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E-mail: iaemedu@gmail.com,
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DRIVING THE FUTURE: THE RISE OF ELECTRIC VEHICLES IN KERALA

Prasad T,

Assistant Professor of Commerce,
Govt. KNM Arts and Science College, Kanjiramkulam, India.

Dr. Sreedevi S.R

Associate Professor of Commerce,
Govt. Arts and Science College, Kinanoor, Karindalam India.

ABSTRACT

The swift and widespread acceptance of Electric Vehicles (EVs) in Kerala illustrates a dramatic change. For an increase in the business, Indian government provide subsidies to the buyer. There seems to be an affinity towards EVs especially with young, literate men in the 2Wheeler segment and brands like Ather, Ola leading in the market, according to studies. Weight is placed on the desire for lower operating costs and some government incentives, with environmental concerns as an underlying thing. While EV users are very satisfied with their vehicles, there remain challenges, including relatively high upfront costs, limited charging infrastructure and service centres, particularly in rural and semi-urban regions. Socio-economic drivers such as increasing fuel prices and beneficial environmental consequences additionally incentivise. The only real barrier of EV adoption is technical issues such as the long charging time and limited range etc. Cutting-edge technologies including wireless charging and light weight vehicles will make a difference, if combined with appropriate

policy interventions in effort to overcome these challenges and drive a faster transition to sustainable mobility in Kerala. The factors, barriers and potentials of electric vehicle uptake in Kerala are discusses in this paper, providing with suggestions for policy makers, industry and environmental communities on how to promote a greener ecosystem for transportation sector on the state.

Keywords: Electric vehicles, consumer satisfaction, charging infrastructure, government incentives, sustainable transportation, socio-economic factors.

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1. Introduction

Kerala is going through a sea change in its transport sector with Electric vehicles getting a thrust all over the state. In 2016, the stage was set for a radical increase in the use of EVs in India: the antecedents could not have been clearer in that a confluence of policy, high fuel costs and technological innovation induced EVs to be embraced—especially by young, educated individuals, and particularly in the two-wheeler category which is dominated by models from brands such as Ather and Ola (S & K.P, K. 2024). The transition is also validated by the state's initiative towards the greener and sustainable mobility systems, aiming for wide-scale electrification and eco-friendly mobility technologies (Rajan, D., Raju, S., Vijith K, C., Jacob, V., & Jos, M. 2019).

While interest in electric vehicles is rising, there are challenges to their uptake. Consumers have identified high up-front costs, limited infrastructure, range concerns, and maintenance worries. Still, operational efficiency, lower running costs, while consumers increasingly board the positive experience of being an EV user are turning the heads of conventional vehicle ownership (B, S., & Mohan, S. 2024). In terms of technologies as a solution in the future, practical initiatives which are wireless charging for EVs and light-weight vehicle structures are under investigation (Paul, E., Paulson, N., & Bijoy, R. (2018). Nevertheless, as Kerala moves to electric mobility, it is important to understand the factors responsible for consumer attitude and satisfaction, to help inform public policy, industry, and environmentally friendly interests. With additional challenges and the abundance of renewable

energy resources, there is an opportunity for Kerala to influence the future of sustainable transport in India (Haridas, A., P, A., Menon, A., S., & P, A.2022).

2. Review of Literature

The global transition to sustainable mobility is shaping interests on electric vehicles (EVs) in addressing climate change, reliance on fossil fuels, and urban pollution. EV adoption globally has grown exponentially. The International Energy Agency (2023) reported that worldwide, EVs represented 18% of all new car sales, with projections of steep growth in the next few years. In India, the government launched several initiatives to promote EV adoption.

The Faster Adoption and Manufacturing of Hybrid and Electric Vehicles (FAME) scheme was launched (FAME I) in 2015, and is also known as FAME II, by extending the previous initiative on 1 April 2019, to promote incentivization for electric vehicles (EVs) and development of related infrastructure (NITI Aayog, 2020). These programs have state level policies to localize and contextualize the EV transition to local needs and requirements.

Kerala took the lead as a progressive state, when they launched their Electric Vehicle Policy (2019), to facilitate the introduction of 1 million EVs on the road, with the section on public electric transport fully electrified by 2030 (Government of Kerala, 2019). The corners-stone of the policy focused on renewable integration, energy efficiency, and charging infrastructure. The policy is enacted by support agencies - Energy Management Centre-Kerala (EMC), and Kerala State Electricity Board (KSEB).

While policies are being enacted, many challenges still remain. Sharma & Goyal (2022) identified barriers to EV adoption in India, including cost of the vehicles, infrastructure, range anxiety, and consumer awareness. Regionally specific studies in Kerala by George & Mathew (2023), identified uneven infrastructure development and deployment for urban and rural areas in the state. The authors highlighted the need for decentralized charging networks, and the incorporation of public-private partnerships to minimize barriers and develop alternative refuelling.

Understanding consumer behaviour is key in helping to explore patterns of adoption. Thomas & Nair (2022), found primary impulsion for EV adoption in Kerala stemmed from consumers' concerns around environmental concerns, government subsidies, and rising fuel prices. Barriers associated with adoption were identified as resale value, battery history/longevity, and inadequate service networks.

Smart grid integration, battery swapping, and vehicle-to-grid (V2G) systems have been planned to increase the sustainability and viability of EVs. The Indian Electrical and Electronics

Manufacturers' Association (IEEMA, 2021) highlighted the need for local innovations suitable for wide-ranging geographies like Kerala. Academic institutions and startups in the state are also engaged with research and development specific to regional priorities.

3. Objectives

- Identify Key Drivers and Barriers for EV adoption
- Assess Technological Innovations and Infrastructure Needs
- Provide Policy and Market Recommendations

4. Importance of the study

The rise of electric vehicles in Kerala is significant for promoting sustainable transportation, reducing emissions and operating costs, and increasing user satisfaction, but faces challenges such as limited charging infrastructure, high costs, and technical barriers that need to be addressed for broader adoption.

5. Research Gap

while there is growing interest and satisfaction in electric vehicles in Kerala, research gaps remain in areas such as long-term user experiences, infrastructure development (especially charging and service facilities), battery recycling impacts, and the effectiveness of government policies in overcoming adoption barriers.

6. Research Methodology

6.1. Research Design

This study was done using mixed-methods, the combination of quantitative and qualitative data to provide a fuller understanding of EV dynamics in Kerala. Research is exploratory and descriptive.

6.2. Methods of Data Collection

The study involved primary data which were obtained through interviewing current EV buyers and non-buyers to identify perceptions, usage experiences, societal forces and demand on EVs (dealers), Charging infrastructure providers, Govt. transport officials etc. Judgement sampling was used to select 150 respondents as the sample. Secondary data were collected from reports of Kerala State Electricity Board (KSEB), Kerala Motor Vehicles Department, NITI

Aayog and Ministry of Heavy Industries, Automotive industry publications; Academic journals, white papers or news articles about EV trends in India and abroad.

6.3. Data Analysis

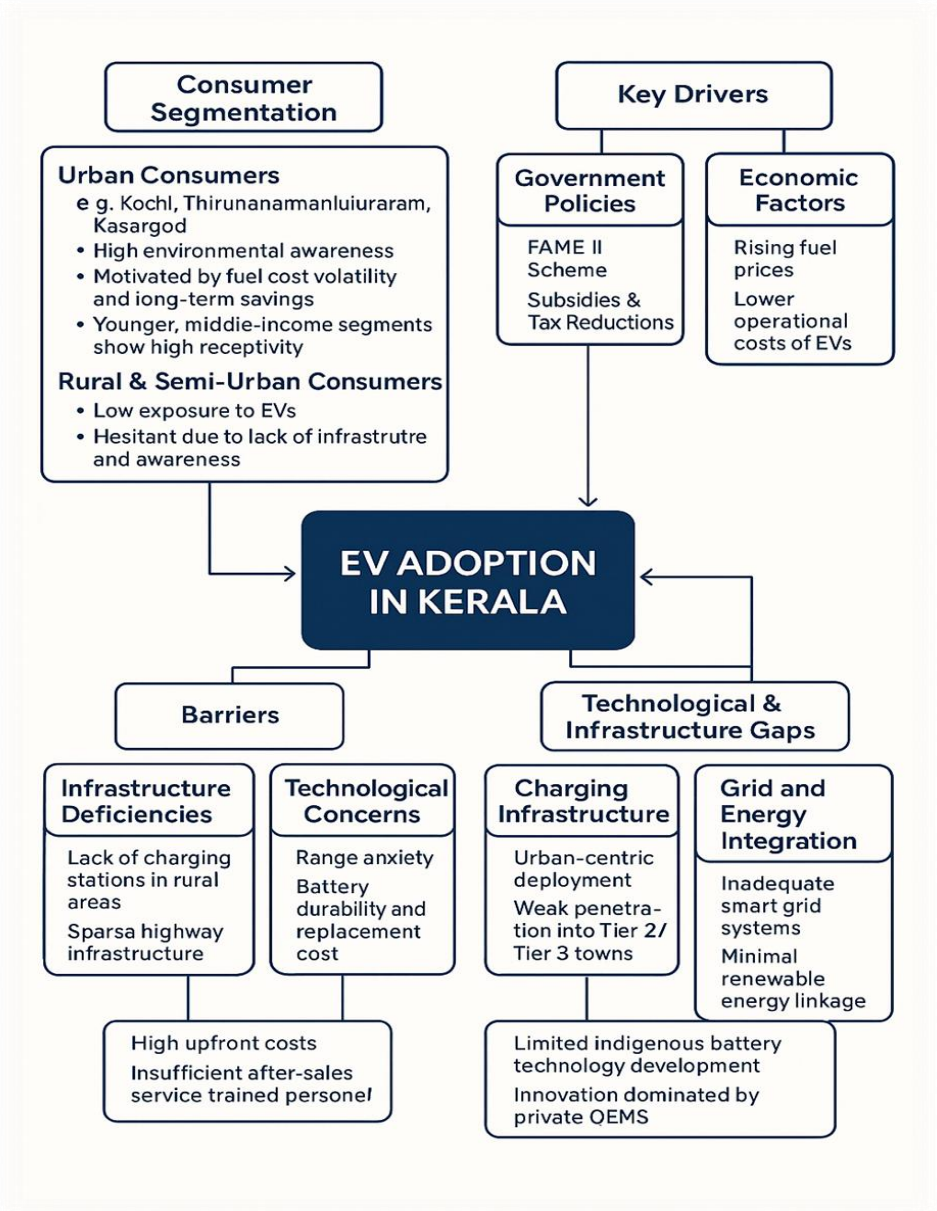
Quantitative Data:

Measurements (descriptive statistics, such as the Mean, Percentages, bar diagram etc) and correlations/regressions (inferential statistics) analysis to look for patterns in data, associations.

Qualitative Data:

Interview and focus group transcripts will be analysed using thematic analysis to identify the dominant constructs in what stakeholders say.

Samples were selected from three main district such as Thiruvananthapuram, Kochi and Kasargod to get regional representation.



7. Analysis of Data

Descriptive Statistics (Quantitative data)

1. The strong interest in EVs, Respondents from most urban areas like Kochi and Thiruvananthapuram, stand 70%.
2. Environmental concern is one of the major reasons to choose EVs as was cited by most (55%) users in age group 25–40.
3. 61% said that the infrastructure barrier to charging was the greatest of all:
4. Currently only 82% of EV owners were satisfied with how well the vehicle delivered but are wary of replacing battery life.

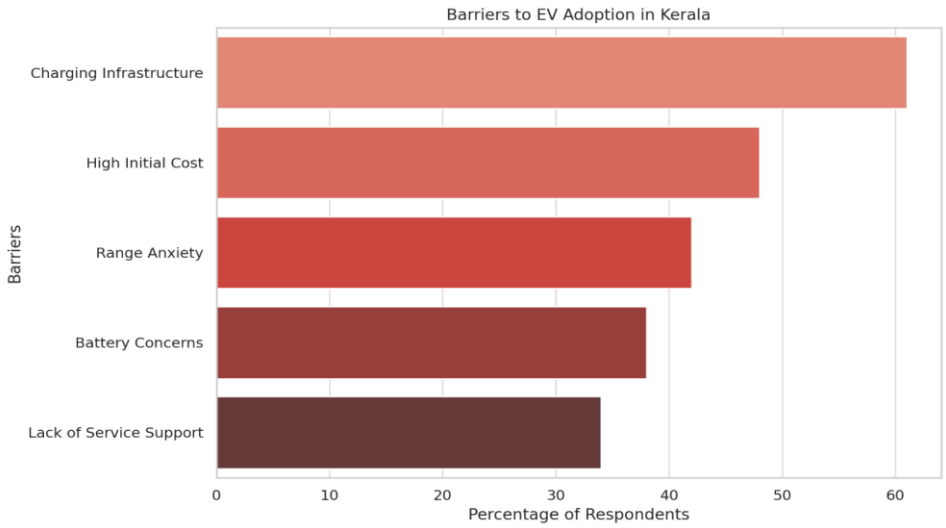
Inferential Statistics

1. EV purchase likelihood and awareness of government incentives are positively correlated ($r = 0.62$) the greater they were aware of EV incentives, more like it was worth buying.
2. Infrastructure availability was found to be the strongest predictor amongst the models explaining EV adoption preferences ($p < 0.05$) followed by price sensitivity by regression analysis.

Qualitative Themes (Interviews/Focus Groups)

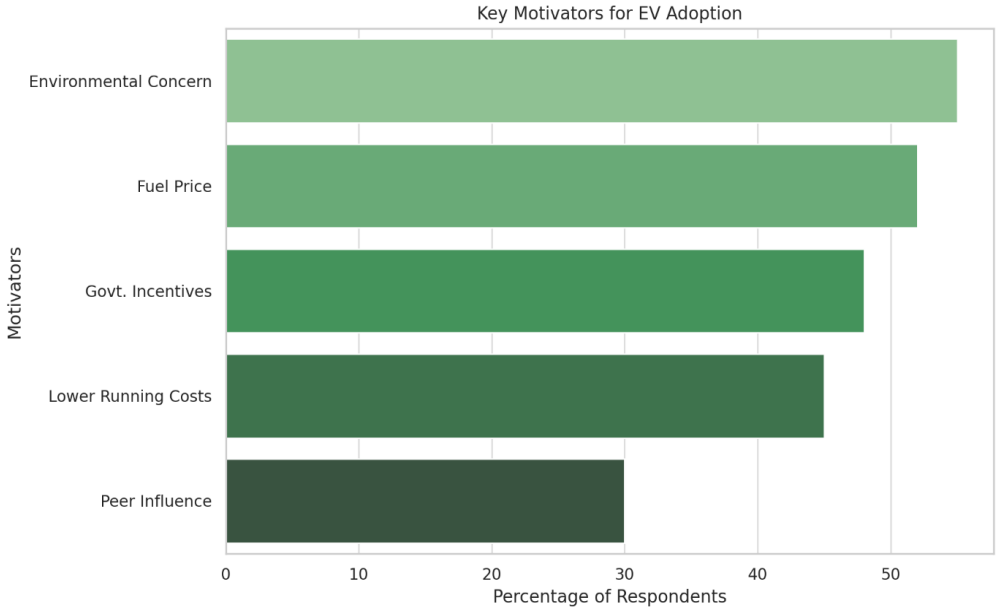
1. Rural consumers feel commoditized because of long distances from charging stations and lack of awareness campaigns.
2. Participants were most worried about the degradation of batteries and service facilities of technology.
3. A couple More walked away because they didn't know what subsidies existed or the apps were too hard

Percentage of Barriers to EV Adoption in Kerala



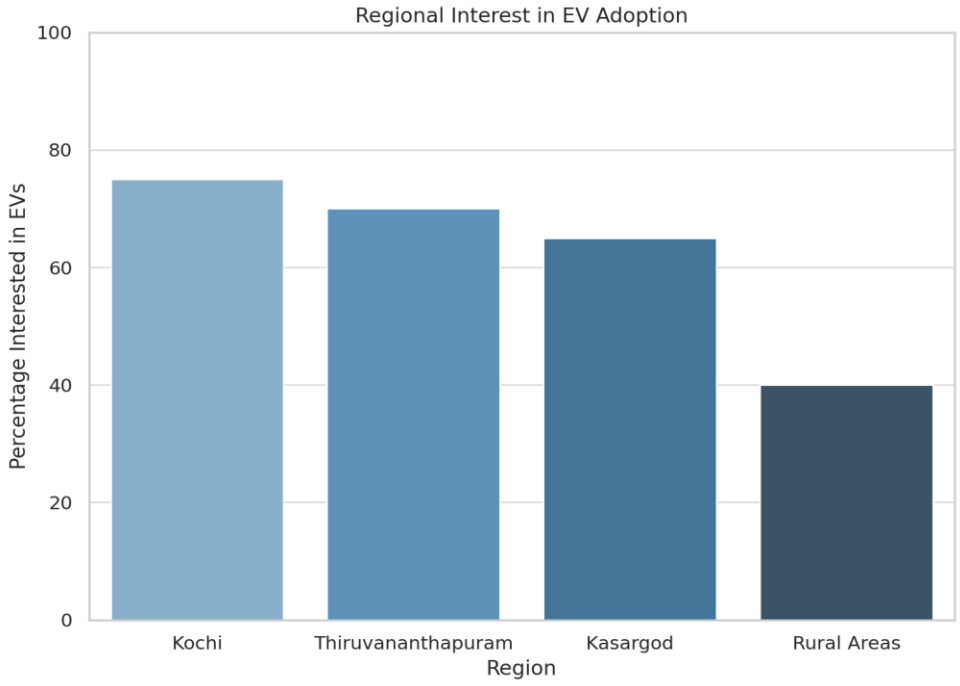
Barriers to EV uptake-The top barrier is scarcity of charging infrastructure which is followed by cost of the vehicles and Range anxiety

Percentage of Key Motivators for EV Adoption in Kerala



EV Motivators – Environmental awareness and depleting fuel prices are powerful ones

Percentage of Regional Interest in EV Adoption in Kerala



EV by region – Cities like Kochi and Thiruvananthapuram seem more in demand than rural areas.

8. Findings

Consumer Attitudes and Adoption Trends

1. The interest in EVs is definitely on the up for the consumers in Kerala especially in cities like Kochi, Thiruvananthapuram and Kasargod due to increasing environmental consciousness and with continuous spike in the fuel prices.
2. Young & middle-income audience embrace EV purchase with cost savings and environmental impact often top out the list of reasons.
3. The adoption in rural as well semi-urban areas is low owing to absence of infrastructure and exposure

EV Adoption Drivers

4. Government incentives such as subsidies, reduced road tax, and FAME II scheme benefits have been strong catalysts
5. As people become more conscious about the environment climate seems to be at the top of the list to prompt them in considering EVs.
6. Long range and low running costs compared to Internal Combustion Engine (ICE) vehicles is a very important long term benefit

EV Adoption Bottlenecks

7. Lack of adequate charging infrastructure, especially in non-urban areas, is the most cited barrier.
8. High initial cost of EVs is a concern for middle-income households, despite long-term savings.
9. Range anxiety as well as battery life and battery performance fears still linger.
10. Limited availability of after-sales support and trained mechanics for EVs reduces confidence among potential buyers.

Technological and Infrastructure Gaps

11. Public charging points are mainly concentrated in big cities, very little soft along highways or smaller towns.
12. Smart grid readiness and integration of renewable energy with EV charging infrastructure are still underdeveloped.
13. Technological innovation is mostly driven by private OEMs; indigenous R&D in battery technology is limited

9. Suggestions

Market and Industry Pushes

1. Create low cost EVs for the two-wheeler and three wheeler segments to reach low and middle-income groups on a rolling basis
2. Facilitate public-private partnerships for charging infrastructure.
3. Training programs for EV mechanics and service technicians should be scaled up to build post-sales confidence

Public Engagement & Awareness

4. Launch statewide EV awareness campaigns through schools, social media, and community programs to build consumer trust.
5. Conducts test drive camps and demo days in Tier-2 Tier-3 towns for EV technology exposure.

Policy recommendations

6. Public EV charging infrastructure — A state-led mission for deploying charging stations in the right places such as in selected tracts of rural/semiurban area & highway
7. Improve financial incentives: Pilot EV loans without interest, launch state incentives for two and three-wheelers and trade-in bonuses for scrapping old ICE vehicles.
8. Local R&D investment — Funding and partnerships for EVs and batteries initiatives in Kerala-based institutions /startups

Conclusion

Kerala stands at a critical juncture in its transition toward sustainable mobility. While consumer interest in electric vehicles is clearly rising, real progress depends on addressing practical barriers such as infrastructure gaps, high upfront costs, and limited technical support. Government leadership, backed by proactive industry participation and informed consumers, can position Kerala as a model state for EV adoption in India. By aligning policy, technology, and public engagement, Kerala can truly drive the future of mobility—cleaner, smarter, and more equitable.

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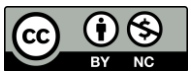

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