



Shaping Sustainable Public Transport in Nepal: Insights from Global Developing Cities

Sanjay Luitel ^{1*}, Trishna Gharti Magar ², Kalpana Budha Magar ³, Abhishek Kumar Subedi ⁴, Sajana Adhikari ⁵, Kuber Nepali ^{6, 7}

¹ Transportation Engineer, Life Member- Society of Transport Engineers Nepal (SoTEN), Kathmandu, Nepal

^{2, 3} Civil Engineer, Independent Researcher, Dang, Nepal

⁴ Transportation Engineer, Independent Researcher, Kaski, Nepal

⁵ Senior Divisional Engineer, Department of Roads, Kathmandu, Nepal

⁶ Joint Secretary, Ministry of Physical Infrastructure and Transport, Kathmandu, Nepal

⁷ Chief Executive Officer, Federal Capital City Public Transport Authority, Kathmandu, Nepal

* Corresponding Author: **Sanjay Luitel**

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Abstract

Rapid urbanization in Nepal has intensified challenges in public transportation, characterized by fragmented institutions, predominance of informal modes, and infrastructural constraints. This paper presents a comparative analysis of public transport experiences from developing countries, including Bus Rapid Transit (BRT), land-use integration, paratransit reforms, and urban rail systems, to distill lessons relevant for Nepalese cities. Findings highlight the critical importance of strong political commitment, inclusive stakeholder engagement, adaptive governance, and sustained financing in achieving sustainable and equitable transit outcomes. However, Nepal's unique socio-political, geographic, and fiscal context necessitates a tailored approach rather than direct replication of foreign models. We propose an adaptive incrementalism framework that advocates phased, manageable reforms aligned with strategic vision, enabling gradual formalization of informal transport, institutional capacity building, and integration with urban development policies. The paper further discusses the institutional landscape of Kathmandu Valley, current public transport challenges, and potential pathways for reform led by the Federal Capital City Public Transport Authority (FCCPTA). Emphasizing the role of technology, data-driven planning and participatory governance, the study outlines actionable recommendations to advance sustainable urban mobility in Nepal.

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1. Introduction

Urbanization has accelerated globally, particularly in developing countries, with the urban population projected to rise from 47% in 2000 to nearly 60% by 2030, placing immense pressure on infrastructure and public services ^[1]. This surge demands efficient, sustainable mobility solutions as cities grapple with overcrowding, inequality, and environmental degradation. In many developing regions, fragmented and underdeveloped transport systems exacerbate congestion, pollution, and limited access especially for low-income populations. Addressing these issues requires context-sensitive strategies that integrate land use and transportation planning while promoting sustainability and equity ^[2]. Recent interdisciplinary research emphasizes the importance of locally grounded, evidence-based mobility policies that account for informal transport dynamics and socio-economic contexts. Public transportation is a critical driver of economic development, social equity, and environmental sustainability in urban areas. Efficient systems improve access to employment, education, and services, thereby fostering inclusion and productivity, especially for marginalized groups.

By reducing reliance on private vehicles, public transit alleviates congestion, lowers emissions, and mitigates health risks. Moreover, it enhances spatial equity by connecting underserved communities, which is essential amid growing urban inequality^[3]. However, many developing cities face barriers such as inadequate infrastructure, financial constraints, and reliance on informal transit, undermining service quality and potential benefits. Tackling these issues through integrated, locally relevant planning is crucial for advancing sustainable urban mobility^[4]. In this context, public transport becomes not just a mobility solution, but a pillar of inclusive urban development, particularly in countries like Nepal.

Developing nations often contend with widespread informal transport modes—such as minibuses and shared taxis—which, while vital, operate with minimal oversight, leading to safety, reliability, and efficiency challenges^[5]. Weak regulatory institutions further hinder effective planning, coordination, and reform^[4]. Infrastructural deficits, including poor road conditions and aging fleets, coupled with limited investment capacity, restrict system expansion and service delivery^[6]. These challenges are compounded by rapid urban growth, rising motorization, and socioeconomic disparities, which intensify congestion, pollution, and exclusion. Addressing this complex landscape requires targeted interventions to regulate informal transport, upgrade infrastructure, and improve financial sustainability—critical steps for fostering equitable and resilient urban mobility in contexts like Nepal.

Despite growing literature on public transit in the Global South, there is a need for comprehensive synthesis that integrates fragmented findings and contextualizes them for country-specific realities. Much research highlights isolated issues—such as informal sector dominance or funding gaps—but lacks a holistic view suited to the geographic, regulatory, and institutional nuances of places like Nepal. This paper addresses that gap by reviewing transportation experiences across developing countries and distilling insights to inform scalable, context-sensitive policies tailored to Nepal's urban mobility challenges.

2. Literature Review: Advancements in Public Transportation in Developing Countries

2.1 Evolution of Public Transport Modes

2.1.1 Bus Rapid Transit (BRT) System

Bus Rapid Transit (BRT) systems have been widely adopted in developing countries to tackle urban transportation challenges driven by rapid urbanization. Successful implementations in Latin America, Asia, and Africa demonstrate how features such as dedicated bus lanes, off-board ticketing, traffic signal priority, real-time arrival updates, and level boarding can reduce travel time, ease congestion, and enhance comfort and accessibility^[7]. These improvements offer a metro-like experience at lower cost, making BRT suitable for budget-constrained cities. However, effective implementation requires strong coordination among government bodies, stakeholders, and users. In many cases, political resistance, limited budgets, and poor inter-agency collaboration have led to substandard infrastructure and reduced system performance^[8]. Additionally, issues like overcrowding, weak intermodal integration, and poor transfer facilities diminish user satisfaction^[9]. Experts stress that political and social considerations must be addressed alongside technical design and quality construction to ensure

the success of BRT systems^[8].

2.1.2 Urban Rail (Metro, Tram, Commuter Rail)

Urban rail systems—such as metro, tram, and commuter rail—are increasingly popular in low- and middle-income countries for their ability to provide high-capacity, congestion-free mass transit. These systems are considered reliable, fast, and environmentally friendly, especially when electrified and powered by renewable energy sources. Over 90% of new urban rail infrastructure development now occurs in developing countries, aiming to improve transit efficiency and alleviate pressure on existing infrastructure^[10]. Such investments have also been linked to positive impacts on economic growth^[11]. However, urban rail development demands substantial financial resources and advanced technical expertise, which can create barriers for many developing nations and foster dependence on foreign technology. To address this, countries like China and India are adopting industrial policies to build domestic capacity and reduce external reliance^[10]. Strengthening local technical expertise and securing adequate financing are essential to fully realize the potential benefits of urban rail systems in the global South^[12].

2.1.3 Conventional Bus Systems

Studies indicate that replacing outdated diesel buses with modern electric or compressed natural gas (CNG) models can reduce environmental impacts, lower operational costs, and enhance passenger satisfaction^[13]. Additionally, improvements in operational practices—such as implementing bus dispatching technologies, automated fare collection, and driver training—can significantly improve ride quality and safety. However, widespread adoption of these advancements is often hindered by operator reluctance, limited financial capacity, and weak inter-agency coordination. Cities like Bogota and Ahmedabad demonstrate that with supportive government policies and effective public-private collaboration, such modernization efforts can lead to substantial improvements in urban transport systems.

2.1.4 Cable Cars and Alternative Modes

Cable car systems offer effective niche solutions for urban areas with challenging topographies, particularly benefiting low-income residents in hilly or mountainous regions where conventional transit is limited. These systems provide high-capacity, reliable, and rapid transportation to hillside communities in developing countries. Similar systems in La Paz (Bolivia) and Rio de Janeiro (Brazil) have supported neighborhood urbanization and social connectivity^[14]. To maximize social benefits, cable car projects should be integrated into broader urban and social development plans with active participation from governments and communities. With construction costs ranging from \$19 million to \$32 million per kilometer and rapid deployment timelines, these systems have been adopted in 18 developing-country cities^[15]. Additionally, fair ticket pricing policies are recommended to ensure accessibility and operational sustainability^[16]. Given their eco-friendly and affordable nature, cable cars serve as valuable transportation options for connecting cities to hard-to-reach areas.

2.2 Paratransit Reform and Integration

Paratransit serves as a vital mode of transport in areas lacking

formal public transit in developing countries, typically comprising minibuses and taxis but often characterized by poor safety, irregular operations, and weak supervision. Efforts to improve this sector include formalizing regulations and integrating paratransit into official transport systems. However, research indicates that simply establishing rules is insufficient; cooperation among governments, owners, and drivers is essential to ensure service responsibility and adherence to agreed standards [17]. Greater transparency and better connectivity with the wider public transport network can be achieved by involving drivers, planners, and the public in route planning and data collection [18]. Successful integration requires attention to financial sustainability, fair licensing, vehicle upgrades, and driver training. Cities like Lagos, Nairobi, and Maputo have improved reliability and safety after organizing driver associations and including them in planning processes [17]. A bottom-up approach that maintains paratransit's flexibility while enhancing organization can increase service availability and quality for all users.

2.3 Smart Mobility and Technology Adoption

Intelligent Transport Systems (ITS) are increasingly implemented in developing countries, utilizing real-time data such as passenger information, GPS tracking, and traffic flows to alleviate congestion and improve efficiency and user accessibility [19]. Mobile ticketing and smart card fare collection have further streamlined operations, as seen in cities like Nairobi and Dar es Salaam, although challenges remain due to costs and limited digital access among users [20]. Ride-hailing apps like Uber and Pathao also contribute to intelligent transport by offering real-time updates and enhancing safety, while generating employment opportunities with attractive earnings [21]. However, effective regulation is crucial to prevent potential negative impacts such as increased traffic congestion and pollution.

3. Critical Issues Affecting Public Transportation Implementation in Developing Countries

Institutional and regulatory weaknesses remain core obstacles to effective public transportation in developing countries. Fragmented governance structures lead to overlapping mandates and poor inter-agency coordination, which undermine strategic planning, disrupt infrastructure investment, and reduce service efficiency and sustainability [18]. Weak enforcement, due to limited administrative capacity, funding, and technical expertise, further enables informal operators like minibuses and shared taxis to function with little oversight. Though these services fill critical gaps, their unregulated nature causes reliability, safety, and access issues that disproportionately affect vulnerable populations. A related challenge is the inadequate integration of land-use and transport planning, often resulting in fragmented systems that deepen socio-spatial inequalities. This disconnect is particularly harmful in rapidly urbanizing areas where coordinated, forward-looking policy is essential. Reform requires enhanced governance capacity, clear mandates, inter-agency collaboration, and inclusive stakeholder engagement [22]. Formalizing the informal sector through regulation and enforcement, backed by political will, is crucial for achieving equitable and sustainable urban mobility.

Funding limitations pose a significant barrier to public transportation development in developing countries. High

capital costs for infrastructure and fleet upgrades often surpass domestic budgets, while reliance on external loans with restrictive conditions undermines financial autonomy and flexibility. Operational sustainability is further threatened by low farebox recovery, driven by fare caps and low-income ridership [23]. These revenue shortfalls constrain maintenance, service improvements, and system expansion, a situation worsened by the COVID-19 pandemic, which sharply reduced fare revenues and highlighted the fragility of current funding models. Although innovative financing tools such as land value capture, congestion pricing, and transport-related taxation hold promise, they remain underutilized due to political resistance and institutional shortcomings [24]. Overcoming these challenges requires integrated financial strategies that combine fare revenues, subsidies, beneficiary contributions, public-private partnerships, and blended finance. Strengthening transparency and regulatory oversight is also vital to attract investment and ensure long-term financial sustainability.

Informal transport modes such as minibuses, shared taxis, and motorcycle taxis play a vital role in urban mobility across developing countries, offering flexible and affordable services where formal systems fall short. However, integrating these operators into formal frameworks poses significant challenges, often encountering resistance due to fears of income loss and reduced autonomy. Effective formalization requires more than regulatory change; it depends on strong institutional capacity to enforce standards while maintaining affordability and service coverage [25]. Because informal services are typically demand-responsive and hard to replicate within rigid formal systems, integration must be guided by context-specific strategies that respect local travel patterns and economic viability. Equity considerations are essential, as many informal workers come from disadvantaged backgrounds with limited alternatives. Formalization efforts must therefore include retraining, compensation, or structured employment pathways to prevent social displacement. Evidence 4 suggests that participatory planning and co-governance, where informal operators are engaged in the reform process, enhance outcomes [26]. Gradual implementation of standards for vehicles, licensing, and routes can incentivize compliance while preserving service diversity, ultimately improving safety, efficiency, and equity by building on the strengths of informal systems.

Rapid urbanization in developing countries often outpaces transport infrastructure, leaving systems unable to meet rising mobility demands. Inadequate road networks, poor maintenance, and the absence of dedicated lanes for public and non-motorized transport reduce efficiency and safety. These shortcomings contribute to congestion, accidents, and overcrowding, disproportionately affecting low-income and vulnerable populations reliant on public and informal transport [27]. A major issue is the poor integration of land-use and transport planning, where projects are often developed without coordination with residential or employment zones, resulting in spatial mismatches and long commutes [2]. This fragmentation undermines infrastructure investments and limits accessibility, while continued emphasis on car-centric development sidelines sustainable modes like walking, cycling, and public transit. Institutional and financial constraints further hinder the provision of dedicated transit infrastructure. Without features such as exclusive bus lanes or signal priority, public transport remains unreliable in

congested conditions. Meanwhile, the lack of safe pedestrian and cycling facilities discourages active transport and contributes to air pollution and negative health outcomes. Addressing these issues requires integrated land-use and mobility policies that support inclusive, sustainable transport, with investments focused on dedicated transit lanes, non-motorized infrastructure, and participatory planning to enhance accessibility and resilience.

Equitable access to public transportation is vital for reducing social exclusion and promoting inclusive urban development in developing countries. Low-income populations often rely on affordable transit but face inadequate or costly services that limit access to employment, education, and healthcare [28]. Improving transit equity not only enhances mobility but also supports social justice, poverty reduction, and inclusive growth. At the same time, urban congestion undermines productivity and livability by delaying the movement of people and goods. Promoting efficient public transit reduces reliance on private vehicles, alleviates congestion, and improves overall mobility. Motorized transport is also a leading source of air pollution and greenhouse gas emissions, with aging, poorly maintained vehicles emitting harmful pollutants such as carbon monoxide, nitrogen oxides, and particulates, contributing to respiratory illness and environmental degradation [29]. Continued dependence on fossil fuels further intensifies climate change. Addressing these issues requires integrated planning that aligns transport, environmental, and urban policy goals. Strategies such as expanding inclusive public transit, promoting walking and cycling, and enforcing emissions standards are essential for improving public health, advancing sustainability, and fostering transport equity.

Frequent political turnover and short electoral cycles undermine the continuity needed for long-term urban transport projects in developing countries. Leaders often prioritize short-term, visible achievements to gain electoral support, neglecting multi-year infrastructure investments that require sustained funding and commitment. This political shortsightedness leads to delays, project abandonment, and inefficient resource use. Institutional fragmentation and shifting policy priorities further disrupt coordinated planning and reform efforts [30]. Successive administrations commonly revise or reverse transport plans, creating uncertainty for operators, investors, and users, and weakening overall system stability. Sustained political will, supported by strong technical and managerial capacity, is essential for long-term success. Early project wins and evidence-based advocacy can help build commitment, especially when transport strategies are embedded within broader development goals. Durable support also requires inclusive, transparent governance involving all levels of government, civil society, and users [31]. Strengthening institutions and establishing autonomous transit authorities insulated from partisan shifts can safeguard policy continuity and enable cities to close infrastructure gaps and achieve lasting mobility improvements.

4. Case Studies: Comparative Public Transport Experiences in Developing Countries

4.1 Bus Rapid Transit (BRT): Experiences across Latin America, Asia, and Africa

Bus Rapid Transit (BRT) systems have emerged as a practical solution in developing countries to address urban congestion, informal transit networks, and inadequate public transport infrastructure [32]. Cities like Bogota, Ahmedabad,

Johannesburg, and Dar es Salaam have implemented BRTs to tackle distinct yet overlapping challenges. Bogota's TransMilenio replaced an inefficient minibus system to reduce congestion and travel time [33], while Ahmedabad's Janmarg offered a low-cost, swiftly implemented system supported by participatory planning [34]. Johannesburg's Rea Vaya focused on improving mobility for communities marginalized during apartheid [35], and Dar es Salaam's DART system formalized informal transport routes to cut commute times. These systems varied in planning and governance—Bogota used a strong top-down institutional model, Ahmedabad promoted stakeholder engagement [34], Johannesburg utilized public-private partnerships [35], and Dar es Salaam relied on national leadership with international support.

The outcomes from these cities highlight critical lessons for Kathmandu and similar urban contexts. Longterm political commitment, inclusive planning, and stable funding are key to success [33, 34]. Public acceptance depends on quality, affordability, and accessibility. Ahmedabad's success was driven by inclusive planning and service reliability [34], whereas Bogota later experienced declining user satisfaction due to overcrowding and service deterioration [33]. Ensuring equitable service for peripheral and low-income populations is essential—something Dar es Salaam and Bogota struggled with. A resilient BRT system also requires consistent maintenance, service upgrades, and feedback mechanisms. For Nepal, a context-sensitive model combining strong leadership, local participation, and integrated feeder services can provide a roadmap for more sustainable and inclusive urban mobility [32, 35].

4.2 Land Use and Transport Integration:

Coordinated Growth Models To ensure sustainable development in rapidly urbanizing areas, integrating land use and transport planning is essential. Comparative experiences from Curitiba, Addis Ababa, and Medellin highlight how different cities have approached this integration. Curitiba's Transit-Oriented Development (TOD) model effectively channeled urban expansion along structured transit corridors with designated bus lanes, supported by strong zoning policies and institutional leadership through IPPUC [36]. This model promoted mixed-use development, increased public transport usage, and improved access to affordable housing. However, over time, enforcement challenges and shifting political priorities undermined its consistency. In contrast, Addis Ababa's Light Rail Transit (LRT) system represents a more recent effort to implement integrated planning. Although it shows potential in promoting compact development and improving access, the lack of institutional strength and enforcement capacity limits its impact [37, 38].

Medellin's Integrated Urban Projects (PUI) offer another example of land-transport coordination, emphasizing revitalization of marginalized neighborhoods through metro and cable car integration [39]. This approach, underpinned by community participation and strong leadership, improved access to services and increased public transport use. Nonetheless, its long-term sustainability faces obstacles such as inconsistent investment and difficulties adapting to dynamic urban conditions. A comparison of these cases reveals shared lessons: successful integration relies on robust zoning, institutional coordination, and adaptive governance. For Nepalese cities, a TOD model tailored to local contexts, backed by participatory planning and sustained political

support, could advance urban mobility, housing, and service accessibility [36, 37].

4.3 Paratransit and Informal Transport: Realities and Reform Attempts

Cities such as Nairobi, Jakarta, Manila, and Lagos rely heavily on paratransit and informal transport systems due to their cost-effectiveness and operational flexibility. However, these systems often lack safety standards, regulatory oversight, and coordination, which hinder their efficiency [40, 41]. Different strategies have been used to improve these systems. Jakarta enforces mandatory vehicle registration and route assignments for mini bus to reduce congestion. Manila promotes fleet modernization by replacing old jeepneys with eco-friendly, safer vehicles while fostering cooperation among operators [42]. Nairobi supports SACCOS—driver cooperatives that enhance regulatory compliance and passenger safety. These localized strategies highlight the value of structured yet context-sensitive reforms.

Gradual integration of informal operators into formal systems has shown greater success than abrupt top-down interventions. Lagos's phased approach, involving training and transitional support for informal operators, helped prevent disruptions and resistance. In contrast, Jakarta's sudden policy shifts faced opposition and reduced compliance. A common challenge across cities is the lack of reliable route-level transport demand data, which complicates planning. Nairobi and Manila have addressed this by engaging drivers and the public in data collection efforts. For sustainable improvements, strong government involvement is essential—particularly in enforcement, financial support, and relationship-building with operators. Nepal can adopt a hybrid approach, combining gradual reforms, data-driven planning, and cooperative partnerships to enhance paratransit systems in a locally adaptive manner [40, 42].

4.4 Urban Rail in Emerging Contexts: Promise and Pitfalls

Urban rail systems have emerged as a popular solution to traffic congestion in rapidly growing cities across Africa and Asia. Cities like Addis Ababa, Dhaka, Cairo, and Hanoi have each pursued rail transit to improve mobility and stimulate economic growth. Addis Ababa launched its Light Rail in 2015 to reduce travel time and operational costs [43]. Dhaka's MRT Line 6, operational since late 2022, has begun shifting commuter preference from paratransit to rail modes [44]. Cairo's historically successful metro system now faces challenges of aging infrastructure and limited expansion capacity [45]. Inspired by similar models, Hanoi has invested in urban rail to address population growth, despite facing significant planning and construction hurdles [46]. While these systems vary in design, they share a reliance on government support and financial planning. However, coordination failures have hindered Addis Ababa's operations despite adequate funding [47, 48], and Dhaka struggles to integrate its MRT with informal transport networks [49]. Cairo's metro expansion is constrained by donor delays, and Hanoi faces delays due to land acquisition and administrative fragmentation [46].

Urban rail systems often face sustainability challenges when coordination is weak and financial strategies are inadequate. Cost overruns of 30–45% and overestimated ridership are common, putting further pressure on long-term viability [50]. Addis Ababa's trains suffer from high rates of inactivity due

to unavailable spare parts. Dhaka's MRT faces an operational deficit due to low fare policies, while Cairo contends with aging equipment and frequent service breakdowns. Hanoi, still in construction, struggles with delayed benefits amid rising costs [46].

5. Public Transportation Dynamics and Challenges in Nepalese Cities

5.1 Overview of Urbanization in Nepal

Nepal is experiencing rapid urbanization, especially in major urban centers like Kathmandu Valley, which has seen its population grow steadily and now exceeds 2.5 million people, with an annual urban growth rate of around 6.5%. This shift from predominantly rural to urban living, driven by government reclassification of 7 rural areas into municipalities and rural-to-urban migration, has led to unplanned land use, shrinking open spaces, and inadequate urban services. Other fast-growing cities such as Pokhara, Bharatpur, and Butwal are also experiencing significant population increases, further intensifying urban growth pressures across the country. Today, about one-third of Nepal's urban population is concentrated in just 16 cities with populations over 100,000, highlighting the concentration of urban demands and infrastructure needs in a few major centers [51, 52].

5.2 Current State of Public Transportation

Nepal's current public transportation system comprises a combination of formal and informal modes. The formal sector is led by Sajha Yatayat, with the Government as a shareholder, a cooperative bus service and the country's only large-scale public bus operator. It operates both electric and diesel buses, primarily in the Kathmandu Valley. Sajha Yatayat's fleet includes 11-meter electric buses and smaller diesel units, with the electric buses demonstrating profitability due to reduced operating costs and government subsidies. Aside from Sajha, the formal sector remains fragmented, consisting of numerous small private operators running diesel minibuses and minibuses under a route licensing system. Informal transport modes, such as tempos (three-wheeled motorized vehicles), taxis, rickshaws, and other privately owned vehicles provide short-distance services and last-mile connectivity. While these modes help supplement formal services, they often lack regulatory oversight, contributing to traffic congestion and safety concerns. Vehicles operated by private entities, particularly minibuses and minibuses, are frequently overcrowded, poorly maintained, and suffer from inconsistent service.

The overall public transport system in Nepal faces significant structural challenges, including limited coordination, an aging fleet, and inadequate financial resources for modernization. However, recent initiatives aim to improve system efficiency through the introduction of electric buses and the implementation of intelligent transport systems, particularly in Kathmandu and Pokhara [53]. Despite these efforts, the current mix of formal and informal transport modes remains inadequate to meet the rising demand for sustainable and efficient urban mobility.

5.3 Dominance of Informal Transport

Paratransit—including informal modes like tempos, rickshaws, and minibuses—is vital to Nepal's urban transport, especially where formal systems have limited coverage and capacity. Valued for their flexibility and

affordability, these vehicles can navigate congested, narrow, and hilly urban areas, providing essential last-mile connectivity^[54]. While rickshaws were traditionally confined to the flat Terai region, their use has expanded into hill cities like Kathmandu, where street constraints limit larger vehicles. However, rickshaws face limitations such as low speeds, limited capacity, and difficulty handling steep or uneven terrain, which challenge their long-term integration into formal transit systems. Advantages of paratransit include low operating costs, flexible door-to-door service, and job creation, serving neighborhoods and terrains poorly served by formal transit. Yet, issues like lack of regulation, poor vehicle maintenance leading to emissions, traffic congestion, safety risks, and inconsistent service quality hinder the sector's development and complicate its coordination within an integrated urban transport framework.

5.4 Institutional Landscape and Governance of Public Transport in Kathmandu Valley

The Federal Capital City Public Transport Authority (FCCPTA) operates under an interim organizational structure pending government approval of formal regulations. Its current setup includes a CEO supported by technical, administrative, and accounting staff. FCCPTA is mandated to develop, regulate, and manage an integrated public transport system in Kathmandu Valley, coordinating with provincial and local bodies. However, the authority is still in a nascent stage and faces critical challenges such as inadequate staffing, weak inter-agency coordination, and legal ambiguities. Legal mandate misses some necessary power such as route permit which is basic requirement as service regulator. Public transport is governed by several acts and regulations, but enforcement and oversight remain fragmented. Dispute between the federal and provincial government regarding jurisdiction and share of revenue from

transport sector is under judicial review. Private operators provide most services, though issues like overlapping routes, poor service reliability, and lack of accountability persist. Route registration is loosely monitored, and fare structures, though set by provincial authorities, are undermined by the absence of digital payment systems, leading to frequent fare manipulation. Informal modes such as tempos and minibuses play a crucial role in last-mile connectivity but operate largely unregulated, contributing to service inconsistency and safety concerns.

To address these challenges, FCCPTA is pursuing reforms such as introducing cashless fare systems, GPS-based tracking, and centralized data management for improved planning and monitoring. The authority is also exploring the formal integration of informal operators through registration, licensing, and enforcement of service standards. Although large-scale planning efforts are yet to begin, FCCPTA engages stakeholders through meetings and its online feedback portal. Funding is sourced mainly from government grants and donor support, with plans to diversify through concessions, service charges, non-fare revenue, and PPP models. Drawing on lessons from initiatives like Sajha Yatayat and past efforts such as the electric trolley bus system, FCCPTA envisions a more sustainable and efficient future. Strategic priorities include establishing robust regulatory mechanisms, improving service delivery through technology, and building skilled human resources while navigating Kathmandu's complex socio-political transport environment.

5.5 Specific Challenges in Nepalese Urban Contexts

Nepal's urban transportation systems face multifaceted challenges shaped by unique geographical, institutional, socioeconomic, and environmental factors (as shown in Fig 1).

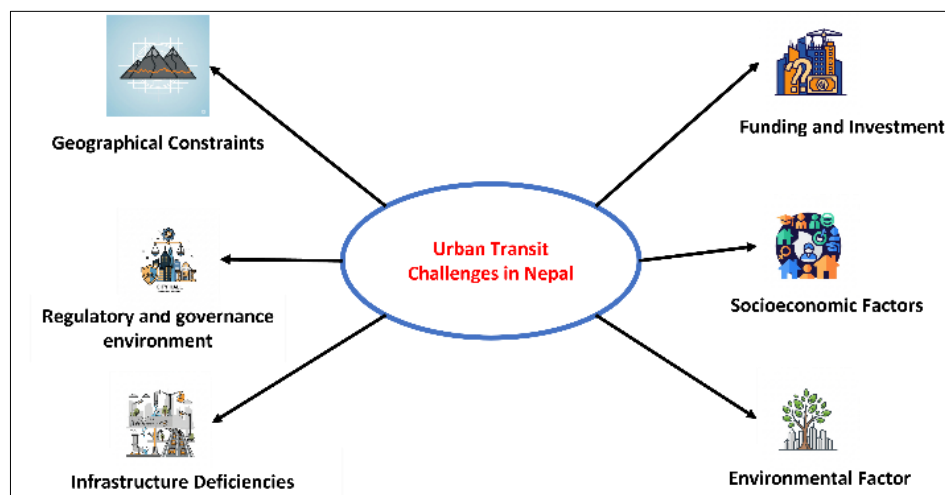


Fig 1: Urban transit challenges in Nepal

Geographical limitations significantly affect the development and operation of transport infrastructure in Nepal's urban centers. The prevalence of narrow, winding roads and rugged hilly terrain—particularly in the Kathmandu Valley and other hill towns—hampers road expansion and complicates the deployment of large-scale transport infrastructure such as dedicated bus lanes or rapid transit systems. While these conditions necessitate transport solutions capable of navigating difficult terrain, they often restrict the operation of

high-capacity vehicles^[55].

The regulatory and governance environment is marked by fragmented institutional authority, with responsibilities divided across multiple agencies. Weak enforcement of traffic laws, inconsistent transportation standards, and instances of corruption hinder effective urban transport planning and management^[56]. This institutional fragmentation obstructs coordination and delays the implementation of integrated transport policies and

regulatory frameworks, especially across formal and informal transport sectors.

Infrastructure deficits remain a significant bottleneck for urban mobility. Many cities lack essential features such as dedicated bus lanes, properly designed and maintained bus stops, transit depots, and vehicle maintenance facilities. These deficiencies contribute to service inefficiencies, increased safety concerns, and declining public transport quality. Poor road conditions further accelerate vehicle degradation and increase operating costs.

Urban transport development in Nepal is also limited by inadequate funding and investment. Public budgets are generally insufficient to support large-scale infrastructure projects, while private sector engagement is deterred by unclear regulatory conditions, high financial risk, and low return on investment. This financing gap contributes to delays in the modernization and expansion of public transport systems.

Affordability is a key concern, given that a large proportion of the urban population belongs to lower-income groups requiring low-cost transport options. Cultural preferences further shape travel behavior, with a strong reliance on informal and flexible transport modes such as tempos and rickshaws. These preferences create challenges for transitioning to more formal, structured transportation systems.

Environmental issues are becoming increasingly critical. Aging, poorly maintained vehicle fleets contribute to high emissions, while traffic congestion exacerbates urban air pollution—particularly in Kathmandu and other large cities^[57]. Mitigating these impacts will require systemic interventions, including the adoption of cleaner technologies such as electric buses, congestion management strategies, and sustainable urban planning practices.

6. Recommended Public Policy Planning Approaches for Nepalese Cities

6.1 Justification for a Tailored Approach

A direct replication of “big bang” reforms or purely disjointed incremental models, such as Bogota’s *TransMilenio*, is unsuitable for Nepal due to its distinct institutional, financial, and governance limitations. The *TransMilenio* system, while successful in phases, required strong political leadership, high-capacity institutions, and substantial upfront investments—conditions often absent in Nepal’s urban transport landscape^[33, 58]. Disjointed incrementalism, though effective for managing complex transitions like phasing in BRT and integrating paratransit, demands consistent inter-agency coordination and regulatory authority to implement complete corridor components, which Nepal lacks^[10]. Moreover, the capital-intensive requirements and opposition from incumbent operators seen in Bogota highlight the risk of replicating such *TransMilenio* models without adaptive strategies. Nepal’s fragmented paratransit ecosystem, low state capacity, and limited fiscal space necessitate a hybrid, context-sensitive approach that incrementally introduces formal transit elements while fostering local ownership, reducing financial exposure, and allowing institutional learning.

6.2 Proposed Planning Concept:

Adaptive Incrementalism (or Step-by-Step with Strategic Vision) Adaptive incrementalism, also known as a step-by-step approach with a strategic vision, is particularly well-

suited for contexts like Nepal, where institutional capacity is limited and the urban transport landscape is dominated by informal paratransit services. This concept is rooted in Lindblom’s theory of simple incrementalism, which argues that policy and planning reforms are more effective when implemented through a series of small, manageable changes rather than infrequent, large-scale overhauls. This gradual process allows for continuous learning and adjustment, making the reform process more flexible and responsive to real-world complexities. Unlike disjointed incrementalism, which can represent abrupt and comprehensive shifts demanding significant social and technical adaptation, adaptive incrementalism emphasizes phased implementation that reduces resistance from incumbent operators and other stakeholders. By introducing high-impact interventions one step at a time, this approach facilitates stakeholder engagement and builds institutional capacity progressively. This mitigates political risks associated with rapid reform and enables policymakers to pilot and refine strategies before wider scaling^[59].

A successful example of this approach is Curitiba’s *Rede Integrada de Transporte*, which evolved over decades through incremental upgrades in service quality, infrastructure, and technology, all while maintaining alignment with the city’s land-use planning^[60]. Institutions established early in the process provided continuity beyond political cycles, ensuring the long-term sustainability of reforms. The step-by-step nature of the plan allowed Curitiba to progressively improve accessibility, affordability, and integration within its transit system without overwhelming operators or the public.

For Nepal, adopting adaptive incrementalism means starting with pilot corridors or targeted service improvements that are financially and technically feasible. These initial phases would enable gradual formalization of paratransit operations, institution building, and public engagement. Scaling would follow as experience and resources grow, allowing for iterative improvements based on ongoing feedback. Crucially, this approach stresses integrating transport planning with urban development policies, ensuring that mobility improvements support broader goals of spatial accessibility, economic inclusion, and sustainable growth.

7. Actionable Recommendations for Public Transportation in Nepalese Cities

We present six interrelated recommendations tailored based on literature analysis to Nepalese urban contexts. Drawing on best practices from developing countries and grounded in Nepal’s unique institutional and infrastructural challenges, each recommendation includes an overarching objective and actionable strategies that promote integrated, sustainable, and inclusive public transportation systems.

A. Institutional Coordination and Governance

Effective governance and clear institutional roles are critical to managing urban transport systems in Nepal. Key actions include:

- Enhance the mandate and capacity of existing urban transport authorities to effectively manage planning, regulation, and oversight.
- Clarify legal mandate to avoid duplication of authority, power and revenue sharing among different tiers of government
- Establishment of workable regulatory apex body e.g.

transport council to support prompt decision making

- Clearly point out and mandate the source of funding to the authority
- Specific guidelines to regulate ride sharing services
- Encourage the establishment of metropolitan-level transport bodies modeled after FCCPTA.
- Promote inter-agency coordination among municipalities, traffic police, and land use departments.
- Clarify legal mandates across government levels to regulate informal transit and reduce institutional overlap

B. Service Integration and Network Optimization

Improving network design and multimodal integration is essential to increasing efficiency and user convenience. Key strategies involve:

- Redesign bus routes to improve efficiency by minimizing duplication and optimizing trunk-and-feeder structures.
- Foster multimodal integration by aligning walking, cycling, and paratransit services with formal public transport.
- Standardize operational guidelines for schedules, stops, and vehicle types across providers.
- Implement coordinated ticketing systems to enhance user convenience.

C. Formalization and Professionalization

Formalizing informal operators and improving workforce skills enhance service quality and safety. Recommended measures include:

- Support the gradual transition of informal operators into cooperatives or companies through financial and technical assistance.
- Implement mandatory training and licensing programs for drivers and conductors.
- Promote fleet modernization with incentives for safer, cleaner vehicles.
- Introduce service contracts with clear quality benchmarks.
- Invest in building technical capacity within transport authorities.

D. Technology and Data Utilization

Leveraging technology and data improves operational oversight and passenger experience. Key interventions are:

- Deploy GPS tracking, electronic fare collection, and real-time passenger information systems.
- Establish centralized data platforms for performance monitoring and planning.
- Use mobile apps and digital feedback tools to engage passengers.
- Encourage open-data policies to foster transparency and innovation.

E. Finance and Investment

Sustainable funding mechanisms are necessary to support service expansion and modernization. Strategic options include:

- Develop performance-based subsidies to support essential but unprofitable routes.
- Explore public-private partnerships for fleet and infrastructure investments.

- Leverage municipal revenue tools such as parking fees and land value capture for funding.
- Provide targeted financial incentives for vehicle electrification and depot upgrades.

F. Social Inclusion and Public Engagement

Ensuring equitable access and fostering public participation strengthen social acceptance and service relevance. Priority actions include:

- Design services that meet the needs of women, elderly, children, and persons with disabilities.
- Conduct regular user satisfaction surveys and involve communities in planning.
- Raise public awareness on safety, behavior, and environmental benefits.
- Facilitate dialogue with transport unions and local associations to ease reform implementation.

8. Conclusion

This study has provided a comprehensive comparative analysis of public transportation systems in developing countries, alongside an in-depth examination of Nepalese urban transport dynamics and challenges. The evidence underscores that successful transit initiatives, such as Bus Rapid Transit (BRT), urban rail systems, and paratransit reforms, are underpinned by critical enablers including sustained political commitment, robust institutional frameworks, inclusive stakeholder participation, and consistent financial support. Moreover, effective integration of land use and transport planning emerges as a pivotal component in fostering sustainable urban mobility.

However, the juxtaposition of international experiences with Nepal's unique context reveals that direct transplantation of large-scale, top-down models is neither feasible nor advisable. Nepal's institutional fragmentation, constrained fiscal capacity, predominance of informal transport modes, and challenging geographical conditions necessitate a nuanced, context-sensitive approach. The concept of adaptive incrementalism, characterized by phased interventions grounded in a strategic vision, offers a pragmatic pathway for Nepal. This approach facilitates progressive formalization of paratransit services, institutional capacity enhancement, and systematic integration with broader urban development policies, thereby promoting equitable and sustainable transit solutions. Looking forward, advancing Nepalese public transportation systems demands prioritization of inter-agency coordination, particularly through strengthening entities such as the Federal Capital City Public Transport Authority (FCCPTA), adoption of technology-driven solutions for operational oversight and fare collection, and exploration of innovative financing mechanisms including public-private partnerships. Furthermore, targeted empirical research focusing on travel behavior, service demand patterns, and the socio-economic impacts of reform initiatives is essential to inform evidence-based policy making. Pilot projects embodying adaptive incrementalism will be instrumental in generating contextually relevant insights and facilitating iterative refinement of implementation strategies.

In conclusion, by synthesizing global best practices with localized adaptations, Nepal's urban centers can progressively cultivate resilient, accessible, and environmentally sustainable public transport systems. Such advancements hold significant promise for enhancing urban

livability, promoting social inclusion, and catalyzing sustainable economic development.

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