partially contradict previous literature advocating for declining quality of basic services away from core cities. These inter-city distinctions in basic service delivery are reinvigorated by the city's spatial location, financial decisions, citizens' representations, and socio-economic characteristics of households, and fundamentally depend on the implementation of decentralisation. Such conditions echo the requirement of strengthening decentralised measures, especially for the distinct cities, which are often homogenised within the metropolitan system.

Keywords: Basic Service Delivery, Decentralised Governance, Metropolitan Periphery

Banking Inside Metro Stations as a Non-Fare Revenue Strategy: Evidence from the Delhi Metro System

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Urban public transport systems play a critical role in ensuring equitable access to mobility, improving environmental sustainability, and supporting economic growth in Indian cities. Metro rail systems are designed to provide high-quality, affordable, and reliable transportation to millions of daily commuters across diverse socio-economic groups. However, despite rising ridership levels and continuous network expansion, most Indian metro systems continue to face persistent financial challenges. Escalating operational and maintenance costs, limited flexibility in fare revisions, and high passenger price sensitivity have constrained the ability of metro agencies to achieve long-term financial sustainability through fare revenue alone. In this context, non-fare revenue has become increasingly important as a complementary strategy to support metro operations without undermining affordability or social equity.

The Delhi Metro Rail Corporation (DMRC), India's largest and most extensive metro system, serves over two billion passenger journeys annually and operates a wide network of stations located in major commercial, residential, and institutional areas. While DMRC has developed multiple non-fare revenue streams, including advertising, property leasing, parking facilities, and telecom infrastructure, these sources remain fragmented and underutilized when compared to international best practices. Existing non-fare

revenue strategies largely emphasize retail outlets, advertising spaces, and large-scale property development, while routine service-oriented uses within stations receive relatively limited strategic attention. One such underexplored opportunity is the integration of banking services within metro station premises.

Banks in Indian cities often struggle to expand their physical presence due to high real estate costs, limited availability of space, and heightened security concerns in densely populated urban areas. Metro stations, by contrast, offer controlled and secure environments with guaranteed pedestrian footfall, excellent connectivity, and convenient access for daily commuters. Despite this natural alignment, banking services in metro stations are frequently treated as isolated conveniences rather than as components of a structured non-fare revenue framework. Existing literature on non-fare revenue sources of MRTs focus on advertising, retail rentals, and land value capture mechanisms, while offering limited analysis of financial service leasing models, particularly within the Indian metro context. This gap is especially evident in studies that simultaneously consider passenger demand, banking feasibility, spatial constraints, and metro revenue objectives.

This study aims to understand this gap by examining the potential of banking services within Delhi Metro stations as a structured non-fare revenue model. Rather than viewing banking facilities merely as supplementary passenger amenities, the study conceptualizes them as commercial assets capable of generating stable, long-term rental income while enhancing commuter convenience and service accessibility.

The research thus combined literature review, secondary data analysis alongwith primary field-based investigation. Secondary data sources included DMRC annual reports, and audit statements. Primary data collection included structured passenger surveys conducted at five strategically selected Delhi Metro stations—Kashmere

Gate, Rajiv Chowk, Botanical Garden, Hauz Khas, and New Delhi—representing key interchange nodes, commercial hubs, and terminal stations. A total of 270 passenger responses were collected, supplemented by interviews with metro leasing officials and banking representatives. This approach enabled a comprehensive understanding of spatial conditions, commuter behaviour, institutional arrangements, and operational constraints.

Survey findings reveal a clear and consistent demand for basic banking services within metro stations. Respondents expressed strong preferences for facilities such as ATMs, cash deposit machines, account support kiosks, and limited-service bank branches, primarily due to time savings, convenience, safety, and ease of access. Demand for such services was significantly higher at interchange stations and stations located near commercial districts, indicating that station typology plays a critical role in determining commercial viability. Importantly, passengers did not perceive banking facilities as disruptive to metro operations, provided that pedestrian circulation, security protocols, and station functionality were maintained. These findings highlight the potential for integrating banking services into metro stations as a viable, scalable, and passenger-oriented non-fare revenue strategy for Indian metro systems.

Keywords: Non-Fare Revenue, Banking Services, Metro Stations, Delhi Metro System, Urban Public Transport Systems

Assessing Land Use Development Trends along the Delhi-Meerut RRTS Corridor

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In the National Capital Region of India, the pace of urbanization in the National Capital Region (NCR) has greatly accelerated the linkage between transport infrastructure and land use development, thereby requiring the urgent need for a composite land use planning approach. In India, the Delhi- Meerut Regional Rapid Transit System (RRTS) project has emerged to counter challenges posed by the existing transit infrastructure, thereby attempting to make the country's first high-speed regional rail corridors that will pave the way for improved regional connectivity, faster travel times, and more sustainable transportation modes. Though the RRTS project will perform the significant role of an infrastructural intervention, its future success will depend not only on its operational performance but also on its effective ability to handle land use development patterns surrounding transit station areas. For the purpose of this research, this study evaluates the land use development patterns along the transit route of the Delhi -Meerut corridor to assess the inaugural response to high-capacity regional transit infrastructure.

The present study focuses on the analysis of land use patterns, development intensity, and their spatial characteristics in the existing station influence areas along the Delhi-Meerut RRTS corridor. It crosses a number of urban contexts involving the dense metropolitan core in Delhi, transitional and industrial zones in Ghaziabad, and rapidly expanding urban areas in Meerut. Because of this reason, it is an important case for understanding how regional transit infrastructure interacts with varying urban forms and development pressures. Broadly, the alignment follows the NH-34 growth axis-an area which has

historically demonstrated incremental urban growth along the axis, through industrial activity, residential demands, and regional commuting.

For analysis, the study focuses on the station area approach, realizing the significance of transit station sites in the creation of accessibility, land value, and development intensity patterns within the context of an urban area. For this analysis, the transit station sites are investigated within of influence area from 0-800 meters, in compliance with national transit development standards. Existing land use patterns are established through the application of secondary data sources, including Master Plans, planning reports, satellite imagery, and GIS analysis. Land use types such as residential, commercial, institutional, industrial, transport, and open spaces are investigated to determine the spatial patterns.

A recent series of findings in Delhi-Meerut corridor reveals that land use development is already started responding towards the expected accessibility advantage of RRTS, even prior to full-scale operation of the system. Core urban places like Sarai Kale Khan and Anand Vihar show high-density mixed-use development with good institutional concentration and multi-modal connectivity. The potential for further intensification and vertical development is relatively high in these areas; however, growth is at a snag due to the scarcity of vacant land, fragmentation of ownership, and multi-layered governance. On the other hand, the peri-urban and emerging stations like Ghaziabad and Meerut South have relatively low density, a higher share of underutilized land, and loosely structured development pattern with more flexibility for planned transit-oriented interventions.

However, the kind of development that takes place in the entire corridor presents varied aspects. While some station areas are experiencing the early stages of mixed-use development, others are growing in a disorganised manner,

mostly fuelled by the speculation of the land by the private sector rather than by planning efforts.

In relation to broader urban systems theories, the Delhi-Meerut RRTS is more than just a transit corridor in terms of an element of structure in the region influencing regional spatial structure. The transit points of the system can be considered nodes in an urban system in relation to urban movement patterns. The significance of regarding regional transit systems and infrastructure as an active element in urban transformation and change, rather than neutral in relation to investment in transit mobility, cannot be underestimated.

The documentation of the existing land use state at an early phase of RRTS implementation ensures the establishment of a baseline state on which future studies on transit-related development along the corridor shall be based. The results of this research inform the discussion on land use and transport integration of rapidly growing regions concerning regional rapid transit systems. The significance of this research lies in pointing to the necessity of proactive planning and management of stations and density through contextual planning.

Thus, the analysis of the trend in land use development in the Delhi-Meerut corridor identifies the potentials as well as the challenges in the implementation of large transport infrastructure projects in the region. Although the RRTS system possesses the capacity to reconstruct the network in the region and develop compact and transport-oriented growth patterns in the National Capital Region. This research identifies the need for the adoption of integrated planning strategies in the development and infrastructure planning processes in the National Capital Region. This analysis is highly pertinent in the context of the formulation of transport infrastructure projects in the region along the emerging Regional Transit Corridors. This analysis also identifies the need for the adoption of integrated transport infrastructure development strategies at the appropriate

stages during the development processes in the National Capital Region.

Keywords: Land Use Development, Regional Rapid Transit System (RRTS), Transit- Oriented Development, Urban Infrastructure, Delhi - Meerut Corridor, Land Use–Transport Integration

Strengthening Traffic Crash Data Reporting Systems in Low- and Middle-Income Countries (LMICS): A Systematic Methodological Review

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The accuracy and trustworthiness of the results are crucial in any research that depends on data quality and reliability. Similarly, road crash data are the backbone of evidence-based road safety planning. Low- and middle-income countries (LMICs) consistently face challenges in generating accurate data, recording complete information, and timely reporting of crash information. LMICs have a higher road crash and fatality rate than high-income countries (HICs), even though the rate of motorisation is much lower, at 60%. According to the World Bank (2020), road injuries remain a serious public health challenge throughout the globe. Worldwide, approximately 1.19 million lives are lost, and 50 million people are injured annually. Approximately 93% of road traffic fatalities occur in LMICs.

These road traffic crashes not only result in life losses and injuries but also impose significant economic losses on the country. Low-income countries (LICs) are facing an average 330% higher risk of fatality in road crashes compared to high-income countries (HICs), and it is 43% higher compared to middle-income countries (MICs). Africa bears the highest burden of crashes, accounting for 9.0% of GDP and 1,149 years of life lost per 100,000 people. East Asia

and the Pacific account for 6.1% of GDP and 1,017 years of life lost, South Asia for 6.9% of GDP and 863 years of life lost, Latin America and the Caribbean for 6.0% of GDP and 878 years of life lost, and the Middle East and North Africa for 5.5% of GDP and 910 years of life lost. Europe and Central Asia show the lowest burden, accounting for 4.8% of GDP and 695 years of life lost per 100,000 people. LMICs such as India, which account for the highest share (11%) of global road crashes, clearly illustrate these challenges. Data quality issues exist in police records, hospital data, and insurance reporting systems.

A comparative review of LMIC crash data systems by Wismans et al. (2016) found that underreporting of non-fatal injuries often exceeds 70%, with police hospital agreement being weak to moderate. High-income countries (HICs) such as the United States, Sweden, Australia, and the United Kingdom have established multi-source data environments linking police data with hospital, insurance, trauma registry, telematics, and ITS sensor data, resulting in more reliable estimates and evidence-based countermeasure programs. This review, therefore, aims to systematically synthesize existing methodologies for traffic crash data collection in India and comparable LMIC settings and to identify persistent gaps as well as emerging good practices. Thus, the objectives of this review are to address the following gaps:

i. Examine existing traffic crash data collection methodologies used in India and other LMICs.
ii. Identify common methodological gaps affecting data quality, completeness, and usability.
iii. Review emerging technological and institutional initiatives aimed at improving crash data systems.
iv. Propose methodological priorities and a roadmap for strengthening national crash databases in LMICs.

A systematic review of literature was carried out across Scopus, Web of Science, TRID, PubMed, and relevant government repositories, published in the last twenty

years, between 2005 and 2025. This study included peer-reviewed journal articles, road safety reports, government records, road safety guidelines, and policy documents related to traffic data collection systems. It included different sources of data reporting systems, such as injury surveillance, police reporting systems, hospital admission registers, and integration of multi-source data platforms. This study was included in the review if it addressed the traffic crashes and injury data in India or other LMICs, data collection methodologies and reporting mechanisms or issues related to underreporting, geospatial accuracy, and digitalization. It also focused on sources of data, the strength of data, and the level of linkage across agencies and technical tools employed for data collection. To summarise and interpret the findings, a qualitative narrative-based synthesis was applied.

This present review examines the major methodological gaps in data reporting that are consistently observed across India and other low- and middle-income countries (LMICs). In LMICs, underreporting of traffic crashes is the most critical issue, particularly in minor injuries and property damage only. Police data system records to prioritise fatal and grievous injuries, while the hospital register captures the type of injury without integration of the crash environment and traffic characteristics. The review found that the crash definitions and severity classification are common in the reporting system. Different authorities have different criteria for defining severity, fatality, and crash type. This is a major lack of standardization of data across regions and time.

The reporting data have some geospatial inaccuracies in LMICs. Many crash records rely on only descriptive location information rather than detailed information about the crash location and precise geographic coordinates. These data make it difficult to perform hotspot analysis and spatial risk modelling or risk prediction modelling. The integration of data in these countries is weakly linked. The

police record and health register data sets are poorly linked, and they report independently, with limited data sharing between them. This results in duplication and inconsistency in outcomes. The digitalization of road crash data remains a challenge for LMICs, particularly at district and sub-national levels.

The present review identified key methodological enhancements to strengthen the traffic data collection system in LMICs. These include adoption of uniform crash criteria definition and standard data formats; spatially enabled and digital-first crash reporting system; systematic linking of police records with hospital injury diary; integration of telematics (GPS location, vehicle speed, sudden braking or acceleration, driving time and fatigue indicators), sensor-based data (speed cameras, CCTV cameras, automatic traffic counters, weather and road-condition sensors), crowdsourced data sources (mobile applications, public reporting platforms, social media or helpline-based reports); sustained the road safety institutional capacity building at sub-national or district levels. For reductions in road crash injuries and fatalities in LMICs, strengthening traffic crash data systems is essential.

Keywords: Traffic Crash Data, LMICS, Road Safety, Data Collection Methods

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