

# FACTORS AFFECTING THE ADOPTION INTENTION OF ELECTRIC VEHICLES: MODERATING EFFECT OF GENDER

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## Abstract

**Purpose-**The main goal of this study is to explore the factors affecting the adoption intention of electric vehicles along with the moderating role of gender.

**Design/methodology/approach-** In this study the data was collected from the 353 respondents and were tested by using PLS algorithm.

**Findings-** Results provide empirical evidence on the significant influence of attitude (ATD), subjective norms (SN), perceived behavioral control (PBC), perceived trust (PT) and consideration of future consequence (CFC) on adoption intention. Further, the mediating results indicate that gender(GND)mediates on ATD, SN, PBC, PT and adoption intention.

**Originality/value-** This study first explore the factors affecting the adoption intention of electric vehicles and test the moderating role of gender

## 1. INTRODUCTION

The phenomenon of global warming and the release of emissions are steadily rising, leading to environmental concerns such as climate change and deteriorating air quality (Wang et al. 2024). The transportation industry is a significant contributor to global emissions, specifically carbon dioxide (CO<sub>2</sub>), which is a crucial greenhouse gas responsible for global warming (He et al. 2024). According to Statista (2020), this industry alone accounts for almost 25% of worldwide CO<sub>2</sub> emissions. Specifically, road transport constitutes around 75% of them (International Energy Agency, 2016). Within this framework, promoting the manufacturing and utilization of electric cars (EVs) can serve as a viable substitute for internal combustion vehicles, consequently mitigating emissions and enhancing environmental conditions (Le et al. 2023).

EVs are an important alternative for reducing emissions of greenhouse gases. EVs not only reduce the dependency on fossil fuel but also diminish the impact of ozone depleting substances and promote large scale renewable deployment (Goel et al. 2021). EVs are revolutionizing the world of road transport, but it is at a nascent stage in India (Jayasingh et al. 2021). India has been falling behind other countries in the deployment of electric vehicle (EV), as it has no explicit policy or strategy (Singh et al. 2021).

India is ranked as the third most polluted country in the world and received 22 of the 30 most polluted cities (IQAir, 2020). The air pollution is caused due to components like nitrogen, sulphur, carbon monoxide, carbon dioxide, dust, and ash. India is the third largest emitter of carbon dioxide, which is one of the major causes for air pollution (Union of Concerned Scientists, 2023). India's transport sector is the third most CO<sub>2</sub>-emitting sector (NITI Aayog, 2021). The MOSPI reports estimates that transportation sector contributes nearly 7.5% of the overall carbon dioxide emissions in India (Tarei et al. 2021).

In this context, the shift to electric mobility has become inevitable to reduce greenhouse gas (GHG) emissions as EVs emit 50% fewer greenhouse gases than petrol or diesel. EV adoption is, therefore, the best solution to tackle the hazardous air pollution levels in choked cities in

India (Jayasingh et al. 2021). The global sales of EVs have increased considerably in the last few years, but their penetration in India is still less than 1% of the total vehicle sales (Dutt, 2023). The EVs market segment is expected to grow considerably and contribute significantly to driving the EV market in India. Therefore, it is essential to analyse the determinants for the adoption of EVs in India.

Present study build on the framework of Thakur et al. (2023) and analyse the determinants for the adoption of EVs along with moderating effect of gender. The relationship between gender and purchase intentions for EVs are widely studied (He et al. 2023; Ivanova and Moreira, 2023; Chaturvedi et al. 2023), but somewhat inconsistent findings were presented by researchers around the world (Jayasingh et al. 2021). Therefore, gender as a would be beneficial in explaining consumers' intention to buy EVs.

## 2. LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT

### 2.1 Underpinning theory

Previous literature (e.g., Deka et al. 2023; Solekah et al. 2023; Thakur et al. 2023; Nguyen-Phuoc et al. 2024) identified the theory of planned behavior (TPB) as one of the most powerful theoretical frameworks to predict consumer's intention to purchase EVs. The TPB posits that individuals' attitudes, subjective norms, and perceived behavioral control positively influence individuals' behavioral intentions (Zhan, 2022). Because of its strong pre-emptive capability, TPB has become one of the most sustained theories in social psychology, and has been applied in an extensive range of study perspectives for the prediction of an individual's behaviors (Dutta and Hwang, 2021). The TPB model is highly flexible. It continues to evolve with several extensions having been formulated to enhance the predictive power of the model (Deka et al, 2023). Ajzen (1991) posit that "in principle, open to the inclusion of additional predictors if it can be shown that they capture a significant proportion of the variation in intention or behavior".

### 2.2 Attitude and adoption intention

Ajzen's Theory of Planned Behavior (TPB), introduced in 1991, is a widely acknowledged conceptual framework that seeks to explain human behavior by integrating cognitive and social factors. Within the TPB model, attitude represents one of the key components influencing an individual's intention to engage in a specific behavior (Ajzen, 1991). Previous studies have consistently emphasized the pivotal role of attitude as a determinant factor in shaping consumers' willingness to adopt EVs (Shalender and Sharma, 2021; Yeğın and Ikram, 2022; Lee et al. 2023; MacInnis et al. 2023). Attitude, in this context, refers to individuals' overall evaluation and perception of EVs, considering factors such as environmental friendliness, cost-effectiveness, and technological advancements (Tiwari et al. 2023). Prior studies also consistently suggest that positive attitudes toward these aspects significantly contribute to fostering a favorable disposition toward EV adoption (Ray and Harito, 2023; Chukwuma, 2023; Shanmugavel and Alagappan, 2023).

H1. Attitude has a positive and significant impact on intention to adopt EVs

### 2.3 Subjective norm and adoption intention

Subjective norms, as an another crucial component of TPB, focus on the perceived social pressures and norms that individuals believe are relevant to their behavior (Ajzen, 1991). Social factors, including the influence of communities, play a pivotal role in shaping individuals' perceptions of whether they should adopt EVs (Asadi et al. 2021). Research consistently

highlights that positive subjective norms, where individuals perceive social support and approval for EV adoption, contribute to a higher intention to adopt electric vehicles (Gansser and Reich, 2023). Positive endorsements or encouragement from social networks can contribute to the formation of positive subjective norms, thereby fostering a more favorable attitude toward EV adoption (Riverso et al. 2023). The alignment of EV adoption with these broader societal norms can positively impact subjective norms, subsequently influencing adoption intentions (Saputra and Andajani, 2024; Cong and Xia, 2023).

H2. Subjective norm has a positive and significant impact on intention to adopt EVs

#### **2.4 Perceived behavioural control and adoption intention**

As an integral element of TPB, perceived behavioural control (PBC) reflects an individual's subjective assessment of the ease or difficulty associated with performing the behavior (Ajzen, 1991). PBC incorporates elements of self-efficacy, perceived resources, and controllability, all of which contribute to an individual's overall perception of their capability to adopt and integrate EVs into their lifestyle (Asadi, et al. 2021). High levels of PBC are generally associated with greater intentions to adopt EVs (Pradeep et al. 2021; Vafaei-Zadeh et al. 2022). Individuals who believe they possess the necessary skills, resources, and control over potential barriers are more likely to express positive intentions toward adopting EVs (Malik and Yadav, 2021; Singh et al. 2020).

H3. Perceived behavioural control has a positive and significant impact on intention to adopt EVs

#### **2.4 Perceived trust and adoption intention**

Perceived trust (PT) in the context of EV adoption refers to individuals' beliefs and confidence in the reliability, safety, and credibility of EVs and associated technologies (Zhang et al. 2022). PT emerges as a critical determinant influencing the adoption intention of EVs, as evidenced by a previous studies (Pradeep et al. 2021). Studies indicate that a higher level of trust in the technological capabilities of EVs positively influences individuals' willingness to adopt this form of transportation (Thakur et al. 2023; Lashari et al. 2021). Overall, recognizing and addressing the dimensions of PT within the context of EV adoption is essential for fostering consumer confidence and facilitating the widespread acceptance of EVs.

H4. Perceived trust has a positive and significant impact on intention to adopt EVs

#### **2.5 Consideration of future consequences and adoption intention**

The consideration of future consequences (CFC) in the context of EVs adoption represents a key psychological factor. Individuals who prioritize future consequences over immediate ones tend to be more forward-thinking and are more likely to perceive the long-term benefits of adopting EVs. This includes considerations of environmental sustainability, reduced dependence on fossil fuels, and the long-term economic advantages associated with lower operational costs. Moreover, the previous literature recognizes that the consideration of future consequences is intertwined with other psychological factors, such as environmental consciousness, risk perceptions, and awareness of the long-term impacts of current behaviors. Individuals who are more attuned to the environmental consequences of their choices are more likely to consider adopting EVs as a means to contribute to sustainability.

H5. Consideration of future consequences have a positive and significant impact on intention to adopt EVs

## 2.6 Moderating effect of gender

The relationship between gender and adoption intentions for EVs are widely studied, but somewhat inconsistent findings were presented by researchers around the world. Previous studies suggest that gender can moderate the impact of attitude on adoption intention (Jayasingh et al. 2021). While both men and women may consider factors like environmental friendliness and cost-effectiveness, studies indicate that women might place a stronger emphasis on the environmental aspect, while men may prioritize technological features (Zafar et al. 2023; Morris et al. 2005). Recent study of Dai and Yang (2024) highlighted that women have a more positive attitude than men towards adoption of EVs. Gender differences also manifest in the influence of SN and PBC on adoption intention. Social influences from peers, family, and societal expectations may impact men and women differently. The study highlighted that women have stronger PBC and stronger SN (López-Mosquera, 2016). Men and women may have also a different criterion for establishing trust and consideration of future consequences in EVs. Notably, however, the question of whether gender can moderate the relationship between determinants and adoption intention has not yet been answered in the extant literature.

H6. Gender moderates on relationship between attitude and adoption intention of EVs

H7. Gender moderates on relationship between subjective norm and adoption intention of EVs

H8. Gender moderates on relationship between perceived behavioural control and adoption intention of EVs

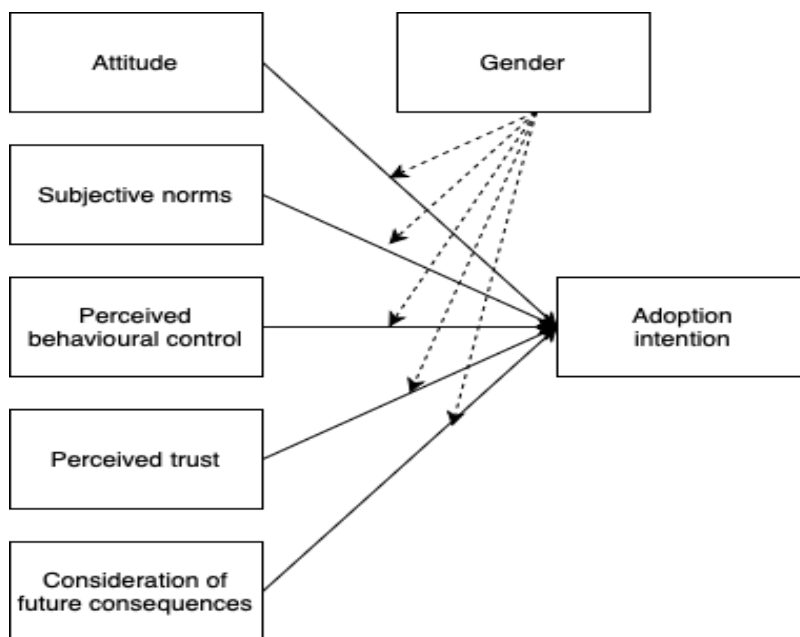
H9. Gender moderates on relationship between perceived trust and adoption intention of EVs

H10. Gender moderates on relationship between consideration of future consequences and adoption intention of EVs

## 3. RESEARCH METHODOLOGY

### 3.1 Sample and sampling technique

The main aim of this study is to examine the determinants of adoption intention of EVs along with moderating effect of gender in Delhi/CR, India. To achieve this objective, we utilized self-reported data obtained through a questionnaire to evaluate our theoretical framework (see figure 1). Given the advantages of the questionnaire method, which enables efficient data collection in a brief period of time (Buchanan, 1981), we employed this approach to collect survey responses. Therefore, a survey utilizing a questionnaire was deemed an appropriate method to assess the theoretical framework. For this study, we employed the snowball sampling technique to select our sample from the target population. We contacted respondents personally and motivates them to participate in the survey. The research was conducted in Delhi/NCR, India, and included participants of various ages, educational backgrounds, and income levels, with both males and females represented. Data collection for the survey took place from Sep 2023 to Dec 2023. The respondent selection for the survey involved two stages. Initially, convenient sampling was used to identify informants from personal networks, followed by the snowball sampling technique to select additional participants. Informants were asked to provide contact information for interested participants, who were then approached personally or by telephonically and sent questionnaires for data collection. Overall, 426 questionnaires were distributed. Finally, 353 responses were received back which was used for data analysis.



**Figure 1. Conceptual framework**

**3.3 Data analysis technique**

The collected data was analyzed using SPSS software version 26. Model 1 analyze the impact of ATD on AINT. Model 2 analyze the impact of SN on AINT. Model 3 analyze the impact of PBC on AINT. Model 4 analyze the impact of PT on AINT. Model 5 analyze the impact of CFC on AINT. Model 6,7,8,9, and 10 analyze the moderating effect of gender on relationship between ATD, SN, PBC, PT, CFC and CPE. These relationships were analysed using linear regression and PROCESS MACRO for SPSS.

**4. DATA ANALYSIS**

Before proceeding to data analysis, multi-collinearity and normality was accessed. The obtained score of multi-collinearity ranged from 1.121 to 2.238 (<10) indicating the absence of multi-collinearity. Moreover, the data is normally distributed since skewness of all the constructs are within ±2 (-.509 to .169) and kurtosis values are within ±3 (-.561 to .254) (see Table 3). Furthermore, the reported values of Cronbach’s alpha was greater than 0.7 which means the scale is reliable. Further, using SPSS Harman’s one-factor (or single-factor) test was applied to reduce the risk common method bias (CMB) and the total variance estimated of all the used independent variables were below the cut-off point of 50% (35.62%). Table 4 represents the results of linear regression for model 1, 2, 3 and 4.

**Table 3. Descriptive and normality analysis**

	M	SD	$\alpha$	VIF	Skewness	Kurtosis
ATD	3.19	1.185	0.791	1.121	-.229	-.561
SN	3.37	1.097	0.762	1.428	-.272	-.343
PBC	3.32	1.019	0.842	2.238	-.392	.254
PT	3.36	1.077	0.794	1.787	.169	.237
CFC	3.41	1.069	0.813	1.818	-.509	.610
AINT	3.76	1.042	0.787	2.021	-.287	-.412

Note: M= mean; SD = standard deviation;  $\alpha$  = Cronbach’s alpha; VIF= Variance inflation factor

**Table 4. Results of linear regression (model 1, 2, 3, 4 and 5)**

	Model 1		Model 2		Model 3		Model 4		Model 5	
	$\beta$	$t$	$\beta$	$t$	$\beta$	$t$	$\beta$	$t$	$\beta$	$t$
ATD	.448	8.301*								
SN			.293	4.791*						
PBC					0.203	3.458*				
PT							.475	7.163*		
CFC									.208	3.025*
R <sup>2</sup>	0.420		0.478		0.512		0.369		0.481	

From Table 4, it is observed that ATD has a positive and significant influence on AINT ( $\beta = 0.448, t = 8.301, p < 0.05$ ). This implies that positive ATD reflects in AINT. Thus, H1 is supported. Model 2 depicts that SN has a positive and significant impact on AINT ( $\beta = 0.293, t = 4.791, p < 0.05$ ). This implies that SN contribute to AINT. Thus, H2 is supported. Model 3 depicts that PBC has a positive and significant impact on AINT ( $\beta = 0.203, t = 3.458, p < 0.05$ ). Thus, H3 is supported. Model 4 depicts that PT has a positive and significant impact on AINT ( $\beta = 0.475, t = 7.163, p < 0.05$ ). Thus, H4 is supported. Model 5 depicts that CFC has a positive and significant impact on AINT ( $\beta = 0.208, t = 3.025, p < 0.05$ ). Further, GND moderates on ATD ( $\beta = 0.691, t = 5.143, p < 0.05$ ), SN ( $\beta = 0.332, t = 4.121, p < 0.05$ ), PBC ( $\beta = 0.489, t = 5.611, p < 0.05$ ), and PT ( $\beta = 0.369, t = 4.282, p < 0.05$ ), and ATD except CFC ( $\beta = 0.011, t = 0.136, p > 0.05$ ).

**Table 5. Moderation analysis of gender**

	Estimate	$t$	95% CI	
			Lower bounds (LB)	Upper bounds (UB)
ATD* GND → AINT	0.691	5.143*	.4271	.9555
SN* GND → AINT	0.332	4.121*	.3136	.7595
PBC* GND → AINT	0.489	5.611*	.2278	.5782
PT* GND → AINT	0.369	4.282*	.3376	.6721
CFC* GND → AINT	0.011	0.136	-.2128	-.1672

## 5. DISCUSSION AND CONCLUSION

This study investigates the factors influencing the intention to adopt electric vehicles, as well as the moderating impact of gender. From Table 4, it is observed that ATD has a positive and significant influence on AINT. Positive ATD is reflected in AINT. Studies on customer behavior repeatedly show that favorable views towards a product or technology enhance the probability of adoption. Past research repeatedly indicates that having positive attitudes towards certain factors has a big role in promoting a favorable attitude towards adopting electric vehicles (Ray and Harito, 2023; Chukwuma, 2023; Shanmugavel and Alagappan, 2023).

Second, SN has a positive and significant impact on AINT. This implies that SN contribute to AINT. This implies that SN captures the perceived expectations of others regarding the behavior in question. If an individual believes that their peers or society expect them to adopt EVs as a responsible or environmentally conscious choice, they may feel compelled to conform to these expectations, thereby increasing their intention to adopt an EV. This finding is consistent with the study of Saputra and Andajani, 2024; Cong and Xia, 2023.

PBC positively and significantly influences AINT. This means that PBC includes perceptions of one's resources, such as financial resources, and abilities, such as understanding of EV technology and the capacity to run and maintain an EV. Confidence in the affordability, operation, and maintenance of an electric vehicle increases the likelihood of a favorable

intention to adopt. This finding aligns with the research conducted by Pradeep et al. in 2021 and Vafaei-Zadeh et al. in 2022.

Fourthly, PT has a beneficial and noteworthy influence on AINT. Trust plays a vital role in consumer decision-making, especially when considering the adoption of new and innovative technologies such as electric vehicles (EVs). Positive encounters with electric vehicles, along with information from reliable sources such as renowned manufacturers and independent evaluations, can boost confidence in EV technology and raise the likelihood of adoption. Research shows that having more trust in the technological capabilities of electric vehicles (EVs) increases people's likelihood to embrace this mode of transportation (Thakur et al. 2023; Lashari et al. 2021).

CFC has a notable and beneficial effect on AINT. Individuals with elevated levels of CFC are more inclined to take into account the lasting environmental effects of their behaviors, such as the influence of car emissions on climate change and air quality. Individuals with higher concern for the environment may be more likely to choose electric vehicles over traditional internal combustion engine vehicles due to their perception as a more eco-friendly option, in order to reduce their environmental impact and support sustainability.

Gender(GND) moderates on ATD, SN, PBC, and PT, except CFC. Gender may influence the connection between attitude and adoption intention. Research may reveal that women emphasize safety and environmental impact when creating attitudes towards electric vehicles, whilst men value performance and technology. Gender variations may affect the intensity or direction of the association between attitude and adoption intention. Differences in cultural norms and expectations related to vehicle ownership and usage between genders can result in varying effects of subjective norms on adoption intention. For example, men and women may interpret social pressures or influences from peers and family members differently, which can impact their willingness to use electric vehicles. Differences in availability to charging infrastructure, technological familiarity, and confidence in driving electric vehicles may vary between genders, impacting their perceived control over adopting an electric vehicle and consequently influencing their intention to adopt one. Gender-specific characteristics like prior experiences, socialization, and risk perceptions can influence trust in EV technology, manufacturers, charging infrastructure, and environmental claims. Gender differences may lead to changes in the strength or direction of the association between perceived trust and adoption intention.

## 6. IMPLICATIONS

Strategies could involve emphasizing the environmental advantages, financial savings, and technological progress of electric vehicles through focused marketing efforts, educational programs, and hands-on experiences like test drives. Interventions could utilize social networks, influential peers, and community leaders to successfully leverage subjective norms, promoting EV adoption and fostering a supportive climate that fosters adoption within social circles. Enhancing perceived behavioral control can be achieved by investing in charging infrastructure, delivering information and support services for EV users, and providing incentives to address concerns such as range anxiety and other practical barriers to adoption. Stakeholders can improve perceived trust by engaging in transparent communication, implementing quality assurance procedures, and making investments in reliability, safety, and sustainability. Building credibility is essential for dispelling doubt and instilling faith in electric vehicles for prospective users. Emphasizing the advantages of electric vehicles in terms of the environment, finances, and society might appeal to people who value sustainability, financial management, and social accountability. Efforts to encourage the adoption of electric vehicles



should focus on addressing individuals' future worries and highlighting the importance of EVs in attaining long-term sustainability objectives.

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