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Determinants of Sustainable Electric Vehicle Purchase Decisions in Karnataka: Evidence from Structural Equation Modelling

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Abstract
Purpose: The proposed study will provide an understanding of the factors that determine sustainable electric vehicle (EV) purchase decisions in Karnataka by assessing the direct and indirect interrelations among behavioural, environmental, infrastructural, and policy-related factors.
Methodology: It was conducted using a quantitative, explanatory research design, with primary data gathered from 260 respondents in urban, semi-rural, and rural areas in Karnataka. The analysis of structured questions with Likert-scale items was conducted using Structural Equation Modelling (SEM) in AMOS/SmartPLS. Cronbach's alpha, KMO, the Bartlett test, and model fit indices were used to assess reliability and validity.
Findings: The most important predictors of sustainable EV purchases are charging infrastructure and pro-environmental behaviour. Positive and significant effects are also demonstrated on environmental concern, product awareness, and socio-demographic factors. However, there is no noticeable direct effect of policy incentives. The pro-environmental behaviour and environmental concern identified by mediation analysis are key factors in enhancing indirect relationships.
Implications: The analysis demonstrates the importance of improved charging infrastructure, increased consumer awareness, and behavioural change as ways to promote EV adoption. Policymakers ought to incorporate incentives into infrastructure and education policies.
Originality/Value: This work provides a thorough, Karnataka-specific SEM-based model that incorporates various determinants and mediation effects, thereby contributing to knowledge beyond intention-based frameworks for sustainable decision-making in EV adoption.
Keywords: Charging infrastructure, Electric vehicles, Environmental concern, Pro-environmental behaviour, Purchase decision, Structural equation modelling, Sustainability, Sustainable mobility

1 Introduction

The swift shift to sustainable mobility is vital to tackling climate change, air pollution, and energy security in India. Since Karnataka, the technological centre of India and one of the main states adopting EVs, is working towards achieving its Clean Mobility Mission, it is urgently necessary to understand the factors influencing sustainable electric vehicle (EV) purchasing. Although previous research has established behavioural, environmental, economic, infrastructural, social, and policy-related factors as determinants of EV adoption in Karnataka, the intricate interactions among the determinants have not been explored in depth.This study will identify the direct and indirect channels that influence consumers' purchase intentions for sustainable EVs in Karnataka. In contrast to traditional regression models, Structural Equation Modelling (SEM) allows the concurrent evaluation of a range of causal relationships, latent-variable relationships, and mediation effects, providing a more stringent perspective of the relations between pro-environmental behaviour, environmental concern, charging infrastructure, product awareness, policy incentives, and socio-demographic contexts and purchase choices.Latest Karnataka-specific findings indicate that environmental concern and income level are strong predictors of adoption, and that the lack of charging infrastructure and high initial cost are the leading barriers. Interestingly, financial benefit has no substantial direct impact on purchase intention, indicating that psychological and infrastructural factors are more influential than pure cost. The effects of performance and awareness are partly mediated by pro-environmental behaviour, and entirely by environmental concern, which mediates the awareness-intention effects. The study will add empirical SEM-based data to guide policymakers, manufacturing and teaching fraternities in developing specific interventions to support the adoption of EVs in sustainable ways among consumers across varied scenarios in Karnataka. Our results can be used in practice as we explain both direct and indirect determinants to speed up the process of converting Karnataka to clean and sustainable mobility.

2 Literature Review

The body of literature on the adoption of electric vehicles reveals that attitudinal, economic, environmental, technological, and policy-related factors interact in complex ways to influence consumer behaviour. In the available literature, scholars have investigated EV purchase intention and adoption behaviour through different theoretical frameworks, including TAM, TPB, UTAUT, S-O-R, and diffusion of innovation.
A broad literature review has shown that there is a consistent trend that emphasizes the role of attitude, affordability, environmental concern, infrastructure availability, and government incentives in the development of the EV acceptance. At the same time, other researches have shown the opposite results about the significance of such aspects as social influence, perceived usefulness, and support of the policies, which suggests that EV uptake is specific to context, type of consumers and type of vehicles. In this way, the literature review will systematise the existing knowledge into thematic groups to give a better picture of convergent and divergent opinions and future research directions in the given sphere of electric vehicles adoption.

2.1 Consumer Attitudes, Intentions, and Behavioural Models:

There is a large literature explaining EV adoption through behavioural intention models such as TAM, TPB, UTAUT, and S-O-R, as well as diffusion-based models. These studies largely concur that attitude is a key predictor of EV adoption intention.Using extended Theory of Planned Behaviour, Shalender and Sharma (2020) found that attitudinal, subjective norm, perceived behavioural control, moral norm, and environmental concern have a positive effect on EV purchase intention. In a similar vein, under the diffusion of innovation theory, Arora et al. (2022) found that attitude was the most predictive of EV purchase intention and mediated the effects of most innovation-related predictors. Jaiswal et al. (2021) also found that attitude is the primary factor in the Technology Acceptance Model, with perceived usefulness and perceived ease of use directly and indirectly affecting adoption intention, mediated by attitude. Similar results were also found by Upadhyay and Kamble (2023), as pro-environmental responsibility led to improvements in pro-environmental value and pro-environmental attitude, which in turn improved EV purchase intention. All these studies demonstrate that EV adoption is not only a technological or economic choice but also an attitude- and value-related behaviour.
Nonetheless, studies differ in the relative significance of the traditional acceptance-model constructs. Krishnan (2021) found that perceived usefulness and ease of use negatively influenced EV purchase intention, which is contrary to Jaiswal et al. (2021), where both were significant positive predictors. Similarly, Shetty (2024), using an extended UTAUT2 for electric two-wheelers, found that effort expectancy, social influence, habit, and facilitating conditions did not play a significant role, contrary to TPB- and UTAUT-based studies, which typically attribute explanatory power to them. This implies that the predictive ability of behavioural constructs might differ across EV categories, sample types, and regional markets.

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2.2 Environmental Values, Sustainability Orientation, and Moral Drivers: Among the important streams of research is the importance of sustainability awareness, environmental concern, and moral responsibility in the decision to adopt EVs.

Kautish et al. (2024) demonstrated that consumers' sustainability consciousness reinforces enabling motives and inhibits barriers, indicating that environmentally oriented consumers are more interested in EV decisions in general. Shalender and Sharma (2020) have provided environment concern and moral norm as significant positive predictors of the intention to adopt. Likewise, Upadhyay and Kamble (2023) have discovered that pro-environmental responsibility and value are significant factors that affect pro-environmental attitude and EV purchase intention. Bhat et al. (2021) posit that environmental enthusiasm has a positive impact on intention among the students of Bengaluru.

Even though they are in Malaysia, Asadi et al. (2020) confirm this argument and say that perceived consumer effectiveness, consequences awareness, responsibility ascription, and personal norms have a positive impact on EV purchase intention. These studies are combined to indicate a theory that environmental and moral considerations are compatible motivational forces in EV adoption literature.

In the meantime, the issue of the environment is not in the focus of every research. The Ali et al. (2022) results revealed that none of the variables in their sample statistically predicted EV adoption and the only significant factor was price. This is contrary to other studies, such as Shalender and Sharma (2020), Bhat et al. (2021), and Kousar (2025), which discovered an effect of environmental concern. This is an indication that environmental values can enhance the purchases of EVs when combined with affordability and awareness, but not in high price sensitivity markets.

2.3 Economic Factors, Price Sensitivity, and Financial Incentives: Economic considerations are one of the themes in literature that are unanimously a subject of discussion. The importance of the cost, affordability, total cost of ownership, and financial incentives is highlighted in numerous researches. Jaiswal et al. (2021) found out that the financial-incentive policy also modulates a number of relationships in the adoption model, thus, increasing the formation of EV intention. Shetty (2024) argues that the price of electric two-wheelers is a strong predictor of the purchase intention and actual buying behaviour. Gautam et al. (2024) determined that the cost has a strong impact on purchase likelihood. Instead, Kamble et al. (2025) discovered that the affordability and government incentives are highly influential on adoption, but overall cost of ownership is not. Government incentives awareness and use , as identified by Kousar (2025) and Zabivullah (2025), were other variables, to have an impact on adoption. The findings are corroborated by Tejesh et al. (2023), who highlighted the cost and government policies as important drivers of EV buying behaviour, and by Jyothika et al. (2025), who discovered that the monetary incentives are a powerful driver behind EV purchasing behaviour. All these papers point to price support and fiscal policy as the most important instruments to promote EV adoption in India. An intriguing exception is Ali et al. (2022), who determined the price to be significant, but not financial incentives, charging infrastructure, social reinforcement, and environmental concern. This is contrary to most other Indian studies and suggests that, with regard to certain consumers groups, fundamental affordability can be a policy or environmental determinant. Instead of rejection of the importance of incentives, this finding can be an indication of their ineffectiveness in cases where the primary price is prohibitively high or the perceived value is not immediately apparent to consumers.

2.4 Infrastructure, Range Anxiety, and Technological Barriers: Charging infrastructure and technology-related issues are consistently highlighted as major inhibitors of EV adoption. Kautish et al. (2024) identified barriers across three dimensions: usage, value, and risk. Michael et al. (2022) discovered that financial barriers, performance barriers, and inadequate charging infrastructure are the barriers to the adoption among consumers in Bengaluru. The same authors and Gautam et al. (2024), found that the purchase probability greatly depends on the availability of charging infrastructure. Muntaqheem et al. (2025) have found that issues related to inadequate charging infrastructure, high initial costs, range, and maintenance remain apparent in urban, semi-urban, and rural Karnataka. Zabivullah (2025) and Kousar (2025) also noted the lack of charging and the infrastructure as a significant issue. Kamble et al. (2025) also reported that the significant psychological barriers include range anxiety and perceived inconvenience. Bhat et al. (2021) found that anxiety negatively impacts adoption intention, and Arora et al. (2022) discovered that the absence of charging infrastructure and perceived complexity suppresses adoption. All these studies point in the same direction that infrastructure preparedness and uncertainty related to technology reduction are key to the expansion of the market.

However, other studies are more subtle. Kim et al. (2022) discovered that policy recognition and information alone do not play an important role in purchase unless accompanied by attractive subsidies and charging service. This indicates that infrastructure is most important when consumers can vividly relate it to convenience and useful policy support, rather than as a background policy issue.

2.5 Social Influence, Image, and Market Signalling: Several studies emphasise the impact of social influence, social image, and social reinforcement in the process of EV adoption. Krishnan (2021) found that social influence positively affects EV purchase intention. Bhat et al. (2021) found beneficial outcomes of social image and social influence, whereas Michael et al. (2022) found the supportive power of societal influence and social awareness. The importance of subjective norm was also demonstrated by Shalender and Sharma (2020), and social motives facilitate choice behaviour, as demonstrated by Kautish et al. (2024).

Lesmana (2025) takes a different approach to this dimension, concentrating on green marketing, perceived quality, and brand image. The researchers concluded that the brand image and green purchase intention have a strong impact on EV usage. This expands the literature by demonstrating that social influence can be exerted not only through peers and norms but also through symbolic consumption, branding, and market positioning. Conversely, social influence was found to be affected by electric two-wheelers to an insignificant degree by Shetty (2024), and social reinforcement was found to be affected by Ali et al. (2022) in their sample. These conflicting results suggest that the social impacts could be contingent on the type of products, referent group salience, and market maturity. Economic and functional considerations of a product might prevail over social signalling in new or high-utilitarian markets.

2.6 Policy Support, Government Initiatives, and Institutional Factors: Government policy is found throughout the literature as both a direct and an indirect driver of EV adoption. The financial incentive policy was included as a moderator by Jaiswal et al. (2021) and was shown to affect consumer intention pathways. Government support was found to be significant for both intention and behaviour by Shetty (2024). Kousar (2025), Zabivullah (2025), and Muntaqheem et al. (2025) demonstrated that government incentives are significant motivators but are underutilised due to a lack of awareness. Gautam et al. (2024) also emphasised that policy incentives influence attitudes and can be more effective at increasing adoption when delivered most effectively.

Tejesh et al. (2023) emphasised the role of government initiatives in consumer decision-making in Bengaluru, and Kim et al. (2022) found that subsidies positively affect purchase decisions when accompanied by appealing charging services. Therefore, policy does not work best as a single signal, but rather as a component of a larger ecosystem comprising incentives, infrastructure and service support.

An opposing opinion can be found in Krishnan (2021), where policy factors hurt purchase intention, and in Ali et al. (2022), financial incentives did not play a significant role. According to these studies, the presence of policy alone is not sufficient to yield behavioural effects, since the quality of implementation, communication, and consumer trust is essential.

2.7 Demographic, Regional, and Context-Specific Differences:Other studies do not rely on psychological models to examine socio-demographic and contextual heterogeneity in EV adoption.

Gautam et al. (2024) discovered that demographic factors have a profound influence on purchase intentions. According to Kousar (2025), intention is increased by income, education, environmental concern and technological readiness. Muntaqheem et al. (2025) found that

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willingness to purchase is strongly associated with income and awareness of subsidies. The benefits of the urban form were evident in Kamble et al. (2025), with the adoption rate significantly higher in urban than in semi-urban and rural areas. Zabivullah (2025) also found differences in awareness, access to infrastructure, and satisfaction between urban and rural areas.

These papers imply that social and geographic lines do not evenly distribute EV uptake. Infrastructure shortages and a lack of awareness disproportionately impact the semi-urban and rural segments. This stream of research is especially useful as it adds data on the real structural disparities to intention-based models.

2.8 Purchase Intention Versus Post-Purchase Behaviour and Satisfaction

The majority of studies focus on purchase intention, whereas a smaller number focus on actual buying behaviour and post-purchase outcomes. Shetty (2024) also linked purchase intention to actual purchasing behaviour and found that it was a strong predictor of realised purchase. Lesmana (2025) further went beyond intention in explaining the decisions to use EV. The case of Zabivullah (2025) is especially crucial, as it examined post-purchase satisfaction levels, indicating that satisfaction is determined by charging availability, vehicle performance, and cost of ownership. This is what makes Zabivullah (2025) stand out among most works focused on intentions, and it shows that adoption and continued user satisfaction are two dimensions that are closely connected yet independent of each other. One of the reasons that a consumer can take is because it is encouraged to do it or because of its environmental ethics, but the ultimate satisfaction will be the usability of the product in real life, the availability of the infrastructure, and the expenses of ownership.

2.9 Distinctive Contributions and Contradictory Findings

Despite the general trends of the literature towards a multidimensional approach to understanding the EV adoption, there are studies that are distinguished by their different purposes, or opposite findings.

The most understandable is Ali et al. (2022), which results in price being the only significant determinant, unlike the larger literature, which suggests the presence of infrastructure, environmental concern, incentives, and social influence. Krishnan (2021) has gone the other way by presenting the negative outcomes of policy attributes and perceived usefulness/ease of use. Shetty (2024) is unlike most of the behavioural studies that demonstrate that some traditional UTAUT factors do not matter in the electric two-wheeler setting.

Conversely, the field is expanded by other studies like Lesmana (2025) and Zabivullah (2025) which focus on brand image, green marketing, EV usage decisions, and post-purchase satisfaction, instead of purchase intention. Another problem outlined by Jyothika et al. (2025) is the issue of retrofitting reluctance, which discloses the way in which infrastructure issues, environmental issues regarding mining, preference to be driven in new cars, and lack of awareness may influence resistance. These works reveal that the literature on EV is moving beyond simple intention theories to market behaviour and product trajectories and post-adoption experiences.

Throughout the studies examined, the adoption of EVs is always influenced by a set of attitudinal, environmental, economic, infrastructural, social, and policy-related factors. The same results are obtained concerning the significance of positive attitude, environmental concern, affordability, charging availability and policy incentives. Simultaneously, there appear to be variations in the importance of social influence, perceived ease of use, usefulness, and policy implications, suggesting that results may differ by region, sample type, EV type, and market maturity. In general, the literature suggests that EV adoption is a complex decision-making process. Although the role of behavioural intentions should not be undervalued, contextual inequalities, post-purchase satisfaction, infrastructure quality, and distinct consumer groups should be given greater prominence in future research and policy to understand better and accelerate the adoption of EVs.

2.10 Research Gaps

The facts about the determinants of the adoption of electric vehicles are still disperse and context-dependent. Nevertheless, the literature available has already come up with a very long list of factors such as attitude, environmental concern, affordability, availability of infrastructure, social influence and government incentives. Most of past studies have looked at purchase intention, adoption intention or actual buying behaviour without conceptualising EV purchase as an environmentally responsible and sustainable decision making process that takes into consideration its economic viability and long-term usage. Therefore, the literature has not provided enough specificity in the interaction of these variables in determining the sustainable electric vehicle purchasing behaviour. In addition, there are studies that have used behavioural models like TAM, TPB, UTAUT, S-O-R and diffusion of innovation theory but the findings are not homogenous across environments. The other variables that have been dominant in some studies and non-dominant in others or even negative in others are perceived usefulness, social influence, environmental concern, financial incentives and policy support. Such discrepancies mean that the factors influencing EV purchases are extremely sensitive to the regional conditions, demographics, and market-specific conditions. In particular, the empirical understanding of the functioning of these relationships in Karnataka is still vague, as urban, semi-urban and rural consumers differ greatly in their consciousness, availability of infrastructure and affordability, as well as in exposure to policies.

The other gap is that most of the literature that can be found on India is either general and national or specific to certain cities such as Bengaluru. It however does not give a synthesised structure of Karnataka on a statewide level. Although research has been carried out in Karnataka to explore the level of awareness, barriers, and satisfaction, as well as demographic issues, it has not been able to explain the attitudinal, environmental, economic, technological, social, and policy as a single concept. Consequently, we do not have a Karnataka-specific study that may offer an insight into the short-term and reciprocal beneficial effects of these determinants on sustainable EV purchasing decisions.

Moreover, previous research has primarily been on the intention-based outcomes, but the intention-becoming decision gap has not been researched significantly. There are possibilities that consumers may be positive about EVs but the constraints on their final buying behaviour may be infrastructural, lack of policy awareness, range anxiety, servicing, and perceived ownership cost. Therefore, in order to have a more realistic and policy-relevant perspective on the EV transition, general intention models need to be replaced with decision-oriented models that are more reflective of consumer decisions related to the concept of sustainability.

3 Need for the Study

The relevance of the existing study is justified by the increased topicality of electric vehicles as an environmentally friendly means of transportation and the unavailability of context-specific information about the factors influencing their users in Karnataka. Even though various drivers that influence EV adoption have been determined, such as attitude, environmental concern, affordability, charging infrastructure, social influence, and government incentives have been reported in prior studies, the findings are fragmented and, in most instances, cannot be compared across markets and consumer segments. Most existing research has concentrated on purchase intention and not sustainable purchase decisions and many have investigated India in general or in a few urban centres, and a representation of the multifaceted nature of Karnataka is lacking. The level of awareness, availability of infrastructure, cost, and policy exposure between urban, semi-urban, and rural consumers in Karnataka is significantly different and may affect the purchase behaviour of EVs in different ways. Moreover, the reviews have inconsistencies with respect to the functions of some of the most important variables, such as the perceived usefulness, social influence, and policy support. Therefore, a more detailed and context-specific study is needed. The study of factors that affect sustainable electric vehicle purchase behaviour in Karnataka is therefore necessary to provide a full picture of how behavioural, environmental, economic, infrastructural, and policy-related concerns interact to influence consumer behaviour.

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The research will give more empirical evidence on the direct and indirect relationships between these determinants using Structural Equation Modelling. Such evidence will not only support the advancement of academic work but will also assist the policymakers, marketers and industry participants in coming up with effective policies to support sustainable electric mobility in Karnataka.

4 Statement of the Problem

The statement of the problem in the present study is due to the growing policy, market and environmental relevance of electric vehicles and the lack of knowledge of precisely what drives consumers to purchase in Karnataka. Although the electric cars are seen as a huge step towards combating carbon emissions, use of fossil fuels and destruction of the environment, their uptake by consumers is affected by a variety of factors in a multifactorial and even contradictory way. According to the existing literature, attitude, environmental concern, price sensitivity, charging infrastructure, social influence, technological perceptions, and government incentives are factors that affect EV adoption, but the results vary across studies. Social influence and policy stimuli play an important role in a few instances and a weak or insignificant role in others. On the same note, the impact of perceived usefulness, ease of use, and environmental concern varies across contexts, consumer groups, and vehicle types. Additionally, most prior studies have focused on purchase intention rather than actual or sustainable purchase decisions, and thus have not provided in-depth insights into how consumers assess EVs in practice. In Karnataka, the issue is of greater concern because consumers in urban, semi-urban, and rural areas may vary in their levels of knowledge, purchasing power, infrastructure availability, and exposure to policy subsidies. Nonetheless, a state-specific framework that looks at these determinants collectively does not exist. Thus, the main issue considered in this research is the absence of an interdisciplinary empirical insight into the behavioural, economic, environmental, infrastructural, social, and policy-related determinants of sustainable electric-vehicle buying behaviour in Karnataka.

5 Objectives

1. To identify and examine the key behavioural, environmental, economic, infrastructural, social, and policy-related factors influencing sustainable electric vehicle purchase decisions in Karnataka.
2. To analyse the direct and indirect relationships among the identified determinants of sustainable electric vehicle purchase decisions in Karnataka.
3. To assess whether the determinants of sustainable electric vehicle purchase decisions vary across consumer contexts within Karnataka.

6 Conceptual Framework

The study's conceptual framework is elaborated to reveal the key factors influencing sustainable electric vehicle purchase decisions in Karnataka and to examine their interconnections. The framework presupposes that sustainable EV purchasing decisions will be determined by a mix of behavioural, environmental, infrastructural, informational, and policy-related factors, as demonstrated in previous research (Shalender & Sharma, 2020; Jaiswal et al., 2021; Gautam & Bolia, 2024). The framework includes dependent, independent, and mediating variables, as the study aims to address both direct and indirect effects.Sustainable electric vehicle purchase decision is the dependent variable of the study. This means the consumer's choice to use or purchase an electric vehicle as a sustainable means of mobility. In contrast to general purchase intention, this variable reflects a broader decision influenced by responsibility towards the environment, the practicality of the decision, and its suitability for extended use in the Karnataka context (Arora et al., 2022; Muntaqheem & Raju, 2025).

The study has independent variables, namely Environmental Concern, Charging Infrastructure, Product Awareness, Policy Incentives and Socio-Demographic Variables. Environmental concern refers to consumers' awareness of ecological problems and the need for cleaner transport, which has been shown to positively impact EV adoption in several studies (Bhat et al., 2021; Kautish et al., 2024). Charging infrastructure refers to the availability and access to charging stations, which will continue to be one of the most critical factors in EV choice (Michael et al., 2022; Gautam & Bolia, 2024). Product awareness involves knowledge of EV features, benefits, and use, which helps consumers make well-informed choices (Kousar et al., 2025; Zabivullah, 2025). One of the policy incentives is the subsidies and governmental assistance that promote the adoption of EVs (Jaiswal et al., 2021; Shetty & Rizwana, 2024). The socio-demographic situation is also pertinent, with income, education, and regional variations affecting consumer preparedness and adoption behaviour (Muntaqheem and Raju, 2025).

The environmental concern is the Pro-Environmental Behaviour, which is the mediating variable in the study. The assumption is that concern for the environment might not be directly linked to purchase decisions without being converted into environmentally responsible behaviour. By doing so, pro-environmental behaviour becomes a significant connection amid consumer concern and sustainable EV purchase decision (Upadhyay and Kamble, 2023; Asadi et al., 2020). Moreover, the environmental concern might also mediate the relationship between the product awareness and purchase decision because an increase in environmental awareness through the product awareness might enhance the purchase decision (Shalender and Sharma, 2020; Kautish et al., 2024).Therefore, the conceptual framework (Figure 1) suggests that sustainable EV purchase decision in Karnataka is influenced by direct and indirect impacts of the identified variables. Structural Equation Modelling would be appropriate to analyse the framework because it aids in the study of interrelationships within the determinants in a holistic manner.

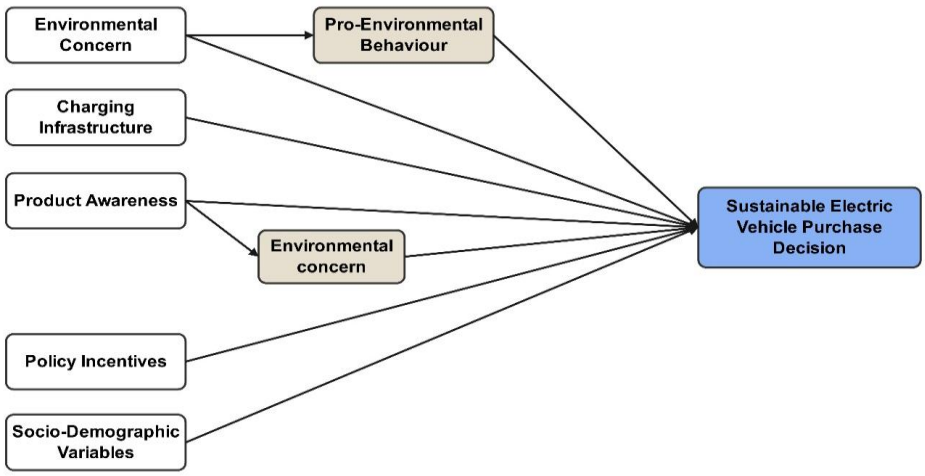

Figure 1: Conceptual Framework

7 Hypotheses Development

According to the literature considered, environmental, infrastructural, informational, policy-related, behavioural, and contextual factors impact sustainable electric vehicle purchase decisions. Previous research indicates that consumers with greater environmental concern are more likely to prefer electric vehicles, with such concern promoting sustainable mobility options (Shalender & Sharma, 2020; Bhat et al., 2021; Kautish et

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al., 2024). Correspondingly, practical determinants such as charging infrastructure are also critical, as insufficient access to charging, range anxiety, and service restrictions may act as deterrents (Michael et al., 2022; Gautam and Bolia, 2024; Muntaqheem and Raju, 2025).
Product knowledge will also play a role, with more informed and positive decisions based on awareness of EV features, benefits, and usability (Jaiswal et al., 2021; Kousar et al., 2025; Zabivullah, 2025). Moreover, the financial burden and consumer confidence can be reduced by policy incentives such as subsidies and government support, which can make EVs more enticing (Shetty & Rizwana, 2024; Tejesh & Devaru, 2023; Jyothika et al., 2025). The socio-demographic background can also influence sustainable EV purchases due to disparities in income, education levels, and access to infrastructure (Gautam & Bolia, 2024; Kousar et al., 2025).Moreover, the literature indicates that environmental concern could also have an indirect impact on sustainable EV purchase decisions through pro-environmental behaviour. Environmentally conscious consumers are more likely to adopt responsible behavioural orientations, which in turn reinforce sustainable purchasing decisions (Asadi et al., 2020; Upadhyay & Kamble, 2023). On the same note, product awareness can contribute to environmental concern by increasing knowledge of EVs' environmental benefits, thereby indirectly influencing purchase decisions (Shalender & Sharma, 2020; Kautish et al., 2024). Based on this, the hypotheses presented below are proposed.

H1: Environmental concern has a significant positive effect on sustainable electric vehicle purchase decisions.
H2: Charging infrastructure has a significant positive effect on sustainable electric vehicle purchase decisions.
H3: Product awareness has a significant positive effect on sustainable electric vehicle purchase decisions.
H4: Policy incentives have a significant positive effect on sustainable electric vehicle purchase decisions.
H5: Socio-demographic context has a significant effect on sustainable electric vehicle purchase decision.
H6: Environmental concern has a significant positive effect on pro-environmental behaviour.
H7: Pro-environmental behaviour has a significant positive effect on sustainable electric vehicle purchase decisions.
H8: Product awareness has a significant positive effect on environmental concern.
H9: Pro-environmental behaviour significantly mediates the relationship between environmental concern and sustainable electric vehicle purchase decision.
H10: Environmental concern significantly mediates the relationship between product awareness and sustainable electric vehicle purchase decision.

8 Methodology

The current research employs a quantitative, explanatory design to investigate the factors that determine the decision to purchase sustainable electric vehicles in Karnataka. An explanatory approach is suitable, as the research is expected to examine causal relationships among two or more variables using Structural Equation Modelling (SEM).A structured questionnaire, based on scales validated in other studies, was used to collect the study data. The questionnaire comprised a few Likert-scale items to obtain respondents' perceptions of environmental concern, charging infrastructure, product awareness, policy incentives, pro-environmental behaviour, and sustainable EV purchasing decisions. The sampling approach was convenience sampling, based on accessibility considerations, and 260 valid responses were received from urban, semi-urban, and rural consumers in the state of Karnataka.The number of items in the constructs used to measure the variables was adequate to provide a good representation of the latent variables. Several independent constructs (environmental concern, charging infrastructure, product awareness, policy incentives, and socio-demographic context), a mediating construct (pro-environmental behaviour) and a dependent construct (sustainable EV purchase decision) were used in the study.Structural Equation Modelling (SEM) was applied to analyse the data, and software like AMOS/SmartPLS was employed, as it allows estimating as many relationships and mediation effects as possible at the same time. Construct reliability was determined using Cronbach's alpha, and construct validity was determined using the KMO and Bartlett tests.
The standard fit indices, such as CFI, TLI, RMSEA, SRMR, and Chi-square/df, were used to evaluate the proposed model. These criteria guaranteed the model was statistically strong and suitable in the context of interpretation of the relationship between the study variables.

9 Data analysis & Interpretation

9.1 Demographic Profile of Respondents

The demographic characteristics of the respondents are a significant background of the sample in the present study. Since the study focuses on the factors that determine the buying behaviour of sustainable electric vehicles in Karnataka, it is important to characterise the respondents by gender, age, education level, occupation, monthly income, and place of residence. Such profiling may be employed to determine whether respondents reflect the demographics of various consumer categories, especially in a state like Karnataka, where urban, semi-urban, and rural settings influence the levels of awareness, affordability, and accessibility of electric vehicle infrastructure differently.

Table 1: Demographic Profile of Respondents

Demographic Variable	Category	Frequency	Percentage
Gender	Male	154	59.2
	Female	106	40.8
	Total	**260**	**100**
Age	Below 25 years	48	18.5
	25–35 years	96	36.9
	36–45 years	67	25.8
	Above 45 years	49	18.8
	Total	**260**	**100**
Educational Qualification	Undergraduate	62	23.8
	Postgraduate	128	49.2
	Professional/Technical	46	17.7
	Others	24	9.3
	Total	**260**	**100**
Occupation	Student	39	15
	Salaried Employee	104	40
	Business/Self-employed	71	27.3
	Professional	28	10.8
	Others	18	6.9
	Total	**260**	**100**
Monthly Income	Below ₹25,000	44	16.9
	₹25,001–₹50,000	78	30
	₹50,001–₹75,000	69	26.5
	Above ₹75,000	69	26.5
	Total	**260**	**100**
Place of Residence	Urban	142	54.6
	Semi-urban	71	27.3
	Rural	47	18.1
	Total	**260**	**100**

Source: Primary data

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As shown in Table 1, the demographic background of the 260 respondents provides important context for the factors influencing purchase decisions regarding sustainable electric vehicles in Karnataka. The sample is quite male-dominated, with 59.2 per cent male and 40.8 per cent female, indicating larger, albeit biased, participation. The 25-35 age group is the largest at 36.9 per cent, and the 36-45 age group is second at 25.8 per cent, suggesting that the study is primarily of economically active and decision-capable consumers. With respect to education, postgraduates comprise the largest proportion (49.2 per cent) of the sample, indicating that the sample is predominantly well-educated and, therefore, more knowledgeable about sustainability and new vehicle technologies. A respondent group that has practical market application is, by profession, 40 per cent, and, by occupation, 27.3 per cent are business owners and self-employed. The data on incomes also reveal that most respondents belong to middle- and high-income groups, which supports the affordability factor in EV adoption. Moreover, most of the people in the city population are covered at 54.6 per cent, followed by the semi-urban and rural populations, which means that the findings are affected primarily by consumers with relatively higher knowledge and access to EV infrastructure.

9.2 Reliability Analysis

To check the internal consistency of the measurement scales used in the study, the reliability analysis was performed. Cronbach's Alpha was used to assess reliability. In general, a Cronbach's alpha of 0.70 or higher is acceptable in social science studies, and an alpha of 0.80 or higher indicates good reliability.

Table 2: Reliability Analysis of Study Variables

Variable	No. of Items	Cronbach's Alpha
Environmental Concern	6	0.821
Charging Infrastructure	6	0.798
Product Awareness	6	0.836
Policy Incentives	6	0.781
Pro-Environmental Behaviour	6	0.848
Sustainable EV Purchase Decision	6	0.872

Source: Author computation from primary data

Table 2 reports the reliability data for the key constructs in the research and indicates that the measurement scale has a good level of internal consistency. All Cronbach's alpha values are greater than the acceptable level of 0.70, indicating that the items used in each construct measure the same concept and do so in a similar fashion. Sustainable EV Purchase Decision has the highest reliability value (0.872), followed by Pro-Environmental Behaviour (0.848) and Product Awareness (0.836), indicating good scale stability. In the meantime, the Policy Incentives (0.781) and Charging Infrastructure (0.798) are comparatively lower but still quite acceptable. Therefore, the table affirms that the instrument employed in the study is sufficiently sound to justify further statistical processing and the interpretation of the determinants of the purchase of sustainable electric vehicles in Karnataka.

9.3 Validity Analysis

A validity analysis was conducted to determine whether the data were suitable for factor-based analysis and whether the items included in the instrument were sufficient to capture the constructs under study. Validity in the current study was measured by using the Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy and the Bartlett Test of Sphericity. The KMO value indicates whether the sample is sufficient for factor analysis, and Bartlett's test assesses whether the variables are sufficiently correlated to warrant factor analysis. Overall, anything over 0.70 is acceptable for a KMO value, and a large Bartlett's Test value means that one can perform a meaningful factor analysis.

Table 3: KMO and Bartlett's Test of Validity for Study Variables

Variable	Bartlett's Test of Sphericity			Kaiser-Meyer-Olkin Test
	Chi-square	DF	Prob > Chi Sq	
Environmental Concern	268.451	15	0.000	0.801
Charging Infrastructure	241.386	15	0.000	0.784
Product Awareness	289.724	15	0.000	0.826
Policy Incentives	226.518	15	0.000	0.768
Pro-Environmental Behaviour	301.642	15	0.000	0.842
Sustainable EV Purchase Decision	318.957	15	0.000	0.861

Source: Author computation from primary data

Table 3 shows that the study variables have been adequately validated by both the Kaiser-Meyer-Olkin (KMO) measure and the Bartlett Test of Sphericity, which are critical in determining the suitability of the data for factor-based analysis. On careful examination of the table, all KMO values are greater than 0.70, with a range of 0.768 to 0.861, indicating good sampling adequacy for the constructs. It is interesting to note that the KMO value for Sustainable EV Purchase Decision is the highest (0.861), indicating that the items on this scale have high common variance. Simultaneously, the Bartlett Test is significant (p = 0.000) for all variables, indicating that the correlation matrices are not identity matrices and that the items are sufficiently correlated. Thus, the table is rather convincing evidence of the instrument's construct validity and indicates that the data can be further analysed, particularly to examine the factors that influence sustainable EV purchase.

9.4 SEM Results Table: Direct Paths

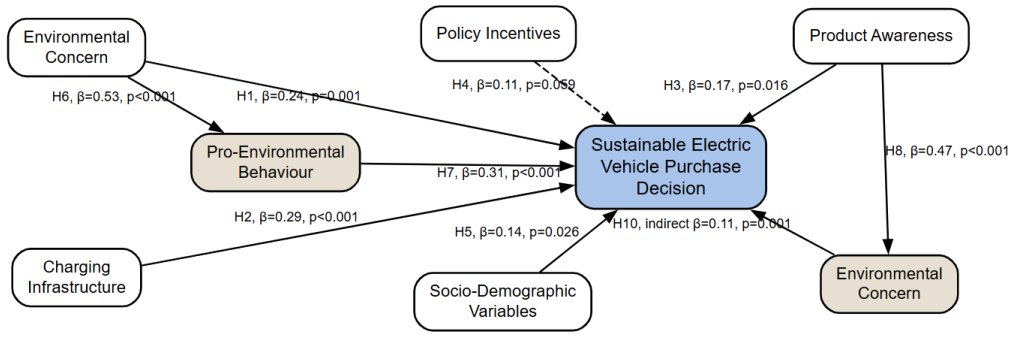

Figure 2: Path diagram

Source: Author composition from primary data

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Table 4: Structural Path Estimates of the SEM Model

Hypothesis	Path	Standardised β	CR / t-value	p-value	Result
H1	Environmental Concern → Sustainable EV Purchase Decision	0.24	3.18	0.001	Supported
H2	Charging Infrastructure → Sustainable EV Purchase Decision	0.29	3.94	0.000	Supported
H3	Product Awareness → Sustainable EV Purchase Decision	0.17	2.41	0.016	Supported
H4	Policy Incentives → Sustainable EV Purchase Decision	0.11	1.89	0.059	Rejected
H5	Socio-Demographic Context → Sustainable EV Purchase Decision	0.14	2.22	0.026	Supported
H6	Environmental Concern → Pro-Environmental Behaviour	0.53	7.12	0.000	Supported
H7	Pro-Environmental Behaviour → Sustainable EV Purchase Decision	0.31	4.37	0.000	Supported
H8	Product Awareness → Environmental Concern	0.47	6.28	0.000	Supported

Source: Author computation from primary data

Table 4 and Figure 2 present estimates of the SEM model's structural path and provide valuable information on the determinants of purchasing a sustainable electric vehicle in Karnataka. The findings show that Charging Infrastructure has the greatest direct impact on the sustainability of EV purchase decisions (β = 0.29, p < 0.001), implying that the availability and access to charging facilities are key practical factors for consumers. Pro-Environmental Behaviour also stands out as a strong predictor, with a direct effect on the purchase decision (β = 0.31, p = 0.001), indicating that an environmentally responsible behavioural orientation is important in translating concern into purchase preference.

In addition, the positive impact of Environmental Concern on sustainable EV purchase decisions is significant (β = 0.24, p = 0.001), thus supporting the idea that ecological awareness promotes sustainable mobility decisions. There is also a statistically significant but relatively moderate direct effect of Product Awareness (β = 0.17, p = 0.016), meaning that the more informed the consumer is, the more likely he or she is to embrace EV. Similarly, the Socio-Demographic Context has a significant positive impact (β = 0.14, p = 0.026), implying that EV decision-making is influenced by income, education, and location-related factors. Nonetheless, there is no statistically significant direct effect of Policy Incentives (β = 0.11, p = 0.059). The coefficient is positive, but the relationship is not as good as the traditional 5 per cent significance level. This means that policy support might not be sufficient to influence purchase decisions without infrastructure preparedness, awareness, and behavioural commitment. In general, the results indicate that behavioural and infrastructural variables are as important as policy indicators in determining sustainable EV purchases.

Table 5: Indirect Effects and Mediation Results

Hypothesis	Indirect Path	Indirect Effect (β)	z / t-value	p-value	Mediation Result
H9	Environmental Concern → Pro-Environmental Behaviour → Sustainable EV Purchase Decision	0.16	3.86	0.000	Supported (Partial Mediation)
H10	Product Awareness → Environmental Concern → Sustainable EV Purchase Decision	0.11	3.21	0.001	Supported (Partial Mediation)

Source: Author computation from primary data

Table 5 and Figure 2 present the mediating effects of the SEM model and indicate that the indirect effects are not only significant but also make sense. The effect of Environmental Concern on Sustainable EV Purchase Decision via Pro-Environmental Behaviour is positive and significant (β = 0.16, p = 0.001). This result confirms H9 and indicates that environmental concern does not merely function as an abstract attitude; it has a greater impact on purchase decisions when it is converted into a more pronounced pro-environmental behavioural orientation. That is, when concern for the environment is embodied in responsible, sustainability-oriented behaviour, consumers concerned about the environment will be more likely to adopt EVs.

Likewise, the influence of the Product Awareness on Sustainable EV Purchase Decision via Environmental Concern is also strong (β = 0.11, p = 0.001), thus proving H10. It means that information about EV characteristics, advantages, and functionality helps make buying decisions, not only by increasing consumers' environmental awareness. Thus, the mediation findings contribute to the model, indicating that awareness and concern are not independent variables but are intertwined; motivation and concern interact in a stratified manner to affect sustainable EV adoption, not only through direct impacts.

Table 6: **Model Fit Indices of the SEM Model**

Fit Index	Obtained Value	Recommended Threshold	Assessment
Chi-square/df	2.14	< 3.00	Acceptable
CFI	0.931	> 0.90	Good Fit
TLI	0.919	> 0.90	Good Fit
GFI	0.903	> 0.90	Good Fit
AGFI	0.874	> 0.80	Acceptable
RMSEA	0.066	< 0.08	Acceptable
SRMR	0.051	< 0.08	Good Fit

Source: Author computation from primary data

The model fit statistics are summarised in Table 6 and show that the proposed SEM model is an acceptable-to-good fit to the observed data. The Chi-square/df ratio of 2.14 falls within the acceptable range of less than 3.00, indicating that the difference between the actual and estimated covariance matrices is acceptable. In line with this, the CFI (0.931) and TLI (0.919) values exceed the suggested cut-off of 0.90, indicating that the model fits well.In addition, the GPI value of 0.903 and the AGFI of 0.874 indicate a good fit in terms of absolute fit. The error-based indices are also useful for indicating model adequacy: RMSEA = 0.066 and SRMR = 0.051, both of which fall within the generally accepted bounds. Taken together, the indices suggest that the structural model is in good health and can be applied to explain the hypothesised relationships between the study variables. By extension, the SEM model can be considered broadly acceptable for elucidating sustainable EV purchase decisions in Karnataka.

10 Discussion of Findings

The research findings are an eye-opener into the variables influencing purchase intention for sustainable electric vehicles (EVs) in Karnataka. The results provide a strong argument in favour of most of the proposed hypotheses and highlight the multidimensionality of EV adoption. Charging infrastructure emerged as the most influential factor, suggesting that accessibility and viability are important considerations in consumer decision-making. This aligns with the existing literature, which identifies infrastructure availability as a facilitator of EV adoption.

Likewise, environmental concern and pro-environmental behaviour were shown to have a significant effect on purchase decisions, which supports the idea that sustainability-oriented attitudes can translate into actual behavioural outcomes under conditions of responsible action. The impact of product awareness was positive and significant, either directly or indirectly through environmental concern, indicating that informed consumers would be more likely to make sustainable mobility decisions. The strong influence of socio-demographic variables also indicates that income, education, and place of residence determine adoption behaviours in the Karnataka setting. Policy incentives, however,

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were not found to have a statistically significant direct effect, indicating they are insufficient in the absence of awareness, infrastructure, and behavioural readiness.The mediation findings provide more in-depth evidence that environmental concern and pro-environmental behaviour are the crucial psychological mechanisms that link awareness and decision-making. The results generally support the view that EV adoption cannot be seen as a mere economic choice but as a complex interaction among behavioural, environmental, and infrastructural factors.

11 Recommendations

The research findings can be translated into useful, research-based solutions to enable the uptake of sustainable electric vehicles in Karnataka. Charging infrastructure development and accessibility should become priorities at the managerial and policy levels. Since infrastructure was identified as the strongest determinant, policymakers and other private-sector stakeholders should invest in extensive, accessible, and transparent charging networks, particularly in semi-urban and rural areas. This will directly reduce range anxiety and increase consumer confidence.Further, awareness campaigns ought to be strengthened. The powerful implications of the high weight of product awareness and its indirect impact via environmental concern are that specific educational campaigns and demonstrations, along with online outreach programmes, are needed. Governmental agencies and manufacturers should all speak with a common voice and provide clear, easy-to-implement data on the EV's performance and cost advantages, as well as its environmental benefits.There was no direct contribution from policy incentives, but it can be enhanced through improved communication, streamlined processes, and infrastructure development. The incentives should be more visible and easier for consumers to access. Future research can focus on segment-based approaches to rural-urban differences, post-purchase satisfaction, and long-term behavioural change. Longitudinal studies may also provide further information about the translation of attitudes into actual adoption over the long term.

12 CONCLUSION

The current study aimed to investigate the predictors of sustainable electric vehicle purchases in Karnataka using Structural Equation Modelling. The findings show that behavioural, environmental, informational, infrastructural, and socio-demographic factors influence consumers' choices to purchase EVs. The most significant determinants were charging infrastructure and pro-environmental behaviour, and environmental concern and product awareness influenced it.The study also highlights that adoption needs to be stimulated by policy incentives, a task that would not be possible without awareness and infrastructure. The mediation effects confirm that psychological processes, particularly environmental concern and pro-environmental behaviour, play a pivotal role in translating environmental awareness into actual decision-making.The study has contributed to the existing literature by providing a unified model of purchase decisions, compared with models based on intention and focused on sustainable decisions. The findings may be valuable to policymakers, industry players, and researchers aiming to accelerate the move towards clean mobility in Karnataka.

In conclusion, facilitating mass EV deployment requires a balanced approach that mobilises infrastructure, behaviour change, and informed consumer participation to achieve a sustainable and inclusive mobility shift.

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