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Driving green or driving towards doomsday? Unveiling fear and norm dynamics in electric vehicle adoption among India's middle-class

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Amidst escalating challenges concerning extreme climatic events, the transition to low-carbon lifestyles has emerged as a significant policy priority. To that end, adoption of low-carbon technologies like electric vehicles (EVs) is critical. This study is a novel examination of the socio-psychological mechanisms shaping intentions to adopt EVs in Assam, a fast-developing region in northeast India, characterized by collectivist cultural norms. While existing research has primarily focused on economic, technical, and volitional factors such as perceived behavioral control, environmental awareness and attitudinal variables, this study examines the combined effect of norm and fear-based drivers of intention to adopt EVs. Utilizing the Norm Activation Model (NAM) and the Protection Motivation Theory (PMT), this study identifies subjective norms and perceived vulnerability as the most significant norm-based and fear-based predictor of intention respectively. Structural equation modeling reveals a parallel rather than sequential operation of norm and fear-based constructs, with mediated intention pathways featuring a complex interplay of affect-cognition mechanisms shaping intention. Unlike findings in Western contexts, personal moral norms have less direct impact in shaping intention in a collectivist setting where social validation and group norms weigh higher. Awareness and environmental concern is also found to be ineffective unless it is accompanied with fear cues indicating personal vulnerability and a belief in the possibility of its mitigation. The findings highlight the need for localized, tailored, affect-filled communication strategies over nation-wide financial incentives alone to accelerate EV adoption. The limitations and directions for further research on evolving EV ecosystems are discussed.

KEYWORDS

electric vehicles, intention, middle-class, fear, norm activation model, protection motivation theory

1 Introduction

In the past few years there has been an increase in extreme climatic events and irregular climatic patterns globally. In 2021, the USA experienced natural calamities like cold waves (in Texas and southern USA), wildfires (in Arizona, Colorado, Idaho, California, Oregon, Montana, and Washington), heat waves, and drought (across the western USA during summer and autumn), floods (in California, and Louisiana), tropical cyclones, etc. (Smith, 2022). Europe experienced extreme heat waves in 2002 and 2010 (Beniston, 2015).

Alpine glaciers lost up to 30 meters of ice thickness in the period between 1997 and 2021. The highest point in Greenland experienced its first-ever rainfall in the summer of 2021. By the year 2100, ~66% of the European population is projected to be affected by climatic disasters, which was only 5% between 1981 and 2010 (Forzieri et al., 2017). In India, around 75% of the districts, housing 638 million people were climatic hotspot regions. Floods have touched record new levels. 2005 recorded the highest frequency of floods with 140 flooding events affecting 69 districts. This increased to 151 in 2019. The frequency of events associated with floods, like landslides, hailstorms, thunderstorms, and cloudbursts, has increased more than 20 times between 1970 and 2019 (Mohanty, 2020). While the northern states of India (like Haryana, Uttar Pradesh, Delhi, and Rajasthan), and western regions (like Gujarat) experience increasing heat waves during summer, these areas also experience extreme cold waves during the winters (PIB, 2022).

Climatic extremes affect the world adversely, particularly in underdeveloped and developing countries, where people are very vulnerable due to the low financial resources required for quicker adaptation to emerging changes. Events like floods and droughts force many households into years of poverty trap. In other words, climate change is destroying all human efforts toward development. Developmental activities in the manufacturing and industrial sectors demand extensive use of energy like oil and fossil fuels. With the urgent need to phase out these energy sources, the development trajectory of these nations is under threat. The phasing-out policies also need to consider the distributional implications at the level of society. For instance, Haiti, a low-income Caribbean nation, is immersed in extensive energy poverty and infrastructural challenges. On top of it, these nations are also historically high importers of high-cost fossil fuels from developed countries. For them, phasing out fossil fuels and a complete shift to cleaner energy production seems like a distant possibility (Perry, 2020).

This calls for a combination of adaptation and mitigation efforts to face the risks of climate change. Such efforts will help to lower climate extremes, atleast in the short to medium term, until all nations acquire the resources required for a complete shift toward cleaner energy. Some mitigation actions to decarbonize the transport sector include reducing the emissions at the source by increasing the share of renewables instead of petrol/diesel, establishing a clean transportation system like electric vehicles (EVs), and enhancing the capacity to capture GHG gas by increasing forest cover. Thus, mitigation involves human interventions to decrease the sources of GHG emissions, increase the sinks, or both. Adaptation, on the other hand, involves measures like building climate-resilient infrastructure, behavioral modifications, etc. Thus, it involves adjustments keeping in mind the present and expected future impacts of climate change.

Successful mitigation and adaptation efforts call for social acceptance, as both strategies involve behavior changes at varying levels. For instance, the establishment of a system of cleaner transportation like EVs will be effective when people adopt the same. This calls for an enhanced understanding of people's behavior in the context of climate change mitigation and adaptation intentions. Behavioral economics has empirically established that personal material gain is not the only determining factor of a person's behavior. There are other factors, such as societal norms, personal norms, perception of threat from climate change, social acceptance, social status, etc., which also determine a person's behavior (Brekke and Johansson-Stenman, 2008). People's myopic view of climate change also undermines pro-environmental actions (O'Neill and Nicholson-Cole, 2009; Spence et al., 2012). A detailed understanding of the interplay of people's short-sightedness (Singh et al., 2017; Sacchi et al., 2016) and their moral obligations to act sustainably will help design more effective policies and incentives. Such insights can help mitigate climate change by initiating actions like establishing an EV market in a nation like India, where demand for personal vehicles is increasing at a 9.7% compound yearly growth rate (Krishna, 2024).

Environmental psychologists have increasingly begun to take a socio-psychological approach to ramp up the uptake of EVs around the world. The theory of planned behavior (TPB), which is based on people's self-interest nature, explains individuals' motivation to buy EVs (Asadi et al., 2021; Shakeel, 2022; Riverso et al., 2023; Deka et al., 2023; Buhmann et al., 2024). The norm activation theory (NAM) based on people's altruistic orientation is also widely used to analyze an individual's intention to buy EVs (Jansson et al., 2017; He and Zhan, 2018; Hamzah and Tanwir, 2021). The protection motivation theory (PMT) based on fear appeal have been used in few studies (Bockarjova and Steg, 2014; Langbroek et al., 2016; Deka et al., 2024). Other theories that have been applied to study people's motivations to buy EVs include several technology acceptance models like the unified theory of acceptance and use of technology (UTAUT), technology acceptance model (TAM), the value-belief-norm (VBN) framework, etc. While these studies explain EV adoption intention from a single psychological dimension, intention formation is a complex process, involving multiple social and psychological aspects (Udall et al., 2019).

Studies have reported that the use of integrated theories like TPB+NAM enhances the applicability and comprehensibility of models. In the context of intention to use EVs, Lee et al. (2023) used VBN+TPB framework for China, Vafaei-Zadeh et al. (2022) used TAM+TPB framework; Asadi et al. (2021) and Hamzah and Tanwir (2021) used TPB+NAM framework for Malaysia. Singh et al. (2023) applied the UTAUT2+NAM framework, Sahoo et al. (2022) used the TRA+TPB+MT framework, Kumar (2022) used TPB+TAM+NAM framework for India, and other studies that have analyzed intention by integrating different theories with TPB. Infact, TPB has been extensively used to analyze different kinds of behaviors. However, TPB theory too has its limitations. It analyzes gain or self-interest motivations but says nothing about environmental, economic, or political impacts on behavior, or the influence of past experiences on the intention formation process of an individual (Kumar, 2022). Thus, we see that researchers have integrated different theories as mandated by the study context to fill the gaps posed by one theory and complement with another, enhancing the overall applicability of models.

This study analyzed the intention to adopt EVs in Assam province in northeast India (shown in Figure 1), where people's past experiences with public infrastructure have not always been the best due to infrastructural and social bottlenecks. Past experiences are especially relevant in adopting a new technology like EV as it shapes their present confidence and openness to try the

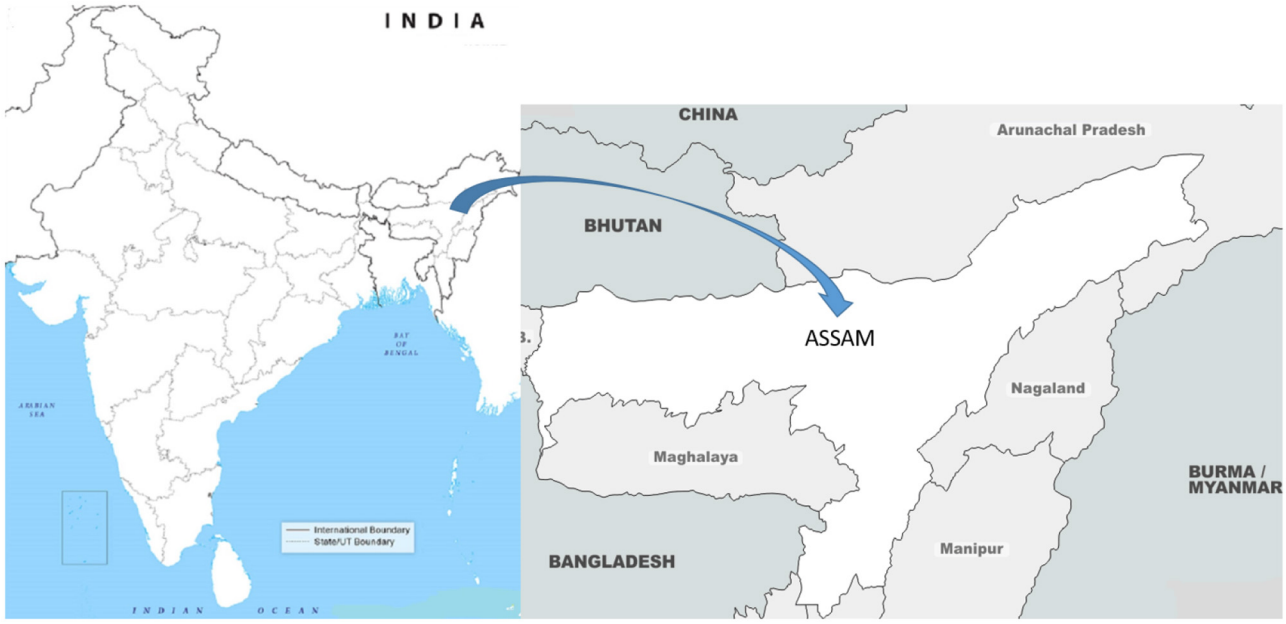

FIGURE 1
The study site (Assam in northeast India). The map is not according to the scale.

same (Khatri et al., 2018). Only since the year 2014, there has been tremendous progress in road and bridge networks reducing travel times from hours to minutes and connecting Assam to the neighboring hilly regions of the northeast. Further industrial boost in the region like setting up of semi-conductor industries in the state in 2024 (PIB, 2025), and increased industrial investments flow after the rising northeast investor summit in 2025 (MDoNER, 2025), this region is set to witness increased road traffic in the coming years with rising trade and people movement. To promote sustainable road traffic, the government has allocated a significant budget for the promotion of EVs, yet the uptake has been low. For instance, the EV sales in India during 2022–23 is only 1.16% of total passenger vehicle sales, while during the same period, petrol-fuelled vehicles constituted 81.28% of total sales. Despite the government's focus on EV promotion, the total number of public EV chargers in Assam in the year 2023 is only 52 in contrast to 9113 in the entire country (IndiaStat, 2024). Hence EV uptake in this region needs to be driven by personal pro-environmental motivations and private initiatives, to compensate for the slow development of EV ecosystem despite robust promotion schemes based on subsidies.

While there have been campaigns about the need to reduce vehicular emissions, the news of EV fires in several towns and cities in India had also made the rounds, causing fear (Shao and Yu, 2023) about climate change and regarding the use of EVs. The interplay of fear and one's moral norms in influencing an individual's intention to adopt EVs seems to fit the context of this study. Fear and protection motivation as explained by the protection motivation theory (PMT) in influencing one's intention to adopt EVs have been used in few studies (Bockarjova and Steg, 2014; Langbroek et al., 2016, 2017, 2019; Deka et al., 2024), so is the use of NAM theory (Norlund et al., 2016; He and Zhan, 2018; Bobeth and Kastner, 2020; Huang et al., 2020). However, the integration of fear and norms to inform one's intention to adopt EVs has not been explored and is a gap in the literature. This study attempts to fill this gap by analyzing individuals' intention to adopt EVs using an integrated NAM+PMT framework. Only 2-wheelers and 4-wheeler personal vehicle segment is considered in this study since these constitute the passenger vehicle composition in India, which is the focus of this study.

The remainder of the paper is structured as follows. We begin with a review of the components of the theoretical frameworks as found in the literature. The detailed literature review first explains the suitability of the NAM+PMT framework based on gaps in the findings from commonly used frameworks like the UTAUT, TAM, VBN, and TPB. This is followed by literature review specific to NAM and PMT theory and derivation of the research hypotheses. We then outline the study context and describe the sample and data collection process. This is followed by an analysis of the data and a discussion of the results. The paper finally concludes with some policy suggestions.

2 Review of literature and derivation of the theoretical framework

2.1 Suitability of NAM+PMT framework in the study context and its added contribution over commonly used conceptual frameworks

The TPB theory, Value Belief Norm (VBN) theory, UTAUT (Unified Theory of Acceptance and Use of Technology) framework, and Technology Adoption Model (TAM), have been widely used to analyze individual's intention to adopt EVs. Some of the most common overarching factors found to shape people's intention to adopt EVs across these theories and in different countries are

TABLE 1 A comparison of significant variables (colored boxes) and gaps in findings (uncolored boxes) from the application of different versions of the UTAUT framework.

Versions of UTAUT	Attitude	Norm	Risk	Hedonic factors	Affect	Social influence	Personal capabilities	Awareness/ knowledge	External facilitators	EV positive attributes	Value	Belief/ trust	Env. concern
UTAUT + env. concern								(Abbasi et al., 2021)	(Ong et al., 2023)				(Jain et al., 2022)
UTAUT + env. knowledge										(Abbasi et al., 2021)			
UTAUT + TPB	(Gunawan et al., 2022)			(Gunawan et al., 2022)		(Gunawan et al., 2022; Sheykhfard et al., 2025)	(Gunawan et al., 2022; Sheykhfard et al., 2025; Ong et al., 2023)		(Gunawan et al., 2022)		(Ajao et al., 2025)		(Ong et al., 2023; Sheykhfard et al., 2025)
UTAUT+NAM		(Singh et al., 2023)				(Singh et al., 2023)	(Singh et al., 2023)						
UTAUT + DOI						(Riverso et al., 2023)			(Riverso et al., 2023)				
Extended UTAUT		(Ajao et al., 2025)		(Manutworakit and Choocharukul, 2022; Alwadain et al., 2024; Hafeez et al., 2024; Shetty and Rizwana, 2024; Ong et al., 2023)		(Manutworakit and Choocharukul, 2022; Selvi and Onem, 2025; Sebastian et al., 2024; Wang et al., 2024; Chaveesuk et al., 2023; Shetty and Rizwana, 2024)	(Alwadain et al., 2024; Manutworakit and Choocharukul, 2022; Sebastian et al., 2024; Ajao et al., 2025; Ahmad et al., 2024; Wang et al., 2024; Hafeez et al., 2024; Shetty and Rizwana, 2024)	(Selvi and Onem, 2025)	(Alwadain et al., 2024; Jain et al., 2022; Manutworakit and Choocharukul, 2022;Selvi and Onem, 2025; Sebastian et al., 2024; Ajao et al., 2025; Hafeez et al., 2024; Chaveesuk et al., 2023; Dutta and Hwang, 2021)			(Ajao et al., 2025)	(Manutworakit and Choocharukul, 2022; Sebastian et al., 2024)

Different versions of the Unified Theory of Acceptance and Use of Technology [UTAUT; According to the UTAUT framework, four constructs: effort expectancy, performance expectancy, social influence and facilitating conditions influence people's intention to use technology (Ajao et al., 2025)] framework are indicated in the 1st column of this table. The rows represent the variables found to significantly explain people's intention to adopt EVs in the existing studies (indicated in the blue-colored boxes). Most studies have combined the UTAUT framework with the TPB theory; or extended the UTAUT framework with other context specific variables. The core components of the UTAUT framework: social influence, performance and effort expectancy (collectively summarized as personal capabilities), facilitating conditions (or external facilitators), are found to explain intention in most studies that used the UTAUT framework. Hedonic factors are used as extensions and are found to be significant in some studies. The uncolored boxes indicate the gaps in the findings. For instance, the UTAUT with its variants do not provide many insights on the influence of factors like risk, affect (emotion), attitude, norms, value and trust on the intention to adopt EVs.

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TABLE 2 A comparison of significant variables (colored boxes) and gaps in findings (uncoloured boxes) from the application of different versions of the TAM model.

Versions of TAM	Attitude	Norm	Risk	Hedonic factors	Affect	Social influence	Personal capabilities	Awareness/ knowledge	External facilitators	EV positive attributes	Value	Belief/ trust	Env. concern
TAM + TPB	(Adu-Gyamfi et al., 2022; Tu and Yang, 2019; Nguyen-Phuoc et al., 2024)	(Nguyen-Phuoc et al., 2024)					(Adu-Gyamfi et al., 2022)	(Adu-Gyamfi et al., 2022; Tu and Yang, 2019; Nguyen-Phuoc et al., 2024)		(Adu-Gyamfi et al., 2022; Nguyen-Phuoc et al., 2024)			
TAM + SOBC	(Rani et al., 2024)				(Rani et al., 2024)					(Rani et al., 2024)			
TAM + knowledge								(Jaiswal et al., 2022)					
TAM + affect factors					(Zhang et al., 2018; He et al., 2022)			(Zhang et al., 2018)		(Zhang et al., 2018)			
Extended TAM		(Bektas and Alcura, 2024)	(Thilina and Gunawardane, 2019)		(He et al., 2025)	Bektas and Alcura, 2024	(Shanmugavel and Michael, 2022)	(Thilina and Gunawardane, 2019; Huang and Ge, 2019)	(Shanmugavel and Michael, 2022)	(Bektas and Alcura, 2024; Shanmugavel and Michael, 2022)			

Different versions of the Technology Acceptance Model [TAM; According to TAM, perceived usefulness and perceived ease-of-use of a technology are antecedents of attitude and intention to adopt the technology (Adu-Gyamfi et al., 2022)] are indicated in the 1st column of this table. The rows represent the variables found to significantly explain people's intention to adopt EVs in the existing studies (indicated in the gray-colored boxes). The existing studies have used the TAM model in combination with the TPB or extended it using context specific variables. Only few studies combined the TAM model with the SOBC (Stimulus Organism Behavior Consequence) model, affect factors and knowledge as a construct. According to existing TAM studies and its variants, awareness/knowledge, positive attributes about EVs, attitude, and affect (emotions) mostly influence people's intention to adopt EVs. Norm, personal capability, social influence, external facilitators (or facilitating conditions) and risk are found influencing intention in few studies. Hedonic factors, value, trust, and environment concern are gaps that the TAM model and its variants do not provide many insights on, in the context of intention for EV adoption.

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personal capabilities, external facilitators, positive attribute of EVs, social influence, knowledge/awareness, attitude, and environmental concern. Other factors with smaller influence in shaping intentions are norms, affect/emotions, values, belief/trust and risk factors. Current research that lends support to the impact of these variables on the intention to adopt EV are explained in Tables 1–4, for the UTAUT framework and its variants; the TAM model and its variants, the VBN theory and its variants and the TPB theory and its variants respectively. The tables list the significant variables that emerged from empirical analysis of the different variations of the framework/model/theory as used in existing studies. The colored boxes indicate significant variables found to influence intention and the references inside the boxes indicate the studies that confirm the variable as significantly influencing intention. The uncoloured boxes reveal the unexplained gaps in the different variations of the framework/model/theory in explaining people's intention to adopt EVs.

We see that the existing frameworks commonly used to analyze EV adoption intention provide a relatively more in-depth analysis of the technological aspects of EVs, like people's perception of its positive attributes of EVs (EV positive attributes), people's perception of their ease of EV use, external facilitating conditions like governments, policies, marketing strategies, etc. Role of social influence, and attitude is also analyzed as core components of the TPB theory. The extensions of the theories have investigated the role of environmental knowledge and concern to some extent. However, the combination of relevant background factors required for the selected study like norms, affect, belief, etc., and fear and protection factors are less explored in the existing studies.

In India, electric vehicle is a new technology in the mobility arena. This is especially true, for emerging cities of Assam in northeast India. EV charging infrastructure is yet to develop in a scale that is required for a significant transition from internal combustion engine vehicles (ICE) to EVs. Of the 313 million (approx.) total registered personal vehicles (2-wheelers and 4-wheelers) in India in 2024–2025, the EV fleet is only 13–15 million. This clearly indicates a huge potential low-carbon mobility transition and the need to facilitate such a transition through EV adoption. Regions in India which have seen a relatively higher adoption of EVs have a domination of battery EVs ($3/4^{th}$ of the total EV sales in 2024-25) over plug-in hybrid EVs ($1/4^{th}$ of the total sale; TOI, 2024). Widely publicized news on EV fires in India in 2021, and loss of a life from EV fire in 2022 also triggers fear around use of EVs and deters its adoption. While the hot and humid weather of India is partly a complementing reason behind the undesired EV fire accidents, cell quality and battery design are also core causes. While improvements in the later factors are ongoing, the former cause is widely popularized triggering inhibitions to adopt EVs (Kethareswaran and Moulik, 2023). This calls for an in-depth analysis of the role of fear and protections factors influencing intention. In addition, the collectivist nature of smaller cities in India calls for analysis of norms for a complete analysis of background conditions shaping intention. An in-depth focus on fear and protection factors in the backdrop of a norm-based collectivist society is a gap in literature and the NAM+PMT framework can be used to provide insights on this research gap.

TABLE 3 A comparison of significant variables (colored boxes) and gaps in findings (uncoloured boxes) from the application of different versions of the VBN theory.

Versions of VBN	Attitude	Norm	Risk	Hedonic factors	Affect	Social influence	Personal capabilities	Awareness/ knowledge	External facilitators	EV positive attributes	Value	Belief/ trust	Env. concern
VBN + UTAUT		(Higueras-Castillo et al., 2024)				(Higueras-Castillo et al., 2024)	(Higueras-Castillo et al., 2024)		(Lee et al., 2023)				
VBN + TPB	(Lee et al., 2023)	(Lee et al., 2023)				(Lee et al., 2023)	(Lee et al., 2023)				(Higueras Castillo et al., 2024)	(Higueras-Castillo et al., 2024)	
VBN + other moderators		(Zhang et al., 2022)											

Different versions of the Value Belief Norm [VBN; According to the VBN theory, personal norms are affected by awareness of consequence and ascription of responsibility. Personal norms shape pro-environmental behavior and attitude, while general beliefs and stable value orientations (egoistic, altruistic, biospheric, and openness to change) influence personal beliefs (Stern et al., 1993)] theory are indicated in the 1st column of this table. The rows represent the variables found to significantly explain people's intention to adopt EVs in the existing studies (indicated in the yellow-colored boxes). Existing studies have used the VBN model in combination with the UTAUT, TPB, and other moderators to analyze intention to adopt EVs. Norm, followed by social influence, personal capabilities, value, trust, attitudes and external facilitators are found to influence intention according to VBN theory and its variants. Existing studies using this theory provide no insights on how factors like risk, hedonic factors, affect, awareness, and positive attributes of EVs can influence intention.

TABLE 4 A comparison of significant variables (colored boxes) and gaps in findings (uncoloured boxes) from the application of different versions of the TPB theory.

Versions of TPB	Attitude	Norm	Risk	Hedonic factors	Affect	Social influence	Personal capabilities	Awareness/ knowledge	External facilitators	EV positive attributes	Value	Belief/ trust	Env. concern
TPB	(Javid et al., 2021)					(Javid et al., 2021)	(Javid et al., 2021)						
TPB + norms	(Shalender and Sharma, 2021);	(Thwe et al., 2025; Mohamed et al., 2016)				(Thwe et al., 2025; Mohamed et al., 2016)	(Thwe et al., 2025; Mohamed et al., 2016)						
TPB + risk			(Buhmann et al., 2024)					(Hu et al., 2025)		(Buhmann et al., 2024)			
TPB + external factors						(Ehsan et al., 2024)	(Ehsan et al., 2024)		(Boo and Tan, 2024)				
TPB + DOI	(Moons and Pelsmacker, 2015)				(Moons and Pelsmacker, 2015)	(Moons and Pelsmacker, 2015)	(Moons and Pelsmacker, 2015)						
TPB + NAM	(Ji et al., 2024)	(Ji et al., 2024)				(Ji et al., 2024)	(Ji et al., 2024)				(Ji et al., 2024)		
Extended TPB	(Thakur et al., 2025; Ackaah et al., 2022; Yegin and Ikram, 2022)	(Hu et al., 2025; Wang et al., 2016)			(Li et al., 2020; Jain and Singh, 2024)	(Deka et al., 2023; Shalender and Sharma, 2021; Yegin and Ikram, 2022; Thakur et al., 2025; Ackaah et al., 2022; Wang et al., 2016; Vafaei-Zadeh et al., 2022)	(Shalender and Sharma, 2021; Deka et al., 2023; Wang et al., 2016; Yegin and Ikram, 2022; Ackaah et al., 2022; Boo and Tan, 2024; Vafaei-Zadeh et al., 2022; Li et al., 2020; Shakeel, 2022; Jain and Singh, 2024; Tanwir and Hamzah, 2020)	(Tanwir and Hamzah, 2020; Zhang et al., 2022; Boo and Tan, 2024)	(Yegin and Ikram, 2022; Moon, 2021; Jain and Singh, 2024; Ramadani et al., 2024; Shakeel, 2022; Ehsan et al., 2024; Li et al., 2020)	(Shakeel, 2022; Ramadani et al., 2024; Boo and Tan, 2024)		(Thakur et al., 2025; Zhang et al., 2020)	(Shalender and Sharma, 2021; Yegin and Ikram, 2022; Ackaah et al., 2022; Mohamed et al., 2016; Zhang et al., 2020; Hu et al., 2025)

Different versions of the Theory of Planned Behavior [TPB; According to TPB theory, attitude, subjective norms, and perceived behavioral control influences behavioral intention (Ajzen, 1991)] are indicated in the 1st column of this table. The rows represent the variables found to significantly explain people's intention to adopt EVs in the existing studies (indicated in the orange-colored boxes). The TPB theory is suitable for extensions, and as such, it has been used in combination with many other theories and extended with other context specific variables. The existing studies using the TPB theory and its variants find that intention is mostly influenced by personal capabilities, social influence, and external facilitators, followed by attitude, environment concern, awareness, affect and positive attributes about EVs. Though norm is not a core component of the TPB model, few studies used it along with the TPB model to provide some insights on impact of norms on intention. The role of risk, value, and trust is scarcely explained using TPB theory and its variants; and effect of hedonic factors remain unexplained.

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2.2 Role of norms in intention to adopt EVs

The NAM theory is based on norms (Schwartz, 1977). Awareness of the problem and its associated consequences is one such common thread. Depending on the psychological orientation of the individual, awareness can trigger one's moral obligations toward the environment, or it can trigger one's feeling of personal responsibility to have been a party to the deterioration process, or it can as well push one to assess the possibility of their susceptibility rather than the possible harm to the environment, or both.

According to the NAM, when an individual is aware of the potentially harmful consequences of a certain action and he/she ascribes a part of the responsibility to himself/herself for the occurrence of such harmful consequence, then their personal norms get activated. Personal norms then determine if a person will take some pro-environmental/pro-social action to stop environmentally/socially harmful action. Problem awareness, ascription of responsibility, and personal norms assume centrality in this theory as these form the basis for the NAM theory (Sawitri et al., 2015).

Awareness of consequence (AC) is a common construct for both normative motivations and for instilling a sense of fear in the threat appraisal process. AC is expressed as an individual's cognizance of the ill effects of engaging in actions that deteriorate the environment (Asadi et al., 2021). In the context of the intention to adopt EVs, many studies find that the presence of an awareness of the consequences of the negative effects of internal combustion engine vehicles (ICEVs) positively influences personal norms (PN; Asadi et al., 2021; He and Zhan, 2018; Jansson et al., 2017). The higher the AC, higher is the PN (Singh et al., 2023). AC directly influences intention to use EVs (Axsen et al., 2016; Deka et al., 2024).

H1: awareness of consequence about ill-effects of petrol-diesel vehicles influences intention to adopt EVs.

Problem awareness also triggers one's feeling of personal responsibility for causing the same (Schwartz, 1977). This feeling of personal responsibility for causing detrimental consequences by not acting in a particular desired way (here, adopting an EV) is called the ascription of responsibility (AR; De Groot and Steg, 2009). The stronger the AR, the higher the PN. Several studies have confirmed the presence of this association (Singh et al., 2023; Asadi et al., 2021; He and Zhan, 2018; Norlund et al., 2016). Jayaraman et al. (2015) and Deka (2022) however, reported that AR directly influences the intention to purchase hybrid EVs.

H2: ascription of responsibility influences the intention to adopt EVs.

Personal norm (PN) is the moral compulsion to engage or refrain from certain actions (Schwartz and Howard, 1981). Stronger PN is associated with willingness to use public transportation systems (Bamberg et al., 2007). It is also found to influence the development of intentions to adopt EVs in Germany (Bobeth and Kastner, 2020), Sweden (Jansson et al., 2017), Himachal Pradesh in India (Singh et al., 2023), China (Wang et al., 2016; He and Zhan, 2018), Taiwan (Ho and Wu, 2021), Pakistan (Javid et al., 2021), and Malaysia (Adnan et al., 2018; Asadi et al., 2021). A greater level of morality at a personal level was found to be a common trait among the owners of alternative fuel vehicles, in comparison to the non-adopters of EVs (Jansson, 2011). PN becomes active when environmentally associated PN is activated. While several studies confirm the associations stated in the NAM theory, i.e., AC and AR influence PN, the reverse is also found to hold in some cases. For instance, PN is found to be positively influenced by AC and AR (He and Zhan, 2018).

H3: stronger personal norm, favorably influences the intention to adopt EVs.

Subjective norm (SN) is another component of norm motivations. It is an individual's beliefs about approval or disapproval of society regarding acting or not acting in a particular way. SN have a high influence on people's intention to adopt EVs in India (Deka et al., 2023), Malaysia (Asadi et al., 2021; Sang and Bekhet, 2015), China (Dong et al., 2020), Hong Kong (Sun et al., 2022), Macau (Lai et al., 2015), etc.

H4: subjective norms influence the intention to adopt EVs.

Environmental concern (EVC) is an individual's awareness of environmental issues and their desire to address them (Newman and Fernandes, 2016). EVC also encompasses people's emotions toward environmental issues like anxiety, and displeasure (Milfont and Gouveia, 2006). Pagiaslis and Krontalis (2014) state that EVC directly and positively influences individuals to engage in eco-friendly consumption, like their preference for different modes of travel (De Groot and Steg, 2007, 2008), intent to adopt (Wang et al., 2016), or purchase (Paul et al., 2016); buy EVs and other sustainable technologies in China (Thyroff and Kilbourne, 2017), lower sensitivity to the price of EVs in Switzerland (Tanner and Kast, 2003), and are found to be willing to pay a premium to purchase EVs in Hong Kong (Ng et al., 2018).

H5: presence of environmental concern influences intention to adopt EVs.

2.3 Role of fear in intention to adopt EVs

The PMT uses fear as a motivator (De Steur et al., 2015). According to the PMT, when individuals face threats, they make two evaluations: threat and coping appraisal (Zhao et al., 2016). During threat appraisal, people assess the severity of the threat and their susceptibility to the same. In the coping appraisal phase, people try to evaluate their ability to handle the severity of the threat, and their vulnerability to the risk associated with the threat (Pakmehr et al., 2020). In the context of EV adoption, few studies have used PMT to analyze one's intention to adopt EVs (Deka et al., 2024; Langbroek et al., 2016, 2017; Bockarjova and Steg, 2014).

So far, we discussed how normative motivations can influence EV adoption. However, decision formation involves the interaction of the conscious and unconscious processes of the mind. Therefore, both cognitive and normative processes need to be considered to get a detailed perspective on the intention formation process. More so, because, in spreading environmental awareness about the dangers of using ICEVs, a person may be exposed to persuasive communications that hint toward personal harm. Shao and Yu

(2023) state that media coverage of news about climatic change issues causes eco-anxiety in many. Such eco-anxiety or fear of possible dangers from climate change is assessed by an individual in the threat appraisal process, according to the Protection Motivation Theory (PMT). Perceived vulnerability (PV) is another widely used threat appraisal component. PV refers to an individual's feeling of susceptibility to a possible threat (Bockarjova and Steg, 2014). PV is found to positively influence EV purchase decisions in Netherlands (Bockarjova and Steg, 2014), and India (Deka et al., 2024).

H6: perception of vulnerability from using petrol-diesel vehicle influences the intention to adopt EVs.

A feeling of vulnerability to possible harm triggers the coping appraisal process in individuals. Perceived behavioral control, response efficacy, and response cost are commonly used to represent the coping appraisal process. Perceived behavioral control (PBC) can be expressed as one's perception of the ability to comfortably use an EV (Deka et al., 2023). PBC positively influences one's intention to buy EVs in Canada (Mohamed et al., 2016), Malaysia (Vafaei-Zadeh et al., 2022; Afroz et al., 2015), India (Deka et al., 2023), and Pakistan (Shakeel, 2022). PBC also favorably influences the intention to adopt connected automated vehicles in six different European nations: the UK, Netherlands, France, Spain, Germany, and Italy (Post et al., 2024). However, no influence of PBC on intention to engage in EV battery swap technology is reported in Jiangsu province in China (Adu-Gyamfi et al., 2022).

H7: perceived behavioral control influences the intention to adopt EVs.

Another coping appraisal component is response efficacy (RE). RE is an individual's evaluation of the effectiveness of the response that is recommended to thwart or minimize the severity of the threat (Delfiyan et al., 2021). RE influences one's intention to adopt EVs (Bockarjova and Steg, 2014; Deka et al., 2024). Besides mobility, RE also favorably influences one's intention to engage in sustainable behaviors in domains like water conservation, sustainable diet, and other general pro-environmental behaviors, etc.

H8: efficacy of vehicular emissions mitigation response influences the intention to adopt EVs.

While evaluating the options for preventing or lowering the negative effect of the threat, an individual also assesses the cost of such actions. Such evaluation of the costs in terms of time and money required to undertake the actions recommended to mitigate threats is called the response cost (RC). Studies find that the lower the RC, the higher the intention to engage in sustainable behaviors. For instance, in the context of EV adoption, this association is found to hold in the context of the Netherlands (Bockarjova and Steg, 2014). However, in the Indian context, RC was not found to have a direct and inverse effect on the intention to adopt EVs (Deka et al., 2024).

H9: cost of mitigation response influences the intention to adopt EVs.

Based on the influence of norm and fear appeals in influencing behavior as stated in the literature, this study proposes to examine the following conceptual framework concerning the development of intention to adopt EVs in India. Hypotheses H1 to H9, in the conceptual framework of the study, are depicted in Figure 2.

The constructs included in the green set are the norm-based constructs, and the ones in the blue set are the fear-based constructs. The constructs in the top blue set represent threat appraisal, and those in the bottom blue set represent coping appraisal. Awareness of Consequence (AC) that lies in the intersection of the green and the blue set is common to both norm and fear-based constructs.

Norm and fear appeals are internalized differently by different individuals. So, the intensity of the effects is found to vary in different contexts. Differences in direct and mediated impacts are also observed for the same constructs in different contexts. Hence it is essential to account for the possibility of both direct and mediated effects of the NAM+PMT constructs on the intention to adopt EVs. As shown in the theoretical framework (Figure 2), we first check for the direct effect of these constructs on the intention to adopt EVs. In subsequent sections on mediation analysis, we shall also check for additional mediated pathways leading to intention formation.

3 Materials and procedure

3.1 Sampling and data

Primary data was collected through a mix of field surveys and online questionnaires. The questionnaire included items for all the constructs illustrated in the conceptual framework of the study (Figure 1). The selection of the sample was based on a combination of convenience and a random sampling framework, in line with existing studies (Jiang et al., 2020). Online questionnaires were emailed through personal email IDs and also shared via WhatsApp groups to which we had access. Hence, a convenient sampling frame had to be used for the online distribution of the questionnaires. Offline questionnaires were distributed to randomly selected office staff members and students in the offices and universities in which we were permitted to conduct the survey. Thus, the selection of the universities and offices was based on convenience and the selection of the sample was random for the offline data collection process. Existing literature (Astuti et al., 2019; Liu et al., 2019), already used students and office workers as samples for behavioral studies.

The use of a mix of convenience and random sampling introduces a limitation in the representativeness of the sample to the broader Indian middle-class population, considering the existence of huge diversity at a national scale. This sample is therefore aimed to only provide a representation of the middle-class population in Assam province of north-east India and those regions with similar socio-economic contexts. To explain EV adoption intentions for middle-class population across India, a quota or stratified sampling can better represent the diverse middle-class population at a national scale.

The targeted sample for the study were individuals between the ages of 18 and 60 years. Hence, both students

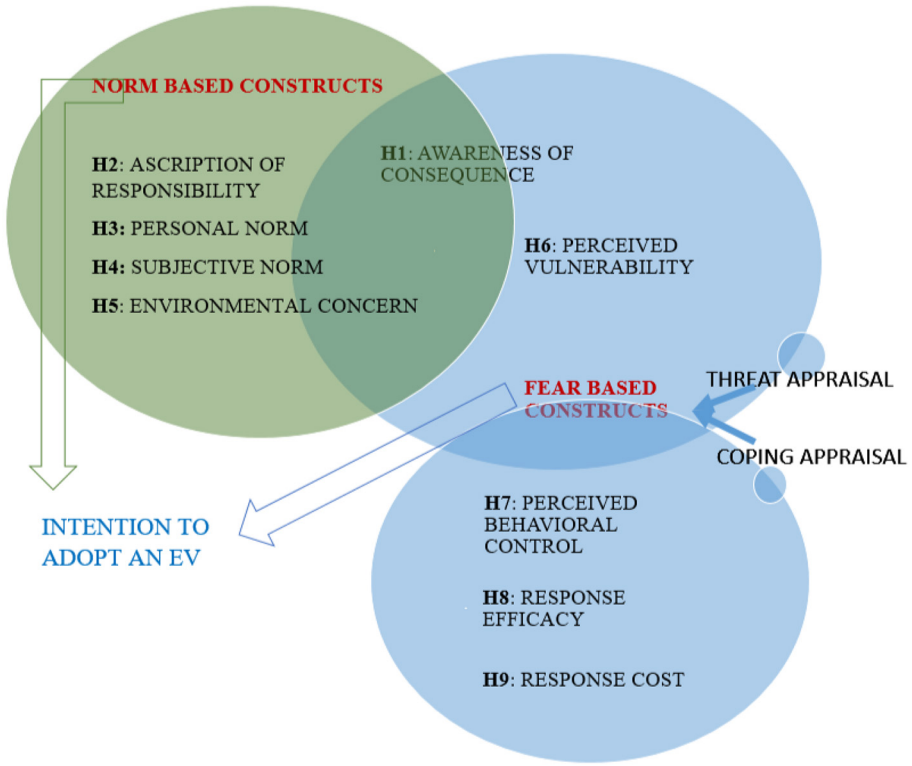

FIGURE 2
The conceptual framework of the study and hypothesis.

(above 18 years), and office workers (within 60 years) were selected to have a better representation of the future potential consumers of personal EVs. Around 400 questionnaires were distributed, and 330 complete responses were received, thus achieving a response rate of 82.50% (=330/400). Only middle-class individuals were selected for the study sample.

The "new middle class" is identified as a collection of people who are formally well-qualified, educated (Scott, 2021), salaried employees in managerial, technical, and other white-collared professions. With enhanced access to lifestyle and information, the middle class is willing to try newer products both in the national and global markets. Based on income, the National Council of Applied Economic Research (NCAER) classified the middle class into two sub-categories: "seekers" who earn an annual income between INR 200,000 and INR 500,000; and "strivers" whose annual earnings lie between INR 500,000 and INR 1,000,000. In the year 2009–10, 28.4 million households earning annual income between INR 250,000 and INR 1,250,000 were classified as middle-class households (Aslany, 2019). According to Atsmon et al. (2012, cited in Javalgi and Grossman, 2016), by 2030, India's middle-class consumers will constitute the world's largest middle-class consumer market and is expected to surpass China as well as the aggregate population of the developed West. This explains the need to consider this group's changing tastes, choices, aspirations, and motivations to increase the adoption of newer sustainable products like electric vehicles (EVs).

3.2 Sample description

Table 5 outlines a summary of the sample characteristics. The sample has an equal distribution of genders, with 49.7% females, and 49.4% males, and the remaining 0.6% chose not to disclose their gender. The younger age group, 18–25 years constituted a majority in the sample with 26.4%, followed by 39.7% of individuals in the age group-26–35. Only 13.9% of the participants belonged to the age group 36–45, and 19.4% in the age group 46–60. Most of the sample were highly educated, with 58.5% possessing a post-graduate degree or higher level of education, and 31% possessing a graduate degree.

The income categories depicted in Table 5 coincide with India's income tax slabs. A large proportion of India's middle-class are salaried employees who fall in the income range from INR 250,000 to 1,250,000 according to NCAER's 2009–10 estimates. Due to people's rising incomes over the years, the last two income categories are also included in this study. The sample displayed a wide distribution of annual household income. 25.4% of respondents earned an annual income of <250,000 Indian rupees (INR)[1] and an equal proportion (25%) also earned an annual income of INR 250,000–500,000. The annual income of almost half of the sample was <INR 500,000. One reason might be that the students constituted a significant proportion of the sample, and they were yet to enter formal employment. Hence, this finding

1 1 USD = 83.43 INR based on the commercial exchange rate on 04/05/2024 (https://Bloomberg.com).

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TABLE 5 Summary of demographic characteristics of the sample in second phase ($n = 330$).

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 and above	193	58.5%
Annual Household Income (INR)	<250,000	84	25.4%
	250,000–500,000	82	24.8%
	500,000–750,000	37	11.2%
	750,000–1,000,000	36	10.9%
	1,000,000–1,250,000	19	5.7%
	1,250,000–1,500,000	18	5.4%
	>1,500,000	33	10%
Residence	Village	46	13.9%
	Town	190	57.6%
	City	89	26.9%

should not pose a financial hindrance to purchase of personal EV purchases in the future. Some 22.2% of the sample earned an income of INR 500,000–1,000,000, while almost a quarter (21.15%) earned INR 1,000,000 and over INR 1,500,000 annually. A majority of the sample (57.6%) reside in big towns; 27% are residents of cities, and 14% live in rural areas.

TABLE 6 Factor loadings of indicators.

Indicator	Standardized indicator loadings
Awareness of Consequence (AC)	
AC1	0.738
AC3	0.756
Ascription of Responsibility (AR)	
AR1	0.873
AR3	0.646
Personal Norm (PN)	
PN1	0.576
PN2	0.727
Subjective Norm (SN)	
SN1	0.646
SN2	0.781
SN3	0.685
SN4	0.697
Perceived Behavioral Control (PBC)	
PBC1	0.714
PBC2	0.648
Perceived Vulnerability (PV)	
PV1	0.782
PV2	0.762
Response Efficacy (RE)	
RE1	0.756
RE2	0.649
Response Cost (RC)	
RC1	0.664
RC3	0.759
Intention (INT)	
INT1	0.889
INT2	0.694
INT3	0.820

4 Results and analysis

4.1 Measurement model

The scales for the latent constructs used in this study were adopted from the literature and were modified according to the requirements of the study (see Appendix A). 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.

Table 6 lists the factor loadings for the indicators of every construct. The indicators with factor loading <0.4 were dropped from further analysis (Hulland, 1999). Indicator "AC2" for awareness of consequence, "AR2" for ascription of responsibility, "PN3" for personal norm, indicators "PBC3," and "PBC4" for perceived behavioral control, "PV3" for perceived vulnerability, "RC2" for response cost are thus removed from subsequent analysis. Most of the other indicators have a factor loading of atleast 0.6.

The values for the composite ratio (CR) and the average variance extracted (AVE), which establishes the reliability and validity of the indicators (Hair et al., 2014) are listed in Table 7. The AVE value of each construct is 0.5 or higher, and the minimum value of CR is 0.638. Most of the other constructs have a CR value of 0.7 or higher. The reliability of the internal consistency is established by the values of Cronbach's alpha at 0.924, which exceeds the minimum recommended threshold of 0.7 (Hair et al., 2014). The AVE value is an indicator of the validity of the

TABLE 7 Reliability and validity assessment of indicators.

Construct	Average variance extracted (AVE)	Composite ratio (CR)	Variance inflation factor (VIF)
Awareness of Consequence (AC)	0.581	0.805	1.634
Ascription of responsibility (AR)	0.593	0.812	1.720
Personal Norms (PN)	0.549	0.779	3.108
Subjective Norms (SN)	0.516	0.809	2.510
Environmental Concern (EVC)	0.583	0.736	1.880
Perceived Behavioral Control (PBC)	0.5	0.638	1.393
Perceived Vulnerability (PV)	0.577	0.803	2.085
Response Efficacy (RE)	0.510	0.674	2.232
Response Cost (RC)	0.545	0.782	1.235
Intention (INT)	0.645	0.844	

measurement model. An AVE value of atleast 0.5 is recommended. From Table 7, we see that the AVE values of the latent constructs meet the desired range of 0.5. The validity of the constructs in the NAM+PMT model is established.

The Variance Inflation Factor (VIF) is used to assess for possible multicollinearity. As seen in Table 7, since the VIF values are <5 for every construct, hence the possibility of multicollinearity can be ruled out. An analysis of the bivariate correlation between constructs indicates low to moderate correlation coefficients, few other pairs of constructs like AR, EVC, PN, SN, PV, and RE exhibit a high inter-construct correlation. We further analyze the correlation matrix for these highly correlated constructs.

In Spearman's correlation matrix shown in Table 8, the inter-indicator correlation values mostly lie in the range 0.2–0.5 and very few values approximately are in the range 0.6–0.65. Since the correlation values are low, there is no significant collinearity among the independent variables. Collinearity is said to exist when the correlation coefficient values between independent variables are closer to 1 (Santibanez-Andrade et al., 2015). The VIF $<$ 5 and low inter-indicator correlations rule out the possibility of multicollinearity in the data.

4.2 Structural equation modeling

By the hypothesis proposed in the study in section 2, 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 9, an acceptable fit for Chisq/DF ($<$ 3) indicates that the model does not deviate significantly from the data used in the study (Kline, 2023). Cronbach's α is a measure of internal consistency reliability of a set of items measuring a construct. It reflects how well the indicators of a construct correlate with one another. A high value indicates strong construct validity of the model (Nunnally and Bernstein, 1994). RMSEA indicates if the approximation error of the model is small enough to be acceptable to the population. An acceptable RMSEA value reflects that the model fits the population covariance matrix well (Browne and Cudeck, 1992). AGFI indicates if the model reproduces the observed data well while penalizing model complexity (in terms of more parameters; Joreskog and Sorbom, 1989). CFI is a relative fit index, comparing the present model to a baseline model (Bentler, 1990).

According to Bentler (1990; cited in Pakmehr et al., 2020), the AGFI needs to be larger than 0.8; the CFI $>$0.9, and the RMSEA $<$0.8. Thus, the NAM+PMT model used in the context of this study is a good fit.

The measurement model also exceeds the recommended cut-offs for goodness of fit, as indicated by Chisq/DF equal to 2.26, root mean square error of approximation (RMSEA) equal to 0.063, and a comparative fit index (CFI) equal to 0.911. Chisq/DF indicates the deviance between the observed and model-implied covariance matrices.

Table 10 lists the squared multiple correlations (SMC), which are equivalent to the R-squared values. SMCs indicate the level of variance for the indicators of the constructs (Byrne, 2010).

The SMC values mostly lie in the range of 0.5–0.7, and the overall explanatory power for the dependent variable, intention (INT) is 0.676. Therefore 67.6% variation in intention is found to be explained by the construct along with its indicators. Thus, combination of norms and fear in the NAM+PMT framework is a significant improvement over the use of only fear motivations encompassed by the PMT framework to study intentions which has an explanatory power of 36.4% (Deka et al., 2024).

The standardized β coefficients for the hypothesized paths leading to intention formation are indicated in Table 11. Subjective norm has a positive and significant influence on the formation of intention to adopt EVs ($\beta = 0.671$, $p = 0.05$). This supports hypothesis H4. Interestingly, environmental concern, which is stated to be a popular determinant of intention in the literature is found to have a significant ($\beta = -0.284$, $p = 0.056$) thus supporting H5, but inverse relationship with intention formation. A plausible explanation for this finding may lie in India's broader energy and environmental context. Despite government's efforts to increase the share of renewables in the power generation mix, India's major share of power generation comes from thermal power plants (ICED, Niti Aayog). EV battery is not an environmentally friendly option as well. Such over-reliance on fossil fuel for electricity generation undermines people's perception of the environmental benefits of using EVs. Additionally, concerns surrounding the carbon footprint of EV batteries, including their production and end-of-life disposal may be another reason for skepticism among environmentally conscious individuals. Perceived vulnerability is found to have a direct and significant impact on the development of intention to adopt EVs, thus supporting hypothesis H7. Thus, the NAM+PMT framework found three direct pathways for influencing the formation of intention to adopt EVs in India.

TABLE 8 Correlation matrix.

	AR1	AR2	AR3	EVC1	EVC2	PN1	PN2	PN3	SN1	SN2	SN3	SN4	PV1	PV2	PV3	RE1	RE2
AR1	1.000																
AR2	0.658**	1.000															
AR3	0.0.541**	0.563**	1.000														
EVC1	0.0.302**	0.293**	0.309**	1.000													
EVC2	0.371**	0.344**	0.321**	0.574**	1.000												
PN1	0.380**	0.357**	0.369**	0.448**	0.495**	1.000											
PN2	0.445**	0.373**	0.377**	0.453**	0.459**	0.467**	1.000										
PN3	0.425**	0.443**	0.389**	0.409**	0.396**	0.460**	0.634**	1.000									
SN1	0.362**	0.357**	0.319**	0.342**	0.318**	0.372**	0.488**	0.602**	1.000								
SN2	0.339**	0.415**	0.346**	0.328**	0.343**	0.341**	0.532**	0.666**	0.539**	1.000							
SN3	0.350**	0.247**	0.255**	0.336**	0.370**	0.265**	0.447**	0.544**	0.474**	0.596**	1.000						
SN4	0.373**	0.308**	0.280**	0.317**	0.396**	0.373**	0.412**	0.565**	0.438**	0.570**	0.515**	1.000					
PV1	0.289**	0.276**	0.263**	0.383**	0.395**	0.332**	0.447**	0.428**	0.402**	0.379**	0.441**	0.307**	1.000				
PV2	0.313**	0.284**	0.284**	0.437**	0.432**	0.394**	0.375**	0.353**	0.282**	0.318**	0.336**	0.330**	0.598**	1.000			
PV3	0.343**	0.359**	0.322**	0.443**	0.378**	0.362**	0.372**	0.313**	0.330**	0.373**	0.323**	0.328**	0.545**	0.650**	1.000		
RE1	0.273**	0.370**	0.289**	0.351**	0.306**	0.364**	0.540**	0.606**	0.467**	0.534**	0.463**	0.411**	0.529**	0.436**	0.421**	1.000	
RE2	0.305**	0.253**	0.191**	0.365**	0.391**	0.351**	0.474**	0.418**	0.425**	0.381**	0.388**	0.348**	0.490**	0.475**	0.463**	0.519**	1.000

**Significant at 5% level of significance.

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TABLE 9 Goodness of fit indicators for NAM+PMT model.

Model	Chisq/DF	Cronbach α	RMSEA	AGFI	CFI
NAM + PMT	2.26	0.924	0.063	0.827	0.911

TABLE 10 Squared multiple correlations.

Squared multiple correlation (SMC)	Estimate
INT	0.676
INT3	0.672
INT2	0.482
INT1	0.791
RC3	0.576
RC1	0.442
RE2	0.421
RE1	0.571
PV2	0.581
PV1	0.611
PBC2	0.419
PBC1	0.510
SN4	0.485
SN3	0.469
SN2	0.610
SN1	0.417
PN2	0.529
PN1	0.332
EVC2	0.676
EVC1	0.506
AR3	0.418
AR1	0.762
AC3	0.572
AC1	0.544

The other remaining hypothesis was found to be rejected in the SEM analysis. The question that arises next is can the other intention formation pathways be straightaway rejected to have an impact at all? According to Preacher and Hayes (2008) and Zhao et al. (2010), even in the absence of a direct relationship between the two variables, there may be an indirect relationship through a third variable, called the mediator. The mediating relationships between the variables are discussed in the next section.

4.3 Mediated pathways

Other than subjective norms, environmental concern, and perceived vulnerability, none of the other constructs are found to have a direct influence on the formation of intentions for EV adoption. The results of mediation analysis show several other indirect pathways of intention formation through a mediator. The central tenet of the mechanism of mediation is that it engages a third variable, 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).

TABLE 11 Results of the structural equation model.

Hypothesized paths	Standardized estimates	*p*-value	Conclusion
H1: AC → INT	−0.153	0.167	Rejected
H2: AR → INT	0.167	0.169	Rejected
H3: PN → INT	0.067	0.821	Rejected
H4: SN → INT	0.671	0.050*	Supported
H5: EVC → INT	−0.284	0.056*	Supported
H6: PBC → INT	0.088	0.617	Rejected
H7: PV → INT	0.490	0.019**	Supported
H8: RE → INT	−0.249	0.417	Rejected
H9: RC → INT	0.115	0.341	Rejected

*Significant at 10% level of significance, **Significant at 5% level of significance.

In Figure 3, the curved arrows indicate the direct intention formation pathways. The straight arrows indicate the indirect pathways. The thicker the arrows, the stronger the effect size. The type of mediated pathways and the effect sizes are listed in Table 12.

The SEM results rejected hypothesis H1, stating no effect of awareness of consequence (AC) on intention (INT). However, AC is fully mediated by perceived vulnerability (PV) toward INT with a strong effect size of 0.2610. AC is also partially mediated by an ascription of responsibility (AR) with an effect size of 0.1496. Environmental concern (EVC) has an inverse relation with intention formation and is also partially mediated by several other constructs like AR (with an effect size of 0.1226); perceived behavioral control (PBC) with an effect size of 0.1036, PV with an effect size 0.2511, and response efficacy (RE) with an effect size 0.2244. AR does not have a direct or mediated pathway toward INT; however, it acts as an important mediator. Hypothesis H3 is rejected, indicating no impact of personal norms (PN) on intention. PN is partially mediated by PBC, leading to another indirect intention formation pathway with an effect size of 0.1034. PN also acts as an important mediator, and it partially mediates the relationship between response efficacy (RE) and INT with an effect size of 0.1696. PV has a direct intention formation pathway and is also partially mediated by PN with an effect size of 0.1762, PBC with an effect size of 0.1107, and RE with a high effect size of 0.2353. Hypothesis H9 which assumes a relationship between response cost (RC) and INT can be rejected as it has no direct or indirect effect, nor does it act as a mediator for any other construct.

Hence, despite the absence of a direct intention formation pathway due to statistical insignificance, most of these constructs are interconnected and influence intention directly or indirectly through mediated pathways with different impact strengths. Therefore, despite some constructs showing no direct statistical significance, yet these are theoretically relevant via mediation.

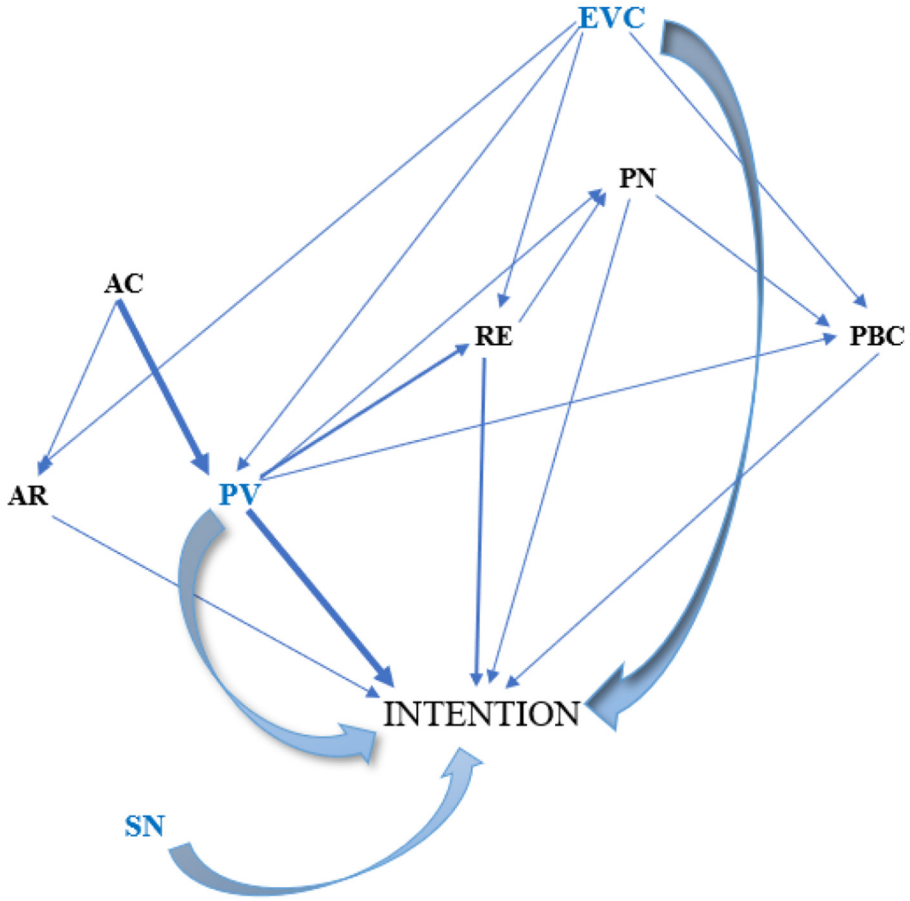

FIGURE 3
Mediated pathways in the NAM+PMT model.

Each construct thus deserves a considerable analysis of its possible impact on intention.

5 Discussions

In the context of middle-class people in a fast-developing province like Assam in India, both fear and norms can be used in combination to motivate one's decision to adopt EVs in the near future. This study accounts for interesting ways in which fear factors can be used to trigger one's pro-environmental intentions in combinations with normative factors. This is a novel contribution of the study, with fear factors being underexplored in the existing literature.

Subjective norms are the strongest norm-based determinant, and perceived vulnerability is the strongest fear-based determinant that has direct influence on intention. This supports Jansson et al. (2017) study which also find significance influence of social norms on people's intention to adopt EVs. Infact evidence on subjective norm is found to be consistent across studies. The other constructs influence intention to varying degrees. In this study, the components of threat appraisal were awareness of consequence (AC) and perceived vulnerability (PV). The components of coping appraisal are perceived behavioral control (PBC), response efficacy (RE), and response cost (RC).

The threat and coping process are not necessarily found to work in a sequential process. Rather, these are found to work in parallel. For instance, the components of threat appraisal, AC, and PV work together in a mediated pathway leading to intention formation. This may be because, despite the initial enthusiasm surrounding EV adoption based on lower operating cost of EVs, and other technical specifications (Munshi et al., 2022), people seem to re-think their adoption decision based on newspaper reports of risk-related issues like EV fires (Rao, 2025), and the limited charging infrastructure, particularly in 2-tier or 3-tier cities of Assam, thereby triggering a feeling of vulnerability with using EVs.

With regards to norm-based constructs, AC and AR do not necessarily trigger personal norms first, which then form intention; rather it is seen that AC, AR, and PN all work through separate intention formation pathways. This finding is in partial agreement to Norlund et al. (2016), He and Zhan (2018), and Choo et al. (2024) which reported that AC sequentially influences AR to ultimately form PN. Unlike Sweden and China, EV is still new in India. And in most of the 2-tier and 3-tier cities, a lack of knowledge regarding charging infrastructure, long-term cost and benefits of using EVs is widely seen among potential personal vehicle buyers (Barman

TABLE 12 Mediated intention formation pathways.

Pathways	Mediator	Effect	Size
AC → INT	PV	Full**	0.2230
AC → INT	AR	Partial**	0.1496
EVC → INT	AR	Partial**	0.1226
EVC → INT	PBC	Partial**	0.1036
EVC → INT	PV	Partial**	0.2511
EVC → INT	RE	Partial**	0.2244
PN → INT	PBC	Partial**	0.1034
RE → INT	PN	Partial**	0.1696
PV → INT	PN	Partial**	0.1762
PV → INT	PBC	Partial**	0.1107
PV → INT	RE	Partial**	0.2353

**Significant at 5% level of significance.

and Dutta, 2024). This is probably why only an awareness of the ill consequences (AC) of using a petrol/diesel vehicle is not sufficient to trigger one's feeling of responsibility (AR) to mitigate the same. People are unsure of taking responsibility without sufficient understanding of the EV eco-system. Nonetheless existing studies also confirm that AC influences intention through mediators, which is in line to the mediated AC-intention pathways as observed in this study. Once PN is triggered, it doesn't influence intention directly. This is in stark contrast to Norlund et al. (2016), He and Zhan (2018), and Choo et al. (2024) which finds PN as the strongest direct predictor of pro-environmental intention to adopt EVs. In Indian collectivist society, social approval and group norms assumes stronger influence on intention. Even if personal obligations may be present, the absence of collective behavior and societal validation reduces PN's direct influence on intention to adopt EVs.

Another contrasting observation from what otherwise seems to be intuitively true as in the case of Norlund et al. (2016) is the negative impact of environmental concern on the intention to adopt EVs. This may be because, in India power generation is majorly based on coal, and hence the potential of EVs to reduce GHG emissions is considered doubtful by many. However, if environmental concern is present along with one's belief in their ability to comfortably use an EV, and a fear of personal harm from continuing to use petrol/diesel vehicles coupled with optimism in the efficacy of their mitigation response, then it can positively influence intention to adopt EVs. This points toward two possibilities- in case individuals consciously and overly analyze EVs as a response to climate threat, then the future optimism gets marred with current lacunae in the ecosystem; and secondly, in the absence of excessive conscious thinking about the EV ecosystem, fear-based constructs can be nudged to trigger one's normative motivations toward EV adoption.

Intention is formed by a complex interplay of conscious and unconscious mental processes, combining past experiences, memories, beliefs, preferences, etc. (Slors, 2019). For individuals belonging to a collectivist society like Assam, opinion of the society plays a crucial role. More so, because personal vehicles are a status symbol in society, and hence others' perception of their personal vehicle choice turns out to be an important determinant of intention. Self-interest and the pressure to excel and outperform others, due to resource constraints of many kinds, are other social traits in this region. Hence, in a trade-off between environmental protection stemming from a simple awareness of the consequence of the ill effects of using a petrol/diesel vehicle vs. their aspirations for luxury involving carbon-intensive consumption, the latter might outweigh the former.

The socio-economic context of this study applies to people of all other regions who have lately begun to develop aspirations for better lifestyles. Particularly so, because the developing cities offering modern amenities and luxuries are a new phenomenon for many people in developing nations who have earlier lived in small towns without access to a variety of consumption options. Thus, the sense of personal vulnerability of resorting to carbon-intensive lifestyle like intensive use of personal petrol/diesel vehicles amidst the salient social competition for status enhancement needs to be perfectly balanced. While fear triggers one's unconscious reflexes and the need to act sustainably, engagement in social status enhancement is a conscious act, and combining fear appeals and normative motivations in EV promotion policies can organically develop people's intentions to do so.

6 Conclusion

This study suggests empirically grounded novel pathways for EV adoption intention based on the norm and fear-based socio-psychological factors, for a collectivist society like Assam, India. While the existing studies contribute knowledge on the technical aspects of EV, external facilitators, and individual volitional factors, this study deepens understanding in suggesting that EV promotion policies can span beyond financial incentives and technical provisions.

Subjective norms and perception of personal vulnerability have surfaced as crucial norm-based and fear-based triggers of EV adoption intention. It provides additional layers of insights in suggesting that mere dissemination of knowledge and awareness is insufficient without communicating how the ill effects might translate to personal vulnerability. The domination of subjective norms over personal norms suggests the importance of societal perceptions and external validation on people's lifestyle choices in collectivist societies.

While current initiatives like FAME (Faster Adoption and Manufacturing of Electric Vehicle) have enabled a steady rise in EV sales for some regions in India, the pace of EV adoption is insufficient to meaningfully mitigate GHG emissions, given the expanding personal vehicle fleet. A faster mobility transition from ICE vehicles to EVs is the need of the hour. Policy makers and EV firms may utilize nuanced behavioral intention pathways in designing the EV promotion policies. Local communication campaigns should link health risks associated to the increasing air quality deterioration from vehicular emissions. Assam being an agrarian state that also suffers from frequent floods and heatwaves in summer, it is hugely vulnerable to changes in rainfall pattern. Localized communication campaigns can also highlight risks of flood/heatwaves (in the immediate future) due to climate

change contributed in part by the excessively increasing vehicular emissions. Community events that highlight actions of peers and provide symbolic recognition can activate mechanisms of social validation which holds potential in a collectivist society like Assam. In addition, feedback tools or platforms that provide observable information on personal carbon footprints may activate one's response efficacy and perceived control. Strategies like the ones discussed aligns with the intention pathways found in this study and can reinforce EV adoption intention with higher efficacy compared to nation-wide campaigns.

A key limitation of this study is its focus on intention rather than on the actual adoption behavior as well, due to insufficient EV sales in Assam. Intention-behavior gap in EV adoption can be an interesting avenue for further research. In collaboration with small EV firms, localized marketing policies can be designed and promoted in accordance with the suggestions made in this study to examine its actual effects on EV sales. Future studies can examine how the EV adoption intention pathways evolve alongside a maturing EV ecosystem.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

Ethical review and approval was not required for the study on human participants in accordance with the local legislation and institutional requirements. Written informed consent from the [patients/participants OR patients/participants legal guardian/next of kin] was not required to participate in this study in accordance with the national legislation and the institutional requirements.

Author contributions

CD: Funding acquisition, Methodology, Writing – original draft, Software, Formal analysis, Investigation, Visualization, Resources, Supervision, Conceptualization, Validation, Project administration, Data curation, Writing – review & editing. MD: Writing – review & editing, Supervision. MY: Software, Writing – review & editing. NK: Writing – review & editing, Supervision.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Appendix

Appendix A. 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). (Please note: The indicators were presented as codes without mentioning the name of the construct that the indicator intends to measure).

1. Indicators for "awareness of consequence" (Shin et al., 2018).

- AC1: The use of conventional fuel vehicles leads to increase in CO_2 emissions into the environment.
- AC2: Increasing CO_2 emissions contribute to the climate change crisis.
- AC3: Increased use of petrol/diesel vehicles is contributing to the lower air quality of my surroundings.

2. Indicators for "ascription of responsibility" (Han et al., 2016; Rosenthal and Ho, 2020).

- AR1: I feel jointly responsible for the environmental damage caused due to the use of petrol/diesel vehicles.
- AR2: I feel jointly responsible for contributing to climate change crisis.
- AR3: I feel jointly responsible for not making an effort to find ways to mitigate vehicular emissions on my part.

3. Indicators for "personal norms" (Zhang et al., 2018; Shin et al., 2018; Rosenthal and Ho, 2020).

- 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.

4. Indicators for "subjective norms" (Zhang et al., 2020).

- 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.

5. Indicators for "environmental concern" (Shi et al., 2017; Ananno et al., 2021).

- EVC1: I am extremely worried about the state of drastically changing climate and what it means for my future.
- EVC2: increased carbon intensive consumption leads to extreme climatic events.

6. Indicators for "perceived behavioral control" (Han and Hyun, 2017; Han et al., 2016; Shi et al., 2017; Zhang et al., 2018; Lopes et al., 2019).

- 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.

7. Indicators for "perceived vulnerability" (Pakmehr et al., 2020; Delfiyan et al., 2021).

- PV1: increased use of petrol/diesel can negatively affect me through increasing air pollution.
- PV2: in my lifetime, I will experience the negative effects of climate change crisis due to increased use of petrol/diesel vehicles.
- PV3: my chances of being negatively affected by climate change crisis is high.

8. Indicators for "response efficacy" (Pakmehr et al., 2020; Delfiyan et al., 2021).

- RE1: my adopting an EV will reduce the negative effect of air pollution on me.
- RE2: my using an electric public transport will reduce the negative impact of carbon emission on my future generations.

9. Indicators for "response cost" (Pakmehr et al., 2020; Delfiyan et al., 2021).

- RC1: taking steps to reduce vehicular pollution costs too much money.
- RC2: taking steps to mitigate vehicular emissions takes up too much time.
- RC3: I find it inconvenient to take steps to mitigate vehicular emissions.