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“Rapid Bus Transit Systems in India and Colombia”

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Submitted by: Sanmesh Ranjanikar (MPP Cohort 2024-26)

Under the Supervision of: Dr. Amrendra Pandey, Assistant Dean of Research, Kautilya School of Public Policy

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Rapid Bus Transit Systems in India and Colombia

Abstract

Indian metro cities are struggling with an ever-increasing population and migration. The current public transport systems in these cities are unable to cope up with the rapid urbanization and population growth leading to an increased dependence on the use of private vehicles, pollution, traffic congestions. This has hampered the productivity of these cities which ultimately has hampered the economic growth. Many of these cities have shifted to capital-intensive public transport infrastructure such as the Metro railway. However, their capacity remains underutilized with a significant gap between the projected and actual passenger ridership. In this context, Bogotá, the capital of Colombia, has set an example of addressing this issue of affordable public transport approach. This paper compares Bogotá's TransMilenio Bus Rapid Transit System with the BRT system in Pune and Pimpri-Chinchwad with a special focus of Pimpri-Chinchwad through a Qualitative Comparative Analysis (QCA). This paper aims to study how Indian cities can learn from Bogotá's approach and implementation of its BRT system and build efficient public transport systems which would help in increasing the productivity.

Introduction

India's population has grown significantly at a rapid pace over the past few decades. This population surge has taken place especially in the urban centres. According to the World Bank, the share of urban population in the total population of the country was around 37% in 2024 (Division, 2025). The top 10 cities in the country account for nearly 9% of the total population. Delhi tops the list with a humungous population of 33.8 million, followed by Mumbai with 21.6 million (Times of India, 2024).

This tremendous rate of increase in population is putting a heavy burden on our cities which are increasingly becoming incapable of accommodating more and more people. To begin with, most of our cities are poorly planned in terms of efficient use of land parcels available in the municipal corporation limits. Construction of illegal settlements in a haphazard way add up to the city's woes. On top of this, inefficient or a complete absence of a public transportation system adds up to the citizens' difficulties. There is an ever-increasing gap between the demand and supply of public transportation services which leads to an increase in the use of private vehicles, greater loss of time in commute, long and frequent traffic jams, etc. Increase in the number of private vehicles is the most important factor amongst these which the metropolitan cities in India are facing.

Public transport systems in India have not been able to keep up with the pace with which the population of the metro cities have grown. For example, the Pune Mahanagar Parivahan Mahamandal Limited (PMPML) which operates the city bus service in Pune and Pimpri-Chinchwad cities, is still short by 4,500 buses with respect to the current fleet of just 1,916 (Shah, 2025). This forces the citizens to rely on other modes of transport such as autorickshaws, taxis and two wheelers. Pune currently ranks third in the number of two wheelers in the country with around 67 lakh vehicles (Kamble, 2025). These increased number of two wheelers, along with the autorickshaws and four wheelers, contribute to the high levels of air and noise pollution and road accidents, during peak hours in Pune and Pimpri Chinchwad.

A new trend has been observed in the country since the past few decades with respect to catering to the increased needs of public transportation, which is the introduction of the Metro rail. As it became successful in Kolkata and New Delhi, many cities tried to imitate the same model subsequently. As of 2024, 21 cities have focused on metro rail systems compared to just five in 2014 (Mishra, 2024). However, many of these systems in the cities are not

being operational to their maximum potential due to low ridership and poor planning of the services.

As a developing country, it is essential to consider that the public services in India should be compared with those in other developing countries and not with a developed country. In this paper, Qualitative Comparative Analysis (QCA) framework is applied to compare the BRT systems in Bogotá, Colombia and Pimpri-Chinchwad in Maharashtra, India. This comparison will help in understanding the socio-economic conditions, urban transport policies, demographics along with the political discourse regarding the BRT system in both the cities. Through this analysis, the outcome and results could be applied to the public transport systems in Indian cities which are facing similar challenges in order to increase their productivity and efficiency.

Necessity of considering Socio-Economic Conditions in BRTS Comparison

To meaningfully compare the Bus Rapid Transit Systems (BRTS) in Bogotá and Pimpri-Chinchwad, understanding the socio-economic conditions is crucial for several interconnected reasons. Transport systems in the cities are not isolated entities. Their design, implementation and their successes are shaped by the population that uses them.

a. **Informing Policy and Design**

   Public transit has emerged in cities to support low- and middle-income residents, who often cannot afford private vehicles and may have diverse employment, education, and health needs. In Bogotá, TransMilenio was explicitly planned to reach marginal neighborhoods and connect workers to city centers, greatly increasing access for poorer populations and women. The city's socio-economic mapping—income, migration, family size, informal sector employment—was used to decide the station

locations, route designs, and fare structures to maximize impacts for the poorer residents of the city (Hub, 2019).

In Pimpri-Chinchwad, rapid population growth and industrialization since the 1980s created a mix of formal and informal settlements within the city with distinctive transport needs. Socio-economic surveys, including assessments of income levels, education, and gender patterns, have helped identify transportation barriers among the working poor, daily wage labourers, and migrant populations. BRTS was an attempt, although with a faulty design, to connect these informal and formal areas with the city centres of PCMC and the neighbouring city of Pune (Pimpri-Chinchwad Municipal Corporation, 2010).

b. Addressing barriers to Equity

Inequalities, which could be of different forms such as economic, gender-based, or spatial—dictate who benefits from public transit improvements. In Bogotá, for instance, targeted fare reductions and accessible station design specifically addressed the travel needs of women, disabled, and the elderly. Conversely, where these socio-economic factors are inadequately addressed, as seen in parts of Pimpri-Chinchwad, barriers remain: physical inaccessibility, unaffordable fares, or exclusion of those in informal settlements from full benefits of public investment (TOI, 2011).

c. Mitigating Negative Externalities

Policymakers need to be mindful of the socio-economic realities of the city, region or state that they are devising policies for. This helps them to avoid and mitigate negative outcomes of their policies, for example, in this case, the displacement from increased land values near the BRT corridors, etc. Without a granular understanding of the socio-economic environment, BRTS could inadvertently deepen inequalities or fail to achieve transformative outcomes (Venter et al., 2013).

Qualitative Comparative Analysis (QCA) Framework

Qualitative Comparative Analysis (QCA) is a methodology for assessing complex social phenomena through systematic comparison of multiple cases. By converting qualitative observations into set-theoretic, Boolean terms, QCA enables researchers to identify necessary and sufficient combinations of causal factors responsible for given outcomes (INTRAC, 2017).

Methodological Steps

1. **Select Cases**: Choose representative, broad cases (e.g., Bogotá and Pimpri-Chinchwad BRTS), ensuring diversity for robust comparison.
2. **Identify Conditions and Outcomes**: Define causal factors (e.g., political support, financial constraints, public opinion, equity) and clear outcomes (e.g., BRTS ridership, inclusivity, sustainability).
3. **Calibrate Data**: Convert qualitative and quantitative information into categorical sets. For instance, “high political commitment” or “low public satisfaction” can be formalized as values between 0 and 1.
4. **Construct Truth Tables:** Matrix all possible configurations and their corresponding outcomes—revealing patterns or contradictions.
5. **Boolean Reduction:** Simplify these configurations to core combinations that most effectively explain observed results.
6. **Interpret Findings:** Map the minimalist explanations to real-world processes and policy.

Applying QCA to BRTS Cases

By comparing each city along key criteria—Political Support, Financial Constraints, Environmental Concerns, Public Opinion, and Equity/Social Inclusion—we can compare the situations and derive evidence-based, context-sensitive lessons.

Comparative Case Studies

A. Bogotá's TransMilenio

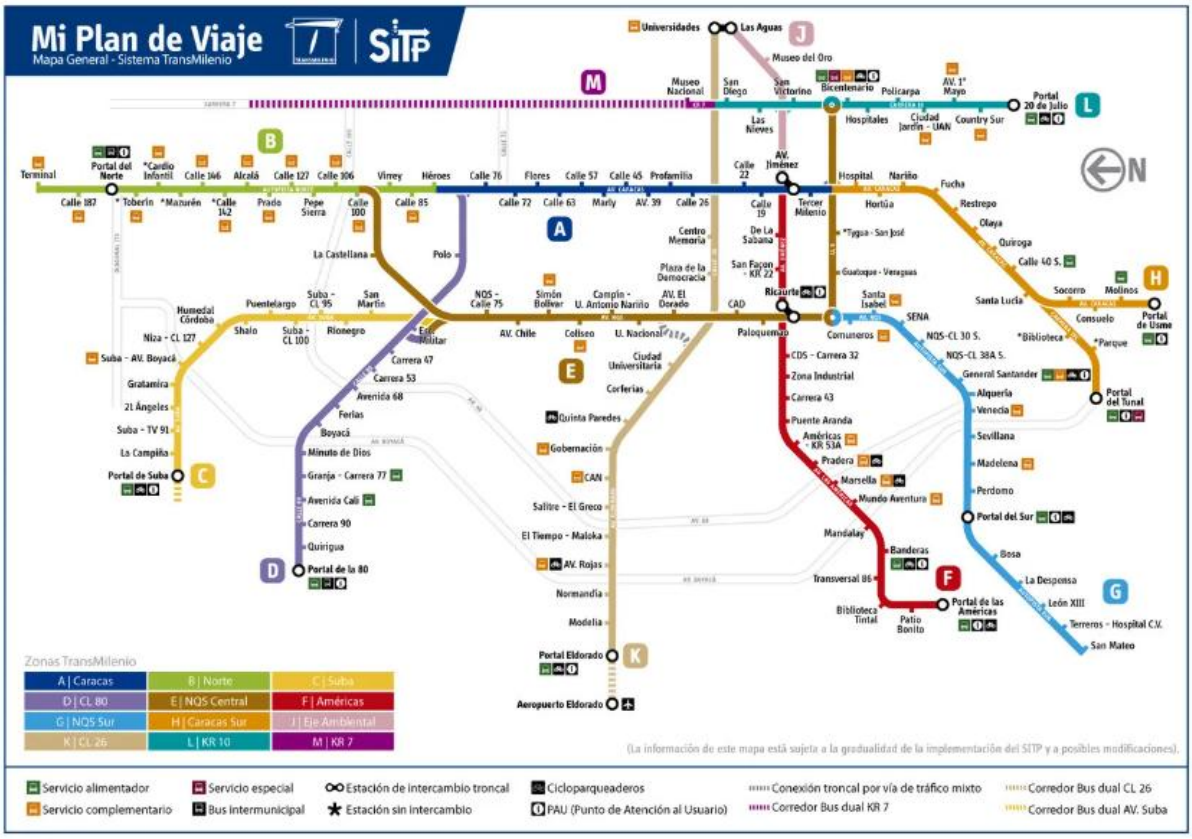

Fig 1: TransMilenio Route Map

1. Political Support

TransMilenio benefited from consistent, high-level political commitment from its launch, notably under Mayor Enrique Peñalosa. Urban transport was made the cornerstone of Bogotá's planning, integrating BRTS into city development strategies. Political branding

sometimes polarized opinion, but the initial momentum enabled rapid construction, capacity planning along with enforcement (Centre for Public Impact, 2024).

2. Financial Constraints

Bogotá utilized innovative financing: a fuel tax, central and local government funds, international loans, and valorization taxes (tax based on the value of a property, product or service) on property to subsidize infrastructure. While this diversified the revenue base, the city also faced deficits, as rising costs for maintenance, infrastructure upgrades, and operational expansion often overshot the fixed dedicated revenues. Similarly, attempts to pass vehicle taxes or tolls faced political resistance, but robust financial planning ensured the system's initial success (Ardila-Gomez & Ortegon, 2006).

3. Environmental Concerns

BRTS replaced older, polluting buses and reduced reliance on private vehicles. It lowered CO2 and particulate emissions—PM levels dropped significantly in zones served by the system. Transition to cleaner fuels and electric buses furthered its environmental agenda, making TransMilenio a model for green public transport in Latin America. However, rapid urban growth and increased ridership led to concerns about overcrowding and associated emissions (Perez et al., 2024).

4. Public Opinion

The project opened to overwhelmingly positive public approval (over 90%), but satisfaction dwindled as ridership surged, creating congestion, crime, and safety issues. Efforts to address these included ongoing feedback, participatory improvement processes, and adaptation of service policies (Sustainable Transportation Lab, 2016).

5. Equity and Social Inclusion

As discussed before, TransMilenio's coverage prioritized vulnerable neighbourhoods, and special programs targeted women, the elderly, and disabled users with discounted fares and accessible design. On the other hand, social management teams too, engaged resettled families affected by construction, providing housing and compensation. However, despite these measures, challenges persisted: property value increases risked displacement and it was observed that informal workers did not always benefit equally as well (Hub, 2019).

Pimpri-Chinchwad BRTS

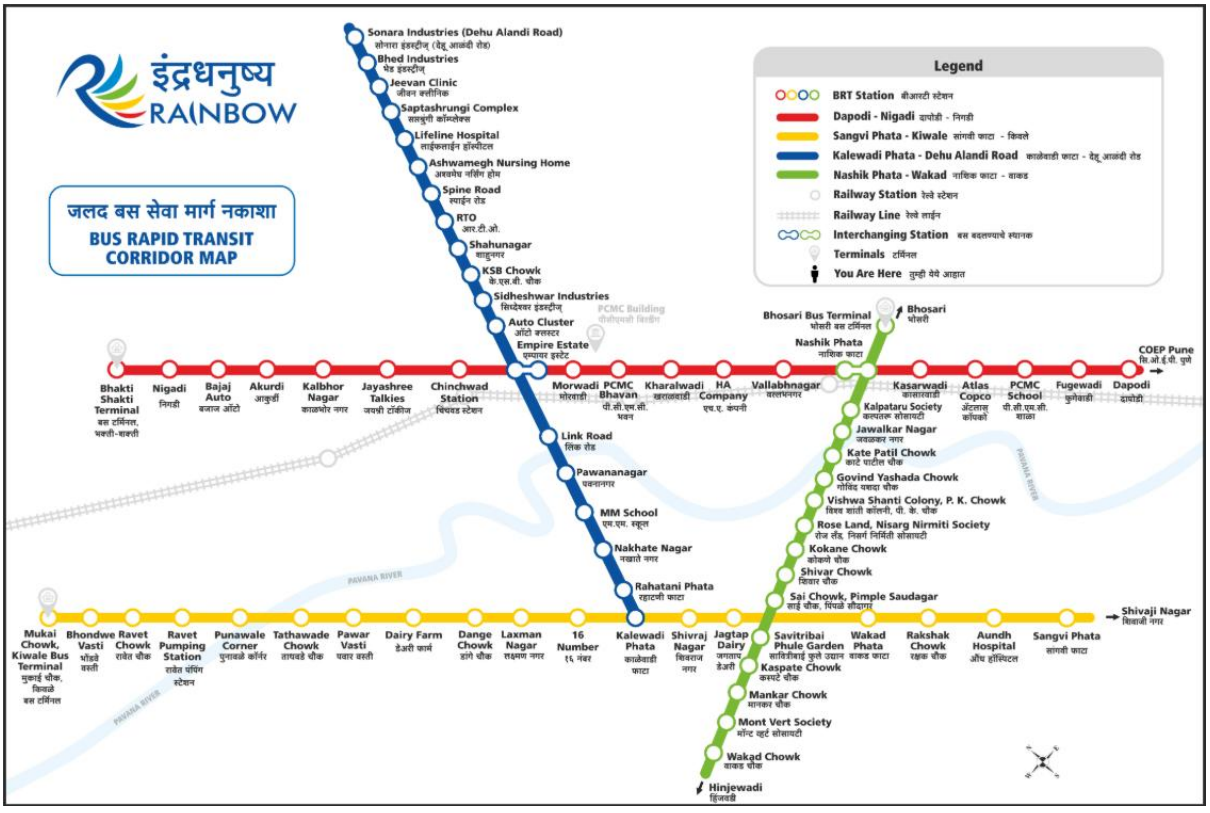

Fig 2: Pimpri-Chinchwad BRTS Route Map

1. Political Support

In PCMC, political will fluctuated; local government and elected representatives often expressed both support and concerns, especially regarding safety, traffic impact, and integration with the Metro project. Multiple deliberations were conducted with the concerned stakeholders, general public, advocacy workshops and public outreach helped disseminate information, but opposition from citizens about lane usage and the shrinking of road space for private vehicles continued as the city has a considerable number of private vehicles which ply within the city as well as to Pune (Express News Service, 2025).

2. Financial Constraints

BRTS financing relied on central and state schemes like JNNURM, municipal budgets, World Bank assistance, and other support from local revenue sources. However, delays, cost overruns, and hesitancy in dedicated budget allocation hampered expansion and upgrades. Along with that, as there was mixed funding sources utilised for the project, it made long-term sustainability a challenge as well as controversies about pilot projects cautioned the local corporators which led to restraining ambitious financial commitments (Power, 2014).

3. Environmental Concerns

Environmental Impact Assessments (EIA) included baseline monitoring of air, water, noise, and land. The benefits which were expected to be achieved included reduced emissions, better congestion management, and improved access to green travel. However, poor enforcement, low bus frequency, and suboptimal planning resulted in limited reductions in environmental pollution and ineffective lane usage on the major roads of the

city. Moreover, planning for clean energy transitions for the future is ongoing but is still in a nascent stage (PuneMirror Bureau, 2025).

4. Public Opinion

Public attitudes towards BRTS have been mixed in the past. While the system offered a potential solution to traffic jams and poor bus services, awareness was low, and skepticism high due to negative experiences in Pune city's pilot project. Other concerns about road safety, inadequate infrastructure amenities, lack of information about the bus routes and timings and fear of further congestion further undermined acceptance. Later on, public outreach and communications improved some perceptions (TOI, 2011).

5. Equity and Social Inclusion

BRTS planning in PCMC involved comprehensive socio-economic surveys. Further, land acquisition and resettlement plans aimed to minimize social impacts; the consultations involved identifying vulnerable groups such as women, low-income section of the population, informal workers along with other lower caste sections such as the scheduled castes. There is, however, ongoing difficulty in achieving full accessibility and inclusive service for disabled, elderly, and informal sector users. There have been efforts to provide affordable fares and amenities which have seen partial success, but physical barriers and income constraints still pose a significant challenge (Pimpri-Chinchwad Municipal Corporation, 2010).

Comparative Analysis

Political Support

Bogotá witnessed sustained, city-wide political prioritization of BRTS; powerful local leadership enabled fast roll-out with integrated planning and resilience against the

opposition hurdles. In Pimpri-Chinchwad, the representatives supported the concept but controversy and competing demands (especially with the Metro project) hampered the commitment, slowed execution of the project and limited transformative change.

Financial Constraints

Bogotá's creative mix of revenue streams allowed it to finance major infrastructure and operations while attracting national and international funds. Similarly, fiscal discipline and political focus sustained investment even amidst rising costs and deficits. On the other hand, Pimpri-Chinchwad's BRTS was more vulnerable to budgetary limitations, slower expansion, and institutional red-tapism along with fragmented funding sources (Municipal Corporation, JNNURM funds, State Government funds, etc) has prevented full realization of planned networks and amenities.

Environmental Concerns

Bogotá's environmental agenda was explicit: reduce emissions, promote modal shift from cars, transition to clean energy buses. Therefore, the results included significant air quality improvement and social awareness. Urban congestion introduced new environmental challenges (e.g., overcrowding), but air pollution indicators improved. Whereas, Pimpri-Chinchwad improved localized pollution metrics and congestion but failed to scale up environmental benefits due to maintenance and operational constraints, and missed chances for rapid clean-energy conversions due to delays in the processes and adoption.

Public Opinion

Bogotá's opening was a celebrated moment, but ongoing service deficiencies, overcrowding, and crime led to mass protests and strong public criticism. Continuous feedback mechanisms helped address some issues, but still some systemic challenges

remained. In Pimpri-Chinchwad, low public awareness, poor communications, and skepticism about service quality resulted in tepid or negative public reception which was accompanied by the memory of Pune's troubled pilot project.

Equity and Social Inclusion

Both systems sought equity: Bogotá designed inclusivity into fare policies, accessible infrastructure, and targeted service whereas their social teams managed resettlement and integrated vulnerable groups. On the other hand, Pimpri-Chinchwad invested in baseline surveys, compensated the project affected citizens along with inclusive designs. Despite these measures, the project has faced greater barriers to full participation for informal workers, women, and disabled due to operational challenges and underfunded measures due to financial constraints.

QCA Truth Table

City	Political Support	Financial Constraints (Low)	Environmental Concern (Addressed)	Positive Public Opinion	Equity & Inclusion	BRTS Success
Bogotá	1	1	1	0	1	1
Pimpri-Chinchwad	0	0	0	0	0	0

Legend:

1 = Condition Present/High/Addressed

0 = Condition Absent/Low/Not Addressed

Interpretation

Bogotá's configuration shows that the presence of strong political support, well-managed finances, environmental considerations and conscious efforts to promote equity and inclusion were associated with clear BRT success—even as public opinion presented significant challenges after its implementation. Whereas, in the case of Pimpri-Chinchwad, it shows the absence or weakness of all major supportive conditions which led to unsuccessful BRT outcomes like barriers in politics, finance, environment, communication, and social inclusion, which in turn have compounded each other to produce a negative picture overall.

Discussion: What Pimpri- Chinchwad Can Learn

Political Leadership and Vision

Bogotá's experience underlines the importance of visionary leadership and institutional clarity. Pimpri-Chinchwad should revise its priorities in urban public transport and consider BRTS with explicit, high-level priority, linking it to broader urban development goals and leveraging consistent political commitment.

Financial Sustainability

To overcome the fiscal limitations, Pimpri-Chinchwad could:

- Introduce special taxes or levies, like Bogotá, specifically funding mass transit and infrastructure.
- Diversify revenue sources and improve allocation from local and national budgets.
- Link operational funding to performance metrics.
- Explore public-private partnerships, enhancing service provision, maintenance, and network expansion.

Environmental Impact

- Increase the already existing fleet of low-emission buses (CNG/Electric) and move towards net-zero urban transport emissions.
- Engage citizens in environmental education campaigns to build public support for transit modal shifts.

Public Opinion

- Invest in education and participatory planning initiatives, run awareness campaigns and regularly seek community feedback on the current status of the service.
- Address misconceptions about the service and demonstrate tangible benefits (e.g. reduced commute times).
- Widen the roads in the main city areas with heavier traffic flows to facilitate construction of new dedicated BRT lanes to reduce the commute times.
- Publish transparent reports on BRTS performance, collecting citizen input and acting upon it.

Inclusive Design and Operations

- Ensuring universal accessibility: Building ramps, offering priority boarding at the bus stations and simplifying the fare structures.
- Integrating gender considerations: Special focus on women, disabled, elderly and informal sector workers.

Continuous Improvement

- Documenting all policy adaptations and stakeholder feedback.
- Link performance evaluation to funding, increasing accountability and adaptation.

Recommendations: What Pimpri – Chinchwad can implement considering the various types of constraints at play

Bogota's success cannot be replicated in India as it is without understanding the unique political, economic and social environment of the cities like Pimpri-Chinchwad. The best way to go about it is to interpret Bogota's guiding principles in a way that suits the urban and institutional realities of PCMC.

1. **Political Commitment and Governance Continuity**

   One of Bogotá's biggest strengths was the strong leadership led by its mayor that drove the project despite resistance from private vehicle owners and political rivals. In contrast, PCMC operates in a more fragmented governance setup, where multiple agencies, namely, the Pune Mahanagar Parivahan Mahamandal Limited (PMPML), PCMC, and the Pune Metropolitan Region Development Authority (PMRDA) share overlapping responsibilities.

   This can be overcome by creating a unified transport coordination cell or a high-level "BRT Steering Committee" that includes representatives from all these bodies. This will ensure that all the representatives from all the administrative bodies are on the same page which can in turn reduce the project delays caused by the red-tapism and the lack of administrative coordination.

2. **Sustainable Financing**

   Bogota adopted a diversified funding model by blending municipal taxes, value-capture from nearby development, and loans from multilateral agencies. On the other hand, Pimpri-Chinchwad, deals with tighter fiscal constraints and a limited tax base. PCMC could take a more realistic approach to increase their finances with modest revenue streams such as parking surcharges in high-traffic zones, developer contributions near BRT corridors, and targeted climate grants for cleaner buses. It

could also link the operator payments to service quality or ridership rather than just the number of trips made. This performance-based model could gradually make the system more self-sustaining.

3. **Traffic Discipline and Lane Enforcement**

   Bogotá succeeded in maintaining lane exclusivity through firm enforcement and physical design measures. For PCMC, the challenge is larger due to the high number of two-wheelers and informal traffic patterns. Enforcement should therefore be gradual and community-oriented.

   Many times, it is observed that in PCMC, private two wheelers, cars, autorickshaws, etc. enter the dedicated BRTS lanes causing disruption in the bus services, thereby causing delays in the commute for the passengers. PCMC can install automatic cameras for ticketing for such offenders, appointment of traffic police at the entry and exits of the BRT routes, etc. This can be paired with creating and running awareness campaigns to create the required behavioural change in the residents.

4. **Integration with Feeder and Last-Mile Systems**

   Bogota connected the peripheral areas with the main lines of the BRT by the feeder network system. This ensured equitable access of all parts of the city to the main lines. PCMC's success also depends on the same concept. Currently, there is a dearth of last mile connection of the outer parts of the city to the main parts such as Nigdi, Akurdi, Pimpri and Dapodi. Feeder services in the form of small buses, shared autos, or e-rickshaws, can be synchronized with the main busy routes and given operational incentives for punctuality.

5. **Operations and Fleet Management**

   While Bogotá deployed high-capacity articulated buses, PCMC may find a mixed fleet strategy more efficient. Before that, PCMC should focus more on increasing the

fleet as it is already operating with a smaller number of buses than required (Abhyankar, 2024).

Further, larger buses can operate on busy main routes, while smaller, more agile vehicles can serve lower-demand corridors and feeders. Apart from this, predictable headways and real-time passenger information can make BRT a genuine alternative to two-wheelers in PCMC.

6. **Data-Driven Monitoring**

   Bogota's system focused on continuous evaluation of ridership, service quality and passenger feedback. For PCMC, establishing a simple operations dashboard, tracking bus frequency, delays, and passenger counts, would greatly improve accountability and service delivery which is currently missing.

7. **Community Engagement and Public Communication**

   Public perception and narratives can make or break a system or a service. Bogota learned this the hard way. Overcrowding and lack of communication led to a dip in satisfaction over time. The response to the BRTS in PCMC is unsatisfactory already. To overcome this, PCMC and PMPML should prioritize early engagement with commuters, vendors, and local businesses.

   Public campaigns showing before-and-after travel time reductions, environmental gains, and safety improvements can help citizens see tangible benefits. However, to convincing the people regarding the benefits of BRTS would only be possible after the service delivery has improved.

Conclusion

The comparative study of Bogotá's TransMilenio and Pimpri-Chinchwad's BRT reveals that the effectiveness of a public transport system depends as much on institutional and social factors as on its technical design. Bogotá's success was not merely a result of infrastructure expansion but of sustained political will, well-defined governance structures, and the ability to link transport planning with social equity goals. Pimpri-Chinchwad's context, marked by a rapidly expanding urban footprint, high dependence on two-wheelers, and fragmented institutional authority, calls for a more adaptive approach rather than a direct imitation of the Colombian model.

For the BRT in Pimpri-Chinchwad to reach its potential, reforms must begin with governance and citizen engagement. A unified transport cell or steering committee could help bridge the coordination gap between agencies, while visible improvements such as reliable service frequencies, safe stations, and better last-mile connectivity can rebuild public trust. Financially, smaller but sustainable revenue mechanisms, coupled with climate-linked grants, could ensure that operations remain viable. Equally important is a focus on inclusivity, affordable fares, accessible design, and safety for women and marginalized commuters.

Ultimately, Bogotá's greatest lesson lies in the idea that transport reform is a social contract rather than a technical project. If Pimpri-Chinchwad can nurture political commitment, transparency, and a shared sense of ownership among its citizens, its BRT system can evolve from a struggling corridor into a symbol of equitable and sustainable urban mobility.

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