

BARRIERS AND DRIVERS FOR ADOPTING SUSTAINABLE TRANSPORT MODES IN DEVELOPING COUNTRIES: POLICY AND INFRASTRUCTURE ANALYSIS

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Abstract

A shift towards sustainable mobility is being actively sought. Cycling is one of the modes which has been seen as a potential mode of transport. The study demonstrates the potential benefits of cycling both for the individual and the urban system and how these benefits can be realized within a developing environment. Many developing countries rely on motorized transportation, although there is still interest and attention in other modes. Cycling may be a viable alternative in medium-sized cities where the demand for travel is below 10 km, and the spatial constraint is not that large. Cycling uses less road space, causes less traffic congestion, has no carbon emissions, promotes personal health and significantly improves access to social engagement. Adoption of this mode of transport is hindered by barriers, especially in developing countries where a lot of the critical transport improvements have not focused on bicycling. Identification of effective policies and measures can only be done if barriers to cycling adoption are assessed. Case studies of many developing countries show there is significant potential for reorienting policy priorities for promoting cycling and integrated transport policies. Encouraging cycling as a mode alone will not achieve beneficial changes. A comprehensive and systemic approach to urban transport, involving the whole system of land use, integration of modes and cycling, strongly connected to urban development types and forms of developing countries might be the subject of increased interest. The implementation of policies for NMP should not happen without tackling the general constraint of capacity, coordination and governance.

Keywords: Sustainable Transport; Urban Mobility; Transport Policy; Cycling Infrastructure; Public Transport.

1. INTRODUCTION

The importance of sustainable transport modes to developing countries to address economic, social, environmental and health problems cannot be overstated. The shift from private to public and non-motorized transport has economic, environmental, public health and social equity benefits. But obstacles to sustainable mobility have to be overcome. This Chapter reviews literature to identify important circumstances and investment requirements for this transition. The policy case for transforming the existing private transport system to mass transport, and walking and cycling, is very strong. Public transport is a very economical and has social benefits which far exceed costs. When low cost bus services are implemented, they have the potential to deliver fast economic returns and public health benefits. Further, pollution reduction of motorized vehicles can boost tourism and fulfil conditions set by donors, and road safety enhancement can reduce costs of traffic accidents and enhance mobility for disabled people by improving road facilities. [1] [2]

2. THEORETICAL FRAMEWORK

Urban development increases congestion and high usage of urban transportation. Transport's share of income is larger in developing countries than in developed countries. Public transportation is underdeveloped, mainly using buses, and the automobile is the most dominant mode of

transportation in developing countries. The situation calls for the significance of urban transport policy making and investments. In developing nations, policy hurdles are not easy to quantify and are high. There is no explicit evidence of political will or regulation. Normal specifications to solve these barriers are not usually consulted [3]. In Figure 1. These are the main barriers and drivers that affect the adoption of S sustainable transport modes in developing countries and environmental, social and economic outcomes.

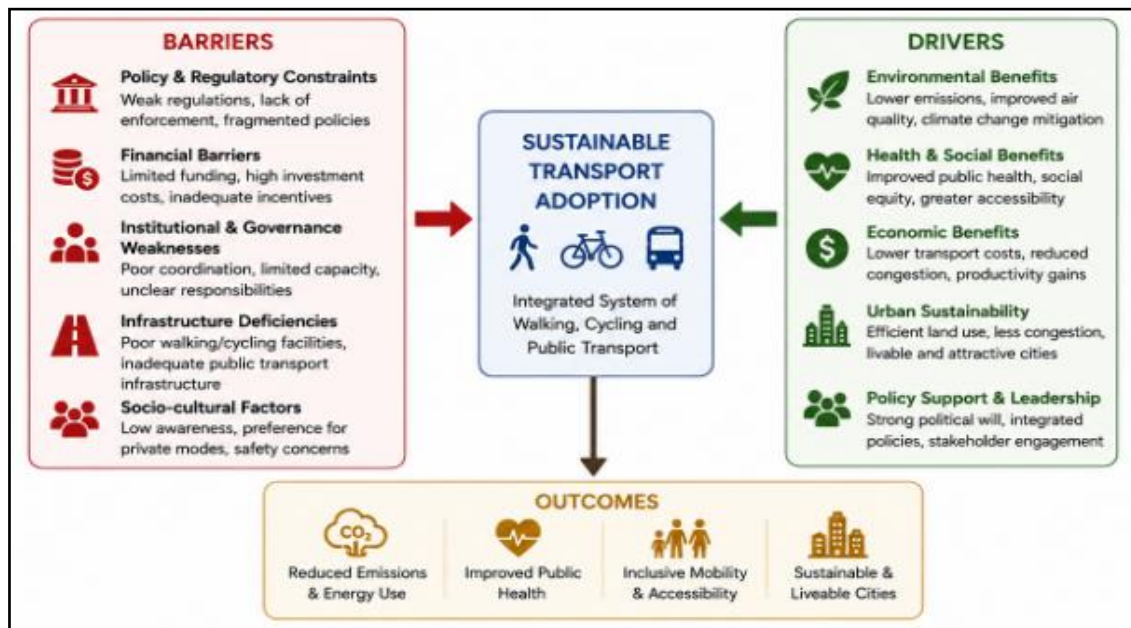


Figure 1: Barriers and drivers influencing sustainable transport adoption in developing countries

3. OVERVIEW OF SUSTAINABLE TRANSPORT MODES

Sustainable modes of transport have lower energy demands and emissions than the dominant modes. The indicators of economic, social and environmental sustainability are crucial for implementation. Key sustainable transportation types include non-motorized transportation (walking and cycling), public transportation (electric railways and bus rapid transit), and elimination of heavy duty trucks for freight. In developed countries, it is expected that the per capita consumption of transport infrastructure will reach a peak in the next ten years, in many developing regions, the growth of per capita consumption will continue for decades. To have a more balanced and less motorized transport pattern in these areas significant changes in public and freight transport are required, which necessitates the improvement of the government policy and resources. [4]

4. POLICY BARRIERS IN DEVELOPING COUNTRIES

In developing countries, sustainable transport is hindered by weak regulatory, institutional and governance systems that are being blocked by policy barriers. There is a lack of transport policy coherence and weak coordination of investments, and funding for capital investment is still limited. When there are sustainable choices available, lack of integration with other transport reduces their value. Political support for policy adjustments is frequently limited, particularly if there are some groups that have to sacrifice something. Regulatory limitations, funding gaps and governance gaps are significant impediments to investment in sustainable solutions. High investment costs for necessary infrastructure can limit the opportunity for investments with potential to induce modal changes such as private bus services and cycling facilities. Barriers such as social acceptance and regulatory issues

need to be overcome and sustainability benefits must be prioritised over costs for decision-makers. Current policies, including fuel subsidies, need to be adjusted in order to encourage sustainable alternatives. Land ownership and right-of-way challenges significantly impact public transport expansion, with local governments crucial in tackling these issues. For new transport modes, high costs are significant challenges in LMI and LI countries. This funding challenge of infrastructure financing is difficult to handle within city budgets in times of economic growth, and the high start-up costs associated with Demand Responsive Transport (DRT) can be prohibitive. It may be more economical to install cycle lanes, but they still take money out of the budget. Local government may lack funding to do bus transit improvements due to the emphasis on low fares not quality. Private service may complement DRT in smaller cities, but public service is necessary to ensure affordable fares and fare subsidies can be used to burden city budgets. Coordinating and effective governance is essential for sustainable transport investment. Stakeholders involvement and performance management are part of urban planning in order to enhance public expenditure control. Clear goals and comprehensive investment evaluations must be in place. Worse governance can cause unsustainable transport, lack of coordination and lack of implementation skills. Political will and social acceptance are crucial but governments tend to focus on economic growth instead of urban transport planning. This disconnect creates project opposition, exacerbated by budget constraints and a diminished focus on socioeconomic needs, and projects are perceived as benefiting only the wealthy. [8][9][10][11]

5. INFRASTRUCTURE BARRIERS AND ENABLERS

Sustainable modes of transport, such as public transport, non-motorised transport and freight, present economic, environmental and equity benefits, but are not without challenge in cities in the process of emergence, such as Indonesia. Only 11% of trips made in Jakarta are by public transport, primarily because of the poor quality of public transport in the city. Though there are various studies, there is still no framework for categorizing barriers/drivers. To limit travel distances (particularly for low income earners) residential, commercial and industrial needs must be considered when planning transportation. The travel pattern and the type of transport mode chosen will be affected by urban form and affect costs. Integrated planning improves logistics investments, and urban design impacts on vehicle kilometers travelled and accessibility. There is a need for country specific strategies to address a variety of freight functions. Effective transit infrastructure, such as railways and BRT, is crucial for sustainable transport, offering eco-friendly alternatives and improving public access. It is essential to upgrade informal services and to allocate specific non-motorized transport areas. Accessibility is increased by high-density transit-oriented development and understanding how people travel after high capacity facility implementation is crucial. In many cities, including Hawassa, Ethiopia, the promotion of non-motorized transport is stymied by weak policies and infrastructure. For many, walking or cycling is a choice driven by cost, but policy neglect restricts and limits walking and cycling. Small informal enterprises are a burden on freight operations, and urban sprawl makes them more difficult to manage. Current facilities support retail activities, causing congestion. Switching to rail transport is essential for sustainable and intermodal solutions. Enhanced reliability and cooperation through formal logistics platforms and improved routing through multi-modal scheduling. In Figure 2. Policy and infrastructure action pathway, with sequential path of policy, investments, governance change, and feedback processes to encourage sustainable transport uptake in developing countries.

Smart technologies are reshaping sustainable mobility services in developing countries, facilitating mobility-as-a-service models. Smart technologies are transforming mobility services in developing countries towards sustainable mobility and mobility-as-a-service models. Running an information system in a structured manner helps to manage data. Efforts in 25 ADB member cities are based on the concept of transport geospatial models for real-time data to enhance project evaluations for non-

motorized transport. Various technologies have been adopted in adaptive traffic signal systems and international databases have been helpful in investment analysis. [12][13][14][15][16][17][18]

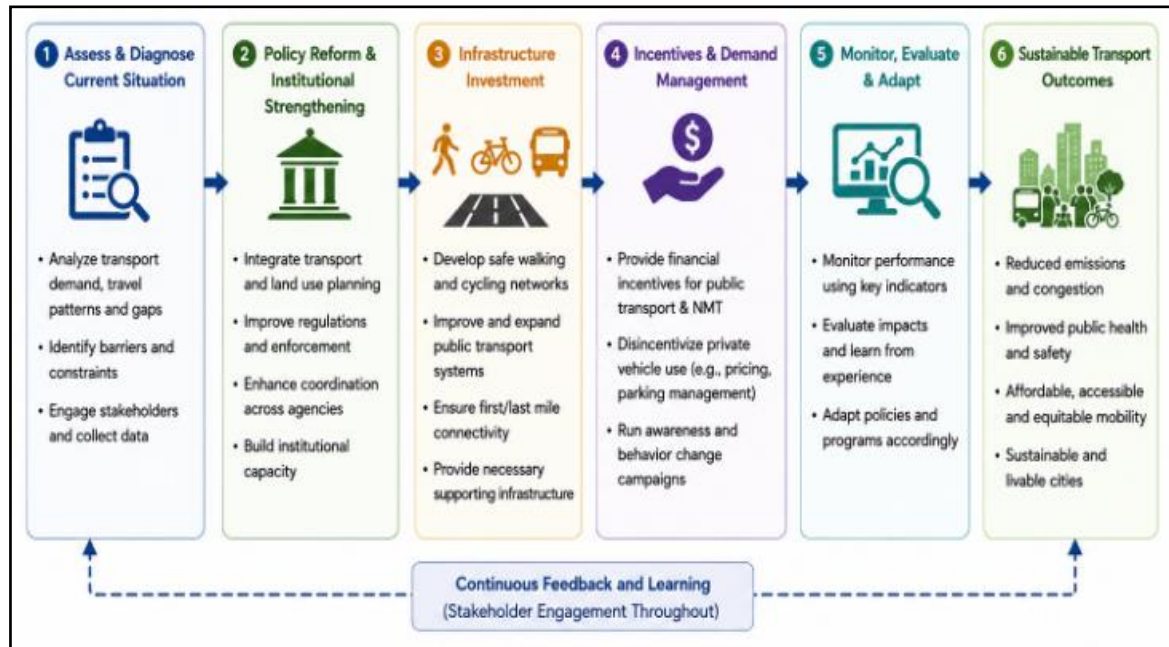


Figure 2: Policy and infrastructure pathway for sustainable transport promotion

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6. DRIVERS OF CHANGE

Cost-benefit analyses of transport pricing policies, such as VAT for fuel tax and differentiated tolls, show slight increases in net present value and significant environmental benefits at low costs (e.g., -1% of GDP). Market-oriented approaches are essential for sustainable land use and urban development. Investments in transport improve health, education, and economic opportunities, requiring consideration of all societal segments, including the corporate sector. The impacts of transport infrastructure extend beyond initial costs, necessitating comprehensive evaluation of costs and benefits. Environmental benefits of public transport systems support regulating bus services for safe and affordable transport.

6.1 Economic Benefits and Cost-Benefit Considerations

Investing in sustainable transport systems yields significant economic gains. Cost-benefit analyses highlight government budget impacts, essential for attracting private sector participation in public-private partnerships. Although sustainable transport reduces societal transport costs, thorough investigations against total costs are necessary. Standard cost-benefit analyses often overlook climate change effects, especially in low-demand areas. Sustainable transport projects can justify costs through Economic Internal Rate of Return calculations but must maintain predictable demand. CBA should focus on transport activity, air pollution, accidents, travel time, and land use changes, advocating policy changes based on social and private transport demand curves.

6.2 Environmental Sustainability and Public Health

Global themes necessitate a reevaluation of transport's role in sustainable development. Transport policies relate to climate change, economic greening, food security, health, and social inclusion. Urban transport contributes significantly to CO₂ emissions, affecting air quality and public health. Transport

policies address energy, poverty, employment, urbanization, and security issues, requiring collaboration between developed and developing countries. Urban pollution decreases life expectancy, while investments in public and non-motorized transport enhance public health. Urban scale significantly affects health outcomes, and improving road safety is critical, as pedestrian and two-wheeler fatalities exceed 50% of total deaths.

6.3 Social Equity and Inclusive Mobility

Lower-income urban households spend more on transport and face greater impacts from rising costs. Enhancing affordable transport services benefits these households, as they often prefer motorized transport and spend more time commuting. Transport design should prioritize reducing travel time for low-income individuals and support their needs without undermining service quality for lower-income users. Recognizing non-motorized transport is crucial, especially in smaller cities. Infrastructure must cater to local demand, minimizing travel times and ensuring equitable resource distribution. Examining road freight logistics is vital, as development can increase freight transport without aiding poorer populations.

6.4 International Support, Aid, and Collaboration

International communication and collaboration can strengthen the push for sustainable transport infrastructure. Development aid can alleviate financial constraints but often has contradictory effects. Donor countries typically support road construction rather than public and non-motorized transport. Focusing development aid on urban public transport is essential, as investment needs in developing countries are high. Multinational companies and financial institutions, like the World Bank, are increasingly emphasizing sustainable transport in these regions, with local businesses also likely supporting urban public and non-motorized transport initiatives. [19]

7. POLICY AND INFRASTRUCTURE CASE STUDIES

Case studies of infrastructure and policy to overcome barriers for sustainable transport in developing countries (4) All studies show that sustainable transport is better implemented if these barriers are overcome. Ho Chi Minh City BRT reform shows how investing in a single mode such as bus systems fails. Decarbonising urban transport: Vietnam's electrification options and outdated regulations that do not enable integration Electric buses have been demonstrated to work on BRT routes in test runs and the Central Government has a key role to play. Integrated systems can yield large environmental benefits at low cost. Earmarked surcharges can fund investments. Five Indian cities are given as examples of successful implementation of non-motorized transport (NMT) policies with little funding or demand modeling. Often projects are ad-hoc for single modes with sub-optimal results and politically driven funding. But even with tight budgets, NMT infrastructure can be prioritized by focusing on rural-urban connections. Analysis of speed and demand indicates problems of road safety that need to be addressed by Road Safety Audits to lift design standards. Reforming the urban bus system in the large cities of the developing countries is an imperative. India's National Urban Transport Policy emphasizes the need to restructure the bus services through public-private partnerships to improve efficiency. Electrification is the way to go to cut emissions. In Delhi, a set of diagnostic frameworks were used to assess the feasibility of reform and to help stakeholders identify viable options for operational and financial restructuring, attracting private operators and implementing clean technologies. Despite the benefits of NMT, however, urban planners have been slow to incorporate walk and cycle in transport policies. Those trips are inefficiencies in many medium-sized and small towns. But the evidence suggests that it is useful to devote 15-20% of road space to cycle lanes. In smaller cities, it is easier to put in place policies that make it better to walk or cycle, because most people in these cities make short trips by walking or cycling. But the absence of infrastructure

like sidewalks and bike lanes puts pedestrians and cyclists at risk, especially in bad weather. Land use and transportation systems are tightly linked and interdependent. Good land use planning can foster transit-oriented development and decrease our reliance on cars. Poor planning results in low density sprawl which results in increased motorization and urban pollution. Urban planners tend to focus on vehicular access and are not usually powerful enough to prioritize sustainable transport. The world is trying to reduce its reliance on fossil fuels and meet its climate goals, which means there is a need for sustainable transport systems. However, there are many challenges, especially in developing countries. The demand of freight transportation requires an integrated logistics system. Cities need effective freight distribution systems in order to be able to reduce congestion and pollution. Efficient connections to ports and airports are crucial for international supply chains. Smart logistics reduce the time goods are standing still and are good for the environment. This means more services, access for operators becomes easier and collaboration is encouraged, for better logistics. Inefficient logistics policies affect the efficiency of service and limit sustainability, while freight modernization can improve the quality of service and reduce urban congestion. [20][21]

8. ANALYTICAL METHODS FOR ASSESSING BARRIERS AND DRIVERS

Barriers and drivers are evaluated with three analytical methods: diagnostic frameworks, multi-criteria decision analysis (MCDA) and cost-benefit or life-cycle assessment. Diagnostic tools: identify bottlenecks for sustainable transport MCDA: focus on solutions, investments Life-cycle analysis considers the environmental impacts, and stakeholder analysis considers the people impacted by changes in transport. Combined, they provide insight into accelerating change. In developing countries, diagnostic frameworks identify barriers including political, financial, regulatory and social challenges. Good governance and skills are key to implementing financial frameworks with multi-national development banks and UN institutions to support local authorities to develop financing mechanisms. Success depends on the building of institutions, the creation of enabling environments and the securing of the commitment of citizens and leaders. In many developing countries, several barriers often result in lower use of sustainable transport options.

The pace of urbanization calls for a variety of transport measures. MCDA evaluates transport issues with multiple criteria such as safety, costs, equity and environment compared with traditional approaches. While it is hard to weight criteria, it is the prerogative of decision makers to define alternatives and preferences. Sensitivity analysis takes care of this. MCDA allows policy makers to consider costs and benefits beyond economic impact and highlight important environmental advantages. This is especially important when trying to drive scarce budgets into projects with large non-economic benefits. Cost benefit assessments are measures of the net benefits of a project for the identification of investments in transport infrastructure. All benefits and costs are included in net-present-value calculations, with shadow pricing.

The cost benefits of sustainable transport modes are discussed but broader analyses can affect their uptake through external factors like the net investment cost of bus rapid transit systems. Life cycle assessments look at the costs and environmental impacts of infrastructure projects over time, especially greenhouse gases or other things. Geographical information systems help to analyze the spatial aspects of investment priorities, while analytic hierarchy processing allows the participation of stakeholders with limited analytical skills. Analysis of governance and stakeholders are important tools to identify barriers for sustainable transport. The barriers to success in evaluating sustainable mobility initiatives in Delhi are the lack of stakeholder support, political acceptability and institutional capability. Most project failures are caused by a lack of stakeholder support and this framework can identify potential problems in an early stage. Car users and businesses resist reallocation of road-space and there are a number of stakeholder interests which need to be carefully managed; [22][3][23]

9. POLICY AND INFRASTRUCTURE RECOMMENDATIONS

Advocating improved policies and capacity development for sustainable transport in developing countries. The funding is particularly important for smart logistics as the transport impacts are less important than the operational costs. Strengthening Governance and Institutions: Barriers to sustainable transport uptake in developing countries influence urban development. Mobility and urban spaces are at the core of the Sustainable Development Goals (SDGs). Transport, energy, urban planning and governance policies are in need of reform. Among the barriers are a lack of regulations and aging infrastructure, which increase people's reliance on cars. Urban mobility is important for economic prosperity, as unreliable transport harms economic prosperity. Technological and environmental improvements matter. More sustainable transportation options can reduce the distance and time traveled, improve the amenities at public transportation stations, and promote healthier ways of getting around. Investment Climate and Financing Arrangements: Cities need to understand the investment landscape, including legislative and governance barriers, to unlock funding derived from grants and private investments. Cities need to build a strong infrastructure bank, pooling funding streams, blending fare revenues, local taxes, national money and EU grants and loans. "A lot of the financing options are dependent on legislative changes." Planning and Design Standards Sustainable transport modes are critical for urban development. Planning elements include non-transport factors, accessibility improvement, integration of land use, and timely completion of projects. Contradictory policies require the evaluation of the freight transportation and the consideration of alternatives to road systems and the synchronization of plans with sustainable development goals. Innovation, Technology and Data Ecosystems: Innovation and data are crucial for sustainable transport development globally. Transit-priority signals and ride-sharing technologies boost performance. These technologies are to be used to assess transport needs and to support an innovative ecosystem. Acceptance of sustainable transportation by users depends on perceptions of sustainability and utility. And focusing on technology alignment within your investments can be a game-changer. [24][3][25][26][27][9]

10. CONCLUSION

The relationship between policies and sustainable transport modes is complex, and can act as both a barrier and a driver to adoption, especially in the developing world. There's a lot to do with infrastructure barriers, like a combined bus and bicycle corridor in Bogota, Colombia. To meet the challenge of sustainable transport, it is necessary to understand current transport and social arrangements, to determine which alternative modes are compatible and affordable, and to recommend simpler alternatives when policies are skeptical. Before introducing new modes, it is important to evaluate if existing spatial patterns and public transport sufficiently fulfill needs. When policies are strong, ineffective publicity and communication can undermine planning. For instance, the impact needed to prompt job exploration and multi-activity trip chaining is pivotal, and we need to look at interactions and motivations of travelers. Even if alternative transport systems exist, people may continue to use the existing transport systems. Many poor solutions arise from the disconnect between operations and the customer's understanding. Conclusions identified a number of barriers and drivers for the uptake of sustainable transport in developing countries. By adding compatible vehicles and systems, the reach and adoption of existing transport environments can be expanded. The forward and backward compatibility of alternative sustainable modes should be considered to avoid aggravating unsustainable situations while moving towards sustainability. But policies alone are not sufficient without compatible and feasible infrastructure. A practical first step towards sustainability is to enhance the public and non-motorized transport systems that serve existing routes

and meet the needs of current passengers. If you want the full solution, I would recommend to read through the framework of use, forces, action and transport tracks. [28][9]

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References

- 1) E. A. Etukudoh, A. Adefemi, V. I. Ilojiyanya, "A Review of sustainable transportation solutions: Innovations, challenges, and future directions," *World Journal of ...*, 2024. [semanticscholar.org](https://www.semanticscholar.org)
- 2) J. A. K. Alhassan and P. Anciaes, "Public transport investments as generators of economic and social activity," *Journal of Transport & Health*, 2025. [sciencedirect.com](https://www.sciencedirect.com)
- 3) V. S.M. Massachusetts Institute of Technology Kumar, "Project identification and evaluation techniques for transportation infrastructure: assessing their role in metropolitan areas of developing countries," 2009. <http://hdl.handle.net/1721.1/47761>
- 4) L. Winkler, D. Pearce, J. Nelson, and O. Babacan, "The effect of sustainable mobility transition policies on cumulative urban transport emissions and energy demand," *Nature Communications*, 2023. <https://doi.org/10.1038/s41467-023-37728-x>
- 5) Y. D. Tazzie, D. Adugna, and B. Woldetensae, "Sustainable transport strategies and their implementation barriers in Addis Ababa, Ethiopia," *Frontiers in Sustainable Cities*, 2025. [frontiersin.org](https://www.frontiersin.org)
- 6) O. Olatinsu, "Integrating digital asset platforms into AML frameworks: Balancing innovation, inclusion, and financial integrity," **International Journal of Research in Finance and ...**, 2025. [researchgate.net](https://www.researchgate.net)
- 7) L. Albertini, "Cycling in a car-dependent city: the case of Lugano, Switzerland," 2025. [aalto.fi](https://www.aalto.fi)
- 8) T. Komornicki and B. Szejgiec-Kolenda, "The development of transport infrastructure in Poland and the role of spatial planning and cohesion policy in investment processes," *Planning Practice & Research*, 2023. <https://doi.org/10.1080/02697459.2020.1852677>
- 9) C. J. Rodríguez-Rad, M. Revilla-Camacho, and M. E. Sánchez-del-Río-Vázquez, "Exploring the Intention to Adopt Sustainable Mobility Modes of Transport among Young University Students," 2023. [ncbi.nlm.nih.gov](https://www.ncbi.nlm.nih.gov)
- 10) L. Sheng and L. Zhang, "Understanding the determinants for predicting citizens' travel mode change from private cars to public transport in China," 2022. [ncbi.nlm.nih.gov](https://www.ncbi.nlm.nih.gov)
- 11) R. Hickman, N. Lopez, M. Cao, B. Mella Lira et al., "'I drive outside of peak time to avoid traffic jams—Public transport is not attractive here.'" Challenging discourses on travel to the University campus in Manila," 2018. <https://doi.org/10.3390/su10051462>
- 12) R. B Cervero, "Linking urban transport and land use in developing countries," 2013. <http://dx.doi.org/10.5198/jtlu.v1.425>
- 13) R. Ranjan and S. Sinha, "A systematic review of mode choice behavior in urban transportation with emphasis on individual preferences and influencing factor," *Discover Cities*, 2025. [springer.com](https://www.springer.com)
- 14) D. Sussana Patil, A. Bailey, U. Narayan Yadav, S. George et al., "Contextual factors influencing the urban mobility infrastructure interventions and policies for older adults in low- and middle-income countries: a realist review," 2022. [ncbi.nlm.nih.gov](https://www.ncbi.nlm.nih.gov)

- 15) T. L. (Tegin Leigh) Teich, "Social change and cycling as a form of sustainable transportation: the behavior-policy interaction in a medium-sized developing city," 2008. <http://hdl.handle.net/1721.1/44369>
- 16) G. Fourie, "Enabling sustainable development through logistics: a case of Southern Africa," 2019. <http://hdl.handle.net/11427/30220>
- 17) A. Tob-Ogu, J. Cullen, N. Kumar, and E. Ballantyne, "Sustainability intervention mechanisms for managing road freight transport externalities: A systematic literature review," 2018. <https://doi.org/10.3390/su10061923>
- 18) M. M. Hansen, K. Koonsanit, and V. Kulmala, "How can data contribute to Smart City innovation: a study from Thailand's Smart City initiatives," *Frontiers in Sustainable Cities*, 2025. frontiersin.org
- 19) NT Nhu, H. Nishiuchi, NTH Mai, TS Sua, "Towards the adoption of green freight transport practices in developing countries: Analysis of owner-operators' behavior on electric trucks," *Transportation Research*, 2026. [sciencedirect.com](https://www.sciencedirect.com)
- 20) N. M. Nhat and N. K. Hoang, "Driving Sustainable Transport Infrastructure in Urban Regions of Developing Markets: Leveraging Private Sector Involvement," **International Journal of Sustainable ...**, 2025. <http://creativecommons.org/licenses/by/4.0/>
- 21) V. T. K. Hanh and N. H. Nga, "Factors influencing sustainable transportation development: A case study of Ho Chi Minh City, Vietnam," *Journal of the International Council for Small ...*, 2026. <https://doi.org/10.1080/26437015.2025.2557417>
- 22) F. Jelti, A. Allouhi, and K. A. Tabet Aoul, "Transition paths towards a sustainable transportation system: a literature review," *Sustainability*, 2023. [mdpi.com](https://www.mdpi.com)
- 23) S. Gbako, D. Paraskevadis, J. Ren, "Sea freight transport in major logistic gateways: a socio-economic and environmental performance evaluation of the United Kingdom's and Continental Europe's inland," **Journal of Environmental Quality**, 2025. [ljmu.ac.uk](https://www.ljmu.ac.uk)
- 24) B. Myles 1973- Cheatham, "Sustainable urban transportation in developing mega-cities: a review of policies, regulations, and technologies," 2002.[PDF]
- 25) S. Werland and F. Rudolph, "Funding and financing of sustainable urban mobility measures: topic guide," 2019. <https://nbn-resolving.org/urn:nbn:de:bsz:wup4-opus-73974>
- 26) U. Motowidlak, "Development and financing of infrastructure investments to shape sustainable and resilient mobility," *Zeszyty Naukowe*, 2023. [academia.edu](https://www.academia.edu)
- 27) x. feikie, d. das, and m. mostafa, "integrating information and communication technology as a solution to sustainable road transportation in south africa," 2017. <http://hdl.handle.net/2263/62727>
- 28) C. Nnaji and C. Okoro, "Leveraging Public-Private Partnership as an effective tool for transportation infrastructure development: an integrative literature review and case study," 2017. <https://hdl.handle.net/10210/244810>