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Smart Sustainable Cities 2025: Pioneering Novel Frontiers for Green Urban Living

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Enhancing Urban Identity Through Smart City Technologies: A case of the medieval port city of Kochi

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Introduction & Research Focus

- ◆ Kochi is among the first 20 Smart Cities under India's Smart Cities Mission.
- ◆ The city's rich cultural heritage faces challenges due to incoherent urbanization.
- ◆ The study emphasizes cultural heritage preservation as a driver for tourism.



Image source: Dreamstime.com

Aim: To focus on enhancing the attributes of cultural heritage that render the city image with smart city technologies, thereby evolving into a state-of-the-art, yet culturally rooted destination with innovative smart technological solutions.

Methodology

- ◆ Comparative analysis approach was employed to benchmark best practices in integrating smart city strategies with heritage conservation
- ◆ Identified heritage-rich port cities with similar urban, economic, and historical contexts for meaningful comparison.
- ◆ Utilized site assessments, policy reviews, and stakeholder insights to evaluate placemaking, smart technologies, and governance models.
- ◆ Developed context-specific strategies for Kochi, addressing sustainability, infrastructure, policy gaps, and community engagement.

Recommendations

Beneficiaries:

Tourists
Developers
Entrepreneurs
Policy Makers
Local Communities

Digital Interactive Kiosks

For real-time cultural
information & navigation.

Smart Event Management Systems

Enhancing cultural
festivals

Augmented Reality (AR) Heritage Trails.

Enhancing experience
through immersive digital
storytelling

Key
SMART
Technology
Interventions

Public Art Installations

Blending heritage with
digital media

Integrated Digital Platforms

Promoting public
participation &
engagement

Smart Lighting & Projection Mapping

Showcasing heritage
structures with dynamic visual
narratives.

: Outcomes

Equitable stages
Inclusive platforms
Unique experiences
Roadmap for Experts
Heritage-led smart city

: Placemaking Impact

Strengthens city identity
Reinvigorate public spaces
Fosters community-driven change
Aids environmentally sustainable ways

Challenges Addressed:

Cultural Authenticity
Sustainability Concerns
Infrastructure Limitations
Funding & Regulatory Constraints

Findings & Conclusion

- ◆ These not only offer a new experience to tourists but also safeguard the well-being of people, heritage, and the environment.
- ◆ The implications of this study promise a roadmap for planners, policymakers and other prominent stakeholders to guide Kochi into a culturally enriched smart city.
- ◆ Further research on AI-driven heritage conservation.

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A3 – Scott Young



CREST

Funding Programme: JPI Urban Europe
 Project Start: 1 April 2022

Authors: Scott Young | scott@augmentcity.no | Silvia Cibien | silvia.cibien@accent-sud.eu

3

YEARS

9

PARTNERS

3

CITIES

Built on AugmentCity Digital Twin technology

GOAL CREST's goal is to explore a new methodology for empowering vulnerable coastal urban areas to cope with the challenge of climate change through digital twinning and citizen science and participatory approaches. This allows for engaging local citizens and communities in environmental decision-making and innovative policy practices, enabling robust and resilient responses to climate change.

Climate Challenges in Coastal Urban Areas

	Urban areas are highly vulnerable to climate change, facing rising sea levels, floods, droughts, and extreme weather events that threaten infrastructure, housing, health, and livelihoods.
	Cities generate 75% of CO ₂ emissions, making them key actors in developing innovative solutions to mitigate climate risks and enhance resilience.
	Challenges include: - Limited awareness and engagement among citizens and policymakers due to complex data and reliance on non-digital tools. - Fragmented climate data and difficulties in harmonizing information to simulate "what-if" scenarios for decision-making.
	Urgent action is needed to bridge the gap between climate data and public understanding, ensuring better preparedness and informed urban adaptation strategies.

Target Groups

	Citizens Households Residents	Civil Society Environmental NGO's Consumer organisations
	Researchers Spatial planners Climatologists Social scientists	Public Authorities Regional / local Gov Municipalities City Halls
	Companies Utilities Transport Construction Real estate	Cooperatives Producers Innovators/ technologists

Methodology

Visualizing climate challenges is key to increasing public engagement and fostering climate resilience. Advanced technologies like Augmented Reality (AR) can enhance understanding and drive action by making climate threats more tangible and immersive.

- We selected three urban areas in France, Poland, and Norway as pilot sites.

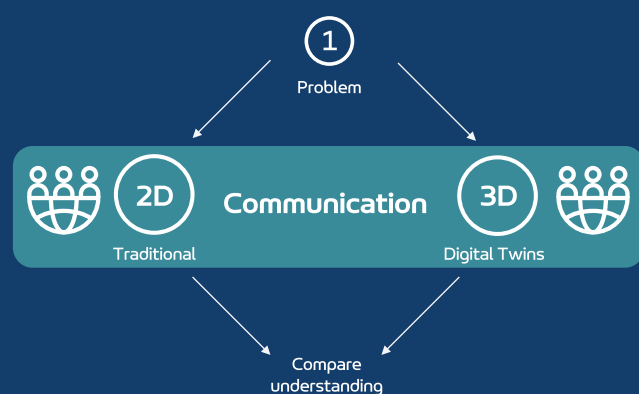


- We defined a Citizen Science research protocol
- Through co-creation workshops, we engaged citizens, experts, policymakers, and civil society to define relevant climate scenarios (use cases)
- Digital Twin technology was tested in these cities through hands-on workshops, demonstrating its potential in local climate adaptation strategies.

Kristiansund, Norway Focus on extreme weather affecting mobility around the city.	01 Normal day All bridges & ferries open	02 Accident Omsundbrua closed but other bridges and ferries open.	03 High Wind All bridges closed but ferries open.	04 Very High Wind All bridges & ferries closed.	05 A+B Flooding Flooding 2050 Flooding 2090
Kolobrzeg, Poland Focus on extreme flooding to housing & residential allotments.	01 Ordinary day No flooding	02 Coastal Flood During a 1% storm event	03 Rain-induced flood During a 1% storm event	04 Dike failure Flood caused by dike failure	05 Dike failure During a storm
Bordeaux, France Focus on marine and river flooding to city centre.	01 Normal day	02 River flooding 1:100 years	03 River flooding 1:1000 years	04 Marine submersion 1:100 years	05 Marine submersion 1:1000 years

Results

AugmentCity developed an innovative Digital Twin (DT) technology, allowing cities to analyze and visualize real-time data and "what-if" climate scenarios. This tool supports policy-makers, researchers, companies, and citizens in better understanding climate-related threats.



Key Differences between Digital and Map-Based Workshops

Comparison between traditional map-based workshops and digital workshops using Digital Twin technology, focusing on environmental risks, transportation, infrastructure, and urban planning challenges. The key findings highlight engagement differences, discussion flow, emotional involvement, and problem-solving approaches.

01	Context and Purpose Maps Workshop: Used physical maps to analyze real-world urban challenges, such as flood risks, mobility issues, and infrastructure weaknesses. Discussions were place-based, drawing from local knowledge and personal experiences.
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	Digital Workshop: Used Digital Twin technology to simulate real-world conditions (e.g., flooding, traffic, strong winds). Discussions were more structured, with a data-driven approach to planning and decision-making.
02	Engagement and Interaction with Tools - Maps Workshop: Participants interacted with paper maps but struggled to visualize detailed locations such as homes or offices. Conversations were broader and more general, focusing on past experiences and historical infrastructure changes. Needed more guidance from facilitators to discuss future scenarios. - Digital Workshop: Participants used a zoomable digital model of the city, making it easier to explore specific locations. Discussions were more precise and analytical, incorporating exact measurements (e.g., traffic speed, flood levels). Facilitators played a smaller role, as participants engaged more independently, reacting to visual simulations.
03	Focus and Discussion Flow - Maps Workshop: Focused on current, tangible issues like narrow sidewalks, outdated infrastructure, or bus schedules. Discussions were subjective and personal, emphasizing individual experiences with climate risks. Less structured, requiring more prompts from facilitators to discuss future scenarios. - Digital Workshop: Focused on predicting and planning for future climate risks (e.g., heavy storms, sea-level rise). Discussions were more structured and solution-driven, based on what the simulations revealed. Participants initiated discussions more frequently, analyzing the impacts on the city rather than just their daily lives.
04	Emotional and Personal Involvement - Maps Workshop: Participants expressed strong personal connections to locations and shared personal stories. Conversations were subjective, based on individual frustrations with current infrastructure. - Digital Workshop: Discussions were more rational and strategic, emphasizing practical solutions over personal experiences. Participants were emotionally invested in future risks, reacting strongly to visualized disaster scenarios.

05	Data Usage and Understanding - Maps Workshop: Used static data (e.g., historical flood maps, traffic data) to interpret trends. Participants relied more on collective memory and local expertise to assess risks. - Digital Workshop: Integrated real-time data (e.g., traffic flow, elevation models, climate forecasts) into a dynamic simulation. Enabled participants to see cause-and-effect relationships visually, enhancing understanding of complex risks.
06	Post-Workshop Feedback - Maps Workshop: Participants felt they already knew the city's geography, but the discussion broadened their awareness of climate risks at a city-wide scale. - Digital Workshop: Highly valued for its ability to show real-time effects of climate change on infrastructure and communities. Helped participants see broader connections between climate risks, transportation, and urban planning.

Overall Conclusion

Both workshops addressed the same environmental challenges, but their approaches and outcomes differed significantly:

Maps workshops encouraged collaboration and community-driven problem-solving, focusing on present-day challenges and past experiences. Digital workshops promoted future-oriented decision-making, with higher engagement, analytical discussions, and structured problem-solving. Digital Twins provided a more immersive and data-rich experience, enhancing long-term planning and climate resilience strategies.

- This comparison highlights the benefits of combining both approaches: maps for local insights and historical knowledge, and digital simulations for predictive modeling and data-driven decision-making.

Resources

On CREST website from April 2025: <https://crestproject.eu>
• Demo videos • Sustainable Pathways • Policy guidebook of Citizen Science for urban resilience

A4 – Anoraga Jatayu

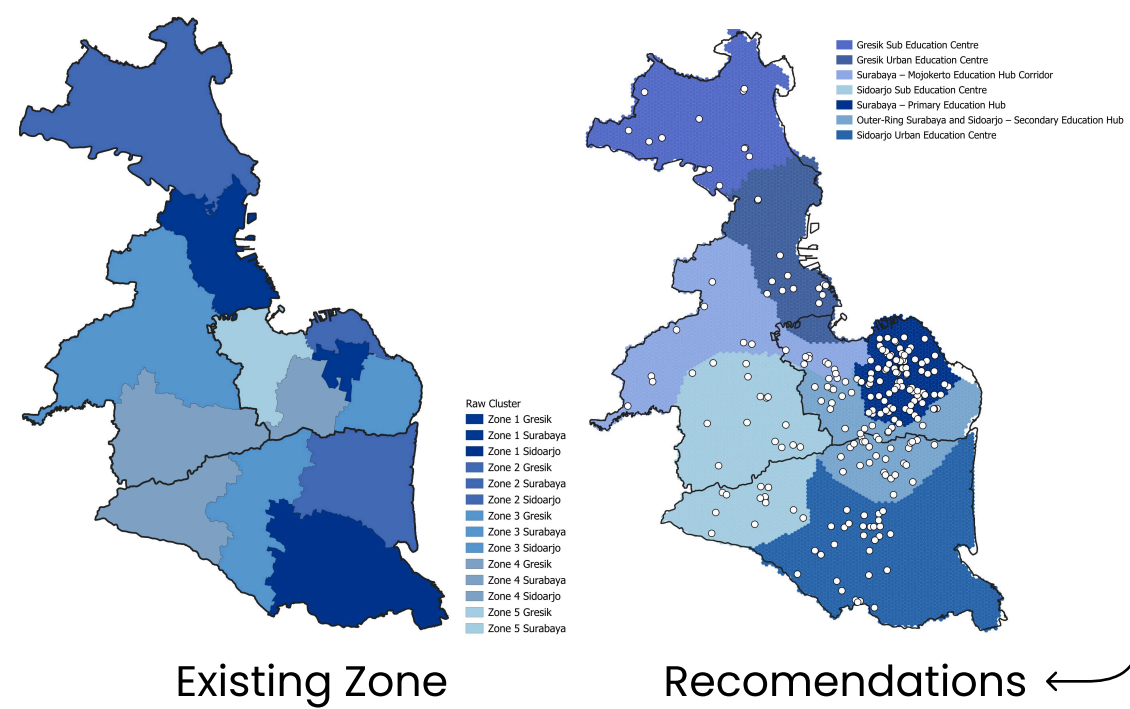
REDEFINING EDUCATION ZONING FOR EQUITABLE ACCESS AND MOBILITY IN THE SURABAYA METROPOLITAN AREA

A Jatayu, R Hamdika , G N A Pranoto, M R I Robbik
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01 Background

Indonesia’s education policy aims for equal access but struggles in non-urban areas due to limited inter-regional access to competitive schools and rigid administrative zoning. This study proposes a more inclusive zoning model for elementary to high school levels in the Surabaya Metropolitan Area, emphasizing cross-boundary access and balanced resource distribution. Using spatial variability of market-based optimum distance, accessibility, population density, and compactness indices, an education zoning is formulated to promote equitable access and mobility in Surabaya Metropolitan Area.

03 Area Orientation Map



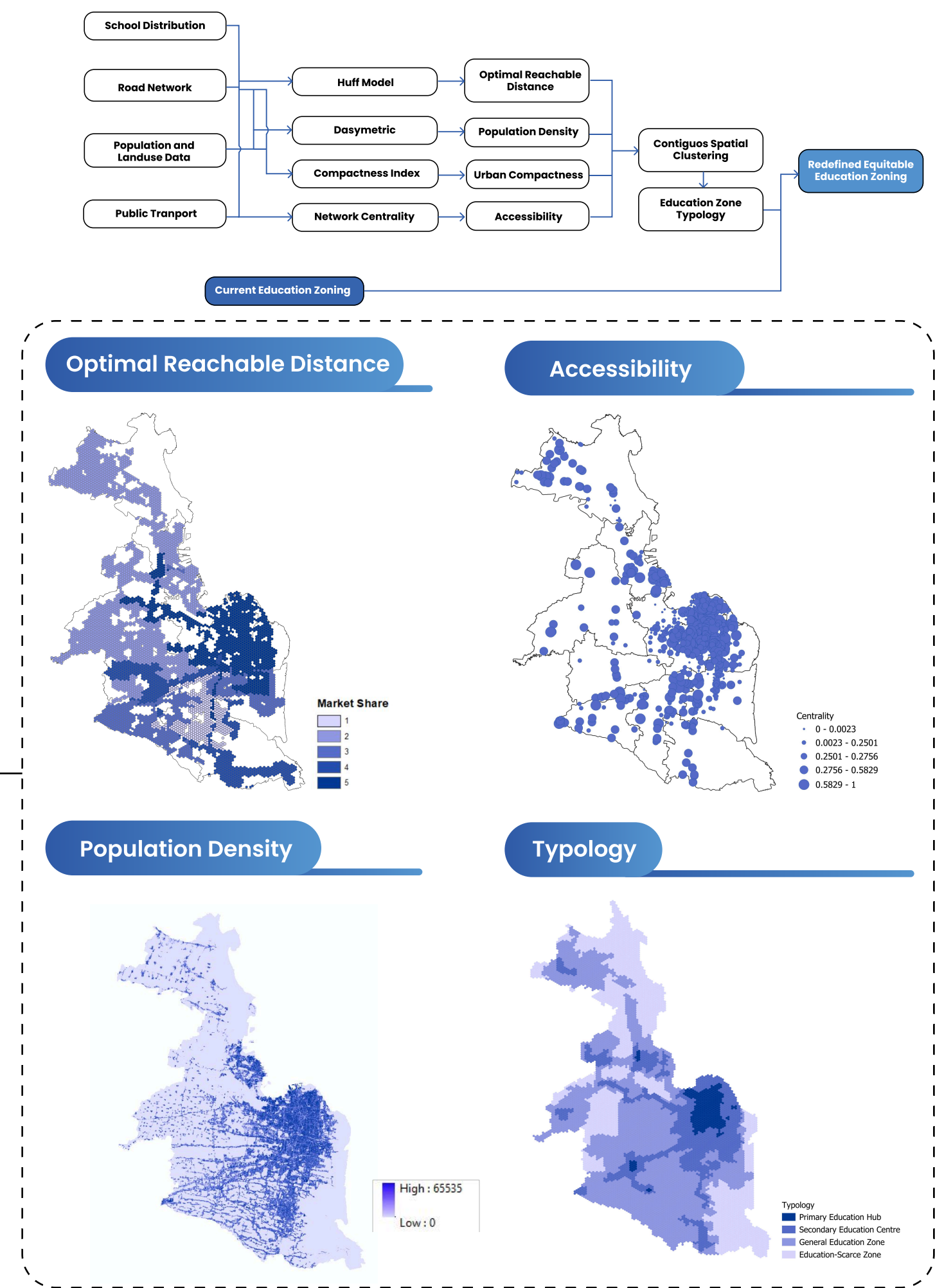
04 Typology Characteristic

Variable	Definition	Typology			
		Primary Education Hubs	Secondary Education Centre	General Education Zones	Education-Scarce Zones
z1	Accessibility	High	High	Medium	Low
z2	Population Density	High	High	Medium	Medium-Low
z3	Reachability (Optimum Distance)	High	Medium	Medium	Low
z4	Compactness	High	High	Medium	Medium-Low

05 Discussion

Spatial variability in reach, access, density, and compactness reveals disparities in education facility quality. Northern Gresik, an industrialized area, faces a significant gap, while improvements emerge near Surabaya’s urban core. The new education zoning enhances accessibility and reachability. Each zone includes a secondary education hub, a grade “A” school, and a balanced population proportion. Seven zones are organically designed in the Surabaya Metropolitan Area, unrestricted by administrative boundaries, with Surabaya as the highest-tier zone.

02 Flowchart



06 Conclusion

Unlike previous zoning regulations, students can now choose schools outside their local zones. Improved public transport will address mobility challenges, ensuring equitable access to quality education while promoting better connectivity across the region.

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A5 – Pablo Pinazo Riera

Urban Activity and Children: Strategies to promote movility

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Introduction and objectives

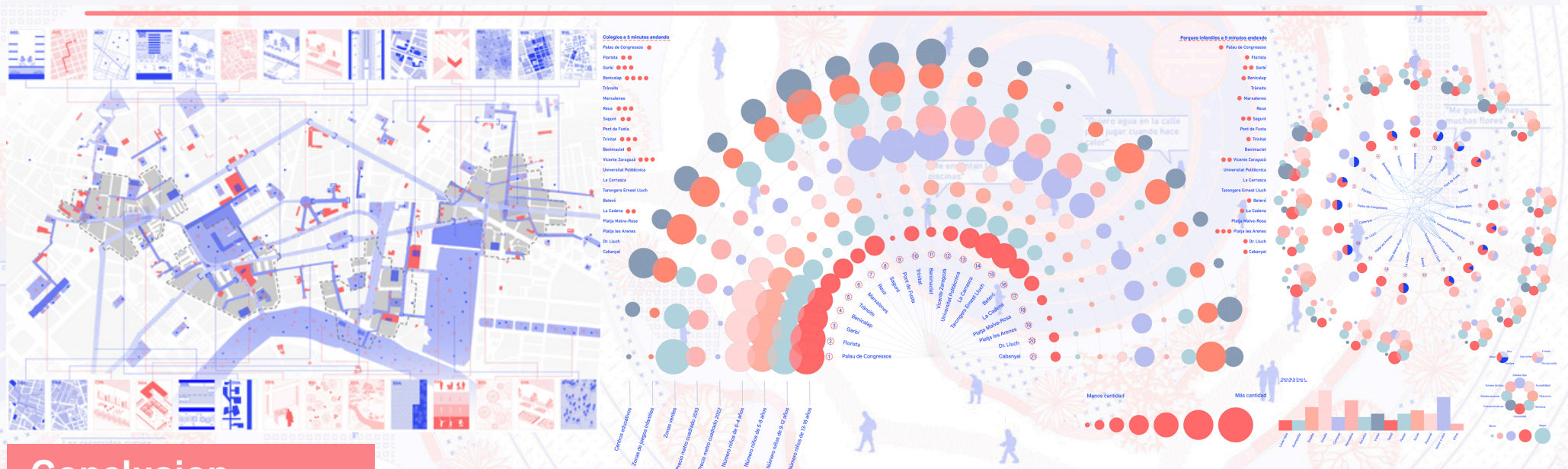
Inclusive urban design is key for promoting sustainable mobility and ensuring cities are accessible to all, particularly children. However, public transportation environments, like tram stops, often lack planning tailored to their needs. This research examines the urban areas around tram stops on Valencia's Tram Line 4, proposing criteria to create inclusive and safe spaces that encourage early use of public transport

- O1. Gather a set of criteria for creating child-friendly public transportation environments, based on an initial diagnosis and a comprehensive literature review.
- O2. Design a diagnostic method that enables the application of this set of criteria to evaluate urban environments near tram stops, identifying areas for improvement.



Methodology and Results

The methodology included a literature review to develop evaluation criteria and defining the study area using 800-meter isochrones. Various data sources, such as cartographic information, social media, citizen participation, and field studies, were used to analyze accessibility from a child's perspective. A catalog of 50 criteria was created, covering accessibility, safety, green spaces, and play areas. The analysis revealed significant deficiencies, such as lack of accessibility and safety, limiting the appeal of tram stops for children and caregivers, negatively affecting their perception of public transportation.



Conclusion

Regarding the first objective (O1), no comprehensive catalogs linking public transportation and children were found in the literature. As a result, a specific catalog of 50 criteria was developed for child mobility. For the second objective (O2), a diagnostic method was designed and successfully applied to evaluate four tram stops, proving its feasibility and replicability. The results emphasize the need to redesign these environments to foster social cohesion and encourage early use of public transportation.

Future research

Future studies could adopt an ethnographic and sociological approach, incorporating citizen participation into urban diagnostics. Exploratory exercises in schools near the study areas have shown the potential of these processes.

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A6 – Vinod Kumar

TITLE: Place-making and city boosterism with metro rails in indian metro cities from a smart city perspective.

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INTRODUCTION:



METRO RAIL SYSTEMS BOOST URBAN DEVELOPMENT, ENHANCING MOBILITY, SOCIOECONOMIC GROWTH, SUSTAINABILITY, AND LIVABILITY, AND PLAY A KEY ROLE IN: CREATING VIBRANT SPACES; PROMOTING CITIES; FOSTERING IDENTITY AND GROWTH; ADDRESSING URBAN CHALLENGES. INDIA'S RAPID URBANIZATION, EXPECTED TO REACH 590 MILLION BY 2030, HAS STRAINED URBAN INFRASTRUCTURE (BHATT & ROYCHOUDHURY, 2024). IN RESPONSE, THE INDIAN GOVERNMENT HAS LAUNCHED INITIATIVES LIKE SMART CITIES MISSION AND AMRUT TO PROMOTE SUSTAINABLE URBAN PLANNING (BHATT & ROYCHOUDHURY, 2024). EFFICIENT TRANSPORTATION, LIKE METRO RAIL, CAN IMPROVE AIR QUALITY, REDUCE CONGESTION, AND ENHANCE MOBILITY, BUT ITS IMPACT ON INDIAN CITIES IS UNDERSTUDIED.



(Source: website of various Indian metro rail corporations)

RESEARCH QUESTION:

HOW DOES METRO RAIL TRANSIT IMPACT THE QUALITY AND IMAGE OF INDIAN METRO CITIES?

OBJECTIVES OF THE STUDY:

1. INVESTIGATE THE IMPACT OF METRO RAIL TRANSIT ON THE PHYSICAL AND SOCIAL ENVIRONMENT OF INDIAN METRO CITIES.
2. EXAMINE THE ROLE OF METRO RAIL TRANSIT IN SHAPING THE IMAGE AND QUALITY OF INDIAN METRO CITIES.
3. IDENTIFY THE BENEFITS AND CHALLENGES OF METRO RAIL TRANSIT SYSTEMS IN INDIAN CITIES.

(Source: website of various Indian metro rail corporations)

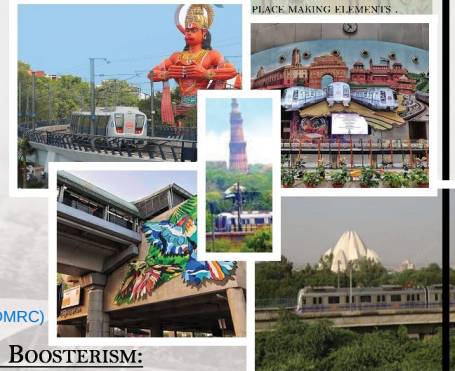
PLACE-MAKING THROUGH METRO RAIL DEVELOPMENT:

THROUGH PLACE-MAKING METRO RESHAPE URBAN SPACES AND ENHANCE CITIZENS' QUALITY OF LIFE. **ENHANCING PUBLIC SPACES** THROUGH WELL-DESIGNED PLAZAS AND STATIONS FOSTER COMMUNITY INTERACTION AND IDENTITY (BECK, 2009). **IMPACT ON LAND USE AND VALUE** DRIVES URBAN TRANSFORMATION, COMMERCIAL ACTIVITY AND LAND VALUE, BUT RISKS GENTRIFICATION (KOURTIT ET AL., 2022). **HUMAN-CENTERED DESIGN ELEMENTS** LIKE OPEN SPACES AND ACCESSIBILITY INFLUENCE USERS' EMOTIONAL RESPONSES, HIGHLIGHTING THE NEED FOR INCLUSIVE DESIGN STRATEGIES (KOURTIT ET AL., 2020).

CITY BOOSTERISM THROUGH METRO RAIL:

METRO RAIL SYSTEMS PROMOTE A CITY'S IMAGE AND DRIVING DEVELOPMENT THROUGH **SYMBOL OF MODERNITY AND SMART CITIES** - EMBODIES MODERNITY, EFFICIENCY, AND SUSTAINABILITY (CHEN ET AL., 2024); **ECONOMIC GROWTH** BY IMPROVES CONNECTIVITY, PROPERTY VALUES, AND ATTRACTS BUSINESSES, JOBS, AND INVESTMENT (BONO ET AL., 2022); **ENVIRONMENTAL SUSTAINABILITY**: REDUCES VEHICLES & AIR POLLUTION (THYNELL ET AL., 2010). CHALLENGES AND CRITIQUES: UNEVEN DEVELOPMENT, PARTICIPATORY PLANNING, AND INCLUSIVE DECISION-MAKING (CILLIERS ET AL., 2015).

(Source: DMRC)



PLACE-MAKING ELEMENTS



(Source: website of various Indian metro rail corporations)



METRO CARDS

INTERPLAY BETWEEN PLACE-MAKING AND CITY BOOSTERISM:

THE RELATIONSHIP BETWEEN PLACE-MAKING AND CITY BOOSTERISM IS COMPLEX AND MUTUALLY REINFORCING. THREE STRATEGIES CAN HELP BALANCE THEIR BENEFITS: **EQUITABLE TRANSIT-ORIENTED DEVELOPMENT (TOD)** - PROMOTE MIXED-USE DEVELOPMENT TO ADDRESS DIVERSE NEEDS AND ENSURE SOCIAL EQUITY; **PARTICIPATORY VALUE CAPTURE FINANCING** - INNOVATIVE FINANCING MECHANISMS, INVOLVING CITIZENS IN PLANNING AND FINANCING FOR INCLUSIVE OUTCOMES. **ADDRESSING INFORMALITY IN SMART CITY PLANNING**: PROVIDE ACCESSIBLE TRANSPORT OPTIONS WITH AFFORDABLE HOUSING AND CITIZEN ENGAGEMENT.

THE ROLE OF METRO RAIL IN SMART CITIES:

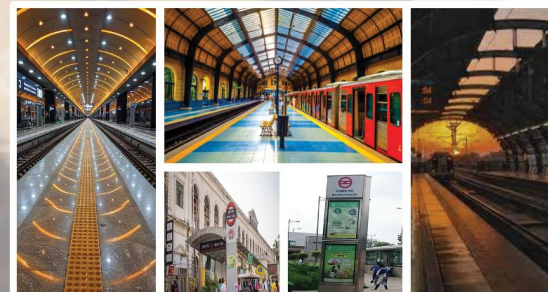
METRO RAIL INTEGRATION INTO SMART CITY FRAMEWORKS ENHANCES URBAN EFFICIENCY, SUSTAINABILITY, AND LIVABILITY (BHATT & ROYCHOUDHURY, 2024). FOUR KEY ASPECTS ARE: **INTEGRATION WITH SMART TECHNOLOGIES**: SMART CARDS AND ENERGY-EFFICIENT INFRASTRUCTURE; **DATA-DRIVEN PLANNING**: USING DATA ANALYTICS TO IMPROVE METRO SERVICES AND URBAN PLANNING; **SUSTAINABLE URBAN DEVELOPMENT**: REDUCING PRIVATE VEHICLES AND PROMOTING EFFICIENT LAND USE; **ADDRESSING URBAN CHALLENGES**: CONGESTION, AIR POLLUTION, AND INADEQUATE PUBLIC TRANSPORTATION.

PARAMETERS OF ANALYSIS:

THIS ANALYSIS EVALUATES THE IMPACT OF METRO RAIL SYSTEMS ON URBAN QUALITY AND IMAGE, FOCUSING ON FIVE KEY PARAMETERS: **PHYSICAL TRANSFORMATIONS**: APPEARANCE, LANDSCAPE, AND CLEANLINESS (FERBRACHE & KNOWLES, 2017); **CULTURAL IDENTITY AND SENSE OF PRIDE**: LOCAL ART AND ARCHITECTURE; **SOCIAL INCLUSION OR EXCLUSION**: ENSURING EQUITABLE ACCESS TO METRO RAIL SERVICES; **ENVIRONMENTAL QUALITY**: REDUCING GREENHOUSE GAS EMISSIONS; **EASE OF ACCESSIBILITY**: INTEGRATING WITH OTHER PUBLIC TRANSPORTATION MODES.

SOCIOCULTURAL APPROACH FOR ANALYSIS:

THIS STUDY USES A SOCIOCULTURAL APPROACH TO EXPLORE HOW METRO RAIL SYSTEMS INTERACT WITH CITY BOOSTERISM AND PLACE-MAKING, CONSIDERING SOCIAL, CULTURAL, AND TECHNOLOGICAL FACTORS TO UNDERSTAND THEIR IMPACT ON URBAN RESIDENTS' QUALITY OF LIFE.



Source: DMRC & LMRC

FINDINGS AND IMPLICATIONS:

METRO RAIL SYSTEMS GENERALLY IMPROVE URBAN QUALITY AND IMAGE, BUT EFFECTS VARY. KEY FINDINGS: **POSITIVE IMPACTS**: IMPROVED AIR QUALITY, REDUCED TRAFFIC CONGESTION, AND ENHANCED ECONOMIC OPPORTUNITIES, PARTICULARLY SIGNIFICANT IN SMART CITIES.

CHALLENGES: HIGH CONSTRUCTION COSTS, POTENTIAL SOCIAL EXCLUSION, AND MAINTENANCE NEEDS.

SUCCESSFUL STRATEGIES: INTEGRATING WITH OTHER TRANSPORTATION MODES, SMART TECHNOLOGIES, AND ADOPTING INCLUSIVE URBAN PLANNING PRACTICES.

CONCLUSION:

METRO RAIL SYSTEMS CAN TRANSFORM CITIES THROUGH PLACE-MAKING, BOOSTERISM, SMART INTEGRATION, AND SUSTAINABILITY. TO SUCCEED, THEY REQUIRE: TECHNOLOGICAL INNOVATION; INCLUSIVITY; SUSTAINABLE PRACTICES; CAREFUL PLANNING AND EQUITABLE DECISION-MAKING. THIS STUDY PROVIDES INSIGHTS FOR POLICYMAKERS TO CREATE SMART, SUSTAINABLE CITIES THROUGH A COMPREHENSIVE APPROACH.

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A7 – Alexandre Santos Serra

A8 – Chinmoyee Deka

From Smart City Goals to Edge City Realities: Challenges and Opportunities for Guwahati's Urban Development

Chinmoyee Deka¹, Abhinandan Saikia²

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INTRODUCTION

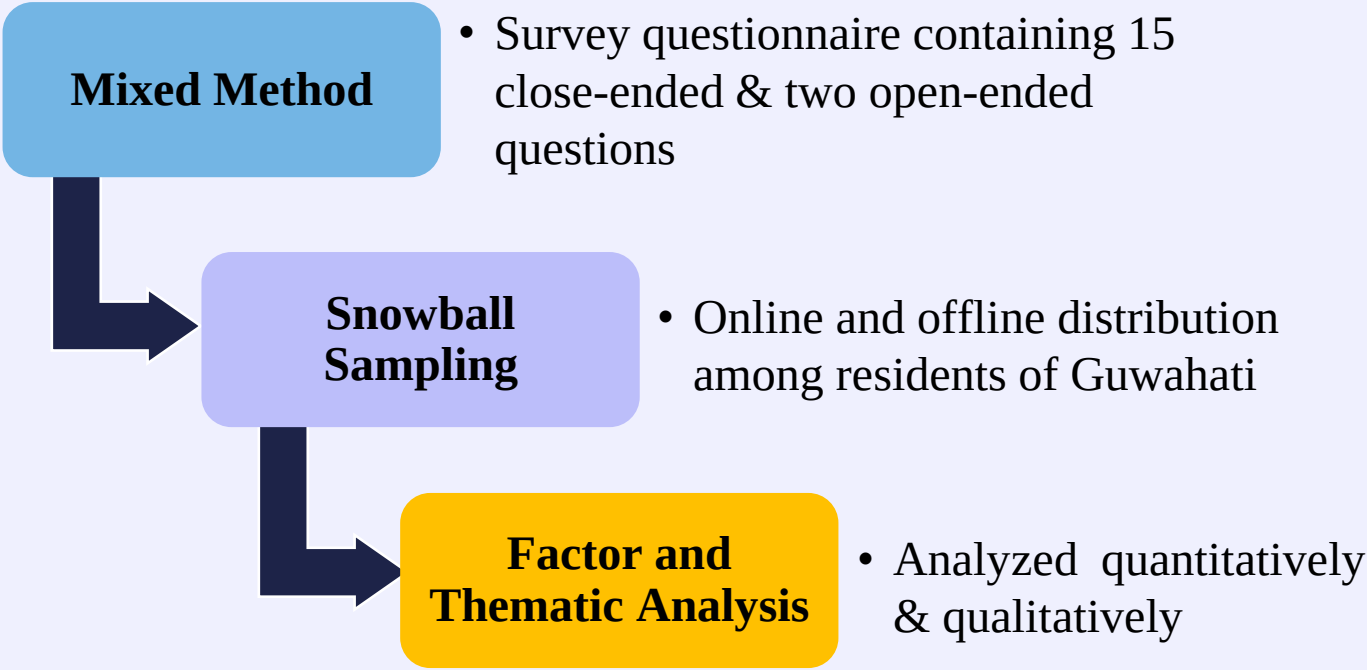
The study aims to:

- Assess public understanding of the "smart city" concept in Guwahati.
- Examine perceptions of ongoing initiatives, focusing on sustainability and socio-economic equity.
- Identify resident challenges and expectations from the smart city project.

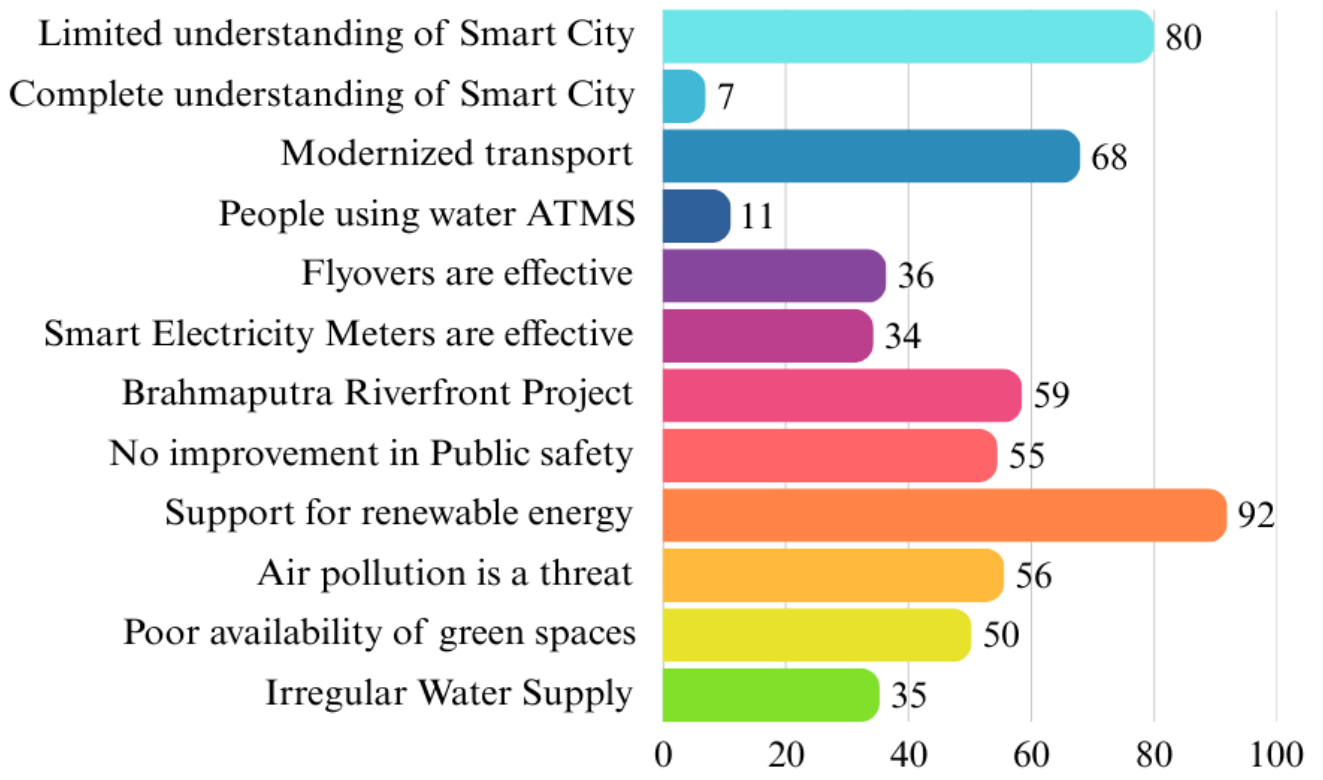
THEORETICAL CRITIQUE

- Over-emphasis on technology, neglecting cultural, political, and governance aspects¹.
- Capitalist urbanization prioritizes profit & market monopoly over infrastructure².
- Private sector dominance (e.g., IBM) raises concerns³.
- Not truly inclusive, but a 'spatial fix'⁴.
- Smart cities reinforce capitalism, deepening inequality and limiting democratic control.

METHODOLOGY



RESULTS*



Awareness & Understanding

- Seen mainly as tech-driven; limited awareness of social, ecological, and governance aspects.
- Needs education & awareness on broader smart city goals.

Urban Infrastructure & Services

- Clean public spaces, better waste management, efficient traffic management, pedestrian & cycling-friendly roads, and improved public transport are expected.

Environmental Sustainability

- Carbon reduction, resource conservation, climate resilience, and a green economy were major concerns.

Social Inclusion & Public Safety

- Emphasis on reducing digital divide, disability-friendly infrastructure, public safety, healthcare, air quality, and mental health support.

DISCUSSION

- Urban development in Guwahati is led by public-private partnerships, not community needs (Lefebvre, 1991), resulting in edge city-like issues (Garreau, 1991): congestion, poor public transport, lack of green spaces, and declining social identity.
- Rapid urbanization has resulted in loss of ecosystem services, causing loss of public health (Parkes et al, 2013). Rising air pollution in Guwahati has led to 20% increase in respiratory diseases (Kalita, 2024). Poor public health weakens economy and productivity, contradicting Smart City goals.
- However, residents value sustainability & social progress despite limited Smart City awareness. Thus, participatory planning and implementation can create equitable, livable, and truly smart urban spaces. A smart city must avoid becoming an edge city by balancing development with inclusivity & sustainability.

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A10 – G.M.A. Balayet Hossain

Water and Sustainable Development: Connecting the Communities of Dhaka City and Canals

Abstract

Water plays a pivotal role in fostering sustainable urban development, particularly in rapidly growing cities like Dhaka. Dhaka’s intricate network of canals historically served as natural drainage, transportation, and community interaction hubs. However, rapid urbanization, poor water management, and encroachment have led to severe degradation of these waterways, contributing to urban flooding, water pollution, and environmental health issues. This study explores the potential of Dhaka’s canals as a foundation for sustainable urban water management, aiming to revitalize these networks and enhance community resilience. Through case studies and spatial assessments, we investigate the role of these canals in supporting local ecosystems and the livelihoods of vulnerable communities. Findings indicate that integrating canal rehabilitation with community-driven approaches can yield multifaceted benefits: reducing flood risks, improving water quality, and fostering green, accessible urban spaces. This research proposes a spatial framework encompassing canal restoration, sustainable drainage systems, and active public places, highlighting the importance of connecting water with local communities. Such an approach aligns with Sustainable Development Goals 6 (Clean Water and Sanitation) and 11 (Sustainable Cities and Communities), offering a replicable model for water-centered urban renewal in similar megacities.

Rampura Canal



How can we effectively connect the gated communities of Banasree and Aftabnagar to the nearby waterfront?

Kallyanpur Canal



Map of the Kallyanpur Canal and its surrounding area.

Unplanned development (Slum)

Water logging is disrupting everyday life.

DND Khal (Canal)



A boundary wall approximately 7.2 kilometers long separates the canal from the surrounding communities.

Rupnagar Khal (Canal)



Rupnagar has an inadequate drainage system. Most drains are blocked with waste.

Importance of Canals

- Canals offer many benefits and services to the city, such as drinking water, food supply, transportation, recreational activities, wildlife habitats, aesthetic appeal, and economic growth.
- Creating green spaces with interactive areas and activities can provide opportunities for stormwater absorption, alternative transportation, and educational features.
- Restored canals have the potential to connect nearby communities, fostering a sustainable future for ecosystems while supporting economic and cultural development.

A11 – Manta Devi Nowbuth



Combined use of Morphometric Analysis and Hydraulic Modelling to support the building of Flood Resilient Cities (Case study: Quatre Bornes catchment, Mauritius)

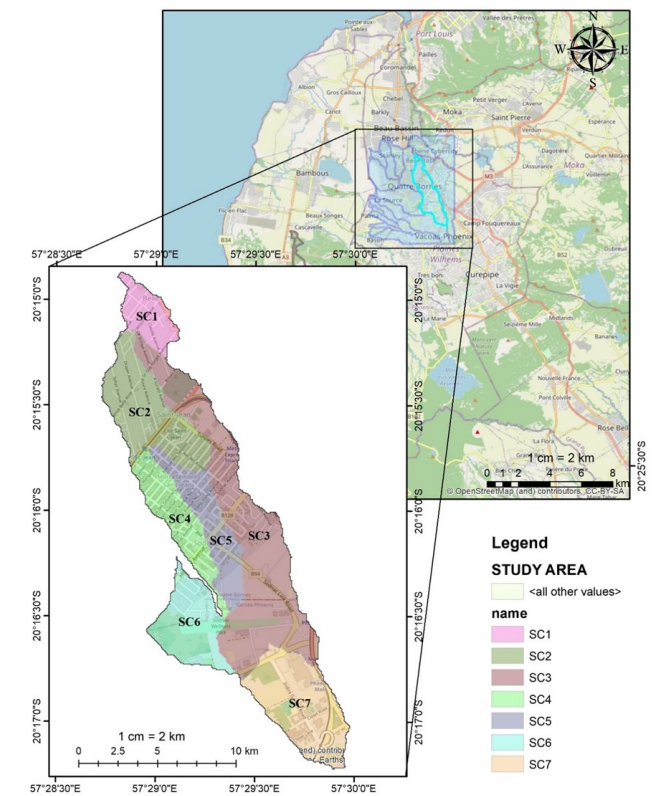
Vydeelingum Seeveeren & Nowbuth Manta Devi
University of Mauritius

Aims & Objectives

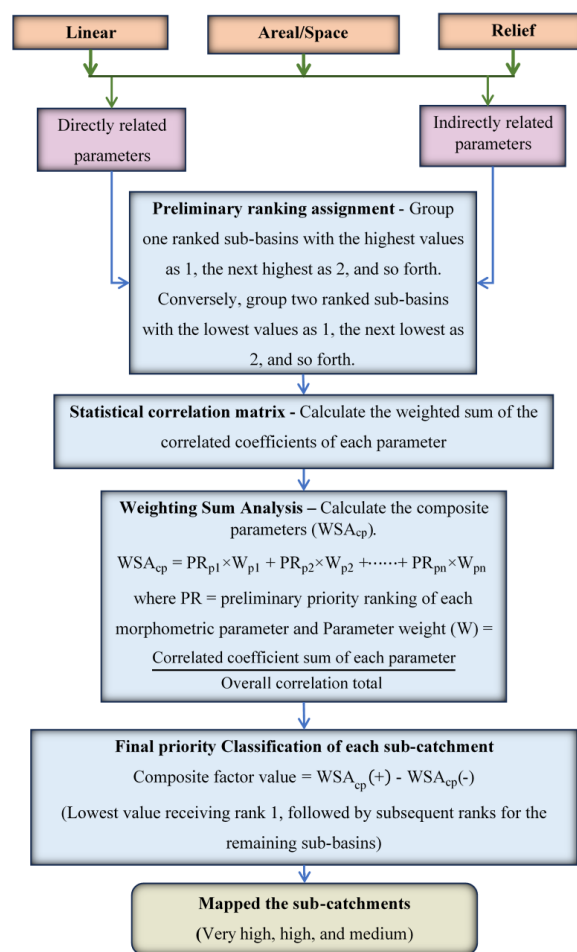
This study aimed at improving management of flood through an improved understanding of the vulnerability of a site to flood.

The specific objectives were:

1. To assess the physical vulnerability of the study area to flood using morphometric analysis.
2. To map flood prone areas using a hydraulic model.
3. To identify the most efficient nature based solutions for building urban resilience to flood events.

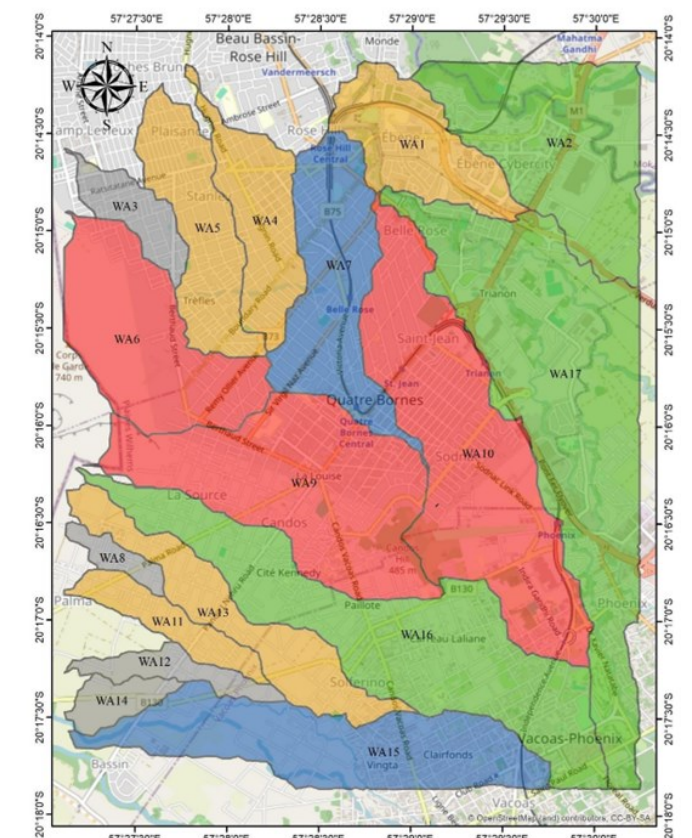


THE PROCESS BEHIND THE MORPHOMETRIC ANALYSIS AT CATCHMENT LEVEL



Subwatersheds	WSAcp(+)	WSAcp(-)	Priority	Priority level	Priority Type
1	11.59289	0.93368	10.65921	12	Low
2	3.98151	-1.3224	5.30391	5	High
3	14.81737	2.48092	12.33645	15	Resilient
4	10.96389	1.42148	9.54241	10	Low
5	11.31765	0.54496	10.77269	13	Low
6	0.20713	-0.68216	0.88929	1	Very high
7	6.79977	-0.11052	6.91029	7	Medium
8	17.90762	3.18976	14.71786	17	Resilient
9	2.01724	-1.391	3.40824	3	Very high
10	0.61117	-2.03124	2.64241	2	Very high
11	12.00909	2.1608	9.84829	11	Low
12	16.83496	2.54952	14.28544	16	Resilient
13	10.33735	0.94892	9.38843	9	Low
14	13.91938	2.61812	11.30126	14	Resilient
15	7.16778	-0.45732	7.6251	8	Medium
16	3.46443	-1.71112	5.17555	4	High
17	2.63701	-2.72864	5.36565	6	High

Key	
Very high	0 to 5
High	5 to 6
Medium	6 to 8
Low	9 to 11
resilient	11 to 15



THE HYDRAULIC MODEL

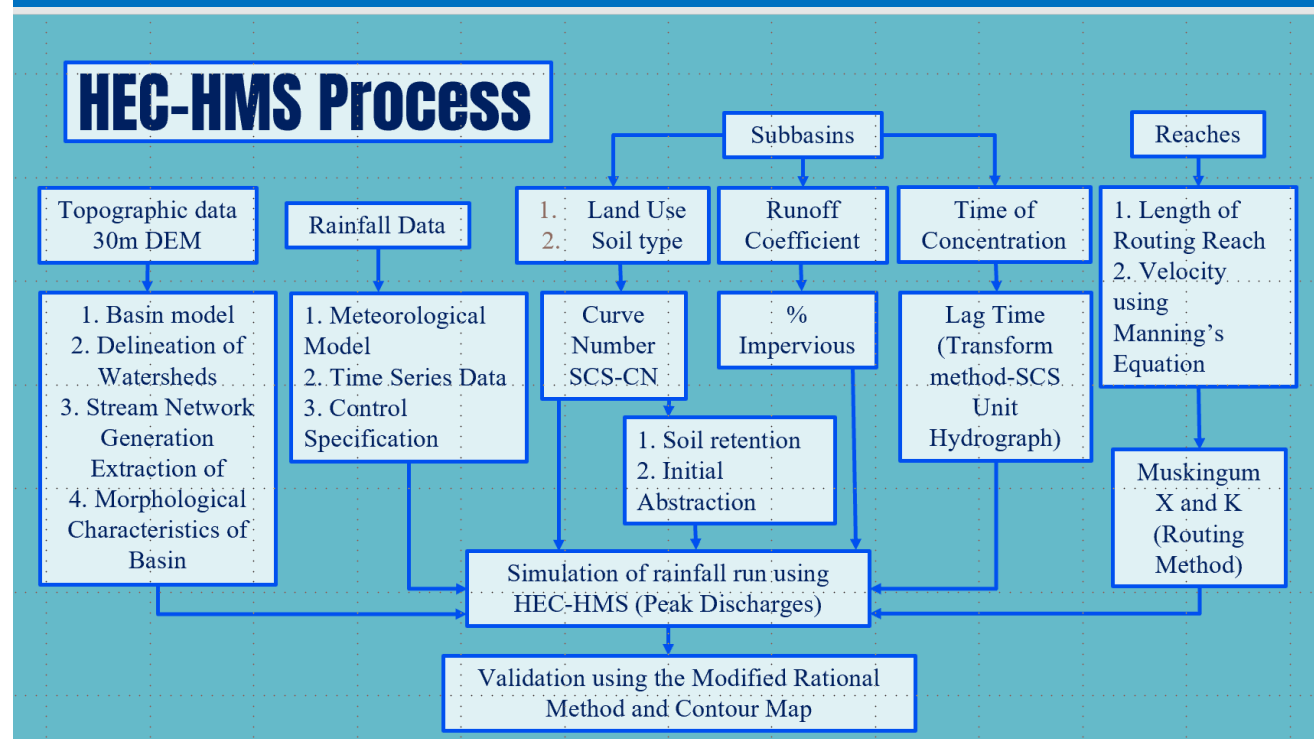
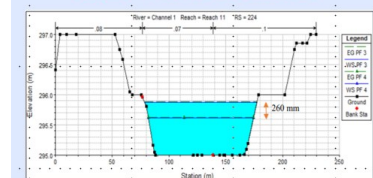


Figure 3: Plan View Simulation Results for Channel 1



Figure 4: Cross-Section 224

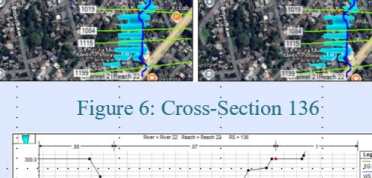


Hydraulic Model Predictions - HEC RAS

Figure 5: Plan View Simulation Results for Channel 2



Figure 6: Cross-Section 136

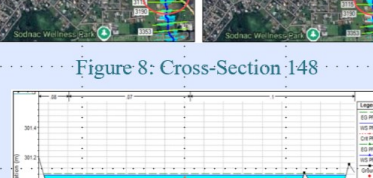


Hydraulic Model Predictions - HEC RAS

Figure 7: Plan View Simulation Results for Channel 3



Figure 8: Cross-Section 148



Hydraulic Model Predictions - HEC RAS

PROPOSED FLOOD MANAGEMENT SOLUTIONS FOR MAKING CITIES FLOOD RESILIENT

Recommendations for Urban Resilience to flood

1. Drains are very important for flood management, but drains are part of the solution.
2. Slope of drains to be steeper at flood prone areas
3. Carrying capacity downstream flood prone areas to be larger.
4. Drains are to be accompanied by Sustainable Urban Drainage Systems—these slow down the surface runoff allowing drains to continue operating at design capacity during heavy storms.
5. Green roofs at residential level combined with wet gardens at subcatchment levels offer the best solutions to water retention & retardation of surface runoff towards drains.



Channel	Runoff without LIDs (mm)	Scenario 1 Runoff using Green Roof (mm)	Scenario 2 Runoff using Rain Barrel (mm)	Scenario 3 Runoff using Infiltration Trench (mm)	Scenario 4 Runoff using Rain Garden (mm)	Scenario 5 Runoff with all LIDs (mm)
Reach 1	42.20	34.11	35.72	35.66	25.27	8.82
Reach 2	53.33	39.49	45.09	44.75	35.82	14.79
Reach 3	30.08	24.52	24.84	24.83	16.72	4.90
Total	125.61	98.12	105.65	105.24	77.81	28.51
Effectiveness (%)		21.89	15.89	16.22	38.05	77.30

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Email: mnowbuth@uom.ac.mu

A12 – Sachin Wijayasinghe

Smart cities beyond technology: reimagining quality of life through citizen-centric approaches

Sachin Wijayasinghe, Vilani Sachithra
Department of Commerce, University of Sri Jayewardenepura

Technology is advancing in an explosive rate, and urbanization is accelerating in Sri Lanka leading to many significant urban challenges urging to explore citizen-centric smart city initiatives to enhance quality of life. This research highlights limitations of pure techno-centric solutions while emphasizing the importance of smart education, constructive feedback mechanisms and developing inclusive policies which can facilitate smooth transitions of sustainable smart cities in South Asia.

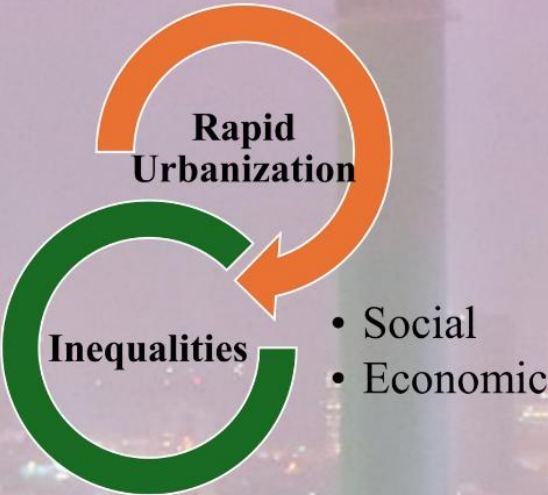
1 Introduction



rate of urbanization in Sri Lanka 2023



rate of urbanization in South Asia 2023

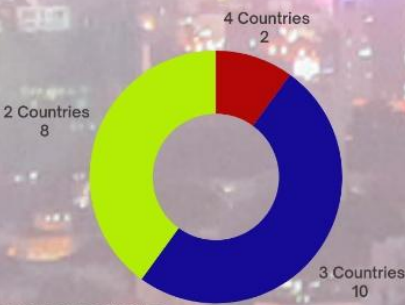


2 Objective

To explore how citizen-centric smart city initiatives improve quality of life while understanding the citizens' perceptions regarding such initiatives.

3 Methodology

Qualitative Approach
Snowballing



100 Towns Improvement Programme

4 Results

Significant areas to focus on in future implementations of citizen-centric approaches of Smart City		
Areas to focus on in the Future	Key Urban Challenge	Perception
Smart Education - Creating awareness - Change Mindset - Role of media	Bleak Atmosphere - Safety issues - Urban Crimes - Social inequalities - Rise of poverty	Smart Living and Smart People - Technologically advanced - More of individualistic
		Smart Culture - Inclusiveness
		Smart Environment - No confidence
Strong Feedback System - Governance - Culture - Law and Transparency	Time Management - Traffic Congestion and Transport Issues - Serviceability issues	Smart Governance - Interconnected - Sustainable solutions - Voice not been heard - Missing transparency and centralized systems
	Well-Being - Mobility uncomfortableness - Energy drained	Smart Culture - Value System - Generic values and eco-friendly
Envisioning - Funding - Infrastructure - Engage external and R&D	Time Management - Planning inefficiencies - Haphazard approaches	Smart Living and Smart People - Mismatch of Consumer patterns
	Well-Being - Pollution	Smart Governance - No strong policy
	Bleak Atmosphere - Global Climatic issues - Improper Waste Management	Smart Environment - Stress-free environment - Tech Savviness

5 Conclusion

- Lack of stakeholder inclusion and poor long-term planning.
- Cultural understanding, community engagement, and policies are crucial.
- Integrating citizen feedback, smart education, and strategic policy frameworks.
- More holistic and participatory approach.

Related literature
Anisetti, M., Ardagna, C., Bellandi, V., Cremonini, M., Frati, F., and Damiani, E. (2018) – "Privacy-aware big data analytics as a service for public health policies in smart cities.
Giffinger, R., & Gudrun, H. (2010). Smart cities ranking: An effective instrument for the positioning of the cities? ACE: Architecture, City and Environment, 4(12), 7-26. <https://doi.org/10.5821/ace.v4i12.2483>

A13 – Zhardei Alyson Naranjo

Integrating Smart Technology to Enhance Place Attachment on Pocket Parks of Dasmariñas City

Zhardei Alyson V. Naranjo

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zavnaranjo@mapua.edu.ph

INTRODUCTION

This study is significant in guiding future researchers and designers in devising a smart sustainable framework for pocket park maintenance by examining the environmental, psychological, and social factors that foster place attachment despite park conditions.

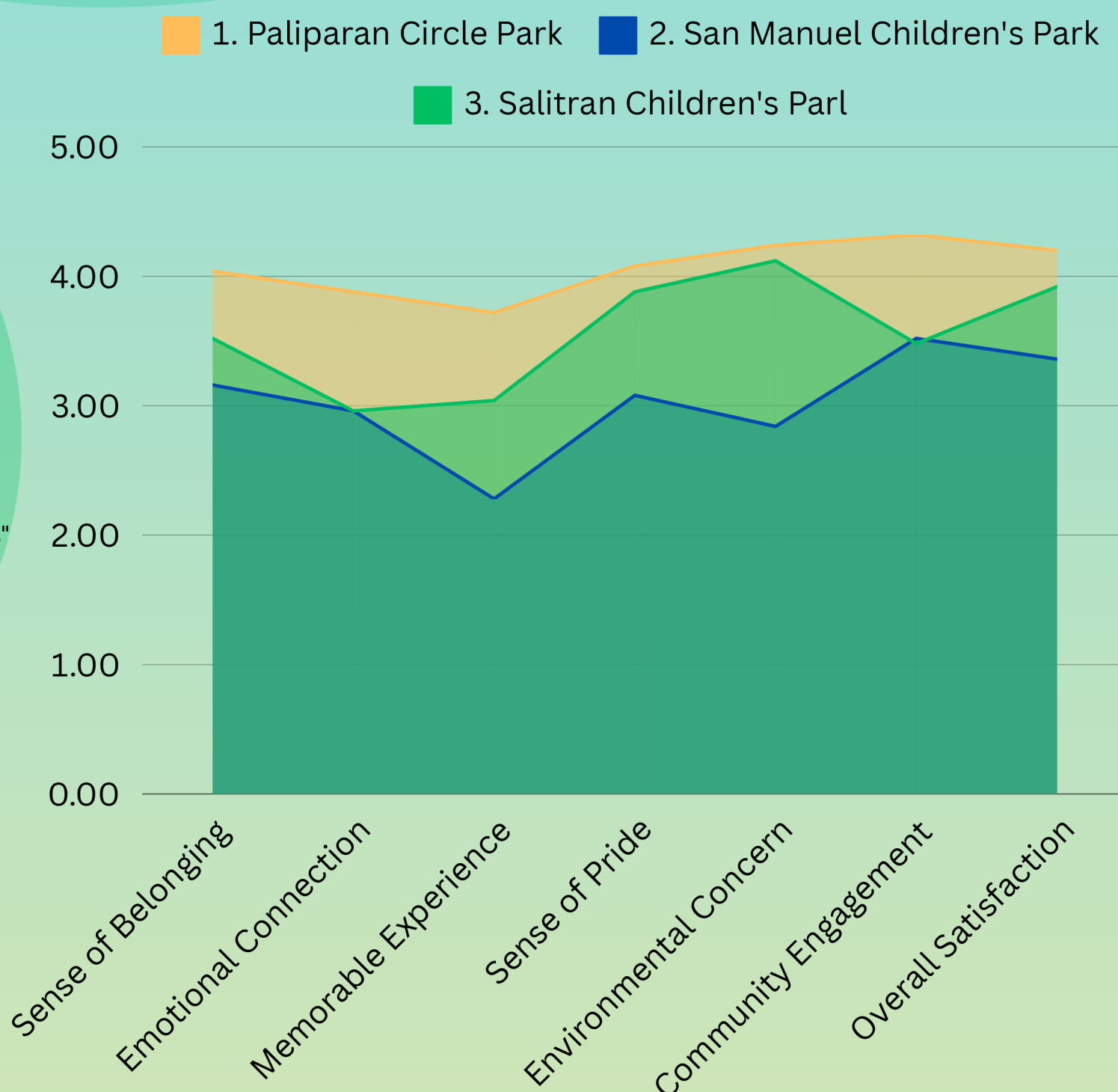
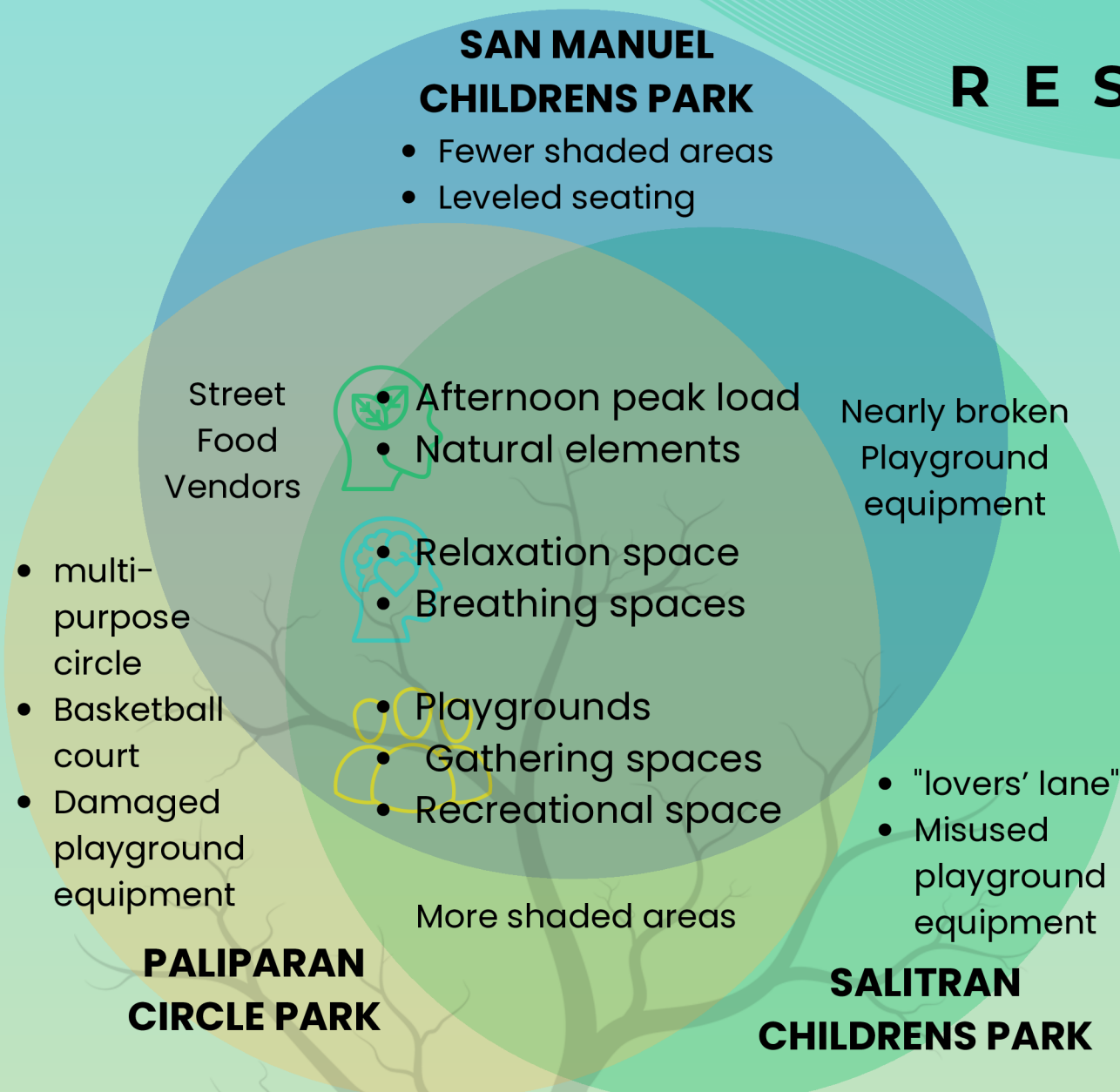
METHODOLOGY

The study is a convergent mixed-method process. Direct and naturalistic observations Quantitative 5-point Likert scale survey

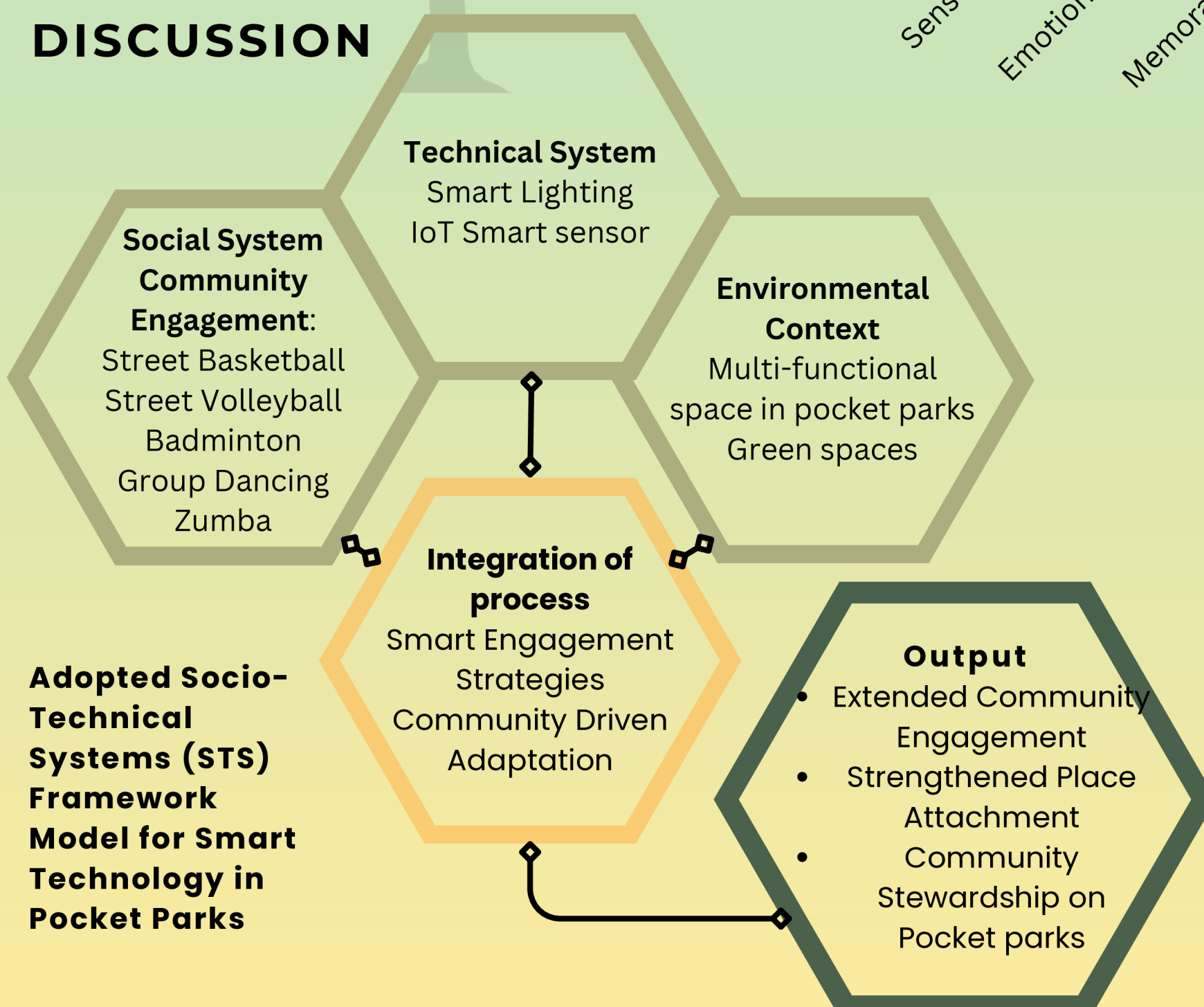
The three pocket parks are:

- Paliparan Circle Park
- San Manuel Children's Park
- Salitran Children's Park.

R E S U L T S



DISCUSSION



CONCLUSION

Findings show that pocket parks foster socialization across age groups, with place attachment driven by activities rather than physical condition.

Thus, the STS framework integrates social, technical, and environmental factors to leverage smart technology, extending community engagement and enhancing place attachment in pocket parks.

As emotional connections deepen, users develop a sense of ownership, leading to active participation in maintenance, and sustainability efforts. Smart features engagement encourages community stewardship to sustain the pocket parks.

A14 – Hussaen Kahachi

Future Cities Defined

A Multidisciplinary Analysis of Their Definitions and Characteristics Across Diverse Fields

Hussaen A. H. Kahachi ^a & ^b, Maria Abreu ^b, Mufeed Ehsan ^a

A14 ^a University of Technology, Baghdad, 10066, Iraq | ^b University of Cambridge, Cambridge, CB3 9EP, UK

Corresponding Email Addresses: ^{*}hahk2@cam.ac.uk, ^{*}Hussaen.a.hasan@uotechnology.edu.iq

Background

Problem:

Urban development faces challenges (urbanization, inequality). Different fields have varying understandings of "future cities."

Research Question:

How can we create a unified, multidisciplinary definition of future cities?

Significance:

A unified definition is vital for policymakers and unified efforts towards sustainable development.

Methodology

Hybrid Systematic-Narrative Review

- Systematic Analysis:** Scopus database: over 22K (2010–2024) Scopus-indexed articles identified and keyword clustered using NLP.
- Narrative Review:** 78 key articles were reviewed across 8 disciplines.
- Focus Groups:** 23 experts validated findings and helped synthesizing the definition.

Key Findings

Future Cities share common key characteristics of across fields, this includes:

- **Sustainability**
- **Advanced Technology**
- **Innovative Design**
- **Well-being of Residents**
- **Economic Prosperity**
- **Social Equity, and**
- **Resilience.**

However, the opinions divided around:

- **Infrastructure and resource management vs urban image and well-being Advanced Technology**
- **Operational efficiency vs. Human needs**
- **Environmental impact vs. Sustainability, and**
- **Technological focus vs. social focus.**

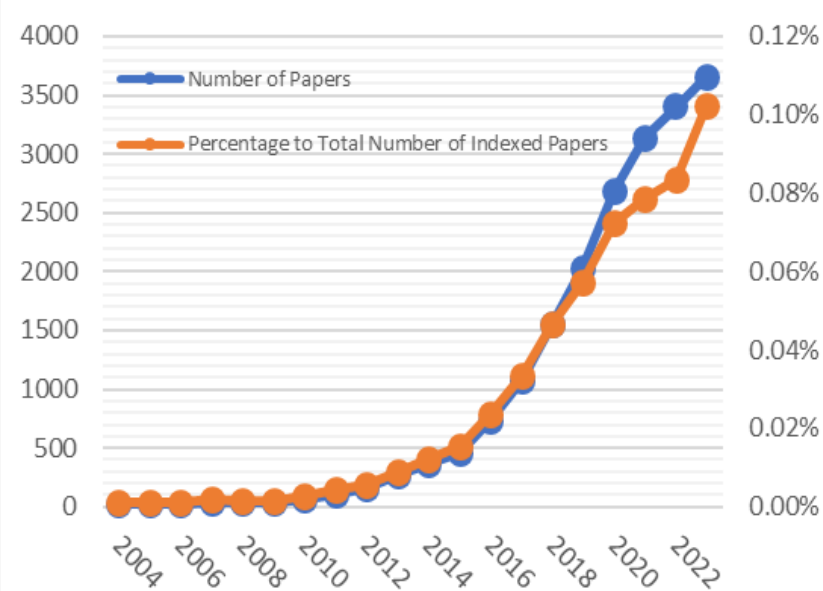
Conclusions

This research highlights key disciplines essential to future city development. Integrating diverse perspectives is crucial to addressing urban challenges and shaping sustainable, resilient, and thriving cities.

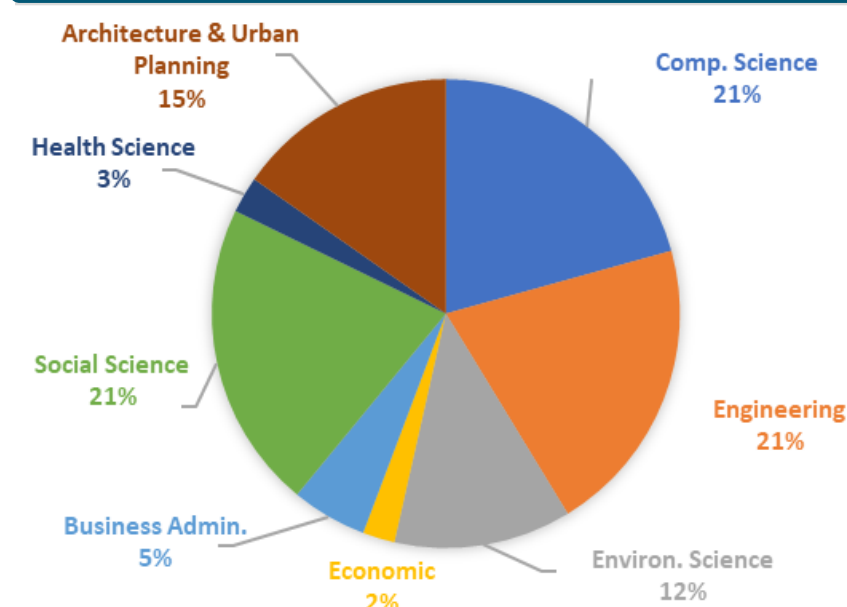
For more details,
Scan the QR code!



Future Cities Research Growth



Future Cities in the Literature



The Concept of Future Cities According to Field of Research



A Unified Definition

A **Future City** is a vision of urban development that prioritizes **sustainability, advanced technology, and the well-being of its residents**. To achieve these goals, it integrates **cutting-edge technologies, innovative design, and sustainable practices** to create a **more efficient, liveable, inclusive, and environmentally friendly urban environment**. They address the complex challenges of rapid urbanization, climate change, and the increasing demand for resources, providing comprehensive solutions for a sustainable and prosperous urban future.

B1 – Sachin Wijayasinghe

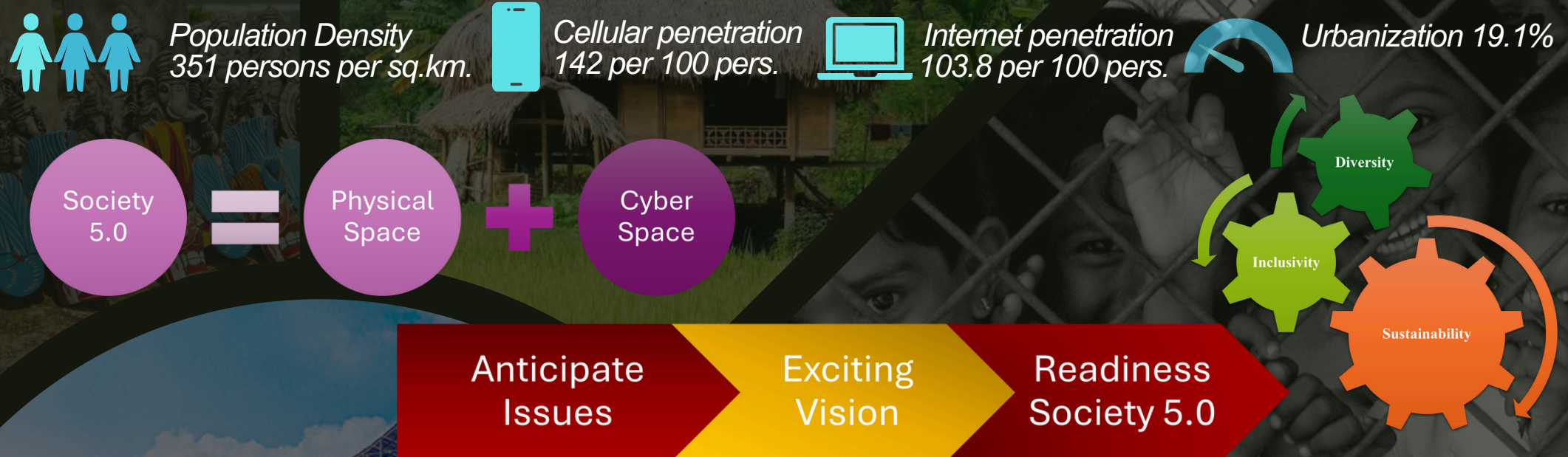
Empowering citizen-centric smart cities: pathways to next-generation cities in emerging economies

Sachin Wijayasinghe, Amesh Pathirana, Ravindu Kulawardena
University of Sri Jayewardenepura

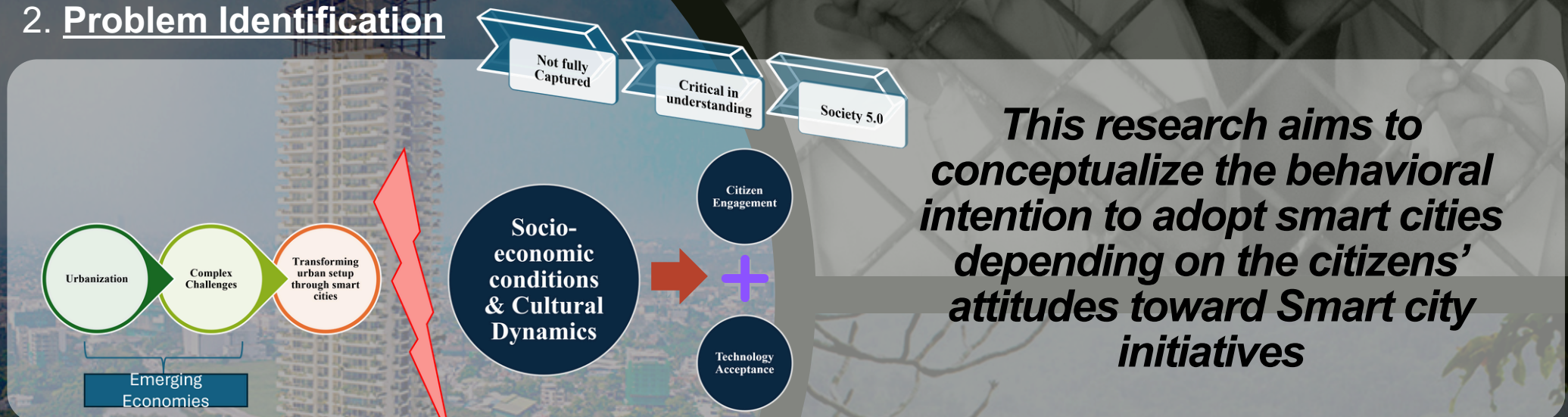


1. Introduction

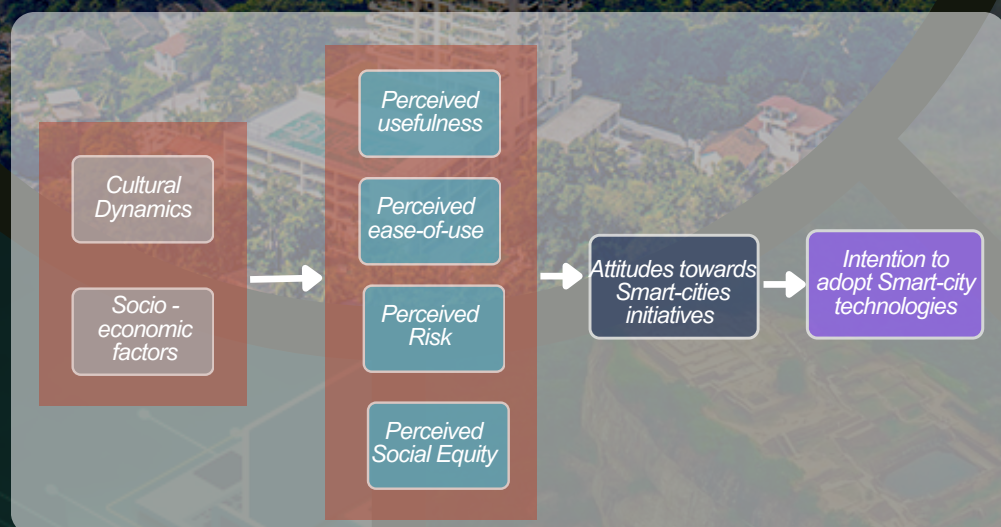
Sri Lanka is an emerging nation with strategic economic growth, transitioning to upper-middle-income status in 2019, and implementing key reforms to achieve sustainable development and stability. Sri Lanka has its deep religious significance, rich cultural heritage, and stunning natural history, reflecting its enduring legacy and contribution to socio-economic growth. Sri Lankans have demonstrated remarkable engineering and cultural achievements throughout their history, particularly in ancient times.



2. Problem Identification



3. Conceptual framework



4. Methodology

Research Philosophy - Positivism

Research Approach - Deductive

Research Strategy - Survey (Structured Questionnaire)

Time Horizon - Cross sectional (Urban citizens)

5. Practical and Theoretical Implications

- Foster proactive initiatives in driving communities toward the **vision of Society 5.0** by integrating human-centric technological advancements.
- Develop an **understanding of socio-economic and cultural diversities** among citizens to ensure inclusive and adaptive policymaking.
- Champion **government-led, inclusive, and agile community care models** that leverage Smart City technologies for sustainable urban development.
- Encourage **attitudinal shifts** in urban communities to embrace digital transformation and smart infrastructure.

Theories of Future Cities for a Sustainable Tomorrow

A Systematic Literature Review

Hussaen A. H. Kahachi ^{*a & b}, Maria Abreu ^b, Mufeed Ehsan ^a

^a University of Technology, Baghdad, 10066, Iraq | ^b University of Cambridge, Cambridge, CB3 9EP, UK

Corresponding Email Addresses: ^{*}hahk2@cam.ac.uk , ^{*}Hussaen.a.hasan@uotechnology.edu.iq

Background

Problem:

Despite the importance of sustainability, only 12-15% of SDGs are on track for 2030. While future cities theories offer an interesting holistic approach towards sustainability, yet their potential is still undetermined, raising concerns about their effectiveness in achieving sustainable urban development.

Research Questions:

- What features make future city theories effective for sustainability?
- How do future cities theories compare in maturity and sustainability applicability?
- What gaps hinder their real-world implementation?

Significance

This study systematically evaluates future city theories, guiding urban planners and policymakers in selecting models that balance environmental, economic, social sustainability.

Methodology

A Systematic Literature Review (SLR) of 27,000+ Scopus-indexed papers from 1990 to 2023 using NLP and statistical analysis to assess 43 future city theories' maturity and sustainability alignment based on criteria like, Comprehensiveness, Consistency, Empirical support, Age and refinement over time, and Sustainability applicability.

Key Findings



Publication Surge (almost ten folds since 2014): Growing focus on future city theories aligns with heightened global interest in sustainable urban development.



Theory Adaptation (40% Shift): Theories like Smart City and Sustainable City lead as adaptable models, often replacing older theories due to limitations.

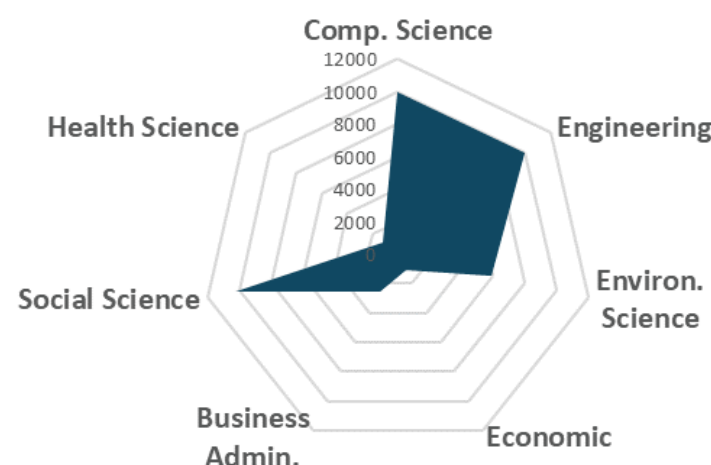


Maturity & Sustainability (~70% SUD Research): Most future cities research discusses sustainability. However, only high-ranking mature theories like Smart, Resilient, and Sustainable Cities show strong alignment with sustainability, though many lack social inclusivity.

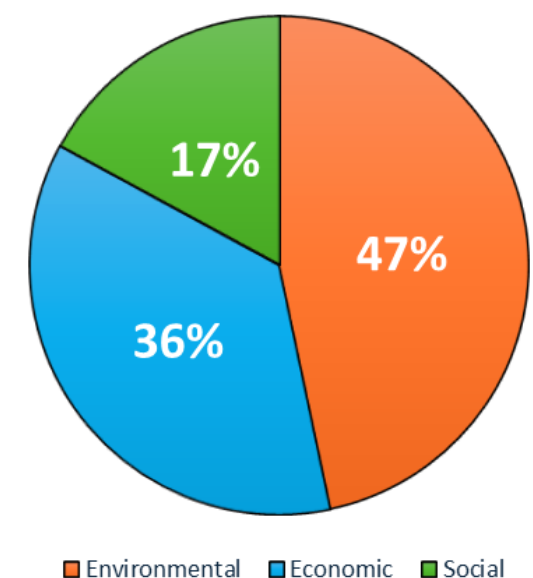


Community Focus: Effective theory implementation requires social equity and community involvement to prevent negative impacts like gentrification.

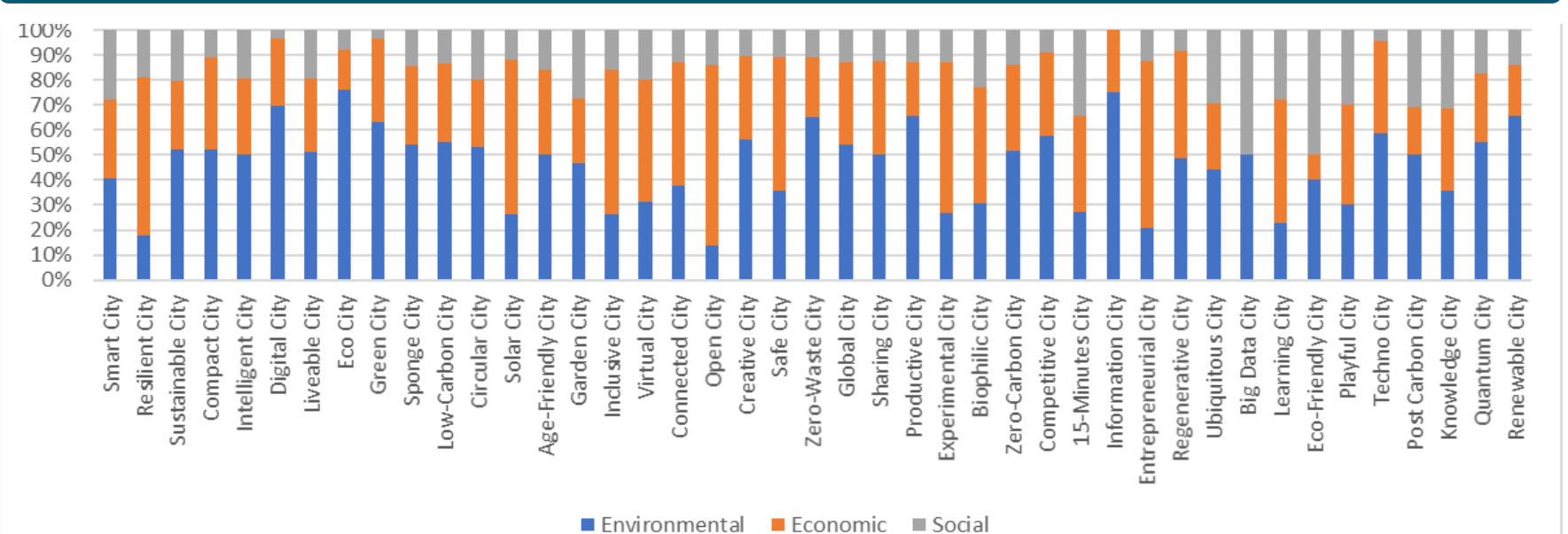
Future Cities Research / Field



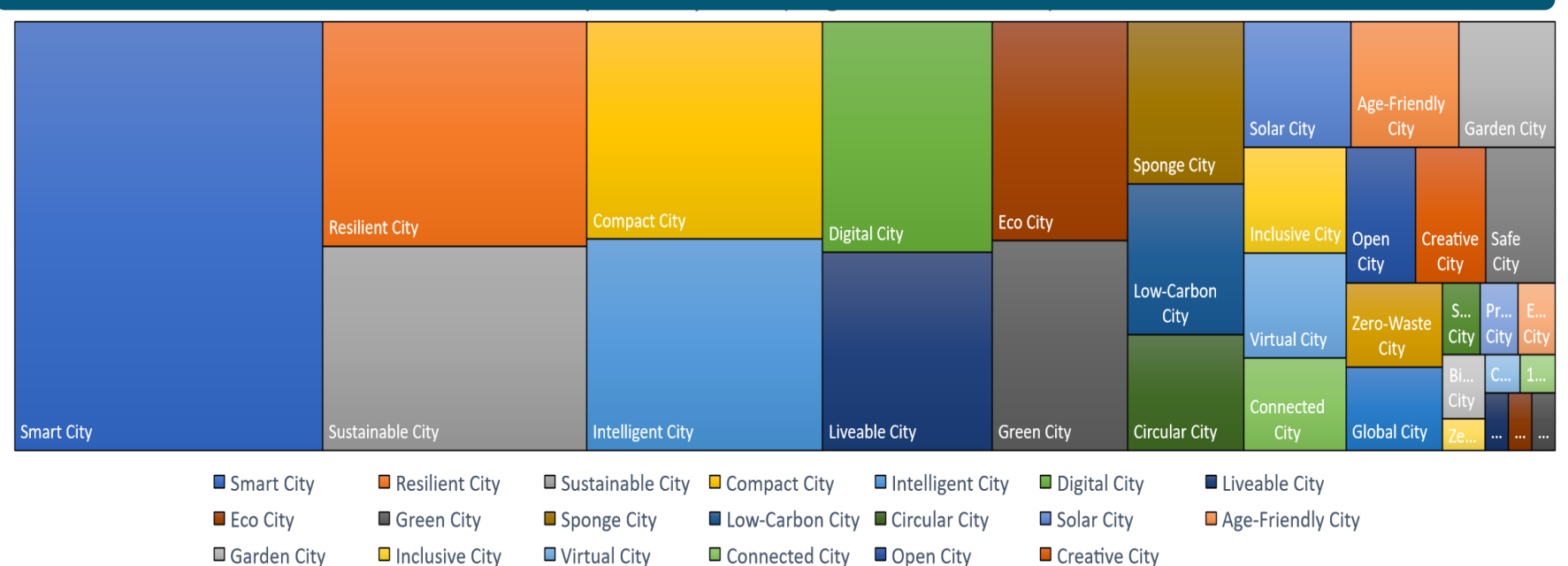
Future Cities / SD Aspect



Sustainable Urban Development Index (Balanced is Better)



Theory Maturity Index (Approx. / Larger = More Mature)



Strategic Approaches: Cities can enhance success by tailoring approaches, collaborating, focusing on equity, phasing implementations, and building local capacity.



Future Research Directions: this includes; Longitudinal Impact Assessments, Cross-Theoretical Integration, Social Equity and Inclusivity, Emerging Technologies and Big Data, and Adaptability to Global Challenges.

As the landscape of urban development evolves, a commitment to continuous development and adaptation is crucial. By prioritizing ongoing research and collaboration, we can pave the way for a better future sustainable city solutions.

For more details,
Scan the QR code!



B3 – Gene Lambert Ramirez Giron

B4 – Leiron Mark De Guzman

B5 – Partha Protim Borthakur

Integrating Traffic Simulation into Urban Planning: A Case Study of Phoolbagan, Dibrugarh

Partha Protim Borthakur¹, Thuleswar Nath², Diganta Hatibaruah²

¹ Mechanical Engineering Department, Dibrugarh University, Dibrugarh, India.

² Mechanical Engineering Department, JEC, Jorhat, India.

INTRODUCTION & AIM

Urban cities are increasingly grappling with traffic congestion due to the surge in vehicle numbers, posing significant challenges for urban planning. To address these challenges effectively, traffic simulation has emerged as an essential tool. This study focuses on a critical three-way traffic intersection in Phoolbagan, Dibrugarh city, Assam, India, and evaluates current traffic conditions, including traffic intensity, vehicle delay, and queue formation, using the advanced traffic simulation software PTV Vissim. Over a period of 30 days, comprehensive data collection was conducted through detailed traffic observation sheets. A simulation model was subsequently developed to analyze current traffic dynamics. The core objective of this research was to assess the potential improvements in traffic parameters through the addition of a new road at the intersection.

METHOD

The traffic data were collected from videos recorded using a drone camera. The collected video data were analyzed to determine vehicle composition, route composition, and the total number of vehicles per hour. These parameters were then used as input for the simulation model. The simulation model was developed using PTV VISSIM software, and it was calibrated for accuracy. The calibration was done by validating the model with real-life data and comparing the results with GEH statistics. Various traffic-related metrics, including queue stop values, were computed using the simulation model. To assess the impact of infrastructure changes, a new road was assumed to be added at the existing intersection. A simulation model was prepared to include this new road, and several parameters were compared. The improvement in queue stop values is presented in Figure 4.

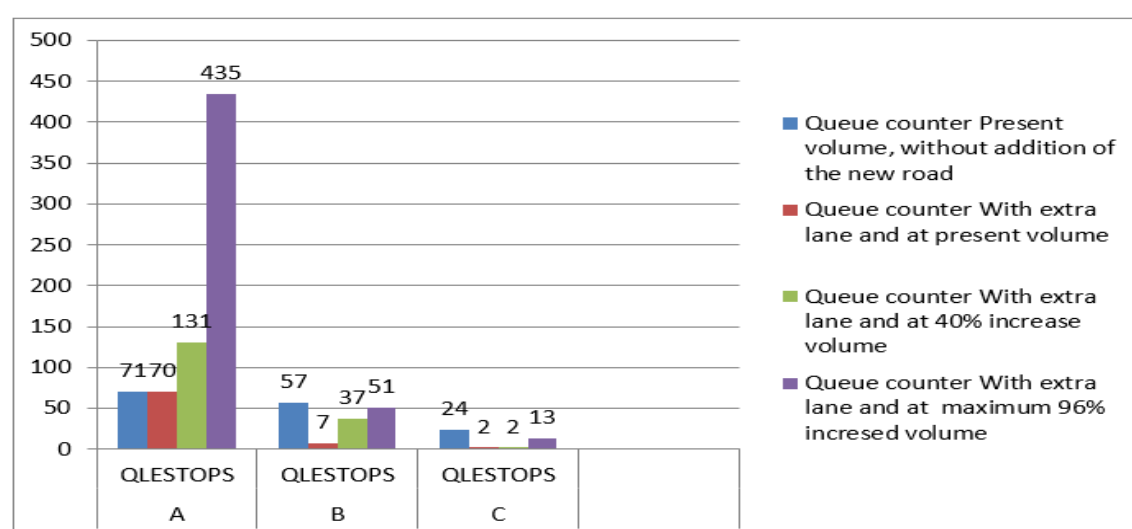


Figure 4: Queue Stop value comparison with addition of new lane.

RESULTS & DISCUSSION

The comparison of queue stop values demonstrates significant improvements in traffic flow with the addition of a new road. At the present volume, adding an extra lane reduces congestion at queue stop B from 57 to 7, at C from 24 to 7, and at A from 71 to 70. Even with a 40% increase in volume, congestion remains manageable, with values of 37 at stop B, 2 at stop C, and 137 at stop A. When the volume increases by 96% and with optimized traffic signal timing, queue stop A reaches 435, but the intersection continues to function without forming endless queues. Stops B and C show only slight increases in congestion, further indicating the effectiveness of the extra lane in managing higher traffic volumes. These results confirm that adding a new lane significantly reduces congestion and enhances the intersection's capacity.

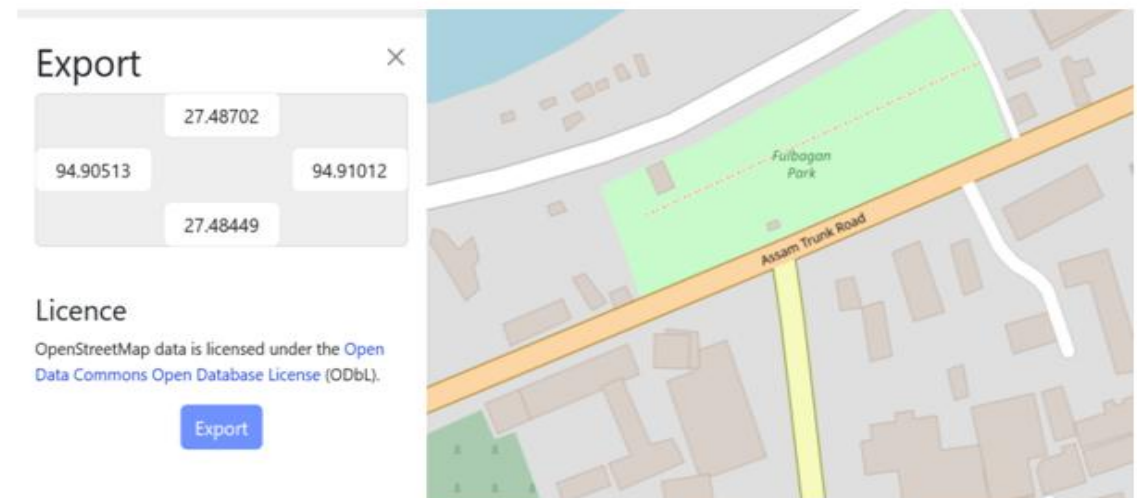


Figure 1: OSM (Open Street Map) of Phoolbagan Intersection



Figure 2: Phoolbagan intersection with Queue counters



Figure 3: Simulation run with addition of a new road

CONCLUSION AND FUTURE SCOPE

The results have shown that the traffic conditions are improved with the addition of a new road. Optimal signal timings are provided by the model, which allows the intersection to operate with the highest efficiency. When the new road is added and the traffic signals are run at optimal timings, it has been demonstrated that the intersection can accommodate an increase in traffic volume by 82%. This indicates that the intersection's capacity is significantly enhanced through the implementation of the new road and the optimization of traffic signal timings. The simulation model developed in this study can be applied to traffic emission and fuel consumption analysis. Additionally, the model can be adapted for use in nearby towns with similar traffic dynamics and conditions, providing valuable insights into traffic management and environmental impact.

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B8 – Fahmida Islam Sinthi

Modular Recycling Hubs: Enhancing Urban Sustainability
in Smart Cities—A Case from DhakaFahmida Islam Sinthi¹, Shahriar Iqbal Raj², Mujtaba Ahsan³, A K M Saleh Ahmed Anik⁴
1,2,3,4 Department of Architecture, North South University, Bangladesh

INTRODUCTION & AIM

Dhaka, one of the most densely populated cities in the country, faces significant challenges in urban waste management and sustainability. Bangladesh is ranked 10th in the world for improper management of plastic garbage, according to a report on the plastic industry by the business consultancy firm Light Castle Partners. According to one of the Interview participants of HBRI, around 90% of the plastic waste and 10-20% of Polythene waste in Dhaka city is recycled (S.I., 2024). A pilot prject taken for this study is at Lalbagh, Showary Ghat to Ali Ghat area along the Buriganga River of Dhaka houses a vital recycling micro-industry that processes materials like metal, plastic, and polythene with quite poor substandard housing for the low income group. Essentially micro-industruies comprise of small enterprises who manufacture goods or services with the help of relatively smaller machines and a few workers (Small Scale Industries: Characteristics, Definition, Examples, 2019). This

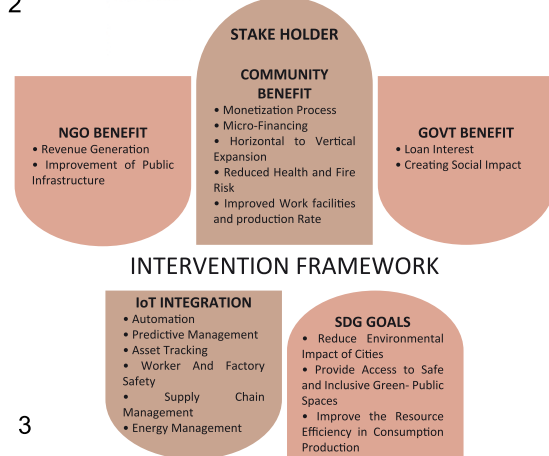


Figure 1. Recycling Hero's Program. Source: World Bank,2023
Figure 3. Site Map. Source: Google Earth,2023

paper aims to explore the impact of modular recycling hubs on urban sustainability in Dhaka, focusing on improved layouts incorporating ventilation, natural lighting, and safety features, creating safer, more efficient spaces. These design elements are further supported by recommendations for future IoT-based integrations in automation, predictive management, asset tracking, worker and factory safety, supply chain management and energy management. The modular design minimizes urban transportation reducing energy consumption. Integrated green spaces within the hubs contribute to Sustainable Development Goal (SDG) 11 by promoting environmental well-being and social inclusion, while enhanced workspaces support SDG 8 through sustainable economic growth. They contribute to environmental sustainability, social equity, and economic resilience by creating jobs, offering affordable recycled materials, and enhancing quality of life. Furthermore, the paper aims to incorporate green space in a densely populated area.



Figure 2. SDG. Source: THE 17 GOALS | Sustainable Development. (n.d.).
Figure 4. Intervention framework. Source: Author,2023

METHOD

The study takes on a pilot project to recycling at the site of Lalbagh, Dhaka. The mixed method research paradigm was conducted to explore the challenges of the site.

1. Site Selection and Context overview: The located site is at Lalbagh, Dhaka along the Showary ghat-Chairman Ghat with a total site area of 26.3 acre. The area falls under Dhaka South City Corporation (DSCC) in Mixed Use Zone (Commercial-Industrial).

2. Data Collection Method: The data were collected through on-site observation, interview with stakeholders and book reviews.

3. Data Analysis

Qualitative Data Analysis: Through Semi-Structured interview with around 3 academics and 43 individuals working with recycling and and local residents were taken.

Quantitative Data Analysis: This includes a number of field surveys for data collection of context, building typologies, activity etc.

RESULTS & DISCUSSION

Zonal Analysis

The pilot site of 26.3 acre contains 473 buildings, out of which 3 major building type include plastic, polythene and steel that is scattered accross the site with an average of one to three storied strcutures. The factories are the individual one-two story Temporary, semi-permanent and permanent structures that has the function of sorting, storing, palletizing, washing and molding of plastic, polythene and steel recycling only.

Traffic Analysis

There is also prominent foot traffic along the ghat until 9-10 pm at night. The primary road is 20', secondary Road ranges from 16'-10', tertiary road at 8' and the minor roads are

mere 5'. There is major issue of waterlogging due to poor drainage and disorganized narrow road connection poses safety risk of fire hazard.

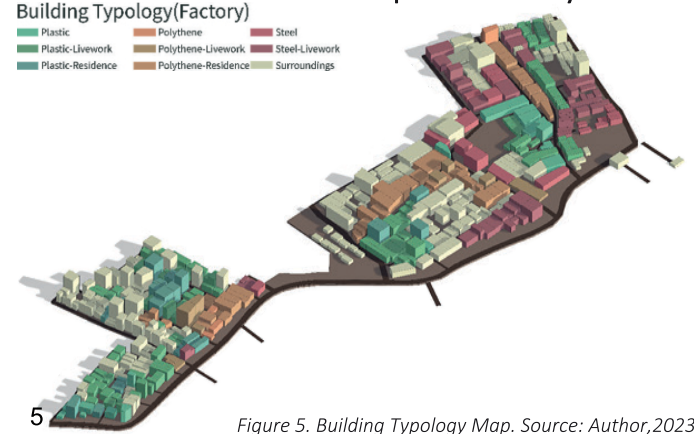


Figure 5. Building Typology Map. Source: Author,2023

1. Modularity

- Bi-furcating System using 2 modules for 3 factories in cluster configuration.

2. Urban Acupuncture

- Urban Regeneration at a local level.
- Highly focused and targeted initiatives help regenerate Recycling Factories (Thus forming Micro Recycling Industry) incrementally deployed urban strategies and to consolidate the social infrastructure.

- Creating buffer spaces and vegetation between the factory and the housings.

3. Phase-Wise development

- Road Network and circulation improvement through wider walkways, cycling track, demolishing of Scattered Recycling Factories.

Plastic & Polythene Recycling Module:

A single module of 1780 sft per floor taken upto 3 floors require **semi-automated** machines like Sorting conveyer belt, Crushing, Paletizing machine for molding with **IoT** application, **Sprinkler System and Air Vent** for air quality control. Also **Solar Panel** on roof bring **Green Energy**. Ensuring **SDG 11.7**.

Steel Recycling - Livework Module:

A single module of 1395 sft per floor taken upto 2 floors require Hudralic Press machine with adequate storage.

Since steel is a light industry,the upper floors contain **living quarters** that are **ergonomic**, **affordable** ensuring better living condition, service areas and gathering space for the workers family. **Rooftop Garden** gives scope of self sufficiency by home grown produce.

Live-Work Module:

A single module of 1270 sft per floor taken upto 3-4 floors. An optimised affordable

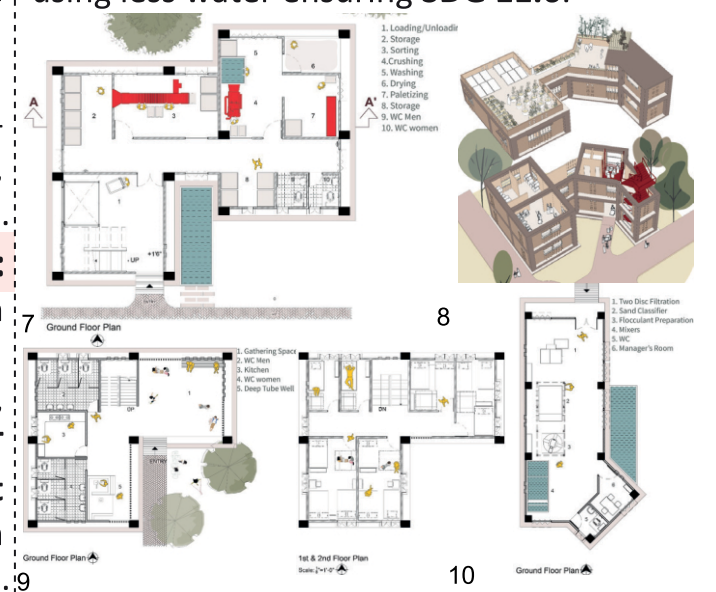


Figure 6. Module Generation. Source: Author,2023

low-cost housing module was devised that can be implemented incrementally , **applicable to other areas** in cluster variation.

Waste-Water Treatment Plant:

A 750 sft 1 storey waste water treatment plant **circulates** the used water from crushed plastic and polythene factories monthly upto a certain point. This results in using less water ensuring **SDG 11.6**.

**Cluster Space:**

Each zone creates relationship between sustainable factory as well as community.

Urban Integration:

The open spaces obtained after conglomeration of the factory and live work areas are utilized into **multipurpose spaces** where the food vendors, hawkers and the morning kacha bazar can function with proper road network work toward accessibility and overall create a **smart city**.

Figure 7. Plastic & Polythene Recycling Module. Source: Author,2024

Figure 8. Steel Recycling Module. Source: Author,2024

Figure 9. Live-Work Module. Source: Author,2024

Figure 10. Waste-Water Treatment Plant. Source: Author,2024

CONCLUSION

The purpose of the study is to explore sustainable approaces to a underutilised sector of small scale industries. By improving quality of life, providing reasonably priced recycled materials, and generating jobs, the local people can avail social justice moving closer to environmental sustainability, and economic resilience. Adopting modular recycling hubs could transform waste management practices, positioning Dhaka as a model for sustainable urban development nationwide. The study is part of the journey to explore the setbacks and opportunity of such approach keeping the community in mind.

FUTURE WORK/REFERENCES

The study helps create a new perspective towards the utilisation of small scale initiatives into making a sustainable and smart interventions and attempt on the SDG Targets.

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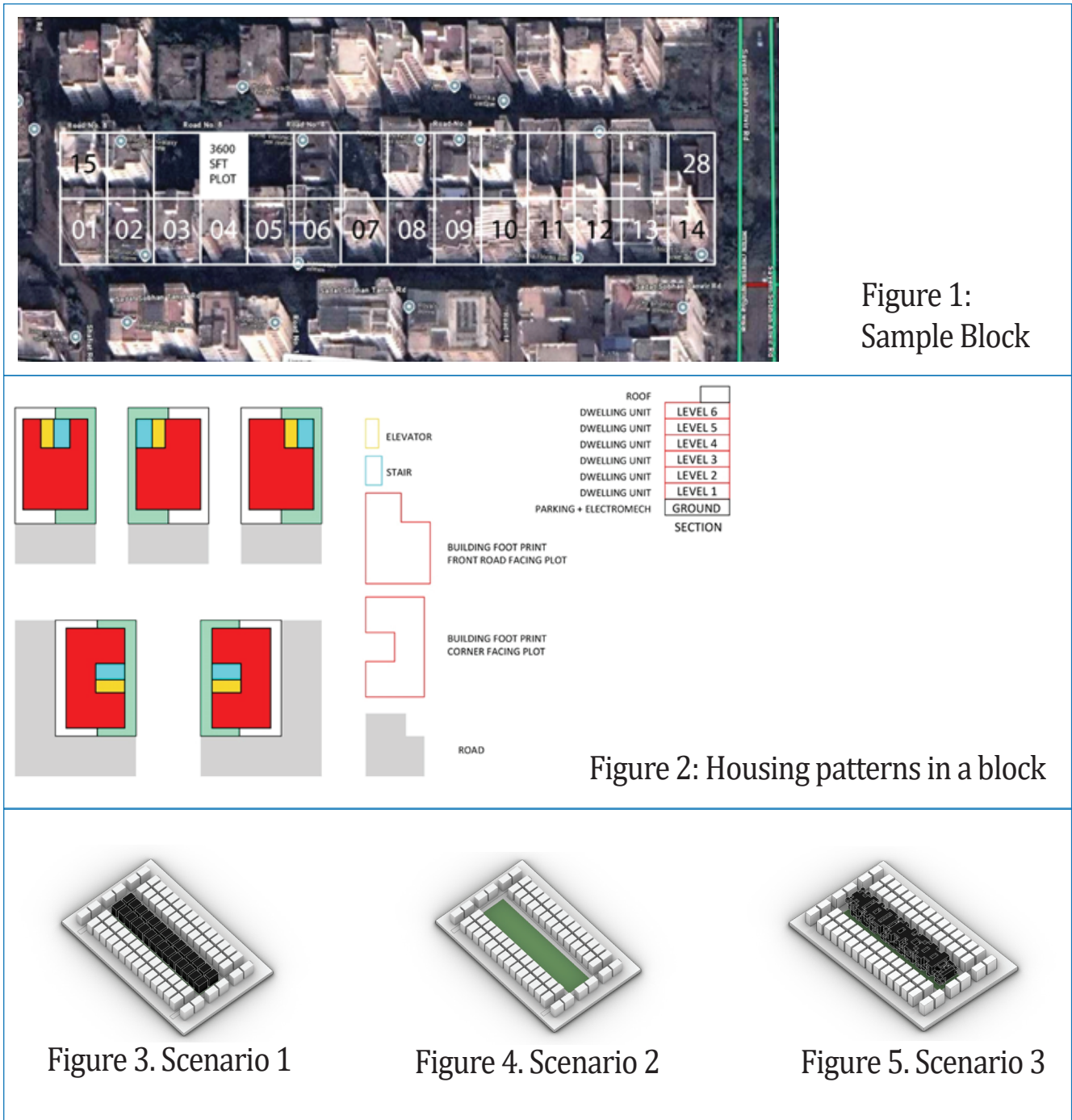
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Introduction & Aim

Block-based housing developments provide multi-functional, community-focused spaces that encourage resident interaction and build stronger social bonds. In contrast to high-density, plot-based development—which has long shaped planned urban land divisions in Bangladesh and often fosters isolation and stress—block layouts integrate shared and green areas more effectively that boost mental health and social connections. They also promote sustainable urban growth by improving walkability, decreasing reliance on cars, and supporting eco-friendly features like energy-efficient designs and green infrastructure. However, drawbacks such as architectural uniformity and social stigma, especially in low-income zones, have sparked demands for more visually appealing and inclusive designs. This study compares pedestrian interaction in an urban block-based housing development as against the traditional plot-based layout on the same site using quantitative analysis.

Methodology

A randomly selected plot-based residential block from the Bashundhara area in the city was chosen for this study. The block is subdivided into 28 housing plots. A simplified analysis of the individual buildings reveals a consistent pattern, as shown in Figure 2. The original plot-based block is depicted in Figure 1. Keeping the number of units the same, the units are reconfigured into urban blocks with three different scenarios of pedestrian access control at the ground level. Using Unreal Engine's AI NPC system, a need-based pedestrian simulation at the ground level was employed to analyze movement patterns across these three scenarios: a current block-based layout, an open field, and a newly designed block with controlled access. Demographics and interests were categorized into the following agents: Adult Males, Adult Females and Children/Young Adults with visitations to Grocery Store 1,2,3, Restaurant 1,2, Toy Shop and Pharmaceutical Store. A simulated population of 100 agents, each with a 120° viewing angle, was implemented to create realistic visual perception and navigation.



Results & Discussion

Scenario 1: In the existing plot-based housing block layout, pedestrian movement is relatively constrained due to the isolated plot-based spatial organization, which separates each plot with boundary walls. The results showed that Grocery Store 1 had 47 visitors, Grocery Store 2 had 97, and Grocery Store 3 had 56. Restaurant 1 received 31 visitors, while Restaurant 2 had 68. The toy shop had 35 visitors, and the pharmaceutical store had 19 visitors.

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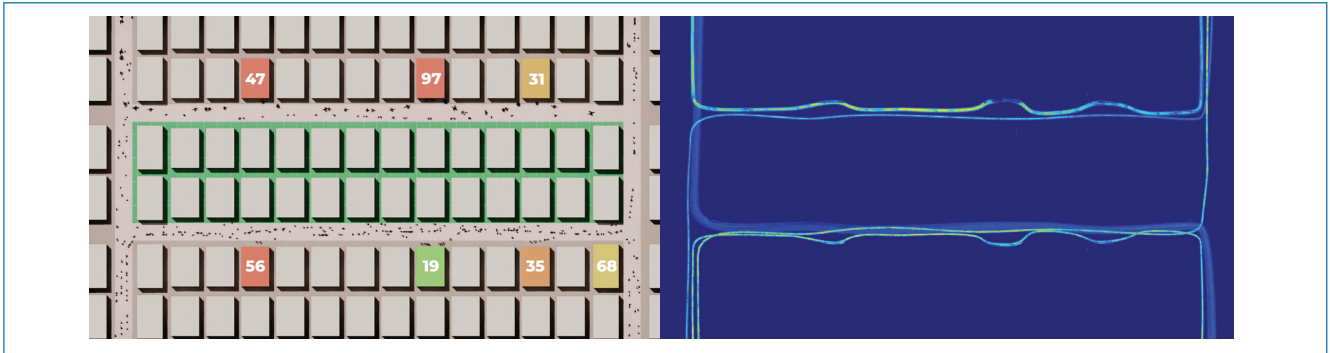


Figure 6: Scenerio 1 restricted access and pedestrian movement heatmap

Scenario 2: Open Field Configuration – With boundary walls removed at ground level, pedestrian flow increased across all amenities due to the absence of spatial barriers. The results were as follows: Grocery Store 1 saw an increase in visitors to 86, Grocery Store 2 experienced a slight decrease to 74, and Grocery Store 3 had a sharp rise to 102. Restaurant 1 received 57 visitors, while Restaurant 2 saw a significant jump to 102. The toy shop attracted 47 visitors, and the pharmaceutical store had 27 visitors. This scenario highlights the impact of a completely barrier-free environment on pedestrian accessibility.

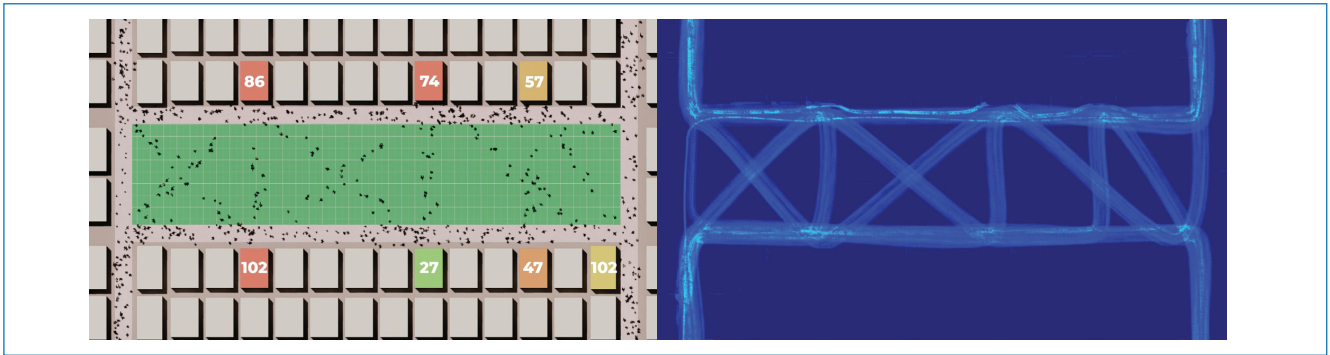


Figure 7: Scenerio 2 open field access and pedestrian movement heatmap

Scenario 3: Designed Block Layout – A structured block layout was tested, allowing controlled access to balance pedestrian accessibility with limited regulation at the ground level. The results showed that Grocery Store 1 maintained high visitation at 84, Grocery Store 2 recovered to 81, and Grocery Store 3 saw a slight increase to 105. Restaurant 1 experienced a further increase to 52 visitors, while Restaurant 2 had a slight rise to 104. The toy shop had 46 visitors, and the pharmaceutical store remained stable at 26.

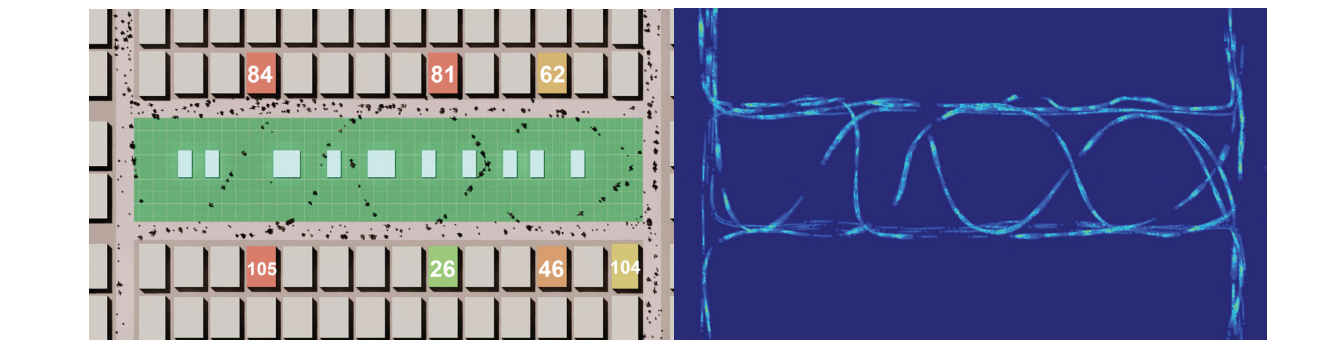


Figure 8: Scenerio 3 controlled access and pedestrian movement heatmap

AMENITIES	SCENARIO 1	SCENARIO 2	SCENARIO 3
GROCERY STORE 1	47	86	84
GROCERY STORE 2	97	74	81
GROCERY STORE 3	56	102	105
RESTAURANT 1	31	57	62
RESTAURANT 2	68	102	104
TOY SHOP	35	47	46
PHARMACEUTICAL STORE	19	27	26

Conclusions

The designed block configuration retained high pedestrian engagement while reintroducing controlled cross-access pathways. Clearly, compared to Scenario 1, this setup improved accessibility. The slight decline in visitors to certain locations compared to Scenario 2 (open field) suggests that some level of access control influences movement choices. Yet, the balance between open organization and controlled access ensures near-open-access efficiency for pedestrian accessibility and movement. This study shows that strategic planning can improve pedestrian experience and accessibility while augmenting the commercial viability of pedestrian-level services within a block. The findings suggest that block-based designs can meet diverse demographic needs more effectively than plot-based layouts, enhancing user access and interactivity.

Future Work

Future work can expand on this by integrating additional environmental factors and refining AI NPC behaviors to simulate more parameters of real-world human movement and goal driven interaction more accurately.

B11 – Thaísa Leal da Silva

INTRODUCTION

The fast-paced modernization in urban centers is accompanied by the implementation of new technologies to improve people's quality of life. For this reason, to create environments more functional, resilient and adaptable to the growing needs of the urban population, emerges the concept of Sustainable Cities and Communities. Therefore, this article aims to analyze the Transport indicators of ISO 37122 for Smart Cities, based on the urban area of Passo Fundo-RS (Brazil), investigating the presence of these indicators in the city.

METHODS

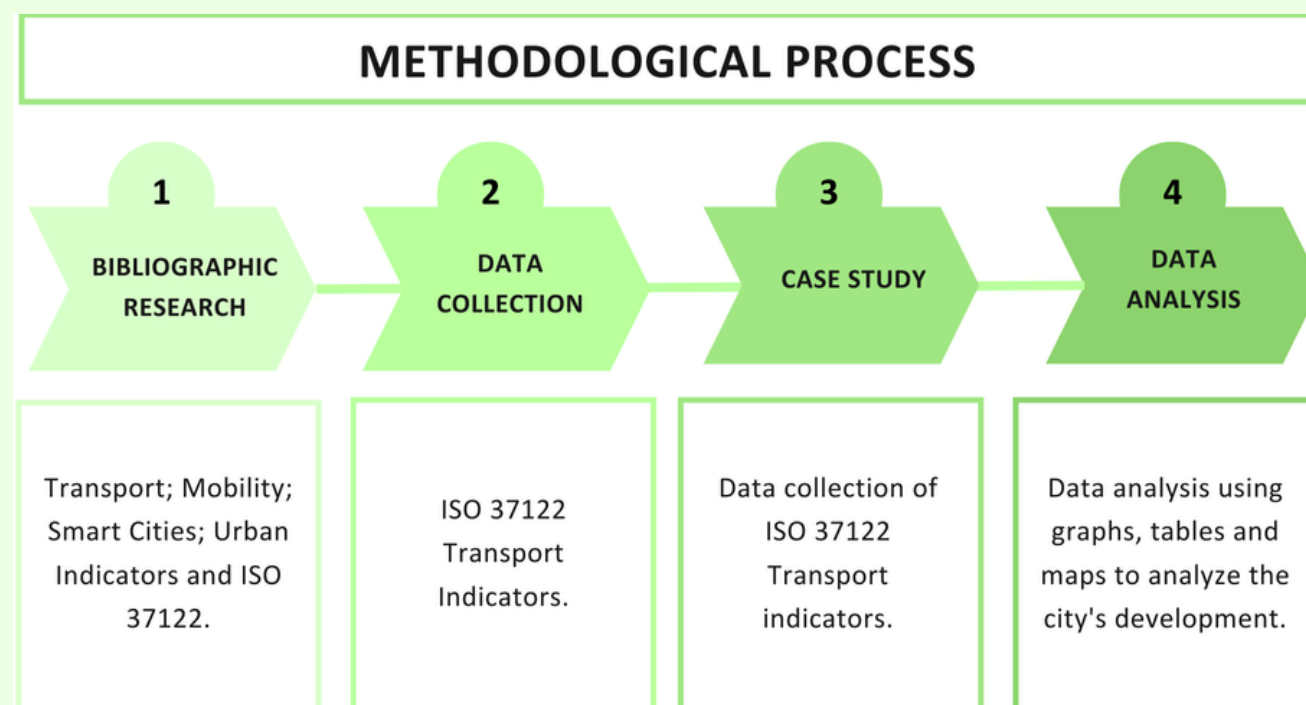
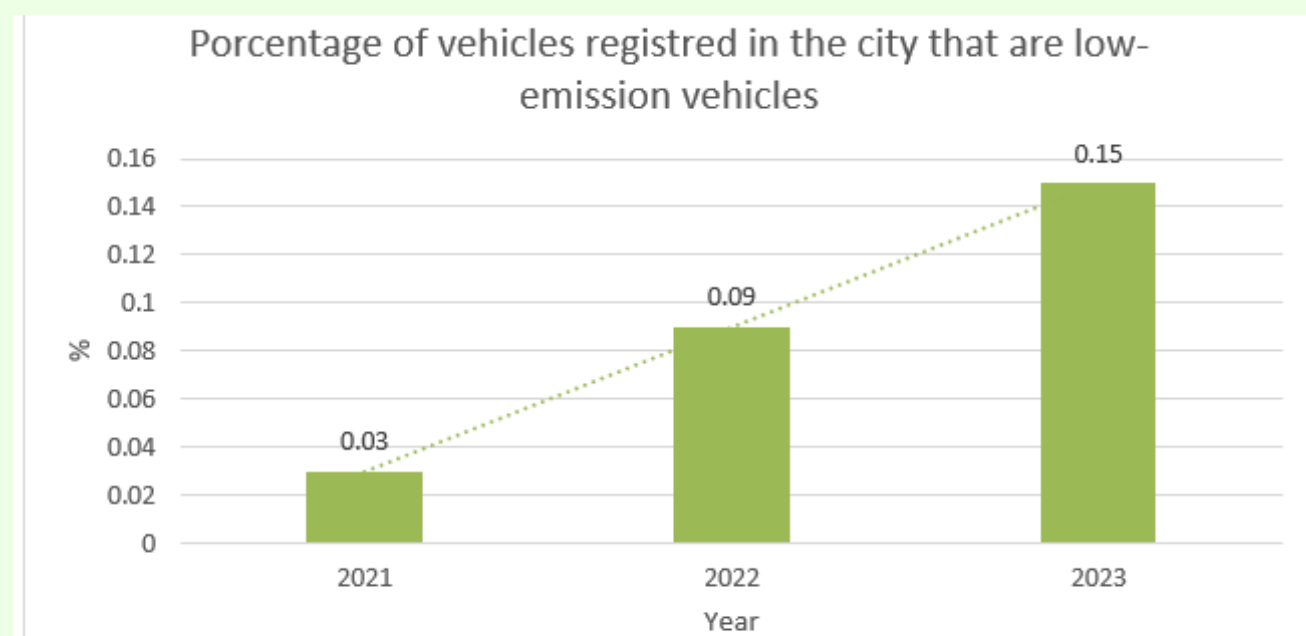


Figure 1. Methodological Process.

ANALYSIS AND RESULTS

The first indicator analyzed presented the percentage of low-emission vehicles in the city (Graph 1), indicating a positive evolution in the city (RCSC, 2023).



Graph 1. Percentage of low-emission vehicles in the city (adapted from RCSC and modify by the authors).

The second indicator presented the percentage of the city's public transport services covered by an unified payment system. According to the Municipality of Passo Fundo (PMPF, 2024), the city did not have this type of payment, but it is implementing it in 2025. The next analysis was regarding the percentage of public transport lines equipped with a system accessible to the public in real time (Table 1). Only Coleurb has this system through the cell phone application *Meu Ônibus Coleurb* (Coleurb, 2024), accounting for around 78.8 % of available bus lines.

COMPANY	NUMBER OF LINES AVAILABLE	NUMBER OF BUS AVAILABLE	ACCESSIBLE SYSTEM IN REAL TIME	% OF LINES WITH THE SYSTEM
Coleurb	26	80	HAVE	78.8%
Codepas	7	23	DO NOT HAVE	21.2%

Table 1. Public transport lines equipped with a system accessible to the public in real time (adapted from Coleurb and Codepas and modified by the authors).

The fourth analysis includes the indicator of percentage of parking spaces public facilities equipped with electronic payment systems. It was found that Passo Fundo contemplates this system through the application Vago (CODEPAS, 2024) or website, in addition, parking meters that accept debit/credit cards.

The following indicator analyzed concerns the percentage of parking spaces public facilities equipped with real-time availability monitoring systems. However, the city does not have this data available. The sixth analysis verified the number of bicycles available through municipal bicycle sharing services per 100,000 inhabitants. According to the analysis, the city has 38.83 bicycles per 100,000 inhabitants, making 80 bicycles available to its population and providing 8 stations through the Passo Fundo Vai de Bici Program (Figure 2).



Figure 2. Location map of shared public bicycle stations in Passo Fundo –Brazil (adapted from *PF vai de Bici* by the authors).

The seventh indicator analyzed was the percentage of traffic lights that are intelligent in the city. Although the Connected Smart Cities Ranking verified the existence of it (RCSC, 2023), it was not possible to verify the quantity of this instrument.

The last indicator analyzed was the percentage of public transport lines equipped with connectivity Internet access for users, offered and/or managed by the municipality. However, it was verified that internet access is not available on bus lines (Coleurb, 2024).

CONCLUSIONS

This research presented an analysis of transport indicators in Passo Fundo according to ISO 37122. Therefore, it can be seen that this measurement is of great relevance for the development of more assertive initiatives for the municipality. From the results of the research carried out, it was possible to verify that, despite having positive indexes in relation to certain indicators, the city still lacks the development of indicators such as monitoring the availability of public parking spaces in real time, and the presence of public transport lines equipped with Internet connectivity. Therefore, new solutions and studies aimed at improving transport in the city are relevant.

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B12 – Syeda Lamiya Mahnaz

Introduction

Smart cities have become a global priority due to the rapid urban population expansion and significant social-technical challenges. Despite increasing interest in smart city concepts, there is a clear need for **theoretical and methodological frameworks that integrate citizen feedback into technology-driven urban transformations.**



A **citizen-oriented maturity model** would empower local authorities to prioritize investments, manage infrastructure assets, and plan future projects in a way that truly aligns with community values. This research addresses these gaps by combining a Framework with a **modified 5-dimension model, underpinned by ISO standards and Smart City metrics**, to create a robust evaluation mechanism using the **TOPSIS** multi-criteria decision method.

Research Objective

Proposal and validation of a five-dimensional, citizen-centric framework, aligned with ISO-based indicators and employing TOPSIS to systematically measure and enhance urban smartness through maturity score while emphasizing citizen engagement.

Methodology: Design Science Paradigm

- Identify problem gaps in Smart city (Focus on Citizen Engagement).
- Define objectives and requirements: ISO-based citizen-centric indicators, 5-D framework, Citizen-centric research goals.
- Design & Develop Citizen-centric 5-D Framework (MCDM-based)
- Demonstrate & Evaluate: Apply to City of Miami (open data), calculate maturity index (TOPSIS).
- Reflection & refinement: Revising framework, weighted indicators.

Results

Figure 1. A Citizen-Centric Smart City Maturity Framework.

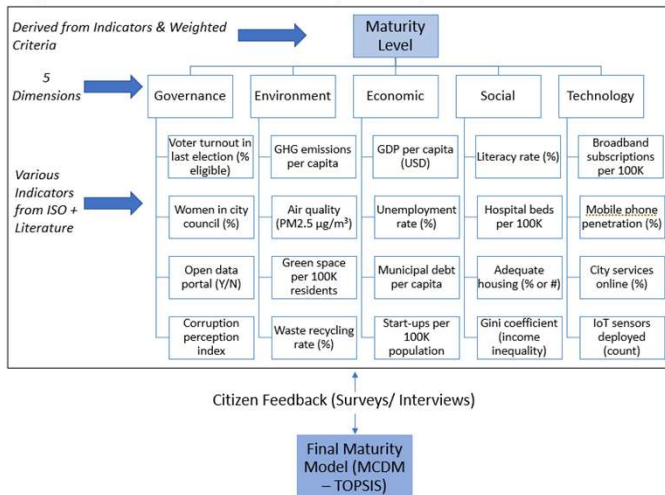


Table 1. plausible 2022–2023 values of Selected Indicators for (Miami Vs. an “Ideal” benchmark).

Dimension	Indicator	Miami	Ideal	Better if
Social-People	P1: Bachelor's+ (%) of adults	32	60	Higher
	P2: Household with internet access (%)	78	100	Higher
Political-Governance	G1: Voter turnout during last election (%)	55	80	Higher
	G2: Open data sets published (#)	450	1000	Higher
Financial-Economic	Ec1: Unemployment rate (%)	2.5	0	Lower
	Ec2: GDP per capita (USD)	45,000	80,000	Higher
Environmental	En1: PM _{2.5} (µg/m ³)	8	5	Lower
	En2: Recycling rate (%)	30	70	Higher
Technological	T1: Broadband coverage (%)	85	100	Higher
	T2: E-services (#) (fully online)	25	50	Higher

Table 2. Dimension Level Normalized Scores from TOPSIS.

Dimension	Score (0-1)	Key Observation
Social-People	.66	High education (32% with bachelor's) & decent net access.
Political-Governance	.57	Average voter turnout, decent open data. Room to improve
Financial-Economic	.68	Good broadband coverage (85%), moderate e-services
Environmental	.62	Good air quality, moderate recycling. Climate resilience
Technological	0.70	Low unemployment, moderate GDP. Overall strong

Comparative Radar Chart of 5-Dimensional Smart City Maturity Scores: Miami vs. Ideal City

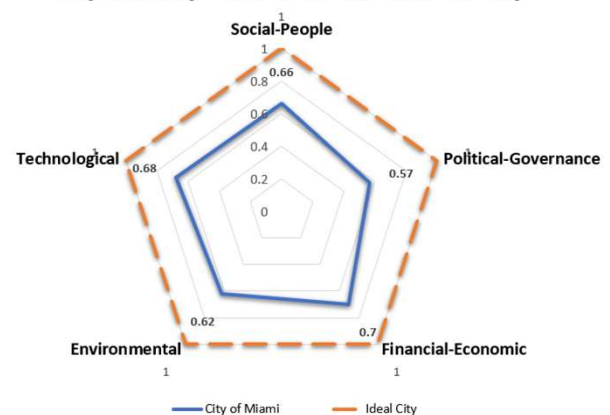


Chart 1. Comparison of 5-Dimensional Smart City Maturity Scores (Miami vs. Ideal City).

Conclusions

- Overall TOPSIS Score **0.63** (approximately) : Miami's overall closeness to an ideal smart city is **~63%**. This is a **moderate-high** level, indicating substantial progress yet leaving significant room for improvement in governance, environment, and digital inclusivity.
- In this case study, **economy** and **technology** are strengths while **governance & people** might require more policy attention (e.g., boosting e-participation, raising education levels)
- This approach is replicable for any city with open data, leveraging a standard MCDM (TOPSIS) method to yield transparent, comparable results.

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