Electrifying The Road Ahead: Survey-Based Insights into Public Awareness, Policy Support, and Barriers to Ev Adoption in Smart Cities of Karnataka

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Abstract

The global transition toward sustainable transportation has placed electric vehicles (EVs) at the forefront of policy and consumer discussions. This study investigates public awareness, perceptions, and barriers related to EV adoption in selected smart cities of Karnataka—Davangere, Shivamogga, and Hubballi-Dharwad. Using a structured questionnaire and responses from 384 participants, the research evaluates the levels of awareness regarding EV technology and government policies, public perceptions of policy effectiveness and incentives, and the infrastructural and psychological barriers hindering EV adoption. A combination of descriptive statistics, Likert-scale analysis, and hypothesis testing was employed to draw insights from the data.

Findings reveal that while a high percentage (92.7%) of respondents are aware of electric vehicles, awareness regarding specific government policies and infrastructure remains comparatively low. Public trust in policy effectiveness is mixed, with affordability and lack of charging stations emerging as primary concerns. Statistically significant associations were observed between demographic variables (such as income, education, and age) and EV purchase intentions. Hypothesis testing further demonstrated that policy awareness, range anxiety, and upfront costs are influential in shaping public attitudes toward EVs.

The study underscores the importance of targeted policy communication, infrastructure expansion, and educational outreach to improve EV adoption rates. Despite certain limitations in geographic scope and methodology, the research provides actionable insights for policymakers, manufacturers, and urban planners to design more inclusive and responsive EV strategies.

Keywords: Electric Vehicles, Public Awareness, EV Policy Perception, Adoption Barriers

1 Introduction

The urgency of climate change and the increasing dependence on fossil fuels have intensified the global discourse on sustainable transportation. In this context, electric vehicles (EVs) have emerged as a promising solution for reducing greenhouse gas emissions, lowering urban air pollution, and decreasing reliance on non-renewable energy sources. India, being the third-largest automobile market in the world and one of the most polluted nations, has recognized the need to transition toward cleaner mobility. The Government of India has introduced several national-level initiatives such as the

Faster Adoption and Manufacturing of Hybrid and Electric Vehicles (FAME) schemes, Production Linked Incentives (PLI), and state-specific EV policies to accelerate this transition.

Karnataka has been one of the early adopters of the EV revolution in India. With its capital Bengaluru often dubbed the "Silicon Valley of India," the state has positioned itself at the forefront of technological innovation and sustainability. Karnataka was the first state to roll out a dedicated EV policy in 2017, promoting electric mobility through infrastructure development, manufacturing incentives, and public-private partnerships. Furthermore, several cities in Karnataka have been designated as "Smart Cities" under the national Smart Cities Mission, aimed at promoting inclusive, sustainable urban development with a focus on smart mobility solutions.

Despite these efforts, the pace of EV adoption in Karnataka's smart cities remains uneven. A deeper understanding of the factors influencing public awareness, policy perception, and adoption behavior is crucial to bridging the gap between policy formulation and real-world implementation. Public attitudes, accessibility of charging infrastructure, upfront costs, lack of awareness, and limited product availability continue to act as barriers, particularly in Tier 2 cities and peripheral urban regions.

This study, therefore, aims to fill the knowledge gap by presenting **survey-based insights** into the perceptions, readiness, and barriers experienced by potential EV users in selected smart cities of Karnataka—namely, Davangere, Hubballi-Dharwad and Shivamogga. By capturing public sentiment, examining the extent of awareness about EV-related policies, and identifying infrastructural and psychological barriers, the study seeks to contribute valuable empirical data that can inform both policymakers and industry stakeholders. The findings are expected to support evidence-based strategies for enhancing EV adoption, improving infrastructure planning, and aligning public policy with ground-level realities in the Karnataka context.

2 Electric Vehicles (EVs) In India: The Drive Towards Sustainability

India stands at a critical crossroads in its pursuit of sustainable development, where the need for environmental stewardship intersects with rapid urbanization and economic growth. The transportation sector, contributing significantly to the nation's greenhouse gas emissions and urban air pollution, has become a focal point in India's climate action agenda. In this evolving landscape, electric vehicles (EVs) have emerged as a transformative solution to mitigate environmental degradation, reduce fossil fuel dependency, and foster green innovation.

The push towards electrification of mobility in India aligns with global climate commitments under the Paris Agreement and the country's own ambitious goals to achieve net-zero emissions by 2070. Recognizing the role of electric mobility in this transition, the Government of India has introduced various policy initiatives such as the Faster Adoption and Manufacturing of Hybrid and Electric Vehicles (FAME I and II)**,** National Electric Mobility Mission Plan (NEMMP)**, and** Production Linked Incentive (PLI) schemes**.** These policies aim to incentivize EV adoption, promote local manufacturing, and build robust infrastructure for clean transportation.

Despite the growing policy momentum and technological advancements, India's EV adoption rate remains relatively modest. As of 2024, electric vehicles account for less than 5% of total vehicle sales, with notable disparities in adoption across different states and urban-rural regions. Key challenges include high upfront costs, limited charging infrastructure, range anxiety, low consumer awareness, and a lack of standardized regulations. These factors, coupled with behavioural resistance to change, continue to hinder the widespread acceptance of EVs.

However, the outlook is not entirely bleak. States like Delhi, Maharashtra, Tamil Nadu, and Karnataka have launched their own EV policies, offering purchase incentives, tax exemptions, and investment in charging networks. Startups and major automotive manufacturers are entering the EV market, creating a dynamic ecosystem for electric mobility. Furthermore, growing environmental consciousness among Indian consumers—particularly in urban areas—suggests a gradual but steady shift in attitudes toward sustainable transportation.

This study explores the multifaceted journey of India's drive toward electric vehicle sustainability**,** with a focus on public perception, infrastructural readiness, policy implementation, and market trends. Through a combination of literature review, policy analysis, and survey data, it aims to identify the key enablers and barriers to EV adoption in India. By examining both challenges and opportunities, this research seeks to provide evidence-based recommendations that can guide stakeholders—including policymakers, industry players, and consumers—towards a greener and more sustainable mobility future.

3 Review of Literature

The transition to electric mobility in India has been the subject of growing academic and policy interest in recent years. The literature reveals a multifaceted discourse surrounding electric vehicles (EVs), ranging from environmental impact and technological development to policy frameworks, consumer behavior, and infrastructure readiness. This review synthesizes key findings from existing studies to contextualize the challenges and opportunities related to EV adoption in India, particularly in the light of sustainability.

3.1 Environmental and Economic Rationale for EVs

A significant body of research emphasizes the environmental advantages of EVs. According to Singh and Garg (2021), transitioning to electric vehicles can reduce vehicular CO_2 emissions by up to 30% when powered by a decarbonized grid. Additionally, studies such as Sharma et al. (2020) highlight how EVs contribute to reducing local air pollution, a major concern in Indian cities. On the economic front, Rao and Venkatesh (2022) argue that electric mobility can reduce oil import bills and create employment opportunities in battery manufacturing, recycling, and renewable energy sectors.

3.2 Policy Initiatives and Institutional Support

Multiple studies have examined the role of government policies in promoting EVs. The Faster Adoption and Manufacturing of Hybrid and Electric Vehicles (FAME I & II) schemes are frequently cited as instrumental in laying the groundwork for India's electric transition (Mehta & Kumar, 2020). State-level policies, such as those in Delhi, Maharashtra, and Karnataka, provide additional subsidies, charging incentives, and registration benefits (Joshi, 2021). However, Ranjan and Das (2023) note the inconsistency and slow implementation of these policies across states, resulting in uneven EV adoption.

3.3 Consumer Awareness and Behavioural Factors

Consumer perception remains a critical determinant in the adoption of EVs. Studies by Patel and Reddy (2020) reveal that although environmental awareness is increasing among urban consumers, price sensitivity and limited product knowledge are still major barriers. Kumar et al. (2021) conducted a pan-India survey showing that while 68% of respondents were aware of EVs, less than 25% felt confident about purchasing one due to concerns about range, resale value, and charging infrastructure.

3.4 Infrastructure and Technological Barriers

Charging infrastructure is consistently identified as one of the most pressing challenges in EV adoption. According to a report by NITI Aayog (2022), India has fewer than 3,000 operational public charging stations, far below the required levels for mass EV adoption. Mishra and Bhatnagar (2020) emphasize the need for government-private sector collaboration to build integrated charging networks, especially in Tier 2 and Tier 3 cities. Technological constraints such as battery performance, charging time, and lack of standardization further complicate adoption (Khan & Verma, 2021).

3.5 Urban Mobility and Smart Cities

The integration of EVs into smart city planning has received particular attention in recent years. Research by Iyer and Suresh (2022) indicates that cities like Bengaluru, Pune, and Hyderabad are experimenting with EV fleets for public transport and last-mile delivery. However, they caution that without cohesive policy alignment, stakeholder coordination, and real-time data systems, smart cities may struggle to scale EV usage effectively.

Gaps in Literature

While numerous studies have explored EV policy, technology, and environmental impact, there is a relative lack of localized, survey-based research focusing on public perception and policy awareness in specific Indian states or smart cities. Very few studies comprehensively analyze how public knowledge, infrastructural gaps, and behavioural barriers intersect to shape EV adoption. This study seeks to address this gap by offering survey-based insights from smart cities in Karnataka, contributing to a more nuanced understanding of India's electric vehicle ecosystem.

4 Statement of the Problem

India is actively promoting electric vehicles (EVs) to reduce emissions and achieve sustainable transportation goals. However, despite supportive policies and growing environmental awareness, EV adoption remains low and inconsistent across regions. Key barriers include high upfront costs, limited charging infrastructure, low public awareness, and consumer hesitation.

In states like Karnataka, especially within its smart cities, there is a lack of localized, survey-based data that reflects public perception, policy effectiveness, and real-world challenges. This gap hinders the creation of targeted strategies for encouraging EV usage. Therefore, this study aims to explore the underlying factors affecting EV adoption in Karnataka's smart cities, focusing on public awareness, policy support, and infrastructural limitations.

5 Objectives of the Study

The main objective of this study is to investigate the factors that influence the adoption of electric vehicles (EVs) in the smart cities of Karnataka, with a focus on public awareness, policy support, and existing barriers. Specific Objectives are:

a. To evaluate the level of public awareness and knowledge regarding electric vehicles in selected smart cities of Karnataka.
b. To assess public perceptions of state and national EV policies, subsidies, and incentives provided to promote electric mobility.
c. To identify the major infrastructural and psychological barriers (e.g., lack of charging stations, range anxiety, cost concerns) affecting EV adoption.
d. To analyze the influence of demographic and socio-economic factors (such as age, income, education, and occupation) on EV preferences and purchase intentions.

6 Research Methodology

This study adopts a quantitative, survey-based research methodology to investigate public awareness, policy perception, and barriers to the adoption of electric vehicles (EVs) in selected smart cities of Karnataka. The methodology is designed to provide measurable insights into the behavioural, infrastructural, and policy-related factors influencing EV adoption at the urban level.

6.1 Research Design

The study follows a descriptive research design, aiming to systematically collect and analyze data from residents in three smart cities like Davangere, Shivamogga, and Hubballi-Dharwad**.** The design is intended to provide empirical evidence on awareness levels, attitudes, policy support, and perceived challenges related to electric mobility.

6.2 Population and Sample

The target population includes residents (aged 18 and above) of the selected smart cities who are potential or existing users of personal transportation. **A** sample size of 384 respondents was determined using the Yamane formula (1967) for a 95% confidence level and a 5% margin of error, suitable for large urban populations.

6.3 Sampling Technique

A stratified random sampling technique was employed to ensure balanced representation across the three cities. Each city was treated as a stratum, and respondents were selected proportionally from residential, commercial, and institutional zones to ensure demographic diversity.

6.4 Data Collection Method

Data was collected through a structured questionnaire**,** administered both online (via Google Forms) and offline (paper-based) depending on respondent accessibility. The questionnaire consisted of close-ended questions covering:

- Demographics (age, gender, income, education, occupation)
- Awareness of electric vehicles and related policies
- Perceptions of EV affordability, performance, and environmental impact
- Infrastructure availability (charging stations, service centers)
- Barriers to EV adoption (cost, range anxiety, lack of information)

6.5 Data Analysis

Collected data was coded and analysed using descriptive and inferential statistical tools via SPSS software. Key statistical techniques included:

- Frequency distributions and cross-tabulations for demographic and awareness analysis
- Chi-square tests to assess relationships between socio-economic factors and EV adoption
- Mean score analysis and Likert scaling for attitudinal and perception-related responses

7 Data Analysis And Discussion:

Table 7.1: Demographic Profile of Respondents (N = 384)

Demographic Variable	Category	Frequency (n)	Percentage (%)
Gender	Male	208	54.2%
	Female	176	45.8%
Age Group	18–25 years	96	25.0%
	26–35 years	112	29.2%
	36–45 years	88	22.9%
	46–60 years	64	16.7%
	Above 60 years	24	6.2%
Education Level	Up to 12th grade	42	10.9%
	Graduate	158	41.1%
	Postgraduate	136	35.4%
	Others (Diploma, etc.)	48	12.6%
Occupation	Student	72	18.8%
	Private employee	138	35.9%
	Government employee	42	10.9%

	Business owner	64	16.7%
	Homemaker/Unemployed	68	17.7%
Monthly Income	Below ₹20,000	86	22.4%
	₹20,001–₹40,000	112	29.2%
	₹40,001–₹60,000	84	21.9%
	₹60,001–₹1,00,000	66	17.2%
	Above ₹1,00,000	36	9.4%
City	Davangere	128	33.3%
	Shivamogga	128	33.3%
	Hubballi-Dharwad	128	33.3%

Source: Primary Survey

Interpretation:

The demographic analysis of the 384 respondents from the smart cities of Davangere, Shivamogga, and Hubballi-Dharwad reveals a well-balanced and diverse sample. Each city contributed equally to the survey, ensuring geographical representativeness. The gender distribution shows a slight male majority (54.2%), with females comprising 45.8% of the sample, reflecting a near-balanced gender representation. A significant proportion of respondents belonged to the age group of 26–35 years (29.2%), followed by 18–25 years (25%), indicating that the data largely reflects the views of young and middle-aged urban residents—key segments likely to engage with emerging technologies like electric vehicles (EVs). In terms of educational qualifications, a considerable majority were graduates or postgraduates (76.5%), suggesting that the respondents are relatively well-informed and capable of making technology-driven decisions. The occupational profile shows a dominance of private sector employees (35.9%) and students (18.8%), capturing a mix of working professionals and future consumers. Income distribution reveals that over half of the respondents fall within the ₹20,001–₹60,000 monthly income range, representing India's expanding middle class. This group is particularly relevant for analysing price sensitivity and purchase intentions regarding EVs. Overall, the demographic profile indicates that the study sample is young, educated, and moderately affluent, making it well-suited for exploring awareness, policy perceptions, and barriers to EV adoption in urban Karnataka.

Table 7.2: Public Awareness and Knowledge About Electric Vehicles

Awareness & Knowledge Variables	Response Options	Frequency (n)	Percentage (%)
Heard about Electric Vehicles (EVs)?	Yes	356	92.7%
	No	28	7.3%
Aware of Government EV Policies (e.g., FAME, state subsidies)?	Yes	198	51.6%
	No	186	48.4%
Knows difference between EV and conventional fuel vehicle?	Yes	304	79.2%
	No	80	20.8%
Aware of local charging stations in their city?	Yes	132	34.4%
	No	252	65.6%
Knows EV brands/models available in Indian market?	Yes	216	56.3%
	No	168	43.7%

Source: Primary Survey

Interpretation:

The data shows high general awareness of EVs (92.7%), but detailed knowledge is limited. Less than 52% are aware of government policies and only 34.4% know about charging infrastructure in their area. While most respondents (79.2%)

understand the basic difference between EVs and conventional vehicles, brand awareness and policy literacy remain moderate**,** indicating the need for enhanced public information campaigns.

Table 7.3: Public perceptions towards state and national EV policies, subsidies, and incentives provided to promote electric mobility.

Policy-Related Statement	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Mean Score
1. I am aware of EV subsidies and government incentives.	36 (9.4%)	58 (15.1%)	92 (24.0%)	136 (35.4%)	62 (16.1%)	3.34
2. Current government EV policies are sufficient to encourage adoption.	94 (24.5%)	108 (28.1%)	92 (24.0%)	64 (16.7%)	26 (6.8%)	2.53
3. Government incentives make EVs more affordable.	48 (12.5%)	86 (22.4%)	102 (26.6%)	110 (28.6%)	38 (9.9%)	3.01
4. Information about EV policies is clearly communicated to the public.	98 (25.5%)	112 (29.2%)	78 (20.3%)	66 (17.2%)	30 (7.8%)	2.53
5. More tax benefits and loan subsidies would increase my interest in purchasing an EV.	16 (4.2%)	20 (5.2%)	42 (10.9%)	152 (39.6%)	154 (40.1%)	4.06

Interpretation:

The Likert-scale data reveals mixed perceptions about the sufficiency and clarity of government EV policies. While **awareness of subsidies** is moderate (mean = 3.34), respondents largely **disagree that current policies are sufficient or well-communicated** (means = 2.53). The statement with the highest agreement (mean = 4.06) shows **strong public support for better financial incentives**, suggesting that practical economic benefits could significantly boost EV adoption interest in Karnataka's smart cities.

Table 7.4: Perceptions towards Infrastructural and Psychological Barriers to EV Adoption

Barrier Statement	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Mean Score
1. Lack of charging stations discourages me from considering EVs.	14 (3.6%)	24 (6.3%)	52 (13.5%)	178 (46.4%)	116 (30.2%)	3.93
2. I am concerned that EVs have insufficient range for long-distance travel.	18 (4.7%)	28 (7.3%)	48 (12.5%)	160 (41.7%)	130 (33.9%)	3.92
3. The high upfront cost of EVs is a major barrier for me.	10 (2.6%)	20 (5.2%)	64 (16.7%)	152 (39.6%)	138 (35.9%)	4.01
4. I worry about the availability of service and maintenance for EVs.	16 (4.2%)	26 (6.8%)	72 (18.8%)	160 (41.7%)	110 (28.6%)	3.83
5. I do not trust the long-term reliability and performance of EVs.	32 (8.3%)	56 (14.6%)	88 (22.9%)	132 (34.4%)	76 (19.8%)	3.43
6. I find EV-related information to be confusing or insufficient.	28 (7.3%)	44 (11.5%)	92 (24.0%)	132 (34.4%)	88 (22.9%)	3.54

Interpretation:

The data clearly highlights **cost, charging infrastructure, and range anxiety** as the **most significant barriers** to EV adoption. The **high upfront cost (mean = 4.01)** and **lack of charging stations (mean = 3.93)** are the top deterrents. Psychological concerns, such as **range anxiety (3.92)** and **maintenance availability (3.83)**, also play a major role.

Furthermore, moderate concern is seen around **trust in long-term performance (3.43)** and **information clarity (3.54)**. These findings suggest that both infrastructure development and consumer education must be addressed simultaneously to encourage EV adoption in Karnataka's smart cities.

Table 7.5: Hypothesis Testing Results-Demographic and socio-economic factors on EV preferences and purchase intentions.

S. No.	Hypothesis (H_0)	Test Used	Variables Tested	p-value	Result	Interpretation
1	H_0: There is no significant association between age and EV purchase intention.	Chi-square Test	Age vs. EV Preference	0.041	Reject H_0	Age has a statistically significant influence on EV purchase intention.
2	H_0: There is no significant difference in EV purchase intention across different income groups.	ANOVA	Income vs. EV Purchase Likelihood (Likert mean)	0.003	Reject H_0	Income significantly impacts willingness to buy EVs.
3	H_0: Educational level does not significantly influence EV preference.	Chi-square Test	Education vs. EV Preference	0.019	Reject H_0	Educational qualification has a significant effect on EV preference.
4	H_0: There is no significant association between occupation and EV adoption intention.	Chi-square Test	Occupation vs. Intention to Adopt EV	0.067	Fail to Reject H_0	Occupation does not show statistically significant influence.
5	H_0: Peer/community adoption has no effect on an individual's preference toward EVs.	Chi-square Test	Peer Influence vs. EV Preference	0.001	Reject H_0	Peer influence plays a statistically significant role in EV adoption preference.

Table 7.6: Hypothesis Testing Results -Public Policy Perceptions & Barriers to EV Adoption (N = 384)

S. No.	Hypothesis (H_0)	Test Used	Variables Tested	p-value	Result	Interpretation
1	H_0: There is no significant association between **awareness of EV policies** and **willingness to adopt EVs**.	Chi-square Test	Awareness of EV Policies × Purchase Intention	0.012	Reject H_0	Policy awareness significantly influences adoption willingness.
2	H_0: There is no significant difference in **perceived usefulness of subsidies** across **income groups**.	ANOVA	Income Level × Agreement with Subsidy Effectiveness	0.003	Reject H_0	Income level significantly affects perceptions of subsidies.
3	H_0: **Trust in government policies** does not significantly	Chi-square Test	Trust in Policy × EV Adoption Likelihood	0.045	Reject H_0	Trust in policy positively impacts

	impact EV adoption intention.					intention to adopt EVs.
4	H₀: **Lack of charging infrastructure** is not a significant barrier to EV adoption.	One-Sample t-test	Charging Infra Barrier Mean Score vs. Neutral Score (3)	< 0.001	Reject H₀	Respondents consider charging shortage a significant adoption barrier.
5	H₀: **Range anxiety** has no significant influence on potential EV purchase decisions.	Chi-square Test	Range Anxiety × Willingness to Purchase	0.029	Reject H₀	Range concerns significantly influence EV decisions.
6	H₀: **Upfront cost concerns** do not vary significantly across different income groups.	ANOVA	Income Level × Cost Concern Ratings	0.002	Reject H₀	Lower-income respondents are more affected by EV cost concerns.
7	H₀: **Information clarity on EV policies** has no significant effect on trust in those policies.	Pearson Correlation	Policy Clarity Score × Policy Trust Score	0.000	Reject H₀	Clear information positively correlates with trust in EV-related policies.

Table 7.7: Combined Hypothesis Testing Results

S. No.	Hypothesis (H₀)	Test Used	Variables Tested	p-value	Result	Interpretation
1	H₀: Public **awareness of EVs** has no significant association with **trust in EV policy initiatives**.	Chi-square Test	EV Awareness × Policy Trust	0.018	Reject H₀	Higher EV awareness leads to greater trust in government EV initiatives.
2	H₀: **Knowledge of EV benefits** does not affect perceptions of **policy effectiveness**.	ANOVA	Knowledge Score × Policy Effectiveness Ratings	0.005	Reject H₀	Informed individuals perceive EV policies as more effective.
3	H₀: **Lack of EV awareness** does not significantly relate to **range anxiety**.	Pearson Correlation	Awareness Score × Range Anxiety Score	0.033	Reject H₀	Poor awareness is correlated with higher range anxiety.
4	H₀: Awareness of **EV models/brands** is not associated with **concern about charging station availability**.	Chi-square Test	Brand Familiarity × Charging Concern Level	0.041	Reject H₀	Familiarity with EV options reduces concern about infrastructure.
5	H₀: Respondents with **higher EV knowledge** do not differ in **cost**	ANOVA	EV Knowledge × Cost Concern Ratings	0.027	Reject H₀	More knowledgeable individuals may perceive EVs as more

	concerns from those with lower knowledge.					cost-effective long term.
6	H_0: Policy awareness does not influence the perceived **importance of overcoming infrastructure barriers**.	Chi-square Test	Policy Awareness × Charging Infrastructure Concern	0.015	Reject H_0	Those aware of policies value infrastructure development more.

Interpretation:

The hypothesis testing across objectives reveals strong interlinkages between EV awareness**,** policy perception**,** and barrier sensitivity**.** Individuals with higher knowledge about EVs tend to trust policies more**, are** less anxious about range**,** and perceive EVs as more affordable over time. Awareness of government support also leads to greater appreciation of the need for charging infrastructure**.** These findings highlight that awareness-building efforts are foundational for addressing psychological and structural barriers to EV adoption.

8 Observations and Findings

The demographic profile (Table 7.1) reveals that male respondents slightly outnumber females, with 54.2% identifying as male. A significant portion of respondents (54.2%) fall within the 18–35 age group, indicating that younger individuals are more engaged with the concept of electric vehicles (EVs). Most respondents (76.5%) possess at least a graduate degree, reflecting a highly educated sample population. A large number are employed in the private sector (35.9%), with many earning below ₹60,000 per month, highlighting the importance of affordability in EV adoption. The geographical distribution across Davangere, Shivamogga, and Hubballi-Dharwad ensures balanced representation from Karnataka's smart cities.

According to Table 7.2, public awareness about electric vehicles is high, with 92.7% of respondents stating they have heard about EVs. However, only 51.6% are aware of government policies promoting EVs, indicating a gap in policy communication. While 79.2% understand the difference between electric and traditional vehicles, just 34.4% are aware of the presence of local charging stations, suggesting insufficient information about supporting infrastructure. Approximately 56.3% of participants can identify EV brands, showing moderate market awareness.

Table 7.3 highlights perceptions regarding EV policies. Although over half are aware of subsidies (mean = 3.34), only 23.5% believe the existing policies are sufficient to promote adoption (mean = 2.53). Many respondents remain neutral or negative about the affordability impact of current policies (mean = 3.01). The lowest scores were recorded for the clarity and communication of policies (mean = 2.53), implying that respondents find the available information lacking. Encouragingly, the idea of offering stronger financial incentives such as tax benefits or interest-free loans received the highest support (mean = 4.06).

Table 7.4 sheds light on the infrastructural and psychological barriers to EV adoption. The biggest deterrents include high upfront costs (mean = 4.01), lack of charging stations (mean = 3.93), and range anxiety (mean = 3.92). Concerns about EV service and maintenance also scored high (mean = 3.83), indicating a lack of trust in the support ecosystem. Reliability concerns (mean = 3.43) and limited information availability (mean = 3.54) further contribute to hesitation in purchasing EVs.

Hypothesis testing based on demographic variables (Table 7.5) confirms that age, income, and education significantly influence EV preferences and adoption intent. Age ($p = 0.041$), income ($p = 0.003$), and education level ($p = 0.019$) were

all statistically significant predictors. Peer influence (p = 0.001) also played a major role, while occupation did not show a strong correlation (p = 0.067), suggesting that social and financial variables are more influential than job type.

Table 7.6 combines policy perceptions and adoption barriers with hypothesis testing results. Awareness of EV policies (p = 0.012), trust in those policies (p = 0.045), and clarity of information (p = 0.000) all show statistically significant correlations with EV adoption willingness. Barriers like inadequate infrastructure (p < 0.001), range anxiety (p = 0.029), and cost concerns (p = 0.002) remain major obstacles. Cross-variable tests also reveal that knowledge improves trust (p = 0.018), reduces range anxiety (p = 0.033), and enhances perceived cost-effectiveness (p = 0.027). Importantly, policy-aware users were more critical of infrastructure gaps, indicating a higher expectation from those already engaged in EV discussions.

9 Conclusion:

This study offers critical insights into the dynamics influencing the adoption of electric vehicles (EVs) in the smart cities of Karnataka, namely Davangere, Shivamogga, and Hubballi-Dharwad. Based on the survey of 384 respondents, the research concludes that while public awareness of EVs is relatively high, there is a considerable gap in awareness regarding specific government policies and incentives. Despite the central and state governments introducing subsidies and tax benefits to promote electric mobility, their reach and clarity remain inadequate, leading to skepticism and underutilization.

The study finds that key infrastructural barriers—particularly the lack of charging stations, poor service networks, and range anxiety—remain significant deterrents to adoption. These challenges are compounded by psychological factors such as perceived high costs and concerns about long-term reliability. The data reveals that socio-economic variables like age, education, and income level significantly influence consumer preferences and willingness to adopt EVs. Younger, more educated respondents with stable incomes are more inclined to consider electric vehicles as a viable alternative.

Moreover, hypothesis testing confirmed that higher levels of EV knowledge are positively associated with trust in policy measures and lower psychological barriers, emphasizing the need for targeted awareness campaigns. Policy support, while conceptually welcomed by most respondents, must be strengthened through improved visibility, simplified application processes, and better infrastructure planning.

In essence, this research underscores that achieving sustainable electric mobility in Karnataka's smart cities requires a multi-pronged approach—enhancing public awareness, strengthening infrastructure, tailoring policies to local needs, and addressing socio-psychological concerns. Only through a concerted effort by government bodies, industry stakeholders, and the public can India's vision of green mobility be fully realized.

10 Limitations and Scope for Further Research

This study is limited to three smart cities in Karnataka—Davangere, Shivamogga, and Hubballi-Dharwad, so its findings may not be generalizable to all urban or rural regions in India. The use of a structured questionnaire may have constrained respondents' expressions, potentially overlooking nuanced opinions.

Future studies can expand the geographic scope to include other tier-1 and tier-3 cities for comparative insights. Longitudinal research can track changes in EV adoption over time. Further, qualitative studies involving interviews or focus groups can uncover deeper behavioural and emotional factors influencing EV adoption. Explorations into specific policy implementation impacts and private sector participation may also enrich future research.

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