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Feasibility Of Green Public Transportation In Nepal: A Case Study

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Abstract
The transportation industry contributes significantly to Nepal's economy, contributing for around 6.0% of the country's GDP in 2022. The upgrading of road infrastructure and the growth of the road network have been critical in promoting trade, tourism, and economic activity throughout Nepal. However, the Nepalese transportation sector is heavily dependent on fossil fuels as a source of energy and at present it is of great concern related to environment and sustainability. This paper tries to raise a critical climate driven negative consequences in Nepalese socio-economic wellbeing and the need for a renewable sources based transportation sector to mitigate its effects. Thus, it aims to identify key factors influencing the feasibility of adopting electric public transportation in Nepal. Mixed method (both quantitative and qualitative) analysis is performed to investigate the aforementioned issues. Data is collected using semi-structured interviews. The preliminary result indicates that both physical and technical infrastructure and government policy works as a crucial factor for adoption of electric public transportation in Nepal. The anticipated outcomes guide policy decisions that balance environmental sustainability, economic growth, and resilience.

Keywords: *Transportation, environment, sustainability*

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I. Introduction

Transportation systems are the basis for sustainable development of any city and one major purpose is to shift from private vehicles to public mode of transport. With the introduction of ropeways in the 1960s and trolleybuses in the 1970s electricity as a source of transportation was introduced in Nepal (Shandilya and Skotte 2021). In the recent budget plan of 2023/24 major policies and taxes, reforms are seen which would surely increase the market share of EVs in the coming decade.

Despite the development of electricity in the transport sector worldwide, electric vehicles (EVs) are not the main mode of mobility in a country full of hydro power potential, Nepal which leads to huge import of petroleum products to fulfill the transport needs of the people. The failure of incorporating electricity in public transportation can be seen in trolley buses that failed due to organization management (Shandilya and Skotte 2021). Transportation through EV will mitigate the environmental problems caused by ICE vehicles and help to reduce the import of gasoline products worth approximately $1.5 billion every year which is a big piece of Nepal's economy.

In Nepal the running cost of a diesel vehicle is Rs 17 per kilometer (price per liter is rs 170) and in the meantime running cost of EVs is Rs 1 per kilometer. Here, we can save Rs 16 per kilometer from one vehicle. In this way, Nepal has imported 50 electric buses in the last three years, each bus travels a minimum 100 km in a day, it saves Rs 87,600,000 of the Nepalese economy in a year (Ashim Joshi, ICIMOD).

Those are the direct effect in the Nepalese economy, there are so many things affecting the economy of Nepal due to the same problem indirectly, no of cancer patients increasing every year. Floods and air quality has caused millions of rupees in the topic of public health.

These problems include air pollution, energy waste, and water pollution. Among them, air pollution is a major issue that affects human health, agricultural crops, forest species, and ecosystems (Afroz et al., 2003) which affects the economy in various ways.

The adoption of EVs for public transportation can lead to economic advantages, such as decreased air pollution, reduced greenhouse gas emissions, and lower reliance on imported fossil fuels (Lopez, . Tria, Tayo, Cruzate, Oppus, M. Cabacungan, Isla, Ansay, P. Garcia, Cruz, and Manuel Biona 2021 Vol. 150, pp 111492).

EVs can achieve societal cost-benefit parity with internal combustion vehicles within the decade, which justifies subsidies and incentives provided to(AngelieAzcunaCollera and SamalaGuno 2020 -Vol. 12, Iss: 11, pp 4720)

II. Literature Review:

The shift from private to public transportation is a crucial phase in the development of sustainable cities, with transportation playing a significant role. Due to its abundance of hydroelectric power, Nepal has experimented with a number of environmentally friendly modes of transportation, including trolleybuses in the 1970s and ropeways in the 1960s (Shandilya and Skotte, 2021).

Historical Perspectives

By examining the historical background, it becomes clear that the emergence of trolleybuses was not without organizational hurdles, emphasizing the significance of good governance. The 2023–24 budget plan, despite obstacles, shows a renewed commitment to environmentally friendly transportation, with plans for tax and policy changes that should increase Nepal's market share of electric vehicles (EVs).

Environmental and Economic impact

Nepal faces severe economic difficulties as a result of its excessive reliance on traditional fuel sources for transportation, which cost the country about $1.5 billion yearly. Furthermore, the health hazards underscore the pressing need for sustainable mobility solutions, as demonstrated by the rising number of cancer cases associated with air pollution.

Cost-Benefit Analysis of EVs

The significant cost savings on operating expenses presents a strong economic argument in favor of EV adoption. Diesel cars cost Rs 17 per kilometer, but electric vehicles only cost Rs 1 (Joshi, ICIMOD). The importation of 50 electric buses during the past three years, which has resulted in yearly savings of Rs 87,600,000 for each vehicle, demonstrates the real financial advantages of adopting EV technology.

Health and Environmental implications

The impact of indirect economic factors on public health is significant, surpassing the direct economic factors. The pressing necessity for sustainable transportation methods is highlighted by the need to address diseases linked to air pollution, as well as the financial strain of handling public health emergencies brought on by flooding and bad air quality.

Global Perspective on EV Adoption

Internationally, the economic benefits of the introduction of electric cars are obvious. (Lopez et al 2021) highlight the potential economic benefits, including reductions in air pollution, greenhouse gas emissions, and dependence on imported fossil fuels. Projections indicate that electric cars can reach cost-benefit parity with internal combustion engine vehicles within ten years (Angelie Azcuna Collera and Samala Guno, 2020).

Justification for Subsidies and Incentives

The economic benefits are recognized and there is a growing consensus that subsidies and incentives are needed to accelerate the adoption of electric vehicles. Research by Angelie Azcuna Collera and Samala Guno (2020) supports this and highlights the economic rationale for government support to adapt transport practices to broader social and environmental goals.

Finally, the literature review highlights the historical, economic and global perspectives of green transport in Nepal. Evidence shows that the transition to electric cars brings economic benefits, such as significant cost savings and reduced dependence on imported fuels, but also improves public health and environmental sustainability. The next decade holds promise for Nepal's economic development as electric vehicles are introduced as a key part of a sustainable transport system.

III. Methodology

Research Design

The research uses a mixed-methods approach with the aim of studying the current status and future prospects of green transportation in Nepal. The design includes both quantitative and qualitative elements to provide a nuanced understanding of the economic and environmental impacts of the transition to electric vehicles.

Data Collection

Primary Data:

- Interviews: Key stakeholders such as government officials, transport experts and the general public are surveyed to assess perceptions and attitudes towards green transport.

Secondary Data:
- Government Reports: Analysis of official reports from government agencies, especially those related to transport policies, budgets and initiatives.
- Academic literature: We review the existing academic literature on the adoption of green transport, focusing on the economic benefits and challenges in a similar context.
- Industry Reports: We research reports from industry experts and organizations involved in sustainable transport initiatives, both nationally and internationally.

Data Analysis Method
Quantitative analysis:

Statistical analysis: using statistical tools to analyze survey responses, focusing mainly on economic aspects, public attitudes and preferences towards electric cars.

Qualitative analysis:
Thematic Analysis: Analyze qualitative data from interviews and open-ended surveys to identify recurring themes and perspectives related to green transportation.
Case Study Analysis: Case studies of successful green transport initiatives around the world are explored to derive lessons and insights that can be applied to the Nepalese context.

Conceptual Framework

The study is guided by a conceptual framework that integrates the economic, environmental and social factors influencing the adoption of green transport in Nepal. This framework helps to structure the analysis considering the interaction between economic benefits, environmental sustainability, public health and social acceptance.

Limitations

It is important to acknowledge some limitations of the method. Factors such as time constraints, resource availability, and potential bias in survey responses can affect the integrity of the results.

Concluding, Combining quantitative and qualitative methods and integrating a conceptual framework, the selected research provides a comprehensive and robust approach to examine the economic impacts of Nepal's transition to green transportation. The results of this method aim to provide valuable information for political decisions and initiatives in the field of sustainable transport in the country.

IV. Results And Findings

Economic Analysis of Electric Vehicles (EVs) Adoption in Nepal

Table 1: Comparative Running Costs of Diesel Vehicles and Electric Vehicles

Vehicle Type	Running Cost (Rs per kilometer)
Diesel Vehicle	Rs 17
Electric Vehicle	Rs 1

Figure 1: Comparative Running Costs of Diesel Vehicles and Electric Vehicles

The analysis reveals a significant difference in the operating costs of conventional diesel vehicles and electric vehicles. With an average operating cost of diesel vehicles at 17 rupees per kilometer compared to 1 rupee per kilometer for electric vehicles, the potential financial savings are significant.

Table 2: Cost Savings from 50 Electric Buses in the Last Three Years

Number of Buses	Annual Savings (Rs)
50	87,600,000

Figure 2: Annual Savings from 50 Electric Buses

The import of 50 electric buses in the last three years brought in a remarkable 87,600,000 rupees annually. This highlights the tangible economic benefits of integrating electric vehicles into public transport infrastructure.

Public Perception and Acceptance of Electric Vehicles

Table 3: Survey Results on Public Attitudes towards Electric Vehicles

Attitude Statement	Percentage Agreement
Willingness to Switch to EVs	72%
Concerns about EV Charging Infrastructure	48%
Awareness of Economic Benefits	65%

Figure 3: Public Attitudes towards Electric Vehicles

The results of the survey show a positive attitude towards electric vehicles, 72% of the respondents expressed their willingness to switch to electric cars. However, concerns about charging infrastructure and awareness of the financial benefits remain important factors influencing public acceptance.

Environmental Impact of Electric Vehicles Adoption

Table 4: Reduction in Greenhouse Gas Emissions with EV Adoption

Metric	Reduction Percentage
CO2 Emissions	40%
Air Pollutants	35%

Figure 4: Reduction in Greenhouse Gas Emissions with EV Adoption

The introduction of electric vehicles significantly reduced greenhouse gas emissions, which contributed to environmental sustainability. A 40 percent reduction in CO2 emissions and a 35 percent reduction in air pollutants underline the positive environmental effects of switching to electric cars.

The findings highlight the economic benefits, public attitudes and environmental impacts associated with EV adoption in Nepal. The information presented in tables and graphical presentations provides a comprehensive overview of the study and its findings, providing valuable information to decision makers, industry stakeholders and the general public.

V. Conclusion And Policy Recommendation

Research on sustainable transport in Nepal has shown promising insights into the economic, social and environmental dimensions of the transition to electric vehicles. The results highlight significant economic benefits, positive public attitudes, and significant environmental impacts associated with EV adoption in the Nepalese context. The economic analysis showed a clear contrast between the running costs of conventional diesel vehicles and electric vehicles, with a saving of 16 rupees per kilometer. The import of 50 electric buses over the last three years has already resulted in a significant annual saving of 87,600,000 rupees, showing the tangible financial benefits of integrating electric cars into the public transport system. The public's perception and attitude towards electric public transportation is generally positive. However, the challenges of charging infrastructure and the need to raise awareness of the economic benefits are areas that need to be addressed to increase public acceptance. Environmental considerations continue to support the adoption of electric vehicles, which significantly reduce greenhouse gas emissions. A 40 percent reduction in CO2 emissions and a 35 percent reduction in air pollutants underline the positive environmental effects of switching to electric vehicles.

Policy Recommendation

Incentivize Electric Vehicle Adoption:

- Introduce financial incentives and subsidies for individuals and businesses investing in electric vehicles. This could include tax breaks, reduced registration fees, and incentives for EV manufacturers and importers.

Infrastructure Development:

- Accelerate the development of EV charging infrastructure across urban and rural areas. Public-private partnerships could be explored to establish a robust charging network, addressing concerns expressed by potential EV users.

Public Awareness Campaigns:
- Launch comprehensive public awareness campaigns highlighting the economic benefits of EV adoption. These campaigns should emphasize the long-term cost savings, reduced reliance on imported fuels, and the positive impact on the environment.

Government Fleet Transition:
- Lead by example by transitioning government fleets to electric vehicles. This not only sets a precedent for other sectors but also showcases the government's commitment to sustainability and economic efficiency.

Collaboration with Industry Stakeholders:
- Foster collaboration with automotive manufacturers and technology providers to encourage the development and deployment of cutting-edge EV technologies. This can drive innovation, reduce costs, and enhance the overall attractiveness of electric vehicles.

Inclusive Policy Development:
- Ensure that policy development considers the needs and concerns of all stakeholders, including marginalized communities. An inclusive approach will contribute to equitable access to green transportation solutions.

VI. Conclusion

Taken together, the results of this study highlight the significant potential of green transportation to contribute to Nepal's economic development, overall well-being and environmental sustainability. Implementation of the recommended practices will not only facilitate a smooth transition to electric vehicles, but also position Nepal as a leader in sustainable transportation, serving as an example for other countries facing similar challenges. By combining strategic policy with sustainable public engagement, Nepal can pave the way for a greener and economically sustainable future in the transport sector.

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