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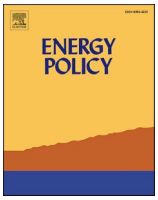

Can gain motivation induce Indians to adopt electric vehicles? Application of an extended theory of Planned Behavior to map EV adoption intention

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ABSTRACT

With the rising demands for personal vehicles of the growing middle class in India, their increasing quest for comfort and social status, the emissions from road transportation are increasing manifold times. To fulfil the dual need of increasing personal demand as well as lower vehicular emissions, it is important to replace all future vehicle purchase with purchase of electric vehicles (EVs). This study analyses the socio-psychological determinants of the process by which an individual might develop an intention to buy an EV in the near future. Using Structural Equation Modeling and mediation analysis, the interrelationships between the Theory of Planned Behavior (TPB) constructs along with three additional constructs, "cost', 'herd behavior', and 'personal norm' are analyzed and several direct and indirect pathways in which intentions possibly form in people's mind are outlined. Subjective norms followed by perceived behavioral control emerge as the significant and direct intention formation pathway. Though cost, herd behavior, and personal norms alone do not influence intention formation, these factors mediates the TPB variables in forming intention to adopt EVs. Hence, the current EV promotion policies, primarily focused on subsidies need to be complemented with other attitudinal and norm-based nudges to promote faster EV adoption in India.

1. Introduction

Transport sector is one of the highest carbon-emitting sectors worldwide, accounting for 25% of global CO_2 emissions, a figure that is projected to double by 2035 (McCollum et al., 2018). In 2016, India's transport sector alone contributed 11% of vehicular CO_2 emissions, making it the world's third highest emitter of CO_2 (Janssens-Maenhout et al., 2017). This is partly because of the huge domestic demand for two-wheelers (Bansal et al., 2021b) and four-wheelers (Chugh and Cropper, 2017), intensified by the growing size of middle-class group, whose incomes and demands are fast increasing (Venkatesan and Annamalai, 2017). About 1 million additional cars and 8 million motor bikes have been added to the Indian roads in the time period 2011–2016 (MoSPI, 2016; cited in Doddamani and Manoj, 2023). In 2022, India surpassed Germany to become the fourth biggest market for automobiles. Several households refuse to get rid of the old vehicles even after purchasing a new one, as the middle-class mind-set of people guides them to use it to the maximum extent possible, say for short travels (James et al., 2023). In addition, multiple vehicles also enhance the status factor of a household (Nielsen and Wilhite, 2023). With such consumption trends, automobile sales are projected to further rise in the coming years (Bansal et al., 2021a). The transportation sector contributes approximately 305.3 MtCO2e GHG emissions (CEEW, 2021). In terms of per capita CO_2 emissions in India, it rose from 0.39 metric tons in 1970 to 1.87 metric tons in 2019 (Tiseo, 2022). Adoption of electric vehicles (EVs) is one of the most promising solutions to eliminate these rising vehicular emissions (De Rubens et al., 2018; Yang et al., 2019; Singh et al., 2020; Huang and Qian, 2021; Bruckmann, 2022; Munshi et al., 2022). EVs have the potential to enhance fuel efficiency by 40–60%, and eliminate the environment's carbon footprint by 30–50% (Wang et al., 2017). This can significantly lower the potential vehicular GHG emissions that will be soon added to the environment in the usual future, and which will continue to warm the atmosphere for millennia (Hansen et al., 2013). The immediate benefits of EV adoption in India are the enhancement of national energy security by reducing dependency on imported oil (Huang and Qian, 2021). In addition,

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consumers also stand to gain from improved air quality (Yang et al., 2019), and substantial savings on fuel (petrol/diesel) used in an ICE vehicle (Dua et al., 2021), whose prices are rising manifold times. The multiple benefits associated with a shift toward EV stand to benefit not only the individuals, and the nation at large, but it can save the climate from further warming, and avoid future climatic catastrophes. Thus, transitioning towards low-carbon mobility by adopting EVs will intensify India's efforts in achieving Sustainable Development Goal 13[1] (SDG 13).

At the 26th UN Climate Change Conference of the Parties (COP26) held in Glasgow in late 2021, India announced a 2070 net-zero target (Vaidyanathan, 2021), while other developed nations set targets for 2050. According to the International Energy Agency (IEA), to reach the 2050 target, 60% of vehicles globally need to be electrically powered by 2030 (IEA, 2021a). With its EV30@30 Campaign, the government of India aims to diffuse electric road vehicle sales by 30% in each vehicle segment by 2030 (Munshi et al., 2022). As announced at COP26, this ambitious goal, along with India's efforts to increase its share of renewables in the energy mix, will help India to decarbonize its transportation sector.

Efforts are underway to strengthen the supporting EV charging infrastructure for faster acceptance of e-vehicles. The FAME (Faster Adoption and Manufacturing of Electric Vehicles) scheme launched by the Indian government is such an initiative. To reach net zero by 2050, 80% of 2-wheelers and 30% of 4-wheelers in India will need to be electric (Dhar et al., 2017).

In 2019, it was found that 39% and 31% of the Indian population, respectively, had a daily commute of 0–5 km and 5–10 km due to the layout of Indian cities (Stadelmann, 2017). The greater the size of the urban center, the greater the daily commute distance, owing to the expansion of the growth centers in the urban fringes, and the city center being already congested with earlier infrastructure. It is interesting to note that light-duty vehicles (LDVs) which had a high share of India's personal vehicle market earlier, have shrunk since 2017, and SUVs have taken their place. Nevertheless, with a sales figure of 3.2 million in 2019, it still constitutes the 5th largest in the world's LDV markets. In terms of fuel consumption, the new LDV fleet was reported to consume around 5.7 L of gasoline equivalent per 100 km (Lge/100 km) in 2019, as against 6.9 Lge/100 km in 2005 (IEA, 2021b). This seems like a significant improvement, however, there lies a paradox. Large and small SUVs, whose sales have picked up in India, were reported to have consumed, respectively, an average of 3.7% and 2.6%, more fuel since 2017 (IEA, 2021b). The tailpipe CO_2 emissions from an average passenger vehicle have dropped to 1.4% per year from FY 2009–10 to FY 2019–20, due to the stringent fuel consumption standards set by the Ministry of Power in FY 2017–18. However, there is still a long way to be covered to achieve its decarbonization targets. Maruti, which covers 47.2% of sales in passenger vehicle sales has been assigned a CO_2 emissions target of 123.1 g/km. The tailpipe CO_2 emissions target differs based on the vehicle's average curb weight. Considering Maruti's lighter curb weight than average, it needs to have a much lower emissions target. Also, the higher sales of SUVs and CNG vehicles have raised the average curb weight from 1068 kg in FY 2019–20 to 1081 kg in FY 2020–21 (Deo and German, 2021). The associated target carbon emissions will also be higher. The use of EVs directly reduces these carbon emissions. However, EV sales had a market share as low as 0.03% in FY 2015–16 and only increased to 0.2% in FY 2020–21.

The full potential of the EV diffusion schemes and overall decarbonization of the transportation sector can be realized only through social acceptance, i.e., when people accept and adopt the same. When social acceptance of new technology is achieved, it becomes sustainable without a huge amount of money having to be invested in incentive schemes. Government policies need to be aligned with consumers' psychological and attitudinal determinants of mobility choices and purchase decisions (Cui et al., 2021). In the existing literature on the barriers to EV adoption, there is currently greater focus on, for example, infrastructure availability, the technical characteristics of EVs, and people's attitudes and norms. This study tries to examine the gain motivators for EV adoption among the middle-income group in the eastern region of India.

Based on the Theory of Planned Behavior (TPB) (Ajzen, 1991), we consider attitude, subjective norm, and perceived behavioral control as the possible determinants of intention to adopt EVs, extending it further to see the impacts of cost and herd behavior.[2] We explore the gain motivators behind individuals' pro-environmental decisions. The wide applicability and flexibility of the TPB theory make it ideal for the study context.

At present, India has become the world's most populous nation. It also has a significant middle-class group, whose incomes and aspirations are rising. It is crucial to transition to low-carbon mobility to stop further vehicular emissions from such a huge section of the world's population. Earlier government's emission reduction policies like 'odd-even rule' in Delhi was not effective (Kaushik et al., 2023). India's proposed 'vehicle scrappage policy' is facing resistance (James et al., 2023). Ma and He (2016) finds that policies last only for a while until people manage a way out of it. Similarly, despite the government's efforts in terms of EV popularization schemes, fuel consumption standards, and others, a sustainable transition from ICE vehicles to EVs needs an understanding of people's intentions to adopt EVs and align governments' low-carbon mobility policies accordingly. We pose the following research questions: what are the most important gain motivators for intention to adopt EV? Might there be a tough road ahead for India with its infrastructural challenges and the technical anxiety related to the adoption of EV technology? Does the high upfront cost of EVs pose a barrier to the formation of an intention to buy an EV? If some members of a social circle purchase an EV, do other members tend to follow suit?

Very few studies have analyzed the pathways of intention formation in the context of India. An organically developed intention to adopt EVs can be sustained unlike paternalistic government policies. This approach adds a novelty to the study. In addition, this study is also one of the few studies to analyz the EV adoption mindset of people living in smaller cities, where EV infrastructure is presently non-existent, but has a high growth potential in the future. This study also extends the TPB theory using new construct called 'herd behavior' and cost, both of which are very relevant to a developing nation, with a huge aspirational class. The scales for the same have also been developed and validated in this study and can be tested in similar contexts.

The remainder of the article is organized as follows. We examine the theoretical background, with a focus on the TPB theory, followed by a summary of the main literature on the vehicle preferences of Indian consumers, and their existing preferences for an EV, followed by the application of the TPB in the context of EV adoption. We then develop the hypothesis of the study, and the research model, focusing on the methodology used, and the analysis of data. We then discuss the findings and policy recommendations. We conclude with a discussion of the limitations of the study, and possible future directions.

2. Literature review

Studies have been conducted to identify different barriers to, and facilitators of EV adoption in different country-specific contexts such as Poland (Lewicki and Drozdz, 2021), Belgium (Afroz et al., 2015), China

[1] SDG 13: "Take urgent action to combat climate change and its impacts" (United Nations, URL: https://www.un.org/sustainabledevelopment/climate-change/).

[2] 'Herd behavior' is described as a social situation, where other people's decisions influence an individual's decision, and they are found to imitate one another (Chen, 2008).

(Junquera et al., 2016), Malaysia (Wang et al., 2018), India (Khurana et al., 2020; Munshi et al., 2022; Sahoo et al., 2022). Earlier, pro-environmental behavior was examined using socioeconomic, and other contextual factors. It was established however that human decisions are guided not only by rationality but also by intrinsic motivators (Yazdanpanah et al., 2021). Understanding such behavioral determinants can also help with the design of EV promotion policies and channel EV-related investments more efficiently.

2.1. Vehicle preferences of an indian consumer

Many Indian cities are very congested. A part of the reason is the huge population, and partly congestion is due to the unplanned expansion of the Indian cities (Chakraborty and Chakravarty, 2023). Such situational contexts, coupled with the fuel economy factor associated with two-wheelers have made it a very attractive option for a personal vehicle (Bansal et al., 2021a). A study by Kathiravana et al. (2010) mentions people's brand recognition, and post-purchase consumer--manufacturer relationship as important factors influencing preferences. Soft factor, like aesthetics, is found to have an important correlation with people's preference for two-wheelers in a small city in Tamil Nadu, India's southernmost state (Sathish and Pughazhendi, 2011). In stark contrast, Yasmeen (2015) analyzed consumers from Chennai, the capital of Tamil Nadu, and found that color and style is the least important factor, and states that performance, price, and mileage are the most important factors in developing a preference for a two-wheeler. Mundu et al. (2011) find that women in Pune city have a preference for automatic two-wheelers owing to their easy maneuverability. Chakraborty and Chakravarty (2023, cited in Bansal et al. (2021a) analyzed two-wheeler preferences in Satara, a city in the western state of Maharashtra, and finds that a brand's social status and popularity influences preferences towards a brand of two-wheelers. Demographics and consumer satisfaction are found to be unrelated in an empirical analysis in Hyderabad city in India (Khan and Datrika, 2018). Bansal et al. (2021a) conduct a study with a pan-Indian sample and reports fuel economy, looks, and style as important factors determining preferences toward a two-wheeler. An average rider of a two-wheeler is found to ascribe high importance to the cost savings to be achieved in the future. Consumers are not found to display myopia, and they use a discount rate of 10% or less, to determine the present value of operating cost in the future at the time of making a two-wheeler purchase decision.

Kumar and Rao (2006) finds family income to be a significant variable determining ownership of a car. Infact, income was found to be more important than the size of a family in determining ownership of a car (Bansal et al., 2021b; cited in Choudhary and Vasudevan, 2017). Fuel efficiency is also found to be a very important consideration in the decision to purchase a four-wheeler (Menon and Mahanty, 2012). Consumers of new cars are found to be relatively less responsive to the price of fuel, and income, with an elasticity of vehicle kilometres traveled (VKT) relative to the price of fuel being −0.18 and VKT elasticity relative to income being 0.14 (Bansal and Dua, 2022). The study also finds that the fuel price elasticity relative to fuel consumption is −0.12, and the income elasticity relative to fuel consumption is 0.15, taking into account the changes in vehicle use and its choice. Own price elasticity and the fuel economy elasticity relative to fuel consumption are found to be −0.651 and 0.571 respectively. While the upfront price of a vehicle does not lead to a rebound effect but the size of fuel consumption elasticity with respect to fuel economy is found to reduce by 17.1% in the context of India, due to the rebound effect. Tax as a disincentive to purchase ICV cars is not found to be very effective. Chugh and Cropper (2017) finds that a 25% tax rate on diesel cars only lowers diesel fuel consumption by 2.4%. A higher tax on diesel cars shifts consumers to petrol cars where petrol is priced even higher. Hence it can be assumed that EVs can be a potential change maker and provide greater consumer welfare if ICVs are taxed higher. Bera and Maitra (2023) find that AC in a car, engine power, seat comfort, and safety features like presence of airbags, anti-lock brakes, child-locks; security features like theft alarm, vehicle tracking facility are important characteristics considered by buyers of small cars. In addition, attributes like looks and style, resale value, maximum speed are some other important excitement factors in purchase decisions.

In the context of preferences for EVs, factors like improvements in battery technology, rising awareness, and economic feasibility can facilitate EV adoption (Digalwar and Giridhar, 2015). Motwani and Patil (2019) find that charging and mobility features influence consumers' preference towards EVs. Technical attributes associated with EVs are found to play a mediating role in local strategies for decarbonization (Goel et al., 2023). Other barriers to the decision to adopt an EV in India are charging infrastructure, lack of people's awareness regarding EVs (Murugan and Marisamynathan, 2023) financial factors like cost price of EVs, cost of maintenance, cost of operation, cost of battery leasing, cost of energy, combined taxes, purchase subsidies (Goel et al., 2023; Chakraborty and Chakravarty, 2023) and high upfront costs (Bansal and Kockelman, 2017). Again, trust in EV technology is stated to have a direct relationship with the level of education. People who are unemployed are found to have lower confidence in EV technology and its implications on the environment (Bansal et al., 2021b).

2.2. Impacts of the TPB components on EV adoption

The TPB is a crucial socio-cognitive model that explains volitional behavioral changes (Ajzen, 1991). It is an extension of the Theory of Reasoned Action (TRA) (Fishbein and Ajzen, 1977). According to the TRA, behavior is directly guided by intention which is, itself, formed by the interaction between attitude and subjective norm. Attitude is defined as "the degree of a person's favorable or unfavorable evaluation or appraisal of the behavior in question" (Fishbein and Ajzen, 1977). Subjective norm is defined as "the perceived social pressure to perform or not to perform the behavior" (Ajzen, 1991). Behavior is thus considered voluntary in the TRA.

Later, Ajzen found that behavior was not always completely voluntary. As a response, Ajzen (1985, 1991) incorporated the construct "perceived behavioral control" (PBC) into the TRA framework and renamed it the TPB model (Yazdanpanah and Forouzani, 2015). Fielding et al. (2008) define perceived behavioral control as "people's perception of ease or difficulty in performing the behavior of interest". PBC is "the perceived control over the performance of a behavior" (Ajzen, 2002).

The TPB model is highly flexible. It continues to evolve with several extensions having been formulated to enhance the predictive power of the model (Yazdanpanah and Forouzani, 2015). Ajzen (1991) mentions that TPB was "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".

According to the TPB model, intention, the central determinant of behavior, has three main components: attitude, subjective norm, and perceived behavioral control. Based on a sample of 3505 people, Mohamed et al. (2016) found that a person's attitude and perceived behavioral control have a significant and large influence on their willingness to purchase an EV. Studies have examined different components of attitude like awareness, use of EVs, the experience of riding an EV, social need, pro-environmental action, social message, fuel consumption, and carbon emissions, finding that these factors have a huge influence on the adoption of EVs (Jayaraman et al., 2015; Kaplan et al., 2016). A detailed analysis of the linkages between attitude and intention formation for EV adoption is still lacking in the literature (Singh et al., 2020). Some studies, however, have attempted to reflect how different components of attitude lead to attitude formation. For example, when a person considers EVs as necessary for society at large, then attitude toward EV adoption is found to be positive (Singh et al., 2020). Again, Fang et al. (2023) analyzed intention to adopt EVs in China and report that general knowledge about the environment, concern for the environment, and knowledge about eco-labels have a positive and significant

influence on attitude towards eco-labels. Attitude in turn significantly influence intention to switch to EVs.

Afroz et al. (2015) find a strong impact of perceived behavioral control on EV purchase intention; however, its' impact is still found to be smaller than the impact of attitude on intention. Exploring psychological variables at the level of emotions, Moons and Pelsmacker (2015) find that reflective emotions such as inter alia, aspects of eco-friendliness, cost economy, and fuel economy, are crucial drivers of the intention to use EVs. The study also reports that reflective emotions have a greater impact than behavioral ones like driving comfort, feeling of relaxation, and enjoyment. Visceral emotions, for example, the power and throb of the engine, appearance, and aesthetics of the vehicle interiors, maximum speed limit, and full digital information display on the car dashboard are not found to have any significant impact on the intention to use EV. Perceived behavioral control is found not to take into account intention toward EV adoption if this results from public opinion and an overly pumped-up desire for EV (Adnan et al., 2017; Mohamed et al., 2016).

Kim et al. (2014), find social variables to be less important in terms of influencing intention towards using EV. Other studies (Jayaraman et al., 2015; Liao et al., 2007) find that newer technologies are adopted with the motivation of receiving external validation. Nevertheless, subjective norm is always proposed as an important construct in most of the theories like the TPB, the Technology Acceptance Model, and the Diffusion of Innovation Theory. Studies support the significant impact of family, friends, relatives, and society on the intention to adopt EVs (Sang and Bekhet, 2015; Liao et al., 2007). Singh et al. (2020) studied social determinants like peer pressure, effects of neighborhood, social responsibility, and empathy, belonging to social networks, being an acceptable member of society, collective efficacy, and external validation.

Social relations like neighborhood effects and herd behavior influence the decision to adopt EVs (Mau et al., 2008; Pettifor et al., 2017). It is stated that higher visibility of EVs in terms of increased purchases by others will further push EV sales (Mau et al., 2008). Infact, McCollum et al. (2017) also incorporated neighborhood effects into the global integrated assessment models (IAMs) as it is found to have strong evidence and a high policy impact as a behavioral determinant of vehicle choice.

A greater level of morality at a personal level was found to be a common trait among the owners of EVs compared to non-adopters (Janssens-Maenhout et al., 2017). Lending support to the influence of personal norms, studies state that a higher level of personal norms is associated with a higher chance of adopting EV (Rezvani et al., 2015; Shanmugavel and Balakrishnan, 2023). Going a step further, He and Zhan (2018) found that personal norms become active when it is associated with the environment. Adnan et al. (2018) also finds that personal norms have a significant impact on the formation of behavioral intention. Self-interest, personal principles, pro-conservation to being open to change, and self-transcendence are some of the attributes encompassed by moral or personal norms (Singh et al., 2020).

Cost is considered to be another extension of the original TPB theory. Although the disposable income of the middle-class group is on the rise, price consciousness is still a big part of the Indian consumer mindset (Basha and Lal, 2019). People care about status signalling (Nielsen and Wilhite, 2023), but cost concerns also exists. Specifically, the high upfront price of EVs acts as a demotivator, despite the lower operational cost of EVs in the long run (Stadelmann, 2017).

The role of cost, herd behavior and personal norms in shaping the step-wise formation of intention are not much discussed in the existing studies. For instance, though studies provide evidence of the presence of herd behavior in India, it does not say about how such behavior influence the formation of intention to make a sustainability investment like that of an EV. Similarly, the existing studies have not analyzed how factors like cost considerations are taken into account by a person in making a sustainability investment. There is no analysis about how such factors influence the socio-psychological factors in finally developing an intention to make sustainable investments. Though the influence of personal norms on intention formation are discussed to some extent in the existing studies, how personal norms work in the case of consumers belonging to one of largest automobile market is still not well documented. These are some gaps in the literature that the study attempts to address.

3. Conceptual framework and hypothesis development

The conceptual framework of the study is shown in Fig. 1. The blue arrows indicate the hypothesized pathways of intention formation. The numbers against the arrows represent the hypothesis.

Fig. 1 specifies the conceptual model. The original constructs of the TPB model are specified on the left-hand side. The right-hand side illustrates 3 additional constructs, each of which is paired with the original TPB model to obtain 3 extended models: TPB + CO, TPB + HB, and TPB + PN. This study examines these three extended models and the pathways in which these lead to the formation of an intention to adopt an EV.

4. Method and data

The methodology used in this study is structural equation modeling (SEM) and mediation analysis. The SEM method is graphically illustrated in Fig. 2.

4.1. Measures

The questionnaire includes all the indicators for the latent constructs illustrated in the conceptual framework of the study (Fig. 1).

Scale for attitude is adapted from Lopes et al. (2019), and Matsumori et al. (2019). Subjective norm is conceptualized as 'an individual's normative beliefs' or whether other people would approve or disapprove of another person performing a given behavior, weighted by their motivations to comply with the norms. Its scale is borrowed from Zhang et al. (2020). Perceived behavioral control is adapted from Han and Hyun (2017), and it is stated as an indicator of an individual's perceived degree of ease or difficulty associated with participating in a specific activity. Personal norm is adopted from Rosenthal and Ho (2020), and Zhang et al. (2020). 'Intention to adopt an EV in the future' is the dependent variable, the indicators of which are adapted from Ajzen (1991).

In addition to the indicators for latent constructs, consumers' gender, age, education level, annual household income in 2022, type of vehicle used, number of vehicles in the household, and average daily distance traveled were used as control variables in this study.

4.2. Data collection

Empirical data is collected for this study from Assam, in India. Assam is the hub of industry, health, and education for the entire northeast region of India. Also this region is fast urbanizing, and might be a potential ground for emergence of new infrastructure in the future. This study aims to examine the intention to adopt EVs for personal use. Hence only e−2-wheelers and e−4-wheelers are considered in the study.

This study was based on a convenience and random sampling framework. Data were collected through a combination of online and field surveys. A similar sampling frame was used in prior literature (Han and Hyun, 2017; Jiang et al., 2020). Online questionnaires were distributed by email and via WhatsApp groups using a convenience sampling frame. Offline questionnaires were distributed to office workers and students in randomly chosen offices and colleges. Students and office staff were also used as behavioral study samples in previous literature (Astuti et al., 2019; Liu et al., 2019). A dual mode of data collection was used to ensure efficient, and timely collection of data. Both student and office workers were surveyed in order to have a better

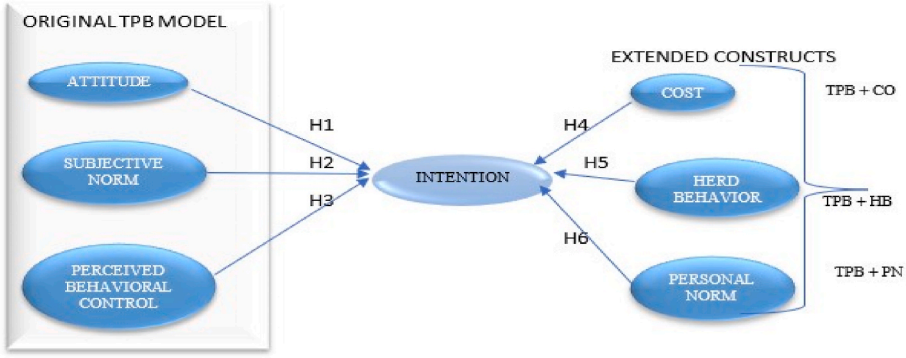

Fig. 1. Conceptual framework.

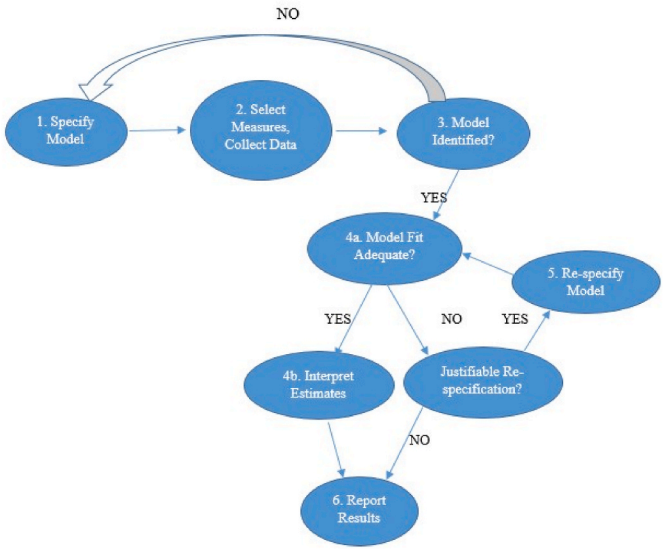

Fig. 2. Steps involved in SEM analysis.

representation of the future potential consumers of e-vehicles.

Prior to the formal data collection process, a pilot study was conducted with around 183 samples. We sent out a total of 220 questionnaires and received around 183 completed ones, with a response rate of 83.18% (=183/220). In the second and formal round of data collection, we received a total of 330 completed responses out of the 400 distributed. After eliminating the incomplete questionnaires, the survey was closed with a total of 317 valid responses for further analysis, a response rate of 79.25% (= 317/400).

The analysis of intention formation pathways will help the policymakers, and corporations design EV policies in sync with people's motivations for sustainability mobility. Such transitions can be brought about more cost-effectively, and without reducing people's welfare through obligatory legislations.

5. Results and analysis

5.1. Sample description

Table 1 provides a summary of the characteristics of the sample used in the study.

The study sample had an equal distribution of males (49.4%) and females (49.7%), while 0.6% of the sample did not disclose their gender. There were more sample participants among the younger age groups (26.4%) among the 18–25s, and 39.7% among the 26–35s than the older age groups, 13.9% in the 36–45s and 19.4% in the 46–60s. The majority

Table 1
Summary of demographic characteristics of the sample in second wave (n = 330).

Demographic Characteristic	Category	Count	Percentage
Gender	Female	164	49.7%
	Male	163	49.4%
Age	18–25	87	26.4%
	26–35	131	39.7%
	36–45	46	13.9%
	46–60	64	19.4%
Education Level	School Level	9	2.7%
	Higher Secondary	24	7.3%
	Graduate	102	30.9%
	Post-Grad & above	193	58.5%
Annual Household Income (INR)	<2,50,000	84	25.4%
	2,50,000-500000	82	24.8%
	50,0000–7,50,000	37	11.2%
	7,50,000–10,00000	36	10.9%
	10,00000–12,50,000	19	5.7%
	12,50,000–15,00000	18	5.4%
	>15,00000	33	10%
Residence	Village	46	13.9%
	Town	190	57.6%
	City	89	26.9%
No. Of Vehicles in Household	None	36	10.9%
	One	115	34.8%
	Two or more	169	51.2%
Avg. Daily Distance Traveled	<10 km	131	39.7%
	10–20 km	100	30.3%
	20–50 km	59	17.8%
	50–100 km	15	4.5%
	>100 km	10	3%

of the sample was highly educated with 58.5% having a post-graduate or higher level of education, and 31% having a graduate degree.

The sample was widely distributed and covered a range of average annual household incomes. In terms of annual income, 25.4% of respondents earned less than 2,50,000 Indian rupees (INR)[3] and a similar proportion (25%) also earned INR 2,50,000–500,000. This means that the annual income of almost half the sample was less than INR 500,000. One reason for the low income could be that a significant proportion of the sample were still students and are yet to enter the job market. Thus, this finding should not pose a financial barrier to vehicle purchase decisions in the future. Some 22.2% of the sample earned an income of INR 500,000–10,00,000, while almost a quarter (21.15%) earned INR 10, 00, 000 and over INR15,00,000 annually.

The study found that 27.8% of the sample did not use any personal vehicle at the time of the survey. Personal cars were used by 16%, bikes/scooters by 28.8%, and multiple personal vehicles by 25.4%. In terms of

[3] 1 USD = 82.03 INR based on the commercial exchange rate on 19/10/2022 (Bloomberg.com).

vehicle ownership in the household, 51.2% owned multiple personal vehicles, 34.8% owned atleast one vehicle, and 10.9% owned none. The middle-class sample owned many vehicles despite 69.99% of them needing to travel less than 20 kms a day. Of the remaining people sampled, 17.8% traveled between 21 and 50 km daily, and a small proportion, 4.5% between 51 and 100 km, and 3% further than 100 km. This also indicates that personal vehicles were used more for non-necessary and within city travel. Hence, some current concerns like battery range anxiety, as pointed out in several studies, should not be an issue in the eastern region of India. A majority of the sample (57.6%) reside in big towns, 27% are residents of cities, and 14% live in rural areas.

5.2. Measurement model

Most of the scales for latent constructs were adopted from existing studies, except for 'herd behavior' and 'cost'. Confirmatory factor analysis (CFA) was carried out to examine convergent validity, internal reliability, and discriminant validity of constructs in this study using AMOS trial version 26 of IBM SPSS. The convergent validity and internal reliability of the indicators are examined by the composite reliability (CR) value, Cronbach's alpha value, the average variance extracted (AVE), and the factor loadings of all the indicators.

Table 2 indicates the factor loadings for the items. Factor loadings represent the explanatory power of an item for the construct. Hence items with very low loadings (<0.4) are dropped from further analysis since they do not provide much explanatory power to the model (Hulland, 1999). An indicator 'AT2' for 'attitude' and two indicators 'PBC3' and 'PBC4' for 'perceived behavioral control' are thus removed from subsequent analysis. The majority of the other indicators have a factor loading of atleast 0.6.

The values for average variance extracted (AVE) and composite ratio (CR), which establish convergent validity of the indicators (Hair et al., 2014) are indicated in Table 3. The AVE value of each construct is atleast 0.5, and the minimum value of CR is 0.637. All other constructs have a CR value higher than 0.745. The reliability of the internal consistency is established by the values of Cronbach's alpha ranging from 0.84 to 0.95, which exceeds the minimum recommended threshold of 0.7 (Hair et al., 2014). The AVE value is an indicator of the validity of the measurement model. An AVE value of atleast 0.5 is recommended. From the table above, we see that the AVE values of the latent constructs meet the desired range of 0.5. The validity of the constructs in the TPB model is established.

The measurement model also exceeds the recommended cut-offs for the goodness of fit, as indicated by Chisq/DF equal to 2.23, root mean square error of approximation (RMSEA) equal to 0.062, and comparative fit index (CFI) equal to 0.967. Fulfilment of all the required cut-offs for reliability, validity, and goodness of fit criteria indicates the appropriateness of the data with the method used in this study.

Table 2
Factor loadings of indicators.

	Indicator	Standardized Loadings
AT1	My adoption of electric vehicle (EV) in the future will result in stopping further damage to the environment	1
AT4	It feels satisfying for me to adopt EV and reducing vehicular emissions on my part	0.95
SN2	If my close ones encourage me to adopt EV, I will follow	1.25
SN3	If the government provides incentive to adopt EV, I will follow	0.98
SN4	The government encourages to adopt EV for the sake of climate change mitigation but does not provide incentives. I will still adopt EV	1
PBC1	It will not take me too much time to figure out the technicalities of using an EV	1.35
PBC2	If I am willing, I have the confidence to drive an EV	1
CO1	The price of EV will determine my intention to buy EV	0.81
CO2	The price of EV will determine if I am capable to buy an EV or not	0.81
CO3	Incentives like subsidies, low-interest loans, lower toll tax, and parking facilities will facilitate me to purchase EV	1
HB1	The use of social media platforms will help me to gain visibility regarding my adoption of EV	1.03
HB2	My adoption of EV will help me get appreciation in my social circles	1.26
HB3	Members in my social circle have already adopted EV. It might be better for me to adopt one too	1.25
HB4	It might feel out of trend not to buy an EV when it is available in the market	1
PN1	I have the obligation to reduce my CO_2 emissions from using petrol/diesel vehicles	0.46
PN2	Adopting EV and reducing CO_2 emissions is consistent with my moral principles	0.63
PN3	I would feel guilty if I do not adopt EV and try to mitigate climate change from my side	1

5.3. Results of SEM

In accordance with the hypothesis proposed in the study (Table 5), we fit the established measurement model into a structural equation model in AMOS. The maximum likelihood estimation method is used to fit the SEM model. As shown in Table 4, good values for the indicators of model fit such as CFI, adjusted goodness of fit (AGFI), and RMSEA were achieved. According to Bentler (1989; cited in Pakmehr et al. (2020), the AGFI needs to be larger than 0.8, the CFI greater than 0.9, and the RMSEA less than 0.08. Thus the TPB model used in the context of the study has a good fit (see Table 6).

As indicated in Table 5, subjective norm has a positive and significant influence on intention formation toward EV adoption ($\beta = 0.484$, $p = 0.005$). This supports hypothesis H2. Perceived behavioral control is another significant factor influencing intention ($\beta = 0.235$, $p = 0.028$), thus supporting hypothesis H3. Attitude however is not found to be a significant construct influencing the formation of intention ($\beta = 0.107$, $p = 0.383$). Hence, hypothesis H1 is not supported.

In the first extension of the TPB, TPB + CO model, subjective norm is found to be significant ($\beta = 0.595$, $p = 0.009$), thus supporting H2. H4 (Higher cost of EV → Lower intention) is not found to be a significant direct intention formation pathway, i.e., simply lowering the cost of EVs by providing purchase subsidies or relaxing tax does not motivate an individual to buy an EV.

In the second extension, TPB + HB model, subjective norm was found to be positive and significant at 5% level of significance ($\beta = 0.613$, $p = 0.044$). H3 is also supported as perceived behavioral control is a significant pathway for intention formation at 10% level of significance ($\beta = 0.209$, $p = 0.089$). H5 (Positive herd behavior → Intention) is not found to be a significant direct pathway in directly influencing intention, i.e., an individual will not simply buy an EV if everyone else is doing so.

In the third extension of the TPB model, TPB + PN two significant direct pathways influencing intention are found. Perceived behavioral control is found to be significant at the 5% level, ($\beta = 0.233$, $p = 0.045$)

Table 3
Reliability & validity assessment of indicators.

Construct	Average Variance Extracted (AVE)	Composite Ratio (CR)
Attitude	0.640	0.842
Subjective Norm	0.511	0.806
Perceived Behavioral Control	0.5	0.637
Cost	0.611	0.823
Herd Behavior	0.542	0.823
Personal Norm	0.542	0.775
Intention	0.648	0.846

Table 4
Goodness of Fit Indicators for TPB & its Extensions.

	Chisq/DF	Cronbach α	RMSEA	AGFI	CFI
TPB	2.23	0.896	0.062	0.912	0.967
TPB + CO	2.51	0.903	0.069	0.883	0.947
TPB + HB	2.65	0.914	0.072	0.876	0.939
TPB + PN	1.88	0.915	0.053	0.928	0.976
TPB + CO + HB	2.78	0.930	0.075	0.850	0.921
TPB + CO + HB + PN	2.52	0.928	0.069	0.845	0.924

Table 5
Results of the structural equation model.

Hypothesized paths	Standardized estimates	p-value	Conclusion
Original TPB model pathways			
H1: Favorable attitude towards the use of EV → Intention to adopt EV in the future	0.107	0.383	Rejected
H2: Higher subjective norm → Higher intention	0.484	0.005	Supported
H3: Higher perceived behavioral control → Greater is the intention to adopt EV in the future	0.235	0.028	Supported
Extensions of the Original TPB model			
H4: Higher cost of EV → Lower intention	0.124	0.267	Rejected
H5: Positive herd behavior → Intention	−0.053	0.751	Rejected
H6: Strong personal norm → Intention	−0.103	0.715	Rejected

Table 6
Significant relationships in the extended TPB structural models.

Hypothesized paths	Standardized estimates	p-value
TPB + CO		
H2: Higher subjective norm → Higher intention	0.509***	0.009
TPB + HB		
H2: Higher subjective norm → Higher intention	0.613**	0.267
H3: Higher perceived behavioral control → Greater is the intention to adopt EV in the future	0.209*	0.751
TPB + PN		
H2: Higher subjective norm → Higher intention	0.512**	0.037
H3: Higher perceived behavioral control → Greater is the intention to adopt EV in the future	0.233**	0.045
TPB + CO + HB + PN		
H1: Favorable attitude towards the use of EV → Intention to adopt EV in the future	0.625*	0.070
H3: Higher perceived behavioral control → Greater is the intention to adopt EV in the future	0.560**	0.012

*** significant at 1%, ** significant at 5%, * significant at 1%.

and subjective norm is also found to be a significant pathway at 5% level of significance (β = 0.512, p = 0.037). Personal norm is again not found to directly influence the formation of intention, i.e., only feeling a moral responsibility to contribute to environment protection will not motivate an individual to buy an EV.

In the combined extended model, TPB + HB + CO model, H3 is supported at 5% level of significance (β = 0.560, p = 0.012), and H1 is supported at 10% level of significance (β = 0.625, p = 0.070). H4 and H5 are again rejected as a direct pathway for intention formation. The four structural models as found in this study are shown in appendix 2.

Since this study involves non-parametric models, hence the mappings between the latent constructs are many-one. This makes it unlikely to be able to determine a unique value for the parameters in the above equations, shown in Table 7. This makes it apt to analyze such equations using structural models. However, structural equation qualifies as one, if we can interpret it in the following way: in an ideal experiment, when we set SN = x (say in the TPB + CO model), and any other variable set

Table 7
Set of equations derived from SEM measurement model.

MODEL	EQUATION FOR INTENTION
TPB	INT = 0.562 S N + 0.215 PBC + ε_1
TPB + CO	INT = 0.509 S N + ε_2
TPB + HB	INT = 0.613 S N + 0.209 PBC + ε_3
TPB + PN	INT = 0.233 PBC +0.512 S N + ε_4

say Y (not containing SN or INT) to y, the value z of INT is given by 0.509 S N + ε_2, where ε_2 is not a mapping of the settings SN and y. Even though in non-parametric models, such controls cannot be done, yet the equations do not become null and void. A researcher conducting SEM in this case, tries to extract maximum information about INT from the minimum information observable.

Also it must be noted that the equality in the equations do not hold the same meaning as in algebraic equations. For instance in the TPB + CO model, if we set INT = 0, then we cannot conclude ε_2 = - 0.509. INT = 0 tells nothing about the association between SN and ε_2.

5.4. Mediated Pathways

From the results of the structural models, we find that none of the three extended constructs: cost, herd behavior, and personal norm have a direct influence on the formation of intention to adopt an EV in the future. This by no means implies that we can ignore the extended constructs. The results of the mediation analysis explain why. The central tenet of the mechanism of mediation is that it engages a third variable which acts as an intermediary in the association between the independent variable and the dependent variable by transmitting the impact of the former on the latter (MacKinnon et al., 2007).

Fig. 3 illustrates the step-wise mechanism of the intention formation process in the context of the decision to adopt an EV. The constructs in blue also have a direct effect on intention, while those in black have no direct effect on intention. The curved arrows indicate a direct effect and the straight arrows indicate a mediated pathway. The thicker the arrows, the stronger the size of the effect (see Fig. 4).

In the original TPB model (Fig. 3A), though attitude has no direct effect on intention formation, it is mediated by perceived behavioral control, which in turn, is mediated by subjective norms. This means simply a presence of positive attitude towards the protection of environment will not motivate an individual to think about buying an EV unless he/she thinks that it will be under their control, comfort and knowledge (perceived behavioral control or PBC) to also drive/ride the same. PBC in turn is positive when an individual observes other people in the society comfortable using/providing good user experience about an EV.

In the TPB + CO extended model (Fig. 3B), cost is found to be partially mediated by perceived behavioral control with an effect size of 0.1495, as indicated in Table 8. This hints to the possibility that when cost is lower and a person also feels that he/she will be comfortably able to ride/drive an EV, only then policies of lowering costs through subsidies or taxes will be effective. Cost also acts as a mediator for attitude and perceived behavioral control with an effect size of 0.1069 and 0.1500 respectively. It indicates the possibility that when a person has a favorable attitude towards environment protection and costs of EVs are also low, then these two factors might together help in the formation of an intention to adopt an EV. Though PBC in itself helps in the formation of a positive intention to buy an EV, yet if costs are also low, then that relationship (H3) gets strengthened.

Herd behavior also acts only as a mediator in facilitating the TPB constructs to develop a positive intention to adopt an EV. The TPB + HB model (Fig. 3C) indicates that herd behavior is fully mediated by subjective norm with an effect size of 0.3977. It indicates that when there is external validation in the society for the act of purchasing an EV, then the act of many others buying an EV will also motivate a person to follow

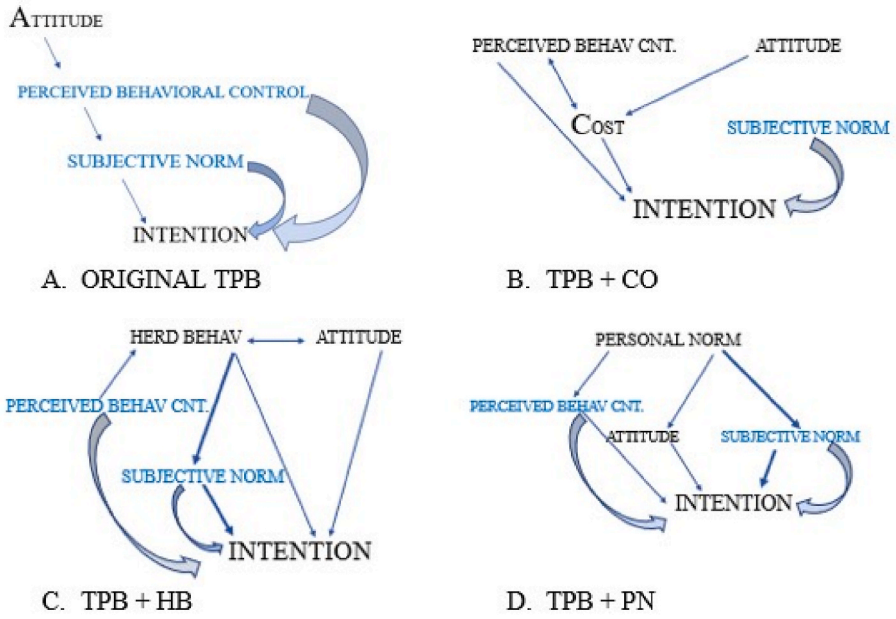

Fig. 3. Mediated Pathways in the TPB model and its extensions.

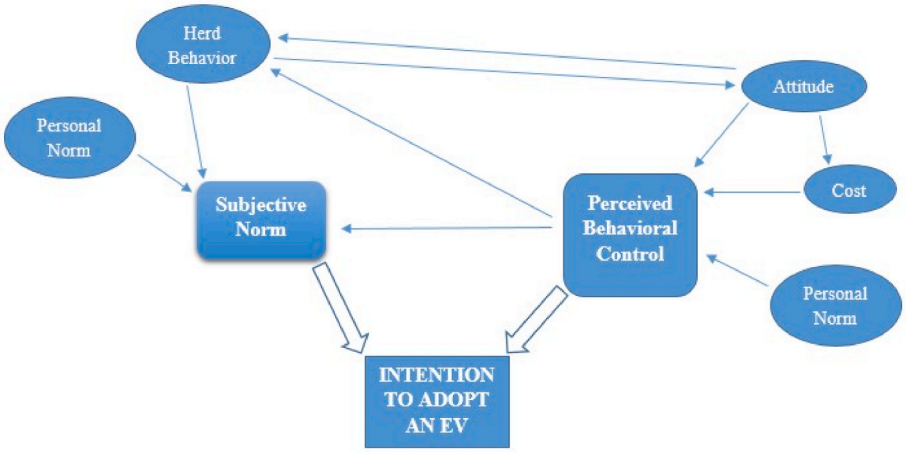

Fig. 4. Summary of the key results.

suit. Herd behavior also partially mediates perceived behavioral control with an effect size of 0.1529 and attitude with an effect size of 0.1878.

Personal norm is also found to be fully mediated by subjective norm with an effect size of 0.3967, and partially mediated by perceived behavioral control with an effect size of 0.1034 in the TPB + PN model (Fig. 3D). Personal norm is also partially mediated by attitude with an effect size of 0.1831.

6. Discussion

In the context of Assam in the northeastern region of India, the subjective norm and perceived behavioral control are the most important gain motivators directly influencing intention. This answer the first research question of the study, namely: what are the most important gain motivators for developing an intention to adopt EV?

Attitude does not influence intention directly, but through herd behavior and/or perceived behavioral control. This differs from previous studies which have reported a positive and direct effect of attitude on intention (Shi et al., 2017; Adnan et al., 2018; Asadi et al., 2021). One explanation for this is the high cohesiveness of people's activities in the towns and smaller cities. Hence, the fact of other people purchasing an EV can reinforce the positive attitude toward buying one.

Perceived behavioral control is found to be a motivator of intention only when an individual believes in his/her own abilities to drive an EV. The presence of a positive attitude without the belief in being able to comfortably drive an EV does not lead to an intention to buy one. This indicates a higher weight on personal ease than on a strong feeling toward environmental protection.

Similarly, the high impact of subjective norms on intention may be due to the collective nature of society in eastern India. Society's external validation is crucial as it unconsciously drives behavior. This is more so for the middle-class group living in towns or small cities. Though an individual might deny requiring society's input for their decisions or imitating others' decisions, it unconsciously feeds into an individual's decision-making process. This could be because of social competition, or because of an individual's eagerness to enhance their social status. Thus, we see that if members of a social circle adopt an EV, there is a high possibility of the others following suit. If an individual does not seek external validation for their action, then herd behavior might not lead to intention formation.

Table 8
Set of equations derived from the mediation analysis
The equations are of the form c = c' + a × b
where c: total effect
c': direct effect
a × b: indirect effect.

HYPOTHESIS	MEDIATOR	MEDIATION EQUATION	OUTCOME
TPB MODEL			
AT → INT	PBC	0.487** = 0.390** + (0.282**x 0.454**)	Partial Mediation
PBC → INT	SN	0.454** = 0.185** + (0.489**x 0.640**)	Partial Mediation
TPB + CO			
CO → INT	PBC	0.454** = 0.305** + (0.493**x 0.454**)	Partial Mediation
PBC → INT	CO	0.454** = 0.303** + (0.493**x 0.454**)	Partial Mediation
AT → INT	CO	0.487** = 0.380** + (0.322**x 0.454**)	Partial Mediation
TPB + HB			
HB → INT	SN	0.509** = 0.112 + (0.710**x 0.640**)	Full Mediation
PBC → INT	HB	0.454** = 0.301** + (0.390**x 0.509**)	Partial Mediation
HB → INT	AT	0.509** = 0.348** + (0.540**x 0.487**)	Partial Mediation
AT → INT	HB	0.487** = 0.299** + (0.540**x 0.509**)	Partial Mediation
TPB + PN			
SN → INT	PN	0.640** = 0.563** + (0.705**x 0.506**)	Partial Mediation
PN → INT	SN	0.506** = 0.109 + (0.705**x 0.640**)	Full Mediation
PN → INT	AT	0.506** = 0.323** + (0.709**x 0.487**)	Partial Mediation
PN → INT	PBC	0.506** = 0.402** + (0.317**x 0.454**)	Partial Mediation

**significant at 5% level of significance.

The big towns will become the engines of growth in the coming years, as the scarcity of space drives industrial enterprises outwards away from the already saturated cities. Hence EV promotion needs to focus equally on the big towns. There needs to be increased investments in Investments on EV-supporting infrastructure should increase. The government's failure to set up an EV-friendly ecosystem in this region poses a doubt on infrastructure readiness and increases technical anxiety. However, this study finds no anxiety related to EV infrastructure in the minds of middle-class Indians. People expressed openness to adopt EVs, provided the government's sets up the infrastructure as planned.

Another question raised here is whether the high upfront cost of an EV could pose a challenge to the formation of intention. Interestingly, cost is not found to be a significant barrier in the intention formation. Herd behavior and personal norm, as directly and fully mediated by subjective norms, also become an impactful indirect determinant of intention to adopt an EV. Hence these variables, if ignored, on account of there being no direct relationship between them, will seriously bias the results.

7. Conclusion and policy implications

This study analyzes possible behavioral pathways for formation of pathways towards EV adoption in the near future. Behavioral route to motivate EV adoption is cost-effective. Secondly, a behavioral route might lead to actions that can be maintained over the long run as such motivations take shape deep within the minds of an individual. Thirdly, the behavioral route to influencing one's intention causes no loss in their welfare, unlike several obligatory government policies. Using data collected from Indian middle-class individuals in Assam, this study extends the TPB model using contemporary contexts. Factors like herd behavior, cost, and personal norm are explored in addition to the usual TPB constructs. Several direct and indirect possible intention formation pathways have been outlined.

There are some managerial and theoretical implications that follows. Theoretically, this research highlights possible ways to map the process of decision-making to some extent, which is otherwise viewed as ambiguous and uncertain. It hints towards possible ways to incorporate behavioral/attitudinal aspects in studies otherwise only considering economic or physical indicators to solve social problems.

Several managerial implications follow. Subjective norms and perceived behavioral control are the direct determinants of intention and policies should thus aim to trigger these two aspects to activate gain motivation. The question that arises is, how policies can trigger subjective norms. For instance, an EV can be positioned as a status symbol among the range of cars in the market. This can be achieved by allotting EVs as the official vehicles for important governments' high-ranked officials like Ministers, Department Heads at both the center and state levels, and the like. Similarly, celebrities in diverse fields can be provided with special incentives to adopt EVs. This would theoretically enhance how "other people" view an EV owner optimally at the local level of a neighborhood or a municipality, where the possibility of people knowing one another increases. Subjective norm is also found to be a very important motivator in middle-class society. The same can also be triggered by rewarding people for their act of purchasing an EV. Rewards should also include social recognition and social appreciation, apart from monetary incentives which are already announced by the governments.

This study also finds that a positive attitude towards the environment or sustainable mobility, in particular, does not directly lead to an intention to adopt an EV. In the presence of a positive attitude, perceived behavioral control or herd behavior needs to be triggered. This will then mediate attitude toward the development of an intention to adopt an EV. People are generally competitive by nature. When people in their social circle adopt an EV, they often believe they can do it too, i.e., their perceived behavioral control gets triggered. Also, examples of other people who have already purchased an EV will further motivate others to do the same. This is because herd behavior is fully mediated by subjective norms, which are also the strongest determinant of intention. Positive attitudes towards EVs and the environment, in general, can also be developed among people by increasing awareness about newer developments in EV technology, frequently updating the status of EV infrastructure developments at the state and district level, and also by removing misconceptions associated with the use of an EV. The presence of a strong social norm about the act of purchasing an EV also triggers the moral consciousness in an individual regarding the need for transitioning towards sustainable mobility. Cost is an important component influencing the formation of an intention to adopt an EV because it can reinforce or weaken one perception of control over the easy manoeuvrability of an EV. The current subsidy schemes should also be accompanied by knowledge dissemination, hand-on-training, and EV drive/ride experiences to realize the full potential of purchase subsidies.

7.1. Limitations & further research

One of the limitations of the present study is that it is confined only to the state of Assam. With differences in the state of existing EV infrastructure, or people's experiences with other public infrastructures in general, intention to adopt EVs might vary. Though this study attempts

to capture the pure effects of TPB constructs and its extensions for some direct and indirect possible pathways for influencing intention, other pro-environmental value based variables might also influence intention. Simultaneously capturing such effects was beyond the scope of this study. Hence it is advised to use the intention formation pathways along with contextual considerations.

Future studies can take into account samples from cities where EV infrastructure is comparatively more developed. Secondly, the intersection of other constructs like values, culture, knowledge, etc., along with the TPB constructs can be explored. A third possible extension to this work would be to compare the stated intention to adopt an EV with the actual purchase of an EV, once such data becomes available. Such an extension will help to understand the intention-behavior gap which is often found to exist in sustainability transition studies.

CRediT authorship contribution statement

Chayasmita Deka: The authors developed research question, identified methodology, collected data, analyzed the results, wrote the manuscript, and revised it. **Mrinal Kanti Dutta:** The authors developed research question, identified methodology, collected data, analyzed the results, wrote the manuscript, and revised it. **Masoud Yazdanpanah:** The authors developed research question, identified methodology, collected data, analyzed the results, wrote the manuscript, and revised it. **Nadejda Komendantova:** The authors developed research question, identified methodology, collected data, analyzed the results, wrote the manuscript, and revised it.

Declaration of competing interest

There is no conflict of interest.

Data availability

Data will be made available on request.

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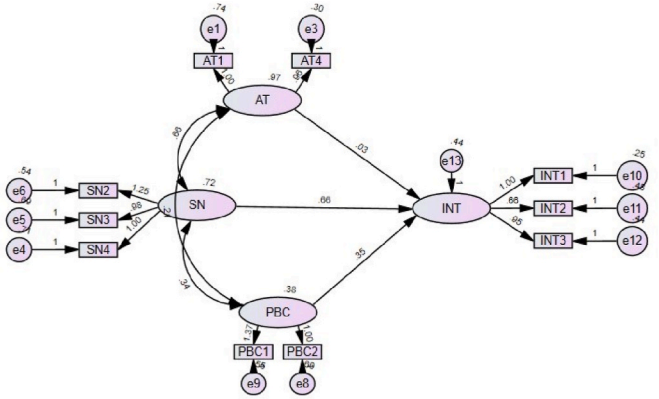
Appendix 1. Survey statements on the indicators of latent constructs

Please read the statements carefully. There are no correct or wrong responses. We are only interested in your personal opinion regarding each statement (1 = strongly agree to 7 = strongly disagree). (The indicators were presented as codes without mentioning the name of the construct that the indicator intends to measure).

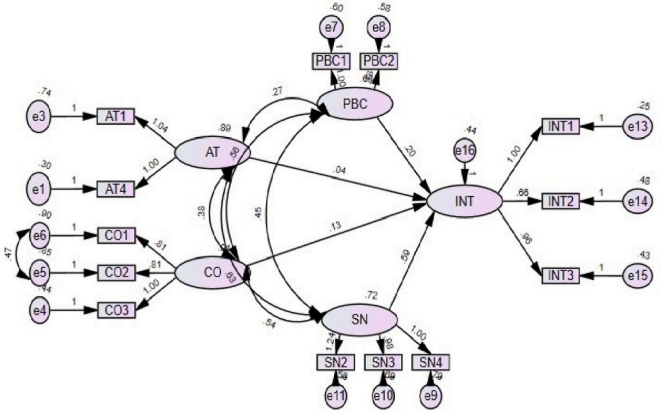
1. Indicators for 'attitude towards EVs'
   - AT1: My adoption of electric vehicle (EV) in the future will result in stopping further damage to the environment
   - AT2: Being able to stop further damage to the air quality and climate at large is good
   - AT3: I think adopting EV to reduce vehicular emission is a smart measure
   - AT4: It feels satisfying for me to adopt EV and reducing vehicular emissions on my part
2. Indicators for 'subjective norms'
   - SN1: People in my social circle thinks that adopting EV in the future is good
   - SN2: If my close ones encourage me to adopt EV, I will follow
   - SN3: If the government provides incentive to adopt EV, I will follow
   - SN4: The government encourages to adopt EV for the sake of climate change mitigation but does not provide incentives. I will still adopt EV
3. Indicators for 'perceived behavioral control'
   - PBC1: It will not take me too much time to figure out the technicalities of using an EV
   - PBC2: If I am willing, I have the confidence to drive an EV
   - PBC3: Whether or not to drive an EV is completely upto me
   - PBC4: It will not take me long to find charging stations near me to charge my EV
4. Indicators for 'cost'
   - CO1: The price of EV will determine my intention to buy EV
   - CO2: The price of EV will determine if I am capable to buy an EV or not
   - CO3: Incentives like subsidies, low-interest loans, lower toll tax, and parking facilities will facilitate me to purchase EV
5. Indicators for 'herd behavior'
   - HB1: The use of social media platforms will help me to gain visibility regarding my adoption of EV
   - HB2: My adoption of EV will help me get appreciation in my social circles
   - HB3: Members in my social circle have already adopted EV. It might be better for me to adopt one too
   - HB4: It might feel out of trend not to buy an EV when it is available in the market
6. Indicators for 'personal norms'
   - PN1: I have the obligation to reduce my CO_2 emissions from using petrol/diesel vehicles
   - PN2: Adopting EV and reducing CO_2 emissions is consistent with my moral principles
   - PN3: I would feel guilty if I do not adopt EV and try to mitigate climate change from my side

Appendix 2. Structural models analyzed in the study

Original TPB model
Supported in this study



TPB + CO
Supported in this study



TPB + HB
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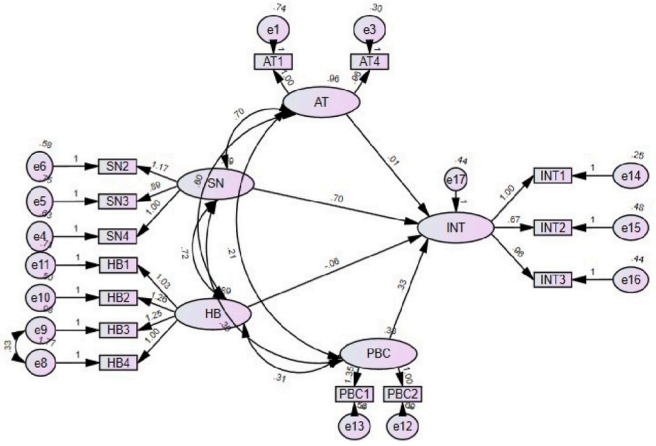
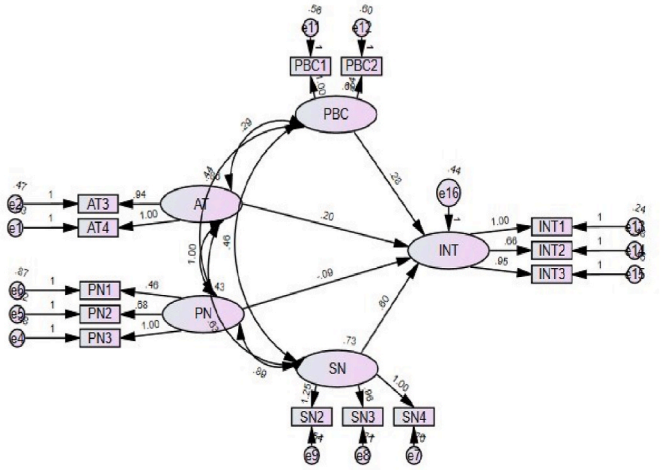


TPB + PN
Supported in this study



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