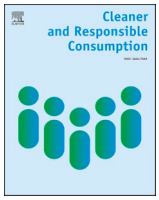
Cleaner and Responsible Consumption 13 (2024) 100191

Contents lists available at ScienceDirect

Cleaner and Responsible Consumption

journal homepage: www.journals.elsevier.com/cleaner-and-responsible-consumption



When 'fear factors' motivate people to adopt electric vehicles in India: An empirical investigation of the protection motivation theory

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ARTICLE INFO

Keywords:
Electric vehicle
Intention
Psychological distance
Threat appraisal
Coping action
Protection motivation theory

ABSTRACT

Climatic extremes have caused immense harm around the world. Its harm in terms of the proportion of people and regions affected continues to increase every single day. Due to people's psychological distance from such climatic threats, active initiatives are not undertaken for mitigation of its source. Rather, localized short-term solutions are marking a new status-quo. This study examines if fear can be used as a motivator to nudge people away from the psychological distance and motivate them to adopt electric vehicles (EVs). While subsidies and tax rebates are popularly adopted means to boost demand and supply of EVs, monetary incentives are costly to sustain for developing nations, amidst their diverse priorities. Instead, use of motivators like 'fear' is cheap, yet not much explored. Using the protection motivation theory, the study interviews 1112 Indian individuals, to examine if fear can nudge EV adoption. Using structural equation modeling and mediation analysis, the study finds that the expectation of personal harm from climatic threats can nudge one to actively mitigate the source of threat. Various aspects of threat and the associated coping processes that need to be triggered sequentially to nudge the formation of a pro-environmental intention to adopt EVs are also outlined.

1. Introduction

Climatic threats are affecting all nations to varying extents. Especially severe is the plight of small island nations in the South Pacific Ocean, like Vanuatu, Tuvalu, and Kiribati which are battling climatic risks in multiple aspects making the island population and future generations extremely vulnerable (Wadey et al., 2017). If the sea level continues to rise according to extreme projections, then 85% land area of several low-lying Maldivian atolls and other small islands could be submerged by the year 2100 (Khan et al., 2002). This directly hints at the displacement of a huge percentage of the population, giving birth to climate refugees in the future (Wadey et al., 2017).

Developing nations in Africa are also not far behind the island nations in terms of their climate change vulnerability. Rainfall in the interior regions in sub-Saharan Africa is projected to decrease by 10% by the year 2050, which will affect rain-fed agriculture amounting to 75% of the total agriculture. Water availability in the Nile basin is projected to decrease, whereas populous nations in the low-lying coastal regions like north Egypt, Gambia, Senegal, Madagascar, Mozambique, and South Africa (Bekun, 2024) face a risk of increased flooding due to rising sea levels. In 2019, more than 7 lakh people in South Africa were impacted by droughts, and 4500 people were displaced due to floods. Nations, earlier free from malarial transmission, like Kenya, Burundi, Rwanda, and Ethiopia are at an increased risk from changed distributions of vectors of certain diseases like malarial mosquitoes by 2080 (Brown et al., 2007). According to estimates, the monetary value of losses due to climatic disasters in South Africa was around $4.5 billion (Bekun, 2024).

South Asian developing nations like India is facing severe climatic impacts, especially the urban cities. Though the nation has learned to adapt to such risks, the unplanned expansion of cities to accommodate the increasing population threatens its adaptation capacity in the long run. Some cities are already experiencing events like urban flooding, water scarcity, conflicts over resources (Revi, 2008), heat and cold waves, etc. Several cities in India experienced temperatures of more than 48 °C in the year 2020. Despite increasing experiences with heavy rainfall, there is a decline in the total precipitation. Atleast one month in a year is marked by extreme water scarcity for billions of people. In

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https://doi.org/10.1016/j.clrc.2024.100191
Received 9 March 2024; Received in revised form 14 April 2024; Accepted 21 April 2024
Available online 22 April 2024

2020, Cyclone Amphan caused economic losses amounting to more than $13 billion and impacted about 13 million Indian people. Infact, the nation's poverty rate is projected to increase by 3.5% by 2040, due to a decrease in food productivity and increased food prices. This translates to about 50 million rise in poor people in one year (Picciariello et al., 2021).

Despite the seriousness of the climate change crisis and the associated threats, only a part of society is actively engaged with climate mitigation actions, others are still filled with disinterest or indifference towards pro-environmental actions (Korteling et al., 2023). Efforts are being made to break this indifference and foster interest. However, there seem to be inherent shortcomings in the present efforts extended via awareness campaigns through education, imagery, story-telling, etc. Communicating climate change threats through future scenario projections is also believed to enhance knowledge. However, some studies report ambiguous results. Scenarios are often projected into the distant future which is cognitively tough to visualize (Butler et al., 2020). People's mind is only capable of imagining up to 10 years in the future (Tonn et al., 2006). This is especially so in developing nations where people's priority is on fulfilling their basic needs (Richter et al., 2021). Several people seem to be psychologically distant from the climate change crisis (Spence et al., 2011). Higher psychological distance is found to be associated with lower pro-environmental intentions.

With the fast deterioration of air quality, health ailments like headaches, eye irritation, damage to the lungs, asthma, etc. are rapidly increasing. Yet, people seem to be indifferent to this crisis and the need to actively prevent the same (Maji et al., 2017; Kaur and Pandey, 2021). This seems like a case of psychological distance from the impending harm of air pollution crisis. Apart from the big metropolitan cities like Delhi, other fast-urbanizing cities like Gwalior (Dandotiya et al., 2020), Agra (Maji et al., 2017), etc., are also experiencing health ailments due to vehicular emissions. Though people are aware of the harmful implications of using internal combustion engine (ICE) vehicles, purchases of ICE vehicles are seen to continue. Awareness of the detrimental consequences of using ICE vehicles is also not found to have a significant impact on the development of pro-environmental intentions (Deka, 2022). Information and awareness might elicit an individual's feeling of helplessness, thus demoralizing them towards actively engaging in mitigation of environmental issues (Salomon et al., 2017). Studies state that an individual's membership in groups that can collectively fight climate change can mitigate such feelings of helplessness (Barth et al., 2021; Stollberg and Jonas, 2021). However, a focus on collective pro-environmental intention was found to have mixed results in terms of its intensity and efficacy (Rabinovich et al., 2022; Geiger et al., 2020). Sustainability actions like switching from ICE vehicles to EVs require all the more focus on an individual's intention rather than changing individual behavior through collective beliefs and norms, as the size of the population targeted for EV adoption can be quite large to assess collective norms.

At the level of individual, several studies have examined the intention to switch to EVs using the theory of planned behavior (TPB), the norm activation model (NAM), and technology acceptance models like TAM (technology acceptance model) and UTAUT (unified theory of acceptance and use of technology). Only five empirical studies have used fear as a motivator to nudge people away from the psychological distance to climate change and shape their intention to adopt EVs (Kothe et al., 2019), and hence there is a scope for more empirical studies on EV adoption using protection motivation theory (PMT). Of the existing 5 studies, one is based in the Netherlands (Bockarjova and Steg, 2014), one in the USA (Rainear and Christensen, 2017), and three studies in the context of Sweden (Langbroek et al., 2016, 2017, 2019). This resonates with the observation made by Ray (2021, cited in Ogunbode et al. (2022) that most studies on the negative effects of climate change issues are centered on Western nations. This is a gap, as young adult respondents in 4 Global South nations: Philippines (92%), Brazil (86%), India (80%), and Nigeria (70%) reported a feeling of fear for the future due to climate change (Hickman et al., 2021). Locational diversity in studies using fear as a motivator for EV adoption needs to be addressed as different regions may have diverse philosophies regarding sustainability (Haba et al., 2023), and differences in how fear is perceived due to past personal, and contextual experiences (Ogunbode et al., 2022). To convert people's fear into motivation and increase engagement in pro-environment behavior like the adoption of EVs, the use of fear appeals theory like the PMT theory is an appropriate choice over the more popular theories mentioned earlier.

This study takes one step forward in addressing these gaps and aims to develop an understanding of the role played by fear and how pro-environmental intentions develop in the process of coping with the threat. To achieve the same, it uses the PMT theory (Roger, 1975) to analyze pro-environmental intentions, in the context of the adoption of cleaner mobility like electric vehicles in India. The rest of the paper is arranged as follows: we begin with a discussion of the existing literature and derivation of the study hypotheses based on the literature, followed by the development of the conceptual framework of the study. We then describe the study location and outline the materials and the method used for the analysis, wherein the measures and the data used in the study are discussed. This is followed by a discussion of the results. The paper finally concludes with a discussion of policy implications, limitations, and directions for future research.

2. Literature review & conceptual framework

This review of literature classifies the findings based on the following themes: protection motivation theory and the intention to adopt EV, and a review of the threat and coping appraisal constructs, leading to the framing of the study hypotheses and the conceptual framework of the study.

2.1. The Protection Motivation Theory (PMT) and intention to adopt EV

The PMT theory is based on the central idea that two cognitive processes: the appraisal of threat and coping ability work together to trigger protective action against the threat. It says that when one is faced with any threat and also has the belief in one's ability to cope with it, then it will trigger one's protective behavior against the threat (Delfiyan et al., 2021). Originally developed to explain the intention to adopt protective behavior for one's health (Prentice-Dunn and Rogers, 1986), the PMT theory has been applied in a variety of sustainability contexts like sustainable management of waste (Janmaimool, 2017), farmer's intention for water conservation (Pakmehr et al., 2020; Mosavian et al., 2023), for sustainable drought management (Keshavarz and Karami, 2016; Delfiyan et al., 2021), people's intention to decrease the use of fossil fuel (Kothe et al., 2023), information seeking behavior for climate change (Li et al., 2023), etc. However, its use to study the development of intention to adopt EVs is limited. Studies that have attempted to map the complex relationships between 'awareness of risk', 'worry', and 'preparedness', have reported mixed findings. The heterogeneity in responses may be due to the differences in the conceptualization of the constructs, variations in cultural and economic settings of the study contexts, or due to the lack of one theoretical framework analyzing risk perception and associated mitigation behaviors (Kothe et al., 2019).

Bockarjova and Steg (2014) found that in the Netherlands, an ability to perceive the severity of the ill environmental effects of using conventional vehicles results in a higher likelihood of EV adoption. The likelihood increases when they have a positive expectation of a reduction in the severe environmental consequences after shifting towards EVs. In the context of Norway, Kester et al. (2020) stated that a large and abrupt change can be achieved by highlighting an undesired future caused by climate change in comparison to a shift that can be achieved by showcasing promises of mobility innovation without the presence of consumer acceptance for the same. Langbroek et al. (2016) found that in the Swedish context, response efficacy and self-efficacy are found to

have a significant impact on the intention to adopt EV. Threat appraisal is not found to have any significant influence on intention. Another study by Langbroek et al. (2017) analyzed the impact of threat appraisal and coping appraisal on the stage of behavior change, in greater Stockholm. The study found an indirect effect of threat appraisal on the stage of behavior change leading to an intention to reduce CO_2 emissions. Response efficacy is found to have a negative effect on the stage of behavior change, i.e., people were found to have a greater self-efficacy to adopt an EV in the later stages of the behavior change process. On comparing a few PMT constructs between people who rented an EV vs those who rented an ICEV on the island of Gotland, in Sweden, Langbroek et al. (2019) found no significant difference between the two groups. In the context of USA, the PMT constructs explained 51% variance in the intention to adopt EVs, with all the threat and coping constructs statistically significant. Perceived severity as a threat construct, and self-efficacy and response-efficacy as coping constructs are found to be the strongest predictors of intention to adopt EV. When threat and coping constructs are compared, the latter is found to have a higher impact on intention as compared to the former. Response cost was found to be the weakest predictor of intention to adopt EVs (Rainear and Christensen, 2017). It has to be noted however, that the PMT constructs are a part of the bigger models of TTM and PMT being tested in the studies by Langbroek et al. (2017, 2019), and not an exclusive empirical examination of the threat and coping appraisal process and its role in in shaping intention to adopt EV. While it adds significant insights into how threat and coping cumulatively function in the different stages of behavior, the direct and indirect mechanism of threat and coping process in shaping the intention to adopt EV is still a gap that needs to be filled.

2.2. PMT constructs & the conceptual framework of the study

The existing studies commonly use 'perceived risk' or 'severity', 'perceived vulnerability' or 'susceptibility', 'awareness of consequences' as the threat appraisal constructs; and 'self-efficacy' or 'perceived behavioral control', 'response efficacy', and 'response cost' as the coping appraisal constructs. 'Maladaptive response reward' is another less common threat appraisal construct found in existing studies.

2.2.1. Awareness of consequence

Marczak et al. (2023) found that awareness about climate change triggers different emotions, of which environmentally conscious Norwegian participants reported having frequent experiences of anger, fear, and sadness. Another online experiment with 3023 participants by Myers et al. (2023) reported that climate change informational messages trigger different emotions like anger, hope, fear, and sadness. People's awareness about climate issues is usually believed to cause one's concern for the same and thus encourage pro-environmental behavior (Chen et al., 2019). The favorable association between environmental knowledge or awareness and pro-environmental behavior is supported by several studies (Hwang et al., 2010; Lee, 2010; Pagiaslis and Krontalis, 2014). Some studies have also found that awareness leads to concern for the environment which then translates to perception of risks associated with climate change. This subsequently encourages one to engage in pro-environmental behavior (Milfont, 2012; Sundblad et al., 2007; Van der Linden, 2015). We thus hypothesize the following:

H1. Higher the awareness of consequence, higher the intention to adopt EVs

2.2.2. Perceived risk or severity

Perceived risk of climate change crisis evoke fear in an individual's mind (Rainear and Christensen, 2017). Several studies reported that a higher level of severity is related to a favorable intention to buy EVs (Bockarjova and Steg, 2014), tourists' energy-saving behavior (Horng et al., 2014), engagement in overall pro-environmental behavior (Rainear and Christensen, 2017; Almarshad, 2017), and involvement in adaptive farming (Keshavarz and Karami, 2016). When the effect of other PMT constructs is controlled for, then severity was not found to positively influence one's support for sustainable policies (Lam, 2015), farmer's soil conservation intention in Chile (Huenchuleo et al., 2012), tourists' energy-saving behavior (Horng et al., 2014). The association between severity and intention for pro-environmental behavior is also stated to vary according to the pro-environmental behavior under consideration, and the respondent's socio-economic status. It found that for the base of the pyramid consumers, severity leads to an intention to engage in low-cost pro-environmental actions, but not high-cost pro--environmental actions. For other consumers, severity was found to influence them to engage in all kinds of pro-environmental actions (Zhao et al., 2016). Chen (2016a,b) administered three levels of fear: high, moderate, and low. The study found that enhanced severity has a positive impact on the intention to lower one's footprint to mitigate climate change. However, participants in the high-fear group reported having experienced less fear compared to the low-fear group during the post-experimental operations. We hypothesize the following:

H2. Higher one's perceived risk of threat, higher the intention to adopt EVs

2.2.3. Perceived vulnerability or susceptibility

A higher level of vulnerability is found to evoke fear in people's minds (Rainear and Christensen, 2017). Perceived vulnerability is associated with an individual's intention to buy EVs (Bockarjova and Steg, 2014), to involve in both high and low cost private pro-environmental activities (Zhao et al., 2016), intention to engage in location-specific forestry among farmers (Eriksson, 2017), involvement in adaptive farming (Keshavarz and Karami, 2016), intention to engage in general sustainable behaviors (Almarshad, 2017), and intention to engage in aggregate index of private pro-environmental actions (Rainear and Christensen, 2017). In the context of public pro-environmental behaviors, susceptibility was not found to increase one's support for pro-environmental policies when the effect of other PMT constructs was controlled for (Lam, 2015), and susceptibility was not found to impact tourists' intention to engage in carbon saving behavior (Horng et al., 2014). It is found that studies that manipulated the perceived susceptibility construct found no favorable impact of the same on intention to engage in pro-environmental behavior. Based on the literature, we hypothesize the following:

H3. Higher one's perceived vulnerability, higher one's intention to adopt EVs

2.2.4. Perceived behavioral control or self-efficacy

Higher perceived behavioral control influences one's intention to buy EVs (Bockarjova and Steg, 2014), the pro-environmental behavior of farmers in conditions of droughts (Keshavarz and Karami, 2016), one's support for sustainable consumer behavior (Lam, 2015), tourist's intent and real energy saving behavior (Horng et al., 2014), intent to involve in sustainable consumer behaviors (Rainear and Christensen, 2017; Almarshad, 2017) and intent to reduce one's consumption of meat (Hunter and Roos, 2016). Zhao et al. (2016) found that the impact of self-efficacy on the intention to be involved in low-cost and high-cost pro-environmental is influenced by an individual's socio-economic condition. Self-efficacy influenced engagement in low-cost sustainable actions in participants with lower incomes, and high-cost sustainable actions in other participants when the effect of other PMT constructs is controlled for. Other studies have also found that self-efficacy has no impact on the intention to buy EVs in a hypothetical situation involving stated choice (Langbroek et al., 2016), and intention to practice location-specific forestry (Eriksson, 2017). The following hypothesis is proposed:

H4. Higher one's perceived behavioral control, higher one's intention

to adopt EVs

2.2.5. Response cost

A lower response cost in terms of monetary cost and cost of time is associated with a higher probability for an individual to engage in coping behavior to mitigate fear (Delfiyan et al., 2021). Higher response cost hurts intention to adopt EVs by Dutch drivers (Bockarjova and Steg, 2014), student's motivation to engage in general pro-environmental behaviors (Rainear and Christensen, 2017), farmer's adaptation to water scarcity (Pakmehr et al., 2020), and adaptive behavior of farmers in the event of droughts (Keshavarz and Karami, 2016; Delfiyan et al., 2021). Mosavian et al. (2023) found no effect of response cost on farmers' intention to conserve water. Based on these findings, we propose the following hypothesis:

H5. Higher the response cost, lower one's intention to adopt an EV

2.2.6. Response efficacy

Higher response efficacy is found to impact one's intention to buy EVs (Bockarjova and Steg, 2014), farmer's intent to pursue adaptive farming (Eriksson, 2017), actual adaptive farming behavior (Keshavarz and Karami, 2016), tourist's intent as well as real energy saving behavior (Horng et al., 2014), intent to shift to sustainable diet (Hunter and Roos, 2016), intent to conserve water at homes (Tapsuwan et al., 2017), intent to involve oneself in an aggregate index of private pro-environmental activities (Rainear and Christensen, 2017), intent for sustainable consumerism (Almarshad, 2017). Unlike in the case of other constructs, Zhao et al. (2016) find that even bottom-of-the pyramid consumers were willing to engage in both low-cost and high-cost pro--environmental activities in the presence of response efficacy, while for the remaining consumers, higher response efficacy was found to have an impact only to engage in low-cost pro-environmental activities. Langbroek et al. (2016) found no impact of response efficacy in the intention to adopt an EV in a situation of hypothetical stated choice. Based on the existing studies, we hypothesize the following:

H6. Higher the response efficacy, higher one's intention to adopt EVs

The hypothesis and the conceptual framework of the study is illustrated in Fig. 1. The threat appraisal constructs are shown in the left side and the coping appraisal construct are illustrated in the right side of the figure.

3. The study location

Due to vehicular emissions, several Indian cities are increasingly facing a serious issue of air quality degradation (Kaur and Pandey, 2021). With rising rural-urban migration, rising incomes, and aspirations of middle-income people who also constitute the largest consumer market for automobiles, the demand for personal vehicles is only increasing (Deka et al., 2023). To prevent further vehicular emissions, it is extremely crucial to replace the demand for conventional ICE vehicles with a demand for personal electric vehicles (EVs). This transition is crucial in both the metropolitan cities which have already expanded in an unplanned manner as well as in the developing cities which are still developing and have the scope for sustainable development. The study is based on three cities in northeast India: Guwahati city, which is a metropolitan city (population size of atleast 1 million individuals, Kundu et al., 2019), and Dibrugarh city and Tezpur city, which are non-metropolitan (population size of less than 1 million) developing cities.

Guwahati city is also one of the world's highest black carbon emitters, owing to vehicular emissions and dust (ENVIS Centre). Over the last 10–12 years, Guwahati city has urbanized very fast to accommodate the increasing population. Yet the absence of planned urbanization has left the city with a scarce network of only two main roads connecting various parts of the city adding to traffic congestion. Also the city's poor system of public transportation makes personal vehicles as the preferred mode for daily mobility. As can be seen in Fig. 2, Dibrugarh located in the easternmost part of Assam, is quite far from Guwahati which is located in the western part of Assam. Naturally, Dibrugarh has emerged as an urban hub in east Assam. Tezpur, located in central Assam is a center for education, tourism, defense, and other cultural & socio-economic activities and has a direct road and trade link with Arunachal Pradesh (Master Plan Urban Development Department

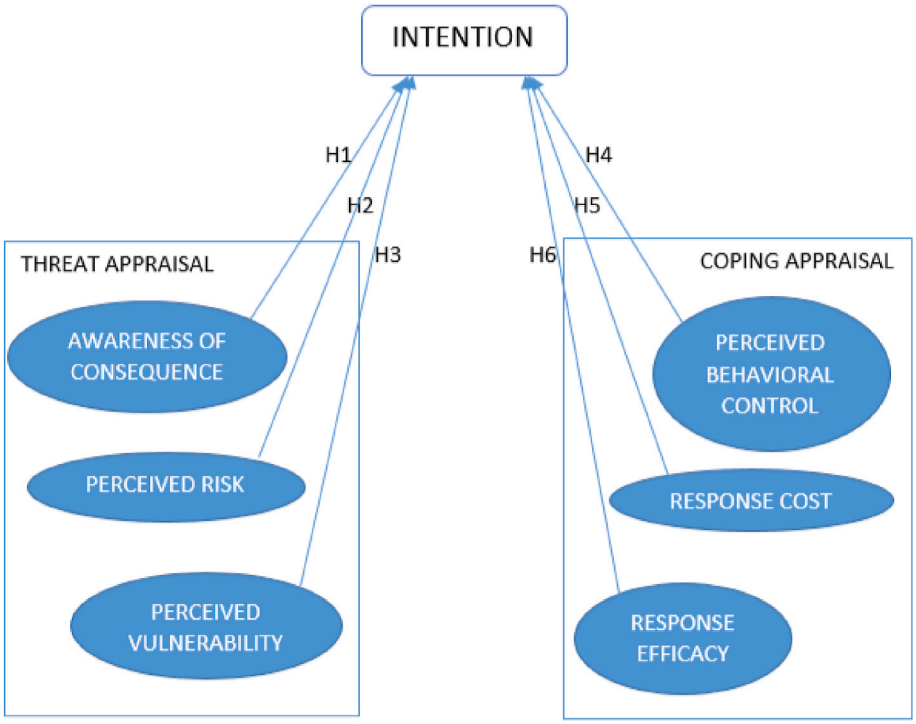

Fig. 1. The PMT model: Conceptual framework of the study.

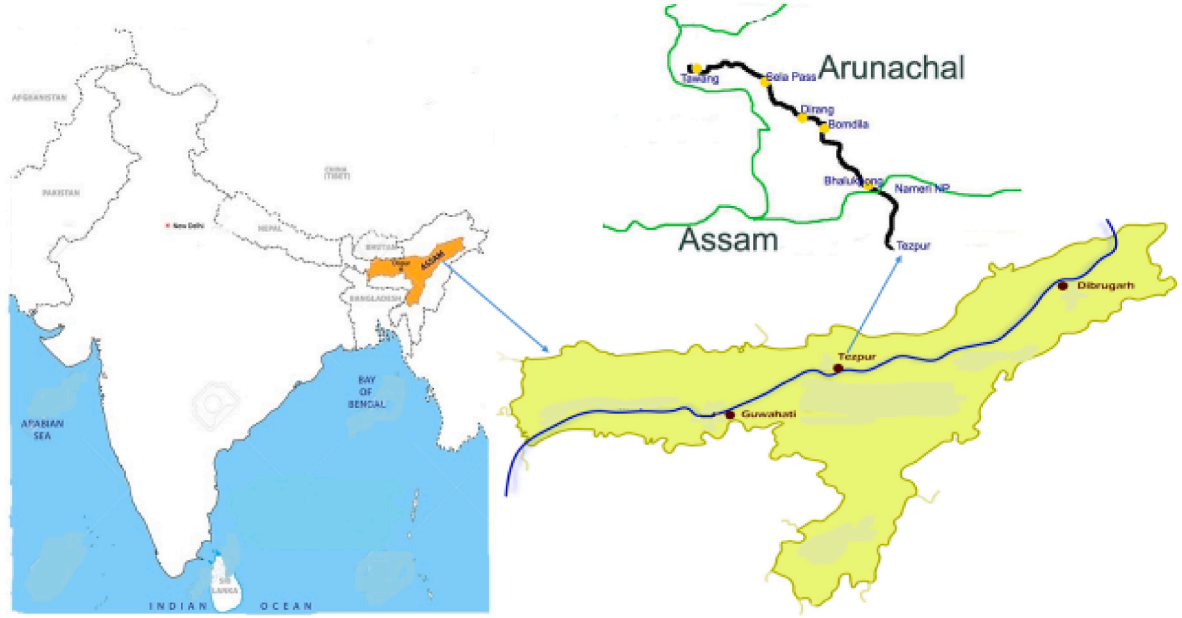

Fig. 2. The study sites: Guwahati city, Tezpur city, and Dibrugarh city in Assam, India (the map is not according to scale).

Housing & Urban Affairs). This study introduces an analysis of people's sustainable mobility intentions in the emerging cities of Assam in northeast India. These results can serve as a reference for analyzing sustainable mobility intentions in several developing nations' emerging cities, which do not have past experiences of best infrastructures but have high optimism for the same. What makes these study sites more interesting is the translation of fear into pro-environmental mobility intentions using the PMT framework, which was earlier examined only in Western nations.

4. Materials and methods

4.1. Measures

The latent constructs that are outlined in the conceptual framework of the study are included in the questionnaire. The scale for 'awareness of consequence' is adapted from Shin et al. (2018), and it represents an individual's knowledge of the consequences of performing or not performing a particular action. 'Perceived vulnerability' represents the degree to which an individual feels that he or she will be personally vulnerable to a threat or personally suffer from the harmful consequences of an action. The scale for perceived vulnerability is adapted from Rainear and Christensen (2017). 'Perceived risk' is adapted from Shahangian et al. (2022). Perceived risk refers to a person's internal evaluation of the gravity of the problem and its possible outcomes (Zobeidi et al., 2021). 'Perceived behavioral control' is measured using the scale used by Han and Hyun (2017), and it indicates an individual's perception of ease or difficulty of performing an action. The scale for 'response cost' is adapted from Delfiyan et al. (2021), and it indicates the cost of making efforts to take recommended actions to reduce the negative outcomes of a potential threat. The scale for 'response efficacy' is adapted from Delfiyan et al. (2021), and it represents an individual's assessment of the effectiveness of efforts undertaken to reduce the negative impact of the threat. Other demographic variables like gender, and location are used as control variables in this study.

4.2. Data collection

This study is based on primary data. This study targets middle-income individuals between the age of 18–60 in the sample pool. A combination of convenience and random sampling framework is used for the selection of the sample. Both online and offline questionnaires were distributed to the participants to have access to a large sample. Earlier studies also used a similar sampling framework (Yazdanpanah et al., 2021; Jiang et al., 2020). The online questionnaires were mailed through personal email IDs, via WhatsApp groups, etc. For the same, we could distribute the questionnaires only to those participants whose email IDs and WhatsApp groups we had access to, and thus online participants had to be selected through a convenience sampling framework. For the distribution of offline questionnaires only those office staff, and university students could be approached, where we could obtain institutional approval for the survey. However, once, the survey approval was attained, the offline questionnaires were distributed to randomly picked participants in each of the sampling locations. The questionnaire mentioned that the anonymity of participants would be maintained and it sought participant's agreement to participate in the survey. It contained the statements for each indicator (see Appendix A), to which the participants had to mark their agreement on a scale of 1–7, where 1 indicated 'strongly agree' and 7 indicated 'strongly disagree'.

Since this study aims to push for EV adoption in the near future, hence students are also considered an important sample for the study, as within the next few years they are expected to be in the working pool and also consumers of commodities like personal vehicle.

Initially, a pilot round of survey was initiated through the distribution of 220 questionnaires through Google forms in WhatsApp groups. Around 184 completed questionnaires were obtained, yielding a response rate of 83.6% (=184/220). In the final round of the survey, a total of 1400 questionnaires were distributed to the sample. 1112 filled responses were received, yielding a response rate of 79.42%.

4.3. Sample description

The demographic features and sample profile for the filled-in sample responses are described in the table below:

After the elimination of incomplete and inconsistent responses, 992 samples were retained for the final analysis. A higher proportion, 60.16% of the sample are females while only 39.84% are males (see Table 2). The disproportionate representation of gender is because a majority of the participants in this study are students enrolled in general (non-professional) graduation courses like economics, history,

geography, etc., and these courses are mostly popular among female students in India. It is important to consider the preferences of small cities which are fast developing and are on the path to becoming bigger cities soon. Hence, two non-metropolitan areas and one metropolitan area were considered in this study. Hence 73.29% of the sample belongs to non-metropolitan areas, while 26.71% sample belongs to metropolitan areas. Again, the middle-income population in India, whose incomes are fast rising are mostly residents in emerging cities, constituting a huge consumer segment for the personal vehicle market. This justifies the disproportionate sample distribution in the metropolitan and non-metropolitan areas (see Table 1).

5. Results and discussion

5.1. Measurement model

The internal consistency reliability, convergent and discriminant validity of constructs in this study were assessed using confirmatory factor analysis in SMART PLS. The values of composite reliability (CR), average variance extracted (AVE), and factor loadings of the indicators were used to examine the validity and reliability of the indicators. The indicators that had a factor loading less than 0.4 were eliminated from the study (Hulland, 1999). For instance, two out of three indicators in the construct perceived risk (PR) had a factor loading less than 0.4 and were removed. Finally, the construct PR had to be eliminated from the model as it was not found to be reliable and valid even after dropping the indicators with lower loadings. In addition, one indicator 'PBC2' is removed from the construct perceived behavioral control due to loadings less than 0.4. The standardized factor loadings of the remaining constructs are indicated in Table 3 below.

The internal consistency reliability of the constructs as indicated by the CR indicator, and the convergent validity of the construct, as indicated by the AVE indicator, is illustrated in Table 4. Reliability indicates the consistency or reproducibility of a construct (Hajjar, 2018). A construct is reliable when it consistently yields the same results under similar conditions (Neil, 2009). Construct validity indicates the accuracy of the construct. The AVE which explains the amount of variance accounted for by the indicators of a latent construct is used as an indicator for convergent validity.

As seen in Table 4, since the CR values for all constructs are greater than the desired cut-off of 0.708 (Hajjar, 2018), hence the internal consistency reliability of the constructs is established. Since the AVE values are higher than the recommended cut-off of 0.50, hence the convergent validity of the constructs is established.

Tables 5–7 indicate the discriminant validity of the constructs. Discriminant validity indicates the distinctiveness of the different constructs from each other. Table 5 lists the Heterotrait-Monotrait ratio (HTMT) value. The HTMT value is the average of all correlations of the items across the latent constructs evaluating various constructs.

As observed in Table 5, since the HTMT ratio values for all constructs are less than the cut-off value of 0.85 (conservative threshold) or 0.9, hence discriminant validity of the constructs is established (Latif et al., 2020).

Fornell-Larcker criterion is another indicator of discriminant validity. According to the Fornell-Larcker criterion, discriminant validity is said to be achieved when a latent construct accounts for more variance in its related indicators (in bold) in comparison to the variance it shares with other remaining constructs in the model (Henseler et al., 2015). As can be seen in Table 6, each construct has a higher variance with its associated indicators (indicated in bold) than the other constructs, hence discriminant validity is established.

Table 7 indicates the cross-loadings of the indicators which provides another assessment of discriminant validity. It reflects an association between an indicator/item and a construct other than the primary construct on which the item loads (Ronkko and Cho, 2022). Since every construct has a higher loading with its indicators (in bold) in comparison to its loadings with indicators of other constructs, hence discriminant validity is said to be achieved.

To rule out the possibility of common method bias, we check for the problem of multicollinearity in our data. Variance inflation factor (VIF) values are used to assess the existence of multicollinearity. It is measured as $V_j = 1/(1 - R_j^2)$, where R_j^2 indicates the R^2 index when the

Table 1
Summary of the sample demographic features.

Demographic Features	Category	Count	Percentage
Gender	Female	669	60.16%
	Male	443	39.84%
Location	Metropolitan	297	26.71%
	Non-metropolitan	815	73.29%

Table 2
Sample profile of the responses received.

Location	Profile	Size
Social Media Platform		180
Statistical Survey of India, Tezpur	Office Staff	7
Life Insurance Corporation of India	Office Staff	20
Cottage Industry Training Institute, Guwahati	Office Staff	20
Dept. of Water Resources Assam, Tezpur	Office Staff	10
Private Enterprises	Small Business Owners	13
Acquaintances	Office/Business	16
HSS Dept., IITG	PhD Research Scholars	30
Tezpur Central University	MSc Mathematics	18
Tezpur Central University	Faculty	6
Darrang College, Tezpur	Faculty	20
Cotton University, Guwahati	Students	185
B Barooah College, Guwahati	Students	92
North Guwahati College	Students	65
Dibrugarh University	Students	250
Darrang College, Tezpur	Students	159
Tezpur College	Students	21
Total		1112

Table 3
Factor loadings of the indicators for the latent constructs.

Construct	Indicator	Standardized Loadings
Awareness of Consequence (AC)	AC1	0.805
	AC2	0.832
	AC3	0.763
Perceived Vulnerability (PV)	PV1	0.824
	PV2	0.842
	PV3	0.703
Perceived Behavioral Control (PBC)	PBC1	0.775
	PBC2	0.786
	PBC4	0.641
Response Cost (RC)	RC1	0.879
	RC2	0.815
	RC3	0.682
Response Efficacy (RE)	RE1	0.908
	RE2	0.799
Intention (INT)	INT1	0.899
	INT2	0.829
	INT3	0.870

Table 4
Reliability & validity assessment of indicators.

Construct	Composite Ratio (CR)	Average Variance Extracted (AVE)
AC	0.842	0.641
PV	0.834	0.627
PBC	0.780	0.543
RC	0.837	0.634
RE	0.844	0.731
INT	0.900	0.751

Table 5
Discriminant validity assessment.

	Heterotrait-Monotrait Ratio (HTMT)
INT <-> AC	0.388
PBC <-> AC	0.377
PBC <-> INT	0.643
PV <-> AC	0.663
PV <-> INT	0.587
PV <-> PBC	0.514
RC <-> AC	0.104
RC <-> INT	0.211
RC <-> PBC	0.394
RC <-> PV	0.194
RE <-> AC	0.413
RE <-> INT	0.659
RE <-> PBC	0.590
RE <-> PV	0.770
RE <-> RC	0.328

Table 6
Fornell-Larcker criterion.

	AC	INT	PBC	PV	RC	RE
AC	**0.801**					
INT	0.300	**0.867**				
PBC	0.247	0.446	**0.737**			
PV	0.480	0.454	0.328	**0.792**		
RC	0.051	0.169	0.248	0.138	**0.796**	
RE	0.272	0.495	0.366	0.513	0.241	**0.855**

Table 7
Cross loadings.

	AC	INT	PBC	PV	RC	RE
AC1	**0.805**	0.229	0.204	0.372	0.068	0.213
AC2	**0.832**	0.246	0.174	0.409	0.016	0.199
AC3	**0.763**	0.245	0.215	0.371	0.040	0.241
INT1	0.243	**0.899**	0.422	0.380	0.142	0.454
INT2	0.282	**0.829**	0.346	0.423	0.123	0.423
INT3	0.257	**0.870**	0.388	0.377	0.174	0.408
PBC1	0.173	0.329	**0.775**	0.247	0.200	0.229
PBC2	0.251	0.355	**0.786**	0.296	0.135	0.263
PBC4	0.110	0.298	**0.641**	0.172	0.222	0.323
PV1	0.430	0.401	0.263	**0.824**	0.083	0.410
PV2	0.412	0.376	0.258	**0.842**	0.135	0.433
PV3	0.279	0.289	0.263	**0.703**	0.115	0.376
RC1	0.062	0.168	0.216	0.118	**0.879**	0.195
RC2	0.067	0.124	0.204	0.138	**0.815**	0.194
RC3	−0.027	0.098	0.170	0.067	**0.682**	0.197
RE1	0.207	0.488	0.369	0.437	0.297	**0.908**
RE2	0.275	0.340	0.238	0.450	0.080	**0.799**

jth independent variable is regressed on the other independent variables in the model. According to the rule of thumb, for any independent variable X_j, $V_j > 10$ indicates a significant level of multicollinearity. $V_j > 5$ indicates a considerable amount of multicollinearity and requires scrutiny (Marcoulides and Raykov, 2019). Since the VIF values (in Table 8) are all less than 5, the data used in this study has no problems of multicollinearity, and the possibility of common method bias can be ruled out.

5.2. Structural equation modeling

In this section, all the reliable and valid constructs from CFA analysis are fit into a structural equation model using PLS-SEM framework.

The standardized β coefficients for the significant pathways leading to the formation of an intent to adopt EVs are indicated in Table 9 and Fig. 3. Four direct intention formation pathways are identified, thus gaining support for four hypotheses: H1, H2, H4, and H6. Awareness of consequences (AC) is found to influence the intention (INT) to adopt EVs with an effect size of 0.067 (significant at 5%) on INT. Personal perceived vulnerability (PV) from the impending climate crisis due to using ICE vehicles is found to influence INT to adopt EVs with an effect size of 0.190 (significant at 1%). Thus according to the structural model, AC and PV lead to the appraisal of climatic threat which in turn triggers them to act towards averting the same. In trying to avert the same, the process of coping appraisal begins in an individual's psyche. Perceived behavioral control (PBC) is one aspect of the coping process. PBC is found to influence INT to adopt EVs with an effect size of 0.262 (significant at 1%). Response efficacy (RE) is found to directly lead to intention formation with an effect size of 0.282 (significant at 1% level).

Table 8
Collinearity assessment.

Indicators	Variance Inflation Factor (VIF)
INT1	2.376
INT2	1.663
INT3	2.145
AC1	1.532
AC2	1.582
AC3	1.273
PV1	1.415
PV2	1.545
PV3	1.287
PBC1	1.280
PBC2	1.265
PBC4	1.091
RC1	1.550
RC2	1.538
RC3	1.259
RE1	1.287
RE2	1.287

Table 9
Results of the structural equation model (significant pathways leading to pro-environmental intention).

Hypothesized paths	Standardized estimates	p-value
H1: Higher the awareness of consequences → Higher is the intention to adopt EVs	0.067[a]	0.048
H3: Higher the perception of vulnerability → Higher is the intention to adopt EVs	0.190[b]	0.000
H4: Higher the perceived behavioral control → Higher is the intention to adopt EVs	0.262[b]	0.000
H5: Lower the response cost → Higher is the intention to adopt EVs	0.006	0.818
H6: Higher the response efficacy → Higher is the intention to adopt EVs	0.282[b]	0.000

[a] Significant at 5%.
[b] Significant at 1%.

Table 10
Mediated pathways with their effect and size.

Pathways	Effect	Size	P-value
AC > PV > RC > PBC > RE > INT	Partial	0.001	0.013
AC > PV > PBC > INT	Partial	0.030	0.000
AC > PBC > RE > INT	Partial	0.007	0.006
AC > PV > RE > INT	**Partial**	**0.058**[b]	**0.000**
AC > PBC > INT	**Partial**	**0.032**[a]	**0.003**
AC > PV > INT	**Partial**	**0.091**[b]	**0.000**
PV > RC > PBC > RE > INT	Partial	0.002	0.009
PV > PBC > RE > INT	Partial	0.014	0.000
PV > PBC > INT	**Partial**	**0.064**[b]	**0.000**
PV > RE > INT	**Partial**	**0.121**[b]	**0.000**
RC > PBC > RE > INT	**Full**	**0.013**[b]	**0.000**
RC > PBC > INT	**Full**	**0.056**[b]	**0.000**
PBC > RE > INT	**Partial**	**0.060**[b]	**0.000**

[a] Significant at 5%.
[b] Significant at 1%.

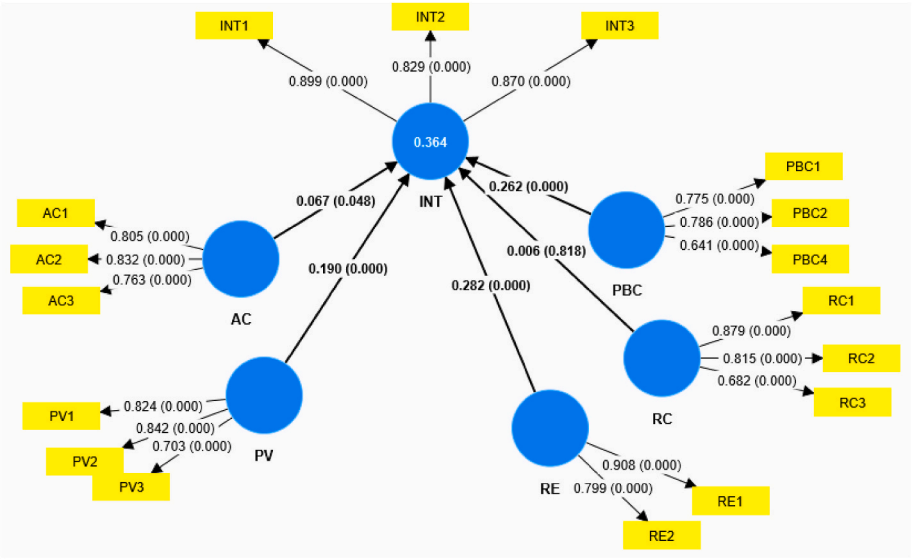

Fig. 3. The PMT structural model.

The cost of climate mitigation response (RC) is not found to have a direct impact on the formation of intention to adopt EVs (see Table 10).

5.3. Mediated pathways

Intention formation is a complex process, involving several steps and mediated processes. In this section, the results of the mediation analysis are discussed to highlight several other indirect pathways through which the intention to adopt EVs forms in an individual's mind. The mechanism of mediation analysis is based on the primary principle that it involves a third variable that functions as a mediator in the relationship between the dependent and the independent variable by transferring the impact of the latter on the former (MacKinnon et al., 2007).

The mediated intention formation pathways are illustrated in the table below. The ones in bold indicate a higher effect size on intention.

Fig. 4 shows the mediated intention formation pathways from each of the different constructs. Fig. 4a indicates the mediated pathways from AC to INT. AC has a direct impact on the formation of one's intention to adopt EVs, as indicated by the blue curved arrow. In addition, it has three indirect intention formation pathways. AC is partially mediated by PV and RE towards INT, with an effect size of 0.058. The second partially

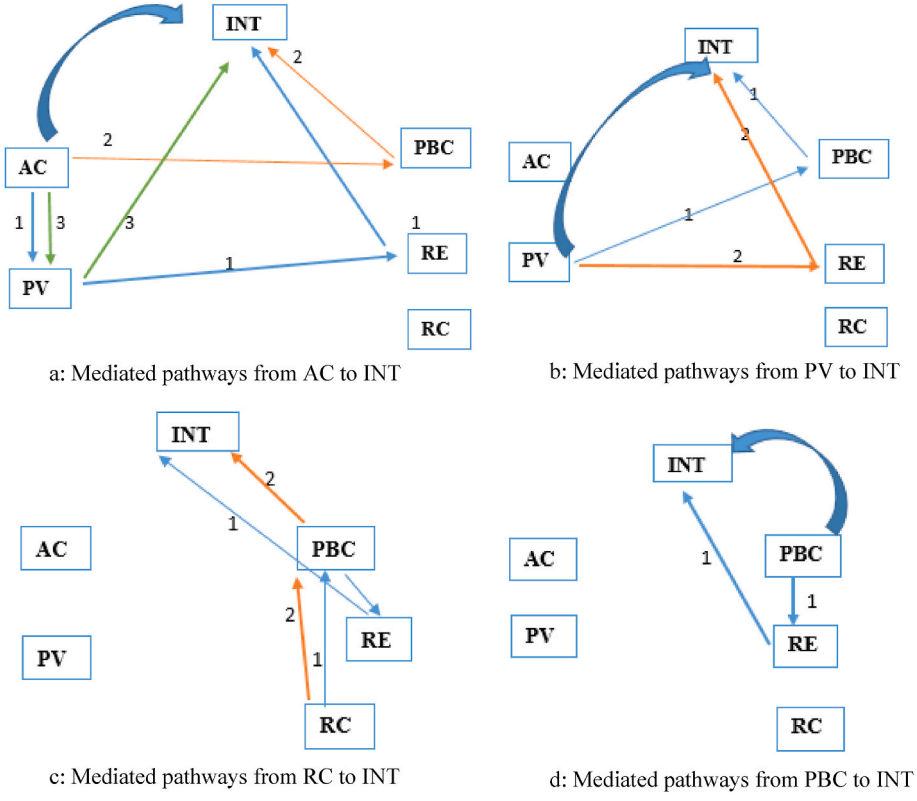

Fig. 4. Mediated intention formation pathways.

mediated pathway is from AC to PBC which then leads towards INT, with an effect size of 0.032. The third partially mediated pathway is from AC to PV which then leads it to INT. It has the highest effect size, 0.091 among all the mediated pathways from AC to INT. This third pathway does not involve the process of coping appraisal. Awareness of the impending harm and a feeling of personal vulnerability to the threat alone triggered threat appraisal. This observation hints at the fact that in the face of fear, an individual at times, may not be capable of systematic thinking to deal with the same, rather they act unconsciously. However, the first and second pathway follows the usual route of threat appraisal leading to coping appraisal finally resulting in pro-environmental intentions.

Fig. 4b shows the mediated pathways from PV to INT. In addition to the direct impact of PV on intention formation indicated by the blue curved arrow, it also has two other indirect pathways. PV is partially mediated by PBC towards INT, with an effect size of 0.064. A second partially mediated pathway is from PV to RE which then leads it towards INT. It has a high effect size of 0.121. In comparison to PBC, RE as a coping appraisal construct is found to be more relevant (more effect size) in the context of India, as observed for both AC and PV. Both AC and PV lead one to assess how effective it will be if they undertake any mitigation action. Hope for positive efficacy of their response leads to higher pro-environmental intentions.

Fig. 4c shows the mediated intention formation pathways from RC to INT. RC has no direct impact on the formation of intention to adopt EVs. Thus each of the two indirect intention formation pathways are fully mediated pathways. RC is found to trigger PBC which then triggers RE and subsequently, the chain leads towards INT. This fully mediated pathway has an effect size of 0.013. The second fully mediated intention formation pathway with effect size 0.056 is from RC to PBC which then leads it to INT. RC is found to have more relevance with PBC rather than with RE. This indicates that rather than assessing whether one's action will yield positive results or not, activation of RC assessment leads one to consider whether undertaking the action is in their control or not. When assessment of RE is involved along with RC and PBC, the chances of formation of one's pro-environmental intention reduces (from 0.056 effect size of path 2 to 0.013 effect size of path 1).

Lastly, Fig. 4d shows the indirect pathways from PBC to INT. PBC is partially mediated towards INT through RE with an effect size of 0.060. Unlike the combination of RC and RE, the combination of only PBC and RE increases the likelihood of the development of positive intentions. This indicates when an individual believes that undertaking an action is in their control and there exist expectations of positive outcomes from that action, then this chain of thinking increases the likelihood of developing an intention to adopt EVs.

These are some of the mediated intention formation pathways with a decent effect size. Several other mediated pathways were identified, which had very low effect sizes. Hence those are not discussed in this section.

6. Conclusion

While fear is mostly assumed to have a negative connotation, it can be used as a behavioral tool to nudge people towards desirable outcomes. This study highlights ways in which different aspects of fear can be cost-effectively used as a motivator. While developing awareness is primarily focused on, it has a small impact on triggering one's pro-environmental intentions. The interesting observation is that unless people experience a sense of personal vulnerability from the impending harm, it is hard to develop strong pro-environmental intentions. A feeling of personal vulnerability also has a three times higher effect on intention compared to only awareness of consequence. This directly points out the self-interest orientation of people, wherein sustainable actions seem attractive only if they yield personal benefit. While perceived risk is proved to have a significant effect in different study contexts as highlighted in the literature, in this study context, perception of risk is not found to be relevant. This may be because of the presence of high psychological distance in people's minds. Both awareness and personal vulnerability are together seen to trigger one's evaluation of threats due to poor air quality from vehicular emissions. Perceived behavioral control and efficacy of response are seen to have a high and direct impact on the development of one's pro-environmental intentions to adopt an EV. In the face of a threat, coping actions can only be triggered if people believe that doing so is within their ability or control. And that their actions can effectively mitigate the threat. Unless these beliefs are strong, organically developing one's pro-environmental intentions for adaptation or mitigation is difficult. The cost of undertaking mitigation actions does not seem to matter at the time when people are facing a threat.

While the PMT theory states that appraisal of threat combined with appraisal of coping strategies leads to pro-environmental actions, this study finds it otherwise in the context of triggering fear. Instead of awareness being combined with one's belief in the efficacy of their mitigation action, awareness combined with a feeling of personal vulnerability seems to have a much higher impact than the traditional route. However once the appraisal of threat is sufficiently high through the combined activation of awareness and vulnerability, then their belief in their ability to control their mitigation action coupled with the efficacy of the same can yield a significant effect on the development of pro-environmental intentions.

In Assam, people's adaptability has increased due to continued exposure to climatic disasters like floods and more recently, heat waves. Due to overexposure, and long years of experience, floods have become a way of life for many. For instance, people highly threatened by floods build houses on stilts, and others in urban areas also increase the height of the ground level of homes to avoid facing water logging during flash floods. People have adapted to climatic disasters without thinking about mitigating their source. While such measures have developed resilience, it is not suitable for a sustainability transition without people's welfare loss or further environmental damage. Whether local adaptation will be successful beyond a certain level of damage to the environment is also in question. Hence, policymakers need to utilize cost-effective tools like 'fear' in their climate action communication.

6.1. Policy implications

This study fills an important gap in outlining the implications of translating fear into intentions to adopt EVs in a metropolitan city and two other fast-emerging cities in a lesser-explored state of Assam in northeast India. One interesting theoretical implication is that threat and coping appraisal mechanisms can operate within their own set of constructs to influence intention. Threat appraisal need not necessarily be mediated towards intention through the coping appraisal mechanism. While in the USA, all the PMT constructs are found to influence one's intention to adopt an EV (Bockarjova and Steg, 2014); in Stockholm, knowledge and threat appraisal (when one is planning to use an EV in the next 6 months) and response efficacy (after one has used an EV for more than 6 months) influences intention (Langbroek et al., 2017), indicating a dominance of threat appraisal factors. Contrastingly, in the emerging cities in India, coping appraisal factors (response efficacy and perceived behavioral control) are found to have a stronger and direct effect on the intention to adopt EVs in comparison to threat appraisal factors (awareness and vulnerability). This indicates the absence of psychological distance in the context of using ICE vehicles among the people in these western nations.

Managers and policymakers must account for such behavioral differences in designing location-specific EV promotion policies. Since coping is relatively more dominant in the Indian context, hence climate change awareness campaigns need to focus more on communicating the effectiveness of using EVs, and the extent to which each individual can effectively de-carbonize the environment by adopting EVs. EV experience camps must be organized in emerging cities to provide the end-to-

end experience of operating an EV, from charging to driving and maintenance. This will instill the confidence in individuals of being able to comfortably maneuver EVs. On the question of using fear to trigger threats, only awareness campaigns may have limited impact. This hints towards the psychological distance that is active in people's minds when it comes to experiencing the negative repercussions of the climate crisis. Efficacy of awareness increases by threefold times if climate activists, policymakers, and EV promoters can communicate the harm that might befall them due to their inaction. In such a communication, care needs to be taken to highlight the harm at a personal level rather than at a macro level of the world, country, or region.

6.2. Limitations & future research

The use of a convenience sampling frame is a limitation. A completely random sample with equal representation of both genders and all age groups can be useful in generalizing the result. Perceived risk is found to be completely redundant in this study sample. Future studies should try to incorporate more contextually relevant items in the perceived risk construct. More studies are required that analyze how fear might differently influence intention in the different stages of the behavior change process, in the global south. Role of income, past experiences, and variations in coping capability that can break psychological distance to climate change and promote pro-environmental intentions can be explored.

CRediT authorship contribution statement

Chayasmita Deka: Writing – review & editing, Writing – original draft, Visualization, Validation, Resources, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Mrinal Kanti Dutta:** Supervision, Software, Resources, Project administration, Investigation. **Masoud Yazdanpanah:** Supervision, Software, Resources, Project administration, Conceptualization. **Nadejda Komendantova:** Supervision, Software, Resources, Project administration, Methodology.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Data will be made available on request.

Acknowledgement

A part of the work was supported by the Dr. Jyoti Parikh and Dr, Kirit Parikh Fellowship obtained during the YSSP 2022 program at IIASA, Laxenburg, Austria.

Appendix A. Statements used in the survey for the measurement 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 'awareness of consequences' (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 'perceived risks' (Shahangian et al., 2022)
   - PR1: Extreme weather events will increase to a large extent due to increase in CO_2 emissions
   - PR2: EVs might be difficult to adopt due to infrastructural issues
   - PR3: EVs might be difficult to adopt due to service-related issues
3. Indicators for 'perceived vulnerability' (Rainear and Christensen, 2017)
   - 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
4. Indicators for 'perceived behavioral control' (Han and Hyun, 2017)
   - 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 up to me
   - PBC4: It will not take me long to find charging stations near me to charge my EV
5. Indicators for 'response cost' (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

6 Indicators for 'response efficacy' (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

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