CHAPTER 64

Evaluating Sustainability of Urban Transport in Cities

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ABSTRACT

Sustainable urban mobility is crucial in order to solve the urgent issues of growing urbanization, environmental degradation, and socioeconomic inequality in Indian cities. Through the identification of crucial factors obtained from an extensive survey of the global literature, this study explores the idea of sustainability in urban transportation. These criteria guide the creation of a comprehensive assessment methodology that evaluates the success of continuous sustainable transportation projects in Indian cities. The study identifies inequalities and regional obstacles to attaining sustainable urban mobility through a thorough spatial analysis carried out for a representative Indian metropolis. The results draw attention to important gaps and areas that require development, including equity, accessibility, and environmental effect. Building on these discoveries, the study suggests practical, situation-specific ways to improve urban transportation's sustainability. In order to encourage equitable and effective mobility, these solutions highlight the significance of integrated urban planning, the use of cleaner technology, and the improvement of public transportation infrastructure. This research provides a thorough method for urban planners and policymakers to change urban mobility systems, making them resilient, inclusive, and environmentally sustainable while also being in line with the larger objectives of sustainable urban development in India. It does this by fusing theoretical viewpoints with real-world applications.

Keywords: Sustainability urban transport; Evaluation framework; Transport policy; City structure; Public and private transport.

1.0 Introduction

The quick pace of urbanization over the globe has heightens weight on urban foundation, with transportation frameworks bearing a noteworthy share of the burden. Urban transport plays a basic part in forming availability, financial efficiency, and natural supportability, however it remains a major donor to nursery gas outflows, discuss contamination, and activity clog (D'Acierno *et al.*, 2022).

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Within the Indian setting, developing urban populaces and rising private vehicle proprietorship have assist strained transport frameworks, driving to declining discuss quality, expanded mischance dangers, and diminished versatility productivity (Monteiro *et al.*, 2024). Economical urban transport is basic to accomplishing broader advancement objectives. As characterized by the World Commission on Environment and Advancement (1987), maintainable advancement meets show needs without compromising future eras. Connected to transport, this infers frameworks that are financially practical, socially comprehensive, and ecologically mindful (Cheshmehzangi & Thomas, 2016). Endeavors such as metro frameworks, Transport Quick Travel (BRT), Non-Motorized Transport (NMT) foundation, and Brilliantly Transport Frameworks (ITS) have developed in Indian cities, however their adequacy remains changed and context dependent.

1.1 Research gaps in evaluating urban transport sustainability in India

Whereas worldwide writing on economical urban transport is developing, there stay basic investigate holes in assessing the supportability of urban transport activities inside the Indian setting. Systems created in progressed economies offer profitable bits of knowledge but may not straightforwardly apply to the complex socio-economic, infrastructural, and behavioral designs interesting to Indian cities. The tall thickness, blended arrival utilize, casual transport modes, and shifted commuter behavior request a context-specific approach. (*ESCAP-2017-RP-Assessment-Urban-Transport-Systems*, n.d.). In spite of the fact that different pointers and models exist for surveying transport supportability, a comprehensive and custom fitted system suited to Indian urban situations is missing.

Existing appraisals regularly center on disconnected measurements such as emanations or ridership, without tending to the complete range of financial practicality, social inclusivity, and natural affect. Additionally, observational assessments of economical transport activities in India are restricted in scope and once in a while receive a holistic focal point. There's a squeezing has to be recognize and prioritize parameters that reflect the substances of Indian cities, and to create an coordinates assessment framework that captures the interconnected dimensions of supportability. Furthermore, proposed arrangements regularly borrow from worldwide best hones which will not be doable within the Indian setting due to asset imperatives and nearby socio-cultural flow. Inquire about must in this manner center on defining down to earth, versatile, and context-appropriate procedures grounded in neighborhood substances. Bridging these holes is basic for advising arranging choices, directing arrangement, and guaranteeing the advancement of flexible, evenhanded, and feasible urban transport frameworks over Indian cities.

1.2 Aim of this study

In light of the recognized challenges and investigate holes, this ponder points to supply a comprehensive assessment of the maintainability of urban transport frameworks in Indian

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cities. It looks for to recognize key maintainability parameters significant to the Indian setting by investigating worldwide best hones and adjusting them to neighborhood conditions. Drawing from scholarly writing, arrangement reports, and reports with a center on creating economies, the ponder will create a custom-made assessment system that coordinates financial, social, and natural measurements. This system will be connected to survey chosen maintainable transport activities actualized over Indian cities.

The ponder assist points to propose reasonable and context-sensitive arrangements to improve the viability and long-term maintainability of urban transport frameworks. These recommendations will be grounded within the discoveries of the assessment and adjusted with the particular challenges and openings display in Indian urban situations. By tending to these targets, the inquire about extraordinary to offer important bits of knowledge for policymakers, urban organizers, and partners, contributing to more comprehensive, versatile, and ecologically sound urban portability methodologies over India.

2.0 Literature Review

2.1 Definition and background of sustainable urban transport

Economical urban transport is basic to adjusting the developing portability requests of urban populaces and economies with the goal to minimize natural corruption, advance social value, and guarantee long-term financial practicality. As urbanization quickens all inclusive, cities—now domestic to over half the world's population—face expanding weight on their transport framework. The diligent dependence on private vehicles contributes to antagonistic results counting activity clog, discuss and commotion contamination, street mischances, and rising nursery gas emissions. These impacts diminish urban quality of life and force critical financial costs. (Smieszek *et al.*, 2019) Worldwide systems, such as those supported by the European Union, have underscored the direness of turning around these patterns through driven objectives like decreasing transport-related emanations. Maintainable transport adjusts with the broader guidelines of economic improvement, pointing to meet show portability needs without compromising those of future eras.

It is coordinating financial reasonableness, social consideration, and natural stewardship—promoting open, secure, and productive frameworks for both individuals and merchandise. (Comi & Polimeni, 2024). In spite of decades of talk, the operationalization of economical transport remains a worldwide challenge. Modern definitions emphasize an all-encompassing viewpoint, enveloping not as it were natural impacts but to get to openings, open wellbeing, urban livability, and evenhanded development.

This worldview move absent from car-centric arranging is reflected in methodologies that prioritize decreasing travel request, bringing down emanations, and reinforcing open and non-motorized transport frameworks. Instruments such as Economical Urban Versatility Plans (SUMPs) represent this move, advertising coordinates, participatory systems for long-term

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arranging. In any case, their application must be custom fitted to the assorted spatial, regulation, and socio-economic settings of cities(Jordová & Brůhová-Foltýnová, 2021).

The concept of economical urban transport has picked up expanding consideration in later a long time due to the developing natural, financial, and social challenges postured by fast urbanization and motorization. Writing highlights that maintainability in transportation includes advancing open travel, non-motorized modes, decreasing outflows, guaranteeing availability, and upgrading security. Thinks about created and creating nations emphasize the require for coordinates arranging, proficient arrive utilize, and solid organization systems. Creators such as Litman (2017) and Rail (2008) contend that feasible portability goes past foundation to incorporate approach changes, administration, and behavioral alter. Within the Indian setting, different analysts have analyzed transport maintainability using diverse pointers, however there's a need of a standardized system. Comparative evaluations stay restricted, particularly over numerous Indian cities utilizing overhauled information. This hole highlights the requirement for a uniform assessment strategy, which this ponders addresses by recognizing 39 important parameters drawn from worldwide and national investigate. The audit gives an establishment for evaluating transport systems' maintainability through an organized, data-driven approach suited to Indian urban settings.

2.2 Past studies in sustainable urban transport

The interest of economical urban transport has picked up critical scholastic and arrangement consideration, driven by the critical got to address the natural, social, and financial impacts of car-dependent urban development. A developing body of multidisciplinary research—spanning building, arranging, financial matters, and natural studies—has reported the antagonistic impacts of motorized transport frameworks, counting diminished open wellbeing, natural debasement, and spatial disparity. These challenges emphasize the require for coordinates transport and land-use arranging that underpins compact, available, and proficient urban situations. (Golbabaei *et al.*, 2021). Later considers highlight a worldview move from routine transport models toward more feasible frameworks, emphasizing options such as open travel, strolling, cycling, shared portability, and low-emission cargo arrangements. Developments like shared independent vehicles (SAVs), last-mile coordinations optimization, and Transit-Oriented Advancement (TOD) are progressively investigated for their potential to diminish emanations, progress openness, and advance evenhanded versatility.

At the same time, rising evaluation frameworks—including execution pointers, multicriteria assessment strategies, and maintainability metrics—seek to degree the adequacy of transport intercessions in accomplishing long-term objectives. (Jordová & Brůhová-Foltýnová, 2021). Arrangement rebellions like Feasible Urban Versatility Plans (SUMPs) have developed as imperative instruments to institutionalize this move, especially in European settings. These plans emphasize partner support, cross-sectoral integration, and steady observing utilizing markers such as security, availability, discuss quality, and outflows. In spite of methodological

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progresses, challenges stay in harmonizing information, adjusting techniques to nearby settings, and adjusting transport frameworks with broader urban improvement objectives. The current talk progressively centers on creating comprehensive, adaptable, and context-sensitive approaches to assessing and directing the maintainability of urban transport frameworks over different city typologies. (Bertolini *et al.*, 2024a).

2.3 Study parameters from literature

Assessing the maintainability of urban transport frameworks requires a comprehensive investigation of interconnected natural, financial, and infrastructural parameters. Key natural pointers incorporate nursery gas emanations, discuss quality (particularly poisons like PM2.5), clamor contamination, and vitality consumption—all of which are impacted by modular choices and mechanical headways. Endeavors to decrease outflows through electric vehicles and progressed open transport are central to climate and open wellbeing goals. From a financial point of view, reasonableness, effectiveness, and transport commitment to urban financial development are basic. This includes looking at the costs of framework improvement, operation, and support, as well as the availability and reasonableness of transport for clients. Infrastructural parameters such as modular share, travel times, blockage levels, and the quality and scope of open transport specifically affect framework execution and maintainability. The accessibility of secure, well-connected foundation for strolling, cycling, and electric portability encourage bolsters a modular move absent from private vehicles. These parameters must be evaluated comprehensively and adjusted to each city's setting, with suitable weighting based on particular urban needs and maintainability objectives. (Jordová & Brůhová-Foltýnová, 2021).

3.0 Methodology

The investigate receives an organized technique to assess the maintainability of urban transport frameworks over five Indian cities—Pune, Bangalore, Hyderabad, Chennai, and Nagpur. The approach coordinating a broad writing survey, auxiliary information investigation, and comparative appraisal of 39 maintainability parameters, enveloping natural, financial, and infrastructural measurements. These parameters were distinguished through a comprehensive survey of insightful articles sourced from Scopus and Google Researcher, centering on topics such as blockage, mischance impacts, framework and operational costs, administration, development, and open cooperation. Information for each parameter was at first extricated from the Comprehensive Portability Plans (CMPs) of the particular cities. To guarantee significance and precision, overhauled information was collected from official sources counting MoHUA, metropolitan organizations, state transport offices, NITI Aayog, and distributed investigation. The information was at that point compared to survey advance, recognizing zones of enhancement or stagnation in transport maintainability. A standardized five-point rating scale was created to assess each city's execution, based on the variance between CMP projections and

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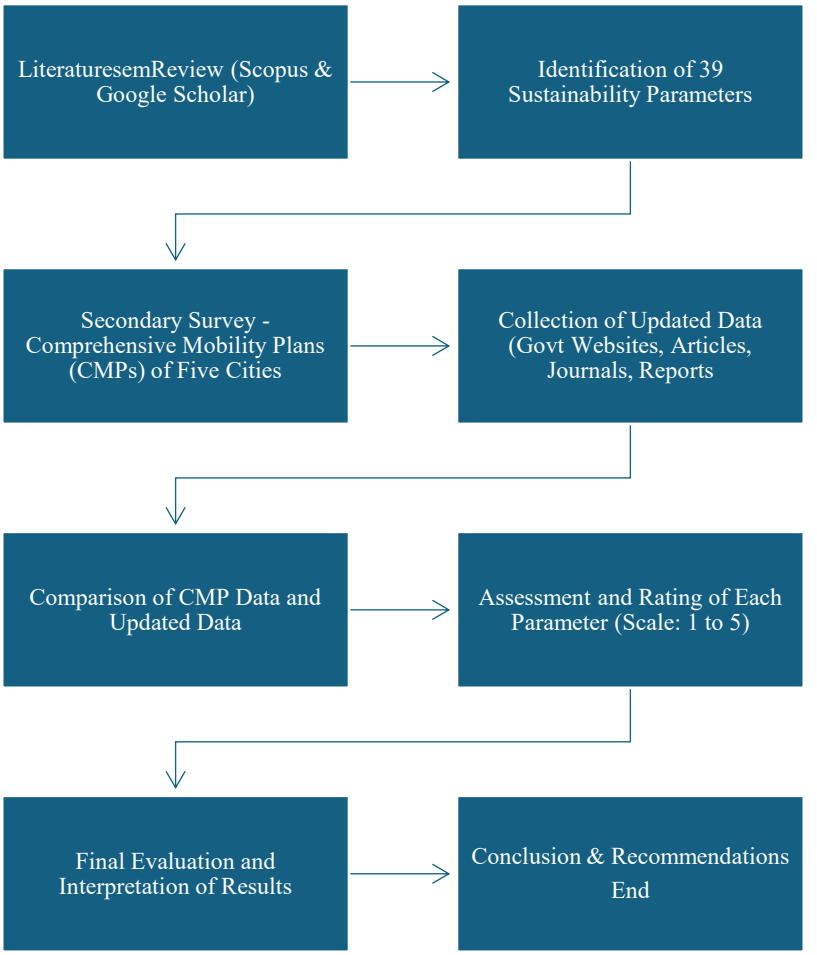
current information, taking under consideration approach execution, foundation advancement, natural affect, and client fulfillment. This strategy empowers a vigorous, comparative understanding of the supportability scene of urban transport in Indian cities.

Figure 1: Flowchart Representation of Methodology



4.0 Result

The supportability execution of urban transport frameworks in five chosen Indian cities—Pune, Bengaluru, Chennai, Hyderabad, and Nagpur—was assessed employing a standardized rating system based on 39 parameters. Each parameter was evaluated on a scale from 1 (Exceptionally Destitute) to 5 (Great), comparing projections from the Comprehensive Portability Plans (CMPs) with upgraded real-time information.

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	Pune	Bengaluru	Chennai	Hyderabad	Nagpur
Transport Infrastructure Cost vs Revenue	3.57	4	4	4	4
Public Transport Cost vs Revenue	3	3	2.75	3.5	3
Transport external costs	3.29	3.75	2.5	4.5	2.5
Financial Health of Transport Institutions	2.3	4	2.5	4	3.5
Accident	3	2.5	3.25	3	1.5
Impacts to habitats	2	1.75	2	3	2.5
Health aspects	2	3.2	3.21	3	2.5
Active citizens	3.5	3	4	4	3
Safety	2.5	3	3.5	4	2.3
Presence	3.5	4	3.14	4.8	2.5
Network/Connectivity	3.43	3.44	3.5	5	4
Accessibility	4	3.75	3.5	4	3
Ridership (Male/Female)	3.5	4	3.25	4	3.5
Multimodal Intergration	4.2	4	4	4	4.5
Emissions	4	3.7	4.5	4	4
Energy consumption	4	2.5	4	4	4
Affordability	3	3	4.4	4	3
Frequency	2	4	3.5	4.5	2.4
Reliability	2.9	4	4	3.5	2.5
Per Hour Per Day Traffic	4	3.25	4	1	3
Modal Share	3	3.5	4	2	2
Vehicle Ownership	4	1.8	2.5	2	2.6
Type of Vehicle	4.5	2	2.6	4.5	1.5
Distance/Avg Distance	4	3	3.46	3	2.3
Energy consumption	3	3	4	3	2
Congestion	3	2	4	3.5	2.5
Pollution	3.5	2.1	4	2	2.5
Road Density	2	2	3	4	2.6
Vehicle Density	2	2	3.85	2	2
Population Density	3.8	3	4	2	3.5
Occupancy	2.5	2.25	4	4	2.8
Land Use Intensity	3	3.65	2.5	4	3
Green Cover lost in Transport Project	3.5	2	2	3	2.5
Noise Pollution	3	2.5	4	3	4
Public Participation in Transport Planning	3.8	5	4	5	4
Policy and Regulatory Frameworks	4	4.5	4	4	3
Governance and Institutional Capacity	3	4	4	3.5	3
Public Transport Subsidies	5	4.3	4	4	4
Innovation in Transportation	3.5	4.5	5	4	4
Final Score	3.276666667	3.203589744	3.548974359	3.546153846	2.948717949

The examination uncovered that Hyderabad developed as the foremost maintainable city with a normal score of 3.56, reflecting viable arrangement usage, framework advancement, and progressed open transport results. Chennai was taken after closely with a score of 3.54,

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demonstrating solid advance in advancing feasible urban portability. Pune and Bengaluru, with scores of 3.22 and 3.17 individually, illustrated direct execution, highlighting the require for changes in transport proficiency and open fulfillment. Nagpur positioned least with a normal score of 2.99, proposing the require for more centered and coordinates techniques to upgrade supportability. These discoveries offer a comparative knowledge into the usage of economical transport measures over Indian cities and emphasize the significance of focused on approach mediations and framework improvement to make strides urban portability frameworks.

5.0 Conclusion

This consider presents a comprehensive assessment of the maintainability of urban transport frameworks over five major Indian cities—Pune, Bengaluru, Hyderabad, Chennai, and Nagpur—using a standardized system of 39 pointers. By comparing anticipated information from Comprehensive Portability Plans (CMPs) with upgraded real-time data, the investigation offers basic bits of knowledge into the adequacy of existing transport procedures and their on-ground usage. The comes about highlight Hyderabad as the foremost maintainable city, taken after closely by Chennai, whereas Nagpur positions least, signaling the require for more focused on intercessions. The discoveries emphasize the significance of persistent approach assessment, speculation in open transport framework, and comprehensive arranging forms to improve supportability results. This investigate not as it were given a replicable system for evaluating urban transport maintainability in Indian cities but moreover emphasizes the require for data-driven, versatile approaches in urban portability arranging. Future endeavors ought to center on coordination multimodal transport, fortifying administration components, and advancing ecologically mindful hones to construct versatile and impartial urban transport frameworks.

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