Journal of Law & Social Studies (JLSS)
Volume 8, Issue 1, pp 1-12
www.advancelrf.org

Advancing Sustainable Urban Mobility in Pakistan: A Policy Analysis of Electric Bus Integration in Islamabad

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Abstract
Urbanization in Pakistan is a fast process that increases the difficulties especially in large cities like Islamabad, prolonged traffic jams, air pollution, and poor systems of public transport. In this regard, electric bus incorporation has become one of the viable ways of achieving sustainable urban mobility. This paper looks at the policy environment surrounding the adoption and implementation of electric bus systems in Islamabad with respect to how such systems meet the requirements of the population in terms of public transport, priority of urban planning and the sustainability of the environment. Using a qualitative research design, the paper integrates policy analysis with stakeholder perspectives to evaluate the readiness of the institutions, the main obstacles, and new opportunities in the integration of electric buses. The analysis of relevant policy documents, government reports and international case studies is made to extract the lessons based on the best practices followed worldwide to inform the local implementation strategies. In addition, the paper appraises the social, environmental, and economic effects of switching to electric public transport. The results show that although the idea of electric buses is aligned with the efforts of Pakistan to reduce its emissions and follow a sustainable development path, the extensive implementation of this concept is prevented by institutional fracturing, financial constraints, and insufficient infrastructure. The paper ends with some policy suggestions that can build stronger regulatory frameworks, improve the public-private collaboration and make the implementation of electric mobility initiatives sustainable in the long run.

Keywords: Sustainable Urban Mobility, Electric Buses, Public Transport Policy, Decarbonization, Pakistan.

Introduction

The process of rapid urbanization in Pakistan is transforming the demographic, economic, and environmental environment of the country making the unprecedented strain on the urban infrastructure and, specifically, transport systems. The growth of major cities is marked with traffic jamming, air pollution, and lack of proper transport facilities, and the growing disparity between the need to move and the institutional ability to move. Despite the initial plan of Islamabad as a planned city and a relatively low population density, it has not been spared of these hurdles. Inefficient and environmentally unsustainable transport system; increased motorization, rapid rural-urban migration, and poor integration of urban mobility policies have led to the development of an inefficient system in the last 20 years (Malik et al., 2024).

The effects of this imbalance are immense. Jamming in major roads like Kashmir Highway and Islamabad Expressway is a frequent occurrence which has augmented travelling time, use of fuel, and inefficiency of the economy. At the same time, air quality in cities, especially fine particulate matter

(PM2.5) and nitrogen oxides, often surpasses the international safety limits, which creates severe threats to the health of the population. In Pakistan, the transport industry is a significant source of urban air pollution and a substantial emission source of greenhouse gases (GHGs), and it constitutes a huge percentage of pollution and deterioration of the environment (Bajwa & Sheikh, 2023).

Such issues have an unequal impact on low- and middle-income groups, which are the most dependent on public transport but do not have a high level of access to high-quality, cheap, and efficient ways to move (Habib et al., 2024). To address these issues, electric mobility (especially the adoption of electric buses) has become one of the most promising ways to achieve sustainable urban transport. Electric buses have considerable environmental advantages, such as less emissions and better air quality and less noise pollution, as well as contribute to more widespread shifts to a low-carbon urban system (Saleem et al., 2024). Understanding this opportunity, Pakistani policymakers have started working on the introduction of electric buses in Islamabad on the basis of the public-private partnership (PPP) approach to modernize the city transportation system and to meet national and global climate expectations. With these developments, the shift to electric mobility in Pakistan is still somewhat complicated and unpredictable.

The application of the electric bus systems does not only entail the use of technology, it entails consistent policy frameworks, institutional coordination, financial sustainability, and infrastructure preparedness. The presence of fragmented governance structures, lack of fiscal space, and inconsistencies in the regulation systems, as well as poorly developed charging infrastructure are major negativities of large-scale deployment in Pakistan (Adeel et al., 2025; Latif, 2025). In addition, although the global experiences can provide important knowledge, they cannot be directly applied to the context of developing countries that have institutional restraints and resource constraints. The literature of the existing research on the topic of electric mobility has devoted much attention to the technological feasibility and environmental advantages of this trend with little reference to the policy and institutional processes that influence the implementation in the Global South. Regarding the example of Pakistan, there is little empirical literature on the governance, financial feasibility, and scalability of electric bus projects. Specifically, the impact of public-private partnerships on facilitating sustainable urban transport transitions, the views of the stakeholders, and the local implementation issues have not been properly researched (Awan et al., 2024).

This research attempts to fill these gaps by performing a policy-oriented research on the integration of electric buses in Islamabad. It looks at the institutional frameworks, governance systems and the operating systems of the initiative, and evaluates their role in ensuring sustainable urban mobility. The analysis, which is placed at the intersection of urban planning, environmental policy, and infrastructure governance, will allow the research to get a comprehensive picture of what opportunities and constraints accompany electric mobility transitions in the environment of developing countries. The research addresses three key questions (1) to evaluate the model of the public-private partnership and the role of institutions in the electric bus project; (2) to evaluate how the electric bus project contributes to sustainable urban mobility in terms of environmental performance, accessibility, and operational efficiency; and (3) to provide policy recommendations to scale the initiatives of electric mobility across large cities in Pakistan. By doing so, the paper can contribute to the academic and policy discussions by providing evidence-based recommendations on how the emerging economies can overcome two opposing needs of urbanization and climate change through sustainable transportation solutions.

Literature Review

Electrification of urban transport has become a key element of sustainable mobility policies at the global level, mainly because of the contribution of the transport sector to air transport emissions and greenhouse gas (GHG) emissions. However, traditional diesel-powered buses though effective on the aspect of passenger carrying capacity have published as the primary contributors to nitrogen oxides (NOx), particulate matter (PM2.5), carbon monoxide (CO), and black carbon emissions, which are

linked to potentially dire health outcomes, such as respiratory and cardiovascular diseases (Bajwa and Sheikh, 2023; Habib et al., 2024). In this regard, battery-electric buses (BEBs) can be a groundbreaking solution to the problem as it helps to remove tailpipe emissions and the noise pollution is significantly lower. It has been proven that BEBs can lead to a positive air quality of cities and decrease the operational expenses in the long run in contrast to diesel fleets (Saleem et al., 2024). Shenzhen, China is one of the brightest examples of the world as the city managed to electrify their bus park with more than 16,000 buses. This shift led to significant changes in the CO2 emissions and operation costs, which puts the environmental and economic sustainability of large-scale electrification into the limelight (World Bank, 2021).

The environmental impact of electric buses is however subject to the intensity of the carbon in the electric grid. In nations where the generation of electricity is dependent on fossil fuels, the lifecycle emission reduction can be small, but the air quality is locally high (International Energy Agency [IEA], 2021). As a result, the literature has highlighted the importance of adopting integrated policy solutions that will involve the electrification of transport coupled with decarbonization of the energy sector. Moreover, researchers also emphasize that effective electrification is contingent on a contextual constituency of institutional ability, governance integrity, financing instruments and preparedness of infrastructure. These are charging infrastructure, grid upgrades, and battery lifecycle management systems, such as recycling and disposal (World Bank, 2021).

Electric Mobility in the Developing Countries. Whereas the developed economies are making progress towards the implementation of electric mobility solutions in a stable regulatory context, the developing economies have different structural issues. These are high initial capital, poor access to concessional capital, poor institutional coordination, and poor infrastructure (Adeel et al., 2025). Shenzhen case can teach so much to the developing nations. It succeeded due to the robust leadership on the municipal level, centralized procurement, coordinated investments in infrastructure, and close cooperation with energy providers. Nonetheless, it is hard to recreate the same models in developing settings because of the fiscal limitation and the disjointed system of governance.

The studies have pointed to the relevance of the public-private partnerships (PPPs) and blended finance models in facilitating the implementation of electric mobility in the low- and middle-income nations. Such models contribute to the sharing of financial risks, mobilizing of investment by the private sector, and operational efficiency (Awan et al., 2024). These lessons indicate that establishing an institutional fit, a gradual approach, and international climate funds are necessary to scale up the use of electric buses in cities such as Islamabad.

The operation of battery-electric buses is extremely sensitive to local operating conditions, such as route characteristics, climatic conditions, and the energy infrastructure. Research indicates that battery performance and car range are strongly influenced by high temperatures, high stop-and-go traffic and road slopes (Saleem et al., 2024). In cities such as Islamabad where the summer temperatures are hot, thermal management and energy consumption are the important design factors. Pricing tactics are also very important. Depot charging systems are easier to install and much of them demand greater battery capacities and load on the electricity grids. On the contrary, opportunity charging systems allow smaller batteries but demand more infrastructure along routes. Recent papers note that the advantages of the combination of smart charging systems with renewable energy sources including solar photovoltaic (PV) systems and energy storage systems (ESS) can decrease peak loads and increase economic efficiency (Latif, 2025).

Economically, the Total Cost of Ownership (TCO) analysis is highly employed to compare the electric and diesel buses. Although the price of electric buses is more expensive, they usually lead to lower lifecycle costs because of lower fuel and maintenance costs. Nevertheless, the influence of local factors on TCO results is very high and includes electrical charges, funding, and the cost of battery changes, which should be analyzed individually. Institutional Gaps in Pakistan. The current

body of literature in Pakistan has largely addressed the issues of urban congestion, air pollution, and Bus Rapid Transit (BRT) systems, but little has been done on the issue of electric mobility through the lens of governance and policy.

Although the literature emphasizes the environmental and technical capacity of electric buses, no adequate research has been conducted on the institutional coordination, policy consistency, and financial sustainability (Masood, 2024). Major administrative frameworks, including the National Electric Vehicle Policy (NEVP) 2019, offer an overall strategy of electric mobility yet do not include a specific implementation process in urban areas. Furthermore, disjointed systems of governance, whereby duties are spread out between the federal, provincial and municipal government, poses a problem of coordination, and inconsistency in policies. There is little empirical evidence regarding the local operation conditions including battery behavior under high temperature conditions and route specific energy consumption. In the same manner, we have no evidence of how well the PPP models, financing mechanisms, and perceptions of stakeholders' work in the Pakistani context. These loopholes indicate the necessity of combined policy and institutional analysis that the present study aims to fill.

Theoretical Framework

Sustainable Mobility Paradigm (SMP)

Sustainable Mobility Paradigm (SMP) offers a normative concept of changing the urban system that depends on cars to sustainable, inclusive, and low-carbon mobility. It focuses on the concepts of environmental sustainability, social equity, and economic efficiency as the most important aspects of planning of urban transport. Within the framework of Islamabad, SMP helps to implement the process of replacing the transport system based on fossil fuel with electric mobility, facilitating the decrease in emissions, the improvement of the air quality, as well as the equal access to public transportation. Electric bus integration is in tandem with climate commitments that Pakistan has in the Paris Agreement, and also meets Sustainable Development Goals (SDGs), such as SDG 11 (Sustainable Cities and Communities) and SDG 13 (Climate Action).

Policy Cycle Theory

This view of policymaking as a dynamic and iterative process, which is the concept of Policy Cycle Theory, entails such stages as agenda-setting, policy formulation, decision-making, implementation, and evaluation. This model is essential to the study of the development of the policy of electric buses in Islamabad. Introduction of electric bus could be outlined in the following steps: agenda-setting (motivated by ecological issues), policy development (involvement of several parties), pilot introduction and testing. According to the theory, feedback mechanisms are crucial as it enables the policy makers to improve the strategies in accordance with the performance results and the reactions of the stakeholders.

Diffusion of Innovation Theory (DOI)

The Diffusion of Innovation (DOI) Theory is a concept used to describe the way new technologies are embraced and become popular within the social system. It determines five attributes that affect adoption which include: relative advantage, compatibility, complexity, trialability and observability (Rogers, 2003). Regarding Islamabad, the electric buses are evident to have relative advantages regarding environmental and economic benefits. These are compatible with the current transport routes, and since they are pilot projects (trialability), they can be adopted gradually. Public acceptance is further boosted by the visibility of benefits, e.g. air quality improvement and passenger comfort. Nevertheless, perceived complexity due to infrastructure and maintenance can diminish the adoption, and this is where institutional support and capacity building can be of value.

Comprehensive Theoretical Foundation

This paper combines SMP, Policy Cycle Theory and DOI Theory to offer an all round analytical approach to the understanding of electric bus integration in Islamabad. SMP establishes goals and

ambitions of sustainability. The Policy Cycle Theory describes the governance mechanisms and processes in the institutions. DOI Theory represents the dynamics of technology adoption and acceptance by stakeholders.

Collectively, these frameworks are used to demonstrate the role of policy processes in influencing innovation adoption which subsequently defines the outcome of sustainability. The integration also emphasizes the feedback loops where feedback on policy evaluation will be utilized in the future decision-making and scaling plans. The operationalized framework establishes the integration of electric buses as a multi-dimensional process that is conditioned by policy inputs, institutional mechanisms, and dynamics of technological adoption. The major inputs are regulatory policies, PPP arrangements and investments in infrastructure. These inputs are acted by policy cycles and adoption processes, and eventually end up producing the results in environmental sustainability, social equity and economic efficiency. The feedback is also built in the framework, as the results of evaluation can be used to make changes in the policy, and it is important to consider that the process will continue to improve and will be scalable. The model can be applied to other urban centers in Pakistan that have the same problem as this dynamic approach is applicable to Islamabad.

The literature points out the enormous potential of the electric buses to revolutionize the city mobility systems, especially in the context of environmental sustainability and operational efficiency. Nevertheless, the change is very contextualized and needs robust institutional structures, new methods of financing and coordinated policy action. Through a combination of varied theoretical viewpoints, the paper gives a holistic insight into the policy, institutional, and technological forces that influence electric mobility in developing nations.

Methodology

Research Design

The case study under consideration follows the qualitative type of case study design in order to investigate the implementation of electric buses in Islamabad as a modern transportation policy intervention in the city. The qualitative approaches are especially effective in exploring some aspects of governance (complexity), stakeholder attitudes, and institutional interactions that cannot be sufficiently measured using quantitative tools (Creswell and Poth, 2018). The strategy will enable a comprehensive examination of the policy making, bargaining, and execution process, the driving forces, obstacles, and dynamics between the most important players (Yin, 2014). A case under consideration is the Islamabad Electric Bus Project which was introduced by the Capital Development Authority (CDA) in partnership with the National Radio and Telecommunication Corporation (NRTC) on public-private partnership (PPP). The project is expected to implement 160 electric buses along major urban routes, such as along NUST-PIMS, PIMS-Bari Imam, and Faizabad-Airport routes to overcome the urban transport issues related to congestion, emissions, and air quality. The project is in line with the National Electric Vehicle Policy (NEVP, 2019), the Revised Nationally Determined Contributions (NDCs) of the Paris Agreement, and Sustainable Development Goals (SDGs 11 and 13).

Comparative Case Analysis

The study employs a comparative case view to increase the level of analysis. The examples of domestic systems, including the Peshawar and Karachi BRTs, can give a clue regarding the way of governance, the financing system, and population acceptance of mass transit, even though they are not fully electrified (Hafeez, 2021). International examples provide transferable lessons Shenzhen, China, can be used as an example of large-scale electrification by government incentives and infrastructure funding; Santiago, Chile, can be used as an example of gradual integration through hybrid fleets and external financing; and London, UK, can be used as an example of gradual adoption of electric buses by pilot projects and regulatory incentives (Basnet & Shrestha, 2021; City of Oslo,

2022; NITI Aayog, 2022). This comparative strategy places Islamabad in the context of world practices and brings out contextual constraints and facilitating factors.

Data Collection

Qualitative data used in the study is triangulated: Document Analysis: The objectives, regulatory frameworks, and institutional roles were identified by analyzing the key policy and planning documents such as the NEVP (2019), CDA reports, and the urban transport planning documents. Semi-Structured Interviews: Primary data were gathered with policymakers, urban transport planners and partners in the private sector to obtain the perceptions, experiences and the challenges faced in the implementation of electric buses. Interviews provided flexibility to investigate the new themes and perspectives of the stakeholders (Bryman, 2016). Secondary Sources: Academic literature and international reports were used to provide a background about best practices and lessons learnt in other cities (Braun & Clarke, 2006).

Data Analysis

The data analysis method was based on thematic analysis to find out the patterns and themes that occurred frequently among interviews and documents (Braun and Clarke, 2006). It included an orientation with the data, coding, grouping them into themes, and analyzing them using theoretical frameworks. Primary themes included: a) Institutional coordination and politics of governance. b) PPP effectiveness and financial sustainability. c) Social and environmental results. d) Coherence of policies and regulatory issues. e) Stakeholder enactment and opposition. These themes were explained in terms of Sustainable Mobility Paradigm (SMP), Policy Cycle Theory, and Diffusion of Innovations (DoI) paradigm (Rogers, 2003) to examine the environmental benefits, social inclusion, economic aspect, and perceptions of stakeholders about the innovation adoption.

Ethical Considerations

This study involved ethics compliance. All subjects were informed consent participants, and they were clearly informed about the goals of the study, the use of the obtained data, confidentiality, and voluntary participation. The research used cultural and linguistic sensitivity as it included the materials in English and Urdu. To protect the subjects and the institutions; confidentiality and anonymity were provided using coded identifiers and selective revealing of the institutional names when publicity of information could be made available. The security measures of data were encrypted storage, multi-factor authentication, safe email communications and limited access to analytical files. Transcription was done by the researcher itself to avoid the risk of outsourcing. Social responsibility was also highlighted in terms of ethics, as the research will be beneficial to the population in terms of improving policies and making cities sustainable (Israel et al., 2013).

Limitations

This research has its own weaknesses. The qualitative method gives breadth but is not statistically generalizable. It was difficult to access high-level government officials and documents and data capture is only what defines short-term projects but does not reflect the end result. There might be language and cultural barriers that were involved in data collection and emerging changes in transport policies that can also impact on the data applicability in the long run. The paper is narrowed down to Islamabad, neglecting other cities, alternative forms of green transport and quantitative analysis of the emissions or the user base of the transport. The study adopts a qualitative case study as a research approach and it intends to investigate the Islamabad Electric Bus Project and it is supported with the comparative case study of local and international scenarios. The data gathering was triangulated, and the thematic analysis was done as well as strong ethical procedures, which brought credible and transferable insights. The results offer an evidence-based explanation of the institutional, financial, and social determinants of the integration of electric buses, which can be applied to the lesson of sustainable transitions to urban mobility in Pakistan and other developing country contexts.

Analysis and Results

They were used in the study in the qualitative data on semi-structured interviews, policy documents, and secondary reports which were handled through thematic analysis (Braun and Clarke, 2006). Such an approach was useful in revealing the trends in connection to institutional issues, perception of stakeholders, financial processes, environmental and social performance, and best practices across the board. The thematic coding was done through the process of multiple iterative reads, an original coding of raw data, classification of codes into groups and finally abstraction of codes into general themes.

Theme 1: Institutional Coordination and Governance Dynamics

It was found that various agencies including Capital Development Authority (CDA), Ministry of Climate Change and local traffic authorities show overlapping roles, vague mandate and lack of inter-agency communication. Such circumstances cause delay in making decisions, getting approval of financing, and executing infrastructure projects.

Theme 2: Financial Sustainability and Public–Private Partnerships (PPPs)

The information has shown the dependence on the PPP structures to finance and run electric bus program. Issues of risk-sharing, affordability of fares, cost recovery, and uncertainties of subsidies were common. There was the concern of uncertain government assistance, and financial sustainability in the long term by the operators.

Theme 3: Environmental and Social Outcomes

The analysis through coding identified the recognition of less greenhouse gas emissions, less noise pollution, and an increased commuter satisfaction in pilot routes (NUST-PIMS, PIMS-Bari Imam). At the same time, it was possible to see the appearance of such themes as equity issues, especially when it comes to the low-income areas where the electric bus routes are not very reachable.

Theme 4: Stakeholder Perceptions and Adoption Barriers

Themes pointed to the reliability concern, readiness to charge infrastructure, compatibility with the existing routes, and workforce preparedness. Careful optimism was exhibited in the commuting and the operators due to the influence of trialability and observability (Rogers, 2003).

Theme 5: Comparative Case Insights

Local (Karachi Green Line, Peshawar BRT) and foreign (Shenzhen, Santiago, London) examples became one of the main points of reference. Themes were used to determine how the model of governance, subsidy framework, pilot testing and stepwise adoption affected outcomes and informed the best practices to apply to Islamabad.

Results

Institutional Coordination and Dynamics of Governance. The findings showed that institutional fragmentation was a major limitation to implementation. According to the stakeholders, the lack of responsibility between the CDA, the Ministry of Climate Change, and the municipal transport authorities is the reason of recurrent delays. The following excerpts were noted during the interviews: In the absence of a single coordinating body, every component of the process, such as route selection, charging infrastructure, and so forth, will be delayed (Interview #4). Evidence of Shenzhen (China) shows that centralized power, mandates, and high political commitment enabled the fast installation of more than 16,000 buses (IEA, 2020). Public-Private Partnerships and Financial Sustainability. Findings indicate that PPP arrangements enabled the project to take off despite the inadequate funding by the people. Nevertheless, tensions during interviews were found between affordability of fares and covering operational costs: Everyone would also like to maintain low fares among commuters, but electricity and maintenance is expensive, and government subsidies are not dependable (Interview #7). The use of gradual transition to electric buses in hybrid buses is an example of Santiago demonstrating how stable subsidies and external funding are essential (Basnet & Shrestha, 2021). Environmental and Social Outcomes. Pilot routes obtained measurable environmental results, such

as decreased emissions and noise, and enhanced quality of their services, such as shorter waiting times and more comfort. Yet, peripheral communities with low-income continue to face problems with accessibility, which implies that social inclusion goals are met partially. The same was the case in Los Angeles where initial electrification enhanced air quality but failed to reach underserved areas at once (California Air Resources Board, 2021). Perceptions and Adoption Barriers of Stakeholders. According to stakeholders, the identified barriers were connected to operational reliability, the absence of charging infrastructure, and the inability to understand new technology. Relative advantage, trialability and observability had an effect on adoption (Rogers, 2003). Another challenge was workforce readiness in which drivers and planners had to train on new operations. Comparative Case Insights The international comparisons (Domestic and international) contained valuable lessons: Peshawar and Karachi, Pakistan: BRT with low emissions exemplify the problem of operational difficulties in financing, readiness of infrastructure, or acceptance of stakeholders (Hafeez, 2021). Shenzhen, China: Centralized governance, government subsidies, and infrastructure planning made it possible to roll out on a large scale (IEA, 2020). Santiago, Chile: Hybrid fleets were gradually integrated, which reduced financial and operational risks (Basnet & Shrestha, 2021). London, UK: The piloting projects fostered societal acceptance and knowledgeable incremental growth (Transport for London, 2020).

Discussion

The thematic analysis and findings have provided a number of main insights on the electric bus adoption in Islamabad. The fragmentation of institutions is also a major impediment to the timely introduction of urban transport reforms. These observations are in line with Policy Cycle Theory, which highlights the fact that agenda-setting, policy formulation and implementation phases entail alignment of the institutional actors (Howlett, 2019). The disintegrated governance of Islamabad is in contrast to the centralized governance of Shenzhen, which implies that better inter-agency coordination is an essential element of the scaling of electric mobility. PPP models offer opportunities and challenges.

Although cost-sharing enables the launch of the project, to make the organization sustainable in long term, the subsidies should be the same, the revenue-sharing mechanisms should be clear, and the fare systems should be affordable. This observation is consistent with those of other countries: Santiago hybrid fleet and gradual implementation minimizes cost risk whereas London incentives spent by pilots enhanced the confidence in adoption (Basnet & Shrestha, 2021; Transport for London, 2020). The program exhibits environmental gains, including the reduced greenhouse gas emissions and noise, which comply with Sustainable Mobility Paradigm (SMP). Nevertheless, the problem of equity is still present in peripheral communities, which means that planning routes is a deliberate action that should be part of the development of acceptable policies. To make SDG 11 (sustainable cities) and SDG 13 (climate action), it is necessary to work on the environmental and social outcomes at the same time.

The perceptions of the stakeholders are of key concerns to adoption, which is in line with DoI theory. Acceptance is caused by relative advantage (less emissions and less operating cost), trialability (pilot routes), and observability (better air quality and commuter experience). The barriers of workforce readiness, commuter awareness, and trust in technology still exist and need specific interventions, including training courses and media information campaigns. Cross case analysis has shown that Islamabad can use gradual, staged strategies based on the domestic and international experiences. The centralized oversight, formal PPP agreements and strong monitoring mechanisms are all part of lessons. The comparative lens highlights that although international best practices provide guidance, it is necessary to adjust to the situation in Pakistan in terms of governance, finances and infrastructure.

Altogether, the discussion shows that the effectiveness of the electric bus programs is multi-dimensional and requires the institutional transparency, financial processes, environmental-social performance, and stakeholder involvement. Combining comparative case lessons and theory can be

applied to practical suggestions of sustainable urban transport policy, such as prioritizing institutional coordination, gradual implementation, and the integration to include planning. Judging by the results of this study, a list of strategic suggestions can be drawn to enhance the sustainable urban mobility in Pakistan.

Institutionally, they can create a National Sustainable Urban Mobility Authority (NSUMA) to bring statutory coordination to federal, provincial and municipal layers, standardize standards of technical aspects, approve national implementation plans, administer green transport funds and have a single system of monitoring and evaluation. Greater inter-agency coordination by use of multi-tiered committees comprising of transport, energy, finance, urban planning and the private sector stakeholders is necessary to streamline planning, facilitate the process of depot electrification, procurement coordination and safety standards enforcement.

The standard of regulatory stability through harmonized legislation, such as an Electric Vehicle and Sustainable Urban Transport Act, would standardize technical and safety standards and entrench the governance frameworks, which would attract the interest of the private sector (Government of Pakistan, 2019; Dawn, 2024). Strategies in finance are also very important. By creating a National Green Transport Fund (NGTF) to be funded in part by carbon revenues, import charges, donor climate funds, and federal budgets, concessional loans, grants and risk guarantees could be given to the procurement of electric buses, the effort to build infrastructure, and technical support (Daily Times, 2024).

Applying the new PPPs based on performance payments in the form of Bus-as-a-Service contracts, themed on the quality of operational KPIs, would align incentives, mitigate the financial risks of the government, and buy lessons on Santiago and Bogota (Enel X, 2022; Sustainable Bus, 2022). The subsidies are to be re-organized in order to focus on sustainable transport, and social concessions of fares are to be directed to be equitable in making access to low-income groups fair (Arab News, 2024). The transfer of technology and capacity building of the electric mobility also play a key role in determining the success of the long-term development of the electric mobility. Domesticization through strategic alliances with established OEMs like BYD can be used to assemble locally, conduct research and development, develop suppliers and train workforce and localization targets will boost local industrial capacity (Architectural Digest, 2022; World Bank, 2019).

Technical expertise and institutional learning can be enhanced through comprehensive capacity-building of the public officials, private operators, and universities; this applies with the help of international exchange programs (ITDP, 2022). The urban transport planning required is integrated to link the electric buses to the metro, BRT, feeder services, and park-and-ride hubs, so that there is a balanced access and maximum ridership. Planning of charging infrastructure and grid integration with solar and battery storage is essential to be able to reverse operational challenges in cities with energy shortages (Express Tribune, 2025). Moreover, adaptive management, learning, and policy refinement can be supported with the help of constant monitoring, performance assessment, and knowledge-sharing platforms, relying on international best practices (ITDP, 2022; Sustainable Bus, 2022).

Conclusion

This paper assessed the role of electric buses in the city of Islamabad as a governance and policy-analysis issue based on Sustainable Mobility Paradigm, Policy Cycle Theory, and Diffusion of Innovation Theory. The results of the study reveal that the effective implementation and introduction of electric buses are not only contingent on the technical capacities and financial resources available, but also institutional commitment, stakeholder involvement and the adaptive management policies (Braun and Clarke, 2006; Rogers, 2003). The experience at Islamabad shows that the pilot experimentation has been successfully converted into the system-wide functioning where 21 routes and 160 electric buses are implemented and the services are improved resulting in the reduction of

waiting time which was formerly 30-45 minutes to 10-15 minutes. The positive impact of these developments has been observed in the form of irrefutable environmental advantages, such as reduced emissions and noise, which lead to a better quality of air and living in cities (ProPakistani, 2026). There is also a socially positive aspect, as the low and middle-income commuters now have more access to transport services due to cheaper fares, and on the economic side, the partnerships between the state and the commercial sector (PPPs) contribute to the functionality of the transport industry due to its limited governmental resources (Government of Pakistan, 2024).

In spite of these gains, the research established that there were still considerable issues especially institutional fragmentations, lack of mandates between Capital Development Authority (CDA), Islamabad Transport Authority (ITA), and Ministry of Climate Change (MoCC), and incoherent funding modalities. Poor integration with other transport modes, limited route coverage, irregular schedules and a lack of planning of charging infrastructure were also obstacles to massive adoption. The deficiency of long-term, performance-based PPP contracts and the little attention paid to the development of local skills and technological transfer also limit the sustainability of the initiative. In general, it can be noted that sustainable urban mobility in Pakistan involves the concerted organizational, technical, financial, and social actions to reach its ultimate goal. Successes on short-term basis as witnessed in Islamabad should be used to provide system-wide policies, infrastructures and local capacities. The lessons learned in the case of Islamabad can be of practical knowledge in the preparation of sustainable transport projects on the national level and can be transferred to other similar developing countries that are facing the same challenge of governance, funding and equity issues.

Future Research Directions

This research paper determines a number of research opportunities that can be enhanced in the future to improve knowledge and application of sustainable mobility in the urban setting in Pakistan and other developing nations. To determine the long-term sustainability, institutional learning, and system performance of electric bus systems, longitudinal research is required, to go past the preliminary feasibility studies. It can be explained by comparative research and analysis of several Pakistani cities or other locations and countries to understand which factors of success are specific to the context and which can be generalized and applied, and the impact of differences in the structure of urban morphology, institutional capacity, economic environment, and political frameworks on policy outcomes can be identified. Future studies ought to examine how the systems of electric buses interact with the wider urban development including land use, economic development, and social equity to guide the planning strategies of integrated cities. Practical implementation strategies and minimized operational risks can be informed using technical research on grid integration, optimization of charging infrastructure, localization of technology, and electrification of depots. Lastly, the political economy studies are required to discern stakeholder reactions, informal networks, and vested interests in the transport sector, which could be highly influential in determining the viability, design and sustainability of policy interventions. Together, these areas of research can produce action-oriented findings that can inform the scaling of electric mobility projects, policy formulation, and transform resource-constrained, fast-urbanizing settings toward sustainable transport.

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