Mitigating Climate Change Through Behavioral Adaptation: Transition to Low- Carbon Mobility in Assam

A thesis submitted to Indian Institute of Technology Guwahati in partial fulfillment of the requirements for the degree of Doctor of Philosophy

Submitted by

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Declaration

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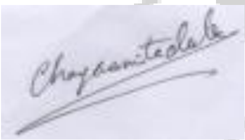
I hereby declare that the thesis titled "Mitigating Climate Change Through Behavioral Adaptation: Transition to Low-Carbon Mobility in Assam" is the result of research work carried out by me in the Department of Humanities and Social Sciences, Indian Institute of Technology Guwahati, India, under the supervision of Professor Mrinal Kanti Dutta, Professor of Economics in the Department of Humanities and Social Sciences, Indian Institute of Technology Guwahati, India.

In keeping with the general practice of reporting scientific observations, due acknowledgement has been made whenever the work described is based on findings of other investigations.



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Certificate

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This is to certify that the thesis titles "Mitigating Climate Change Through Behavioral Adaptation: Transition to Low-Carbon Mobility in Assam" submitted by Ms. Chayasmita Deka for the degree of Doctor of Philosophy in Economics in the Department of Humanities and Social Sciences at the Indian Institute of Technology Guwahati embodies bona-fide record of research work carried out under my supervision and guidance.

The present thesis or any part thereof has not been submitted to any other University for award of any degree or diploma. All assistance received by the researcher has been duly acknowledged.

Mrinal Dutta

Prof. Mrinal Kanti Dutta
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List of Abbreviations

AAS: Allocation of Allowance Savings
AC: Awareness of Consequence
AFV: Alternate Fuel Vehicle
AR: Ascription of Responsibility
ARF: Anonymous Reference Point
AT: Attitude
A&POA: Action & Post-Action
BS: Bharat Stage
CDM: Clean Development Mechanism
CFA: Confirmatory Factor Analysis
COP: Conference of Parties
CRF: Close Reference Point
CV: Conventional Fuel Vehicle
DMA: Diversified Mental Account
ET: Emissions Trading
EVs: Electric Vehicles
EVC: Environmental Concern
FAME: Faster Adoption and Manufacturing of Electric Vehicles
GHG: Greenhouse Gas
GIMC: General Information Mobility Choice
GLE: Green Labeled Earning
HAS: High Allowance Savings
HEV/PHEV/BEV: Hybrid/Plugin/Battery Electric Vehicle
ICE: Internal Combustion Engine
IEA: International Energy Agency
INT: Intention
JI: Joint Implementation
LDV: Light-Duty Vehicle
Lge: Liters of gasoline equivalent
MRF: Moderate Reference Point
NAM: Norm Activation Model
NEMMP: National Electric Mobility Mission Plan
PBC: Perceived Behavioral Control
PDNI: Pre-Decision No Interest
PDUS: Pre-Decision Unsure
PMV: Print Media Visibility

PMT: Protection Motivation Theory
PN: Personal Norm
PR: Perception of Risk
PRA: Pre-Action
PV: Perceived Vulnerability
RC: Response Cost
RE: Response Efficacy
SDG: Sustainable Development Goal
SEM: Structural Equation Modeling
SMV: Social Media Visibility
SN: Subjective Norm
SRBC: Self-Regulated Behavior Change
SUV: Sports Utility Vehicle
TAM: Technology Acceptance Model
TPB: Theory of Planned Behavior
TRA: Theory of Reasoned Action
TTM: Trans Theoretical Model
VBN: Value Belief Norm
UNFCCC: United Nations Framework Convention on Climate Change
UTAUT: Unified Theory of Acceptance and Use of Technology

Abstract

In recent years, there has been a manifold rise in the frequency of extreme climatic events. These unprecedented changes in weather patterns are hugely driven by anthropogenic causes led by increasing economic activities and exploitation of the natural quality of the environment. Of all the environmentally detrimental anthropogenic activities, the transportation sector is one of the huge contributors to the rising greenhouse gas (GHG) in the atmosphere, thereby accentuating climate change issues. This necessitates adopting low-carbon consumption in different carbon-intensive sectors. Some of the low-carbon transport options in India include public transport or the latest technological advancement in the form of electric vehicles (EVs). However, very few cities in India have an extensive network of public transport. In the case of Assam, several emerging towns and cities are not yet connected with a timely and efficient network of public transport systems. This leaves people with only one option, i.e., to use personal vehicles. With the rising incomes and aspirations of the middle-income group, the demand for carbon-intensive goods like internal combustion engine (ICE) personal vehicles is only increasing. Replacing the demand for ICE vehicles with demand for electric vehicles (EVs) can significantly decarbonize the transport sector, one of the highest carbon- emitting sectors. Such a transition towards low carbon mobility can be a step towards climate change mitigation on the part of individuals.

This thesis aims to address the existing research gap on climate change mitigation through behavioral adaptation, by critically examining different ways to incentivize people's adoption of EVs in Assam. Using structural equation modeling (SEM) and mediation analysis, we identify the direct and indirect pathways through which people might develop an intention to adopt EVs. Variations in the intention pathways for different demographic groups (gender, age and location) have also been analyzed and explained in terms of gain, norm, and fear & protection motivation, underlying the theory of planned behavior (TPB), norm activation model (NAM) and protection motivation theory (PMT) respectively. This thesis further develops a mental accounting-based vignette-stated choice survey to examine the impact of different nudges on people's stated choice for sustainable mobility and the results are analyzed by conducting a multinomial regression analysis. This thesis finally analyzes how the EV adoption intention pathways, and the impact of nudges differ according to the stage of behavior that a person is in.

Intention formation being a cognitive process, it is an individual level process. Therefore, the

socio-psychological indicators that influence the intention to adopt EVs in the developed nations are very different from the social, cultural, and economic contexts in a developing nation. This study fills a gap by critically examining various aspects of behavioral route to incentivizing EV adoption in the context of emerging towns and cities of Assam in India. The major findings of the thesis diverge significantly from the leading previous studies on drivers of EV adoption in nations like USA, UK, Germany, Australia, etc. Previous studies found attitude as one of the primary drivers of intention. In the context of Assam, subjective norms are found to significantly influence EV adoption particularly among middle-income people in small towns, where societal validation shapes decisions. Perceived behavioral control and ascription of responsibility also shapes intention to adopt EVs. Social media is found to amplify attitude, while social competition and status enhancement further drive intention. Encouraging people to view themselves as agents of change can boost their willingness to adopt EVs. However, environmental concerns about the use of coal-based electricity generation deter some environmentally conscious individuals. EV adoption depends on government initiatives like an increase in the use of renewables-based power generation, and an expansion of the EV infrastructure.

Women are found to be influenced by confidence of EV use, comfort, and moral obligations, while men respond more to social impressions due to frequent social engagements. Awareness campaigns combined with addressing the environmental concern are found to influence women towards EV adoption, while coping appraisal factors has an impact on both men and women. Demographic and regional factors also shape EV adoption preferences. Younger individuals are more influenced by personal confidence with EV use and digital communication, while middle aged individuals are more influenced by societal approval and efficacy of EVs.

Metropolitan residents expressed a stated choice for EV hatchbacks and SUVs, leveraging the presence of better infrastructure and a sense of control, whereas non-metropolitan residents are primarily motivated by societal approval. Financial behaviors and an individual's preferences of personal income allocation are also found to influence EV adoption intention. Individuals who are found to allocate income from green source to consumption of necessities or those who prefer to save income earned from green sources are more inclined to choose EVs. People who tend to save income towards luxury commodities and indulgence are found to be more likely to choose EV SUVs. General information about climate change is found to be an effective nudge in influencing one's choice favorably towards EVs over ICE vehicles. Behavioral transitions towards EV adoption decision is not found to necessarily follow a linear pathway as explained in the Stage Regulated Behavior Change (SRBC) model. In the early stages of pro-environmental behavior formation, subjective norms are found to dominate, but as an individual's behavior progresses, perceived behavioral control gains better control on one's decisions. The findings of this study underscore the need for targeted policies addressing gender, age, regional factors, and behavioral tendencies to effectively promote EV adoption.

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Chapter 1. Introduction

"*Climate change knows no borders. It will not stop before the Pacific Islands and the whole of the international community must shoulder a responsibility to bring about sustainable development*". These were the words of Angela Merkel, the Chancellor of Germany, as she calls out to the international community to act upon the looming climate crisis during the 2014 Annual Lowy Speech at the Lowy Institute in Sydney (Merkel, A. 2014).

The last five decades have witnessed much of the impacts of increasing greenhouse gas (GHG) emissions, climate change being one of them. GHG emission is considered as one of the biggest market failures, and negative externalities that the world has experienced (Stern, 2008). The future implications of increasing GHG emissions will depend on the present human activities and current consumption patterns (Canadell et al., 2010). The use of fossil fuel-based economic and lifestyle activities in most parts of the world is adding to the woes. Unlike other environmental externalities, the increasing GHG-induced climate change is not a localized externality, as it has a wide distributional effect (Bohringer, 2003). The impacts are felt worldwide with some island nations and low-income nations at the highest risk. Added to the grave nature of this global negative externality is the uncertainty associated with it (Nordhaus, 1993). Also, the limited technological, social, and financial resources make the developing nations most vulnerable to climate change impacts (Nath and Behera, 2010; Leichenko and Silva, 2014).

Along with the concern for rising GHG concentrations, there has been a parallel concern about the depletion of fossil fuel reserves. Few studies have pointed out the importance of considering fossil fuel depletion in its climatic projections (Aleklett et al., 2003). The issues of climate change and depletion of fossil fuel are related as the burning of fossil fuel is the major anthropogenic activity leading to increased CO_2 concentrations (Brecha, 2008; Kharecha and Hansen, 2008; Nel and Cooper, 2009; Zecca and Chiari, 2010). It has been found that a unit pulse injection of CO_2 into the atmosphere takes somewhere between a year to 1000 years to be absorbed by the natural carbon sinks, thus causing the global surface temperature to increase over the years (Zecca and Chiari, 2010).

The transport sector is one of the highest carbon-emitting sectors, accounting for 25% of the world's CO_2 emissions. It is projected that the CO_2 emissions from transport sector will double by 2035 (McCollum et al., 2018). With an increase in extreme climatic events, the need to mitigate greenhouse gas emissions has become even more crucial. Sustainable transport systems or the use of electric vehicles (EVs) have been accepted as one of the most promising solutions for decarbonizing the transportation sector (Bruckmann, 2022; Munshi et al., 2022; Huang and Qian, 2021; Singh et al., 2020; De Rubens et al., 2018). This shall also enhance a nation's oil security by reducing dependency (Huang and Qian, 2021) and curb local air pollution (Yang et al., 2019; Hawkins et al., 2012) as the immediate benefits. Hence, the multiple benefits associated with a shift towards EV also justify the urgency for the same.

1.1 The Current Mechanisms for Climate Change Mitigation

The sense of urgency for lowering carbon emissions among policymakers around the world led to the signing of the United Nations Framework Convention on Climate Change (UNFCCC), in 1992, whose main goal was to bring down GHG emissions to the 1990 levels. However, UNFCCC targets failed to materialize, and instead, GHG emissions rose considerably. Taking note of this development, in 1995, the Conference of Parties-1 (COP1) meeting came to the agreement that GHG concentrations can only be reduced by outlining strict emission reduction targets for individual countries, which needs to be achieved within a stipulated timeline. This resulted in the formation of the Kyoto Protocol, which was framed in the COP3, 1997, and modified through further negotiations (Finus, 2008). One important feature of the Protocol was the "Annex B" list of 38 developed nations of the OECD and a few nations of the former USSR. The Protocol lays down the GHG emissions limit for the Annex B nations. Talking of developments, three emission reduction mechanisms were developed through the Kyoto Protocol and are still applied in different parts of the world. These are Emissions Trading (ET), Joint Implementation (JI), and Clean Development Mechanism (CDM). Under the Emissions Trading mechanism, the Annex B nations can trade unused emission permits with one another. In the Joint Implementation mechanism, one Annex B nation can take up an emission reduction project in another Annex B nation at the cost of the beneficiary nation's emission permit. Keeping the same structure intact, these kinds of projects can also be undertaken in a non-Annex B nation under the Clean Development Mechanism (Grubb, 2004). But the CDM is a little complicated in its requirement of an independent agency's certification of the project (McKibbin and Wilcoxen, 2002). Today, even after 24 years of the emergency of the Kyoto Protocol, it has not been completely implemented. In fact, the very efficacy of the Kyoto Protocol mechanisms has been placed under the scanner by various researchers (Finus, 2008; McKibbin and Wilcoxen, 2002; Nordhaus, 1993).

It has been pointed out by Nordhaus (1993) that for mitigating climate change efficiently, consideration of the costs and benefits of such actions is very essential. In other words, efficient policies have to strike a fine balance at the margins, of the benefits of minimizing future damages, and the costs of efforts to slow down climate change. The Kyoto Protocol requires the participating nations to limit emissions to the 1990 level as it is considered as the benchmark level. The Protocol holds the 1990 benchmark level as fixed without considering the benefits and costs of doing so. Also, considering the uncertain nature of climate change, it is not possible to accurately estimate the marginal cost of abatement of GHG emissions. Monitoring private firms' marginal costs of abatement is all the way more difficult. In addition to that, the mechanisms necessitate immediate incurring of costs, with the outcomes to be realized years later. This means that even for the developed nations, compliance to the Protocol brings small environmental merits attached to significant compliance costs (McKibbin and Wilcoxen, 2002). With technology and innovation moving at a fast pace, it is believed that mitigation costs may be brought down further in the future. This is another reason behind nations' delaying compliance to the mechanisms (Finus, 2008). A case in point is USA's stance in its compliance with the Protocol (Grubb, 2003). The efficacy of the Protocol mechanisms also depends on its implementation. With no supranational authority to ensure compliance and high monitoring costs, there is a greater tendency towards free riding (Bohringer, 2003).

There are many flaws in the Kyoto Protocol mechanisms. Therefore, shifting to renewables as the primary energy source seems like another promising route to mitigate climate change. Literature has pointed out that India has immense potential for solar power generation, considering India's location and climate (Sen et al., 2016; Manju and Sagar, 2017; Lu et al., 2020). But unless cheaper storage technology is developed, even solar power must be complemented with fossil fuel-based power to ensure continuous power supply at night (Sindhu et al., 2016; Sindhu et al., 2017). This is the technological side of the mitigation effort that science is taking care of. As economists and policy researchers, we can develop ways to make people adopt renewables or switch from the present energy use patterns to renewables once these are economically viable. This necessitates a behavioral understanding of people's motivations for doing so. Mitigating climate change through behavioral adaptations is cost-effective (Andor and Fels, 2018) and can lead to a significant difference in a short time frame. For reductions in carbon emissions to be visible, it is a responsibility of each individual to change their present carbon-intensive behavior and adapt to sustainable choices. Individual climate action commitments are what lies in the actual control of every individual. Hence, it is of utmost importance to place climate mitigation policies within the realms of individual behavior. In the next section, we will establish the need for behavioral adaptation to mitigate climate change.

1.2 The Need for a Behavioral Recourse to Climate Change Mitigation

Driven by increasing consumerism, anthropogenic factors have recently aggravated the issues of climate change immensely, and climate extremes have begun to surface. People's lifestyle and behavior are impacting the climate and in turn, adverse climatic issues are changing human lifestyles (Gifford et al., 2011). These intricate interrelationships make climate change mitigation a complex subject. Hence, to realize the same, changes ought to be made right from the societal level encompassing agents as small as the households, or better still, individuals because around 72% of all GHG emissions are due to household consumption activities of various kinds, (Stankuniene et al., 2020) yet human behavior is that aspect of climate change studies that is least understood (Gifford et al., 2011).

According to Stephenson et al. (2010), achieving every marginal shift towards adopting energy- efficient behavior requires the knowledge of factors that drives behavior and their application into well-designed interventions. However, bringing a change in lifestyle patterns to mitigate increasing GHG concentrations is found to be daunting. Therefore, Stoll-Kleemann et al. (2001) stresses on the need to analyze psychological and social motivators behind individuals' creation of mental barriers in their self-commitment to mitigate climate change, despite their existing anxieties about threats related to climate change. Behavioral economics has empirically established that personal material gain is not the only determining factor of a person's behavior, but there are other factors such as societal norms, perception of fairness, social acceptance, social status, etc., which also determine a person's behavior (Brekke and Johansson-Stenman, 2008; Evensky, 2005). If we can make modifications in people's behavior to minimize the demand for energy, or make demand more responsive to energy shortages over space and time, then it will contribute tremendously in implementing low-carbon technologies, renewable energy, and mitigating climate change issues. Research insights on behavioral economics state that 'nudge' or behavioral intervention can be useful tools in modifying people's behavior towards low-GHG emission sources (Andor and Fels, 2018). According to Thaler and Sunstein (2009, pp 6 and 8), a nudge is "any aspect of the choice architecture that alters people's behavior in a predictable way without forbidding any options or significantly changing their economic incentives". The following example elucidates the rationale for using nudge: out of the several decisions we make in a day, some are impactful, while others are trivial. Some decisions present before us, a series of tough alternatives to choose from, while others are quite easy. In all these situations, a lot of information accumulation takes place. But mostly, when one must make decisions instantly, they hardly analyze the accumulated information, instead, they rely on their gut feeling (Lofgren and Nordblom, 2020), or other mental heuristics or shortcuts. Such cognitive limitations make it difficult to comprehend the situation that a person is in and explain their imperfect capability of processing novel information (Thaler and Sunstein, 2003). This is why people fail to display consistent behavior while making decisions on their long-term intentions (O'Donoghue and Rabin, 1999). Nudges can provide solutions in such situations (Momsen and Stoek, 2014).

Several studies have proved the efficacy of using nudges in the context of energy consumption behavior (Allcott, 2011; Allcott and Rogers, 2012; Costa and Kahn, 2013), and also in using nudges as instruments in designing energy policy (Allcott and Mullainathan, 2010). Nudges that modify the choice architecture are typically used to guide the choices of people towards the desired behavior without creating limitations or distortions in the choice alternatives available in that situation (Lofgren and Nordblom, 2020).

1.3 Use of Nudges for Pro-Environmental Behavior Change

The existing literature on nudges is mostly empirical. Meub et al., (2019) report the results from a field experiment carried out in the German context. They aimed to analyze the implications of two different nudges (social comparison and consumption feedback) targeting electricity use behavior. Studies carried out on similar lines have found a significant effect of treatment on the consumption of electricity, but there might be a sizeable difference in the individual behavior as a response to these treatments. It reported no significant effect of treatments in the electricity consumption among German participants. This heterogeneity in outcomes hint towards the fact that the context of the study also influences the outcomes of social comparison and consumption feedback treatments.

Mahmoodi et al., (2018) state that one way of achieving sustainability goals for electrical utilities is by designing efficient tariffs which can prime consumers to conserve electricity. Past literature finds that imposing penalties on overuse can help promote electricity savings among consumers, which is also in accordance with behavioral theories which say that people react more in the domains of losses than in the domains of gains. In this study, the authors use a choice experiment in the context of Switzerland, to analyze consumers' choice for electricity consumption tariffs that combines penalties and rewards. Results indicate that consumers' preference is for tariffs which provide rewards for consumers who can decrease their use of electricity as compared to tariffs that impose a penalty for excessive consumption of electricity. Also, combining rewards and penalties in tariffs can help achieve huge acceptance in the market.

Nudges are also finding wide acceptance as complementary tools along with economic incentives for behavioral change. However, non-complementarities between them have also been pointed out. Synergies do not exist between behavioral interventions like goal setting and feedback, and the traditional policy tools like financial incentives. There is no complementarity between them. In fact, using nudges as a tool deviates the attention of people away from financial incentives (Fanghella et al., 2021). In our daily lives, we are embedded in many different social networks. Many times, we compete with the other acquaintances in our networks to be ahead in many aspects, be it consumption or lifestyle. A series of four experiments carried out by Antinyan et al., (2020), tried to explore ways to reduce the consumption of luxury goods, even when people are competing to be ahead of each other in their social networks. When the number of participants undergoing the intervention and the intervention type (tax or nudge) is manipulated, it was found that both tax and nudge can work as efficient instruments to limit luxury goods consumption, when the intervention is administered to the whole network. However, if only the core network node is taxed or nudged, then there are no spillover effects to the other nodes from the core. In this case, nudge and tax might not be effective. Ghesla et al. (2019) studied the impacts of default nudge and possible spillover effect and states that no unfavorable spillover effect results in pro-social behavior initiated through choice defaults. Peer et al. (2020) analyzed the person-to-person variations in styles of decision-making and selects the most effective nudge that a person should be given from a list of different online password nudges. It finds that customized nudges can provide a better result and enhance the efficacy of nudge by up to four times in comparison to a 'one-size-fits-all' nudge.

My and Ouvrard (2019) examines the impact of a tax or a nudge on the levels of contribution to a public good. The tax was found to be more effective than a nudge. The impact of the nudge was dependent on the person's sensitivity to the environment. Secondly, the impact of a nudge was found to be effective only for people who had high sensitivity towards the environment, and the efficacy of the nudge was only temporary. Murakami et al., (2020) analyze the implications of non-monetary and monetary incentives on people's energy-saving behavior. From a field experiment conducted in Japan, the authors find that on average, there is a 4% decrease in consumption of electricity due to the rebate; whereas the energy saving achieved from nudge is almost zero. Through the application of machine learning techniques and analysis of causal inference forecasts, it finds that nudge interventions lead to more heterogeneity at the level of households. Hence, to enhance the efficiency of non-monetary and monetary interventions, people should be selectively targeted with different treatment.

Russell-Bennett et al. (2019) studied the impact of interventions on the demand side, where it attempted to examine in what way the demand-side interventions can support consumers to lessen the consumption of electricity on extremely hot or cold days, thereby lowering the infrastructural load and maintaining lower prices. It tested the impacts of the four nudges namely: 'hugs' (prize, or reward), 'smack' (penalty or punishment), 'nudge' (default option), and 'shoves' (limited options). The study finds that 'shove' is best responded to by participants and is also more long- lasting, whereas, in the context of peak demand, consumers are found to react to small shoves, with the effect diminishing over time. Andersson and Nelander (2021) examined the effect of 'Menu-Primacy' on customers' choice of lunch. They found that if a vegetarian option was placed on the topmost part of the menu and the non-vegetarian option at the bottom, there was an 11% reduction in the sale of the meat. This led to a 6% reduction of daily GHG emissions due to the sale of food.

The point of this discussion is that nudges are increasingly applied as a behavioral economic tool to bring about desired behavioral changes without coercion, and without completely ruling out conscious action. Considering these characteristics of nudges, this can be a productive way to mitigate GHG emissions by promoting low-carbon consumption. This can be a potential way to shape people's pro-environmental intentions even in the context of one-time high-impact actions like the purchase of an EV.

1.4 The Situation of Climate Change in India and the Need for EVs

1.4.1 The climate change situation in India

Increasing GHG emissions are leading to visible climate change impacts in India. In the recent years, an increase in the frequency of climate extreme events like high temperatures, irregular monsoon, increased floods, and an overall irregularity in the regional climatic pattern etc., has been observed. This period of climate emergency also coincides with India's fast urbanization and economic growth process. Increasing economic activities, changes in land use for commercial, industrial, and residential use, and consumption of energy for transportation, appliances, infrastructure, etc., increases GHG emissions which further aggravates the climate extreme events (Mukhopadhyay and Revi, 2016). Today, almost all regions in India is facing some form of vulnerability from climate risks. Coastal regions in India are vulnerable to flooding, rise in sea level, urban heat island etc. (Murali and Kumar, 2015; Pramanik, 2017; Sanchez and Govindarajulu, 2023). Rise in the sea level is set to severely impact coastal farming and the fishing community who makes up 17% of India's population in 593 coastal districts in Mumbai, Kutch, Kerala, Lakshadweep, and Tamil Nadu (Roy et al., 2023). Increase in the salinity of soil caused by the rise in sea level and irregularities in rainfall patterns have impacted agricultural production, leading to risks of food shortages. About one-third population in India depends on the agricultural sector for their living. Rising temperatures in recent times have caused increased evaporation, decreased quantity of water available for irrigation, thereby, affecting crop yields (Ahmed et al., 2023). A drastic rise in the semi-humid to humid zone and semi-arid to arid zone transition caused by irregular patterns of precipitation in parts of Gujarat and Rajasthan in the western region of India is projected to be at increased vulnerability to cyclones, and extreme flood events by the year 2050 compared to the present time (Panda et al., 2023). The emergence of seasonal daytime and night-time urban heat islands has been observed in emerging cities like Guwahati in northeast India and Bhopal, respectively (Mohammad and Goswami, 2023). Other issues like urban flooding are increasingly affecting not only megacities but also affecting billions of people living in the smaller and intermediate cities (Singh et al., 2023).

1.4.2 Contribution of India's transport sector to climate change

The transport sector is one of the highest carbon-emitting sectors worldwide, accounting for 25% of global CO_2 emissions. This figure is projected to double by 2035 (McCollum et al., 2018). In 2016, India's transport sector alone contributed 11% of vehicular CO_2 emissions, making it the world's third-highest emitter of CO_2 (Janssens-Maenhout et al., 2017). Road transportation alone accounted for 56% of CO_2 emissions in the year 2023 (Hossain et al., 2023). This is partly because of the huge domestic demand for two-wheelers (Bansal et al., 2021) and four-wheelers (Chugh and Cropper, 2017), intensified by the growing size of middle-class group, whose incomes and demands are fast increasing (Farrell and Beinhocker, 2007). In 2022, India surpassed Germany to become the fourth biggest market for automobiles.

Automobile sales are projected to further rise in the coming years (Bansal et al., 2021a). The transportation sector contributes approximately 305.3 MtCO2e GHG emissions (CEEW, 2021). In terms of per capita CO_2 emissions in India, it increased from 0.39 metric tons in 1970 to 1.87 metric tons in 2019 (Tiseo, 2022). Adoption of electric vehicles (EVs) is one of the most promising solutions to eliminate these rising vehicular emissions (De Rubens et al., 2018; Yang et al., 2019; Singh et al., 2020; Huang & Qian, 2021; Bruckmann, 2022; Munshi et al., 2022). EVs have the potential to enhance fuel efficiency of personal vehicles by 40-60%. It is also said to eliminate the environment's carbon footprint by 30-50% (Wang et al, 2017). This can significantly reduce the vehicular GHG emissions that will otherwise soon be added to the environment in the usual future, with petrol/diesel vehicles. Such business-as-usual scenario which if not sustainably adapted to, will continue to warm the atmosphere for millennia (Hansen et al., 2013). The immediate benefits of EV adoption in India are the enhancement of national energy security by reducing dependency on imported oil (Huang & Qian, 2021). In addition, consumers also stand to gain from improved air quality (Yang et al., 2019), and substantial savings on fuel (petrol/diesel) used in an internal combustion engine (ICE) vehicle (Dua et al., 2021), given that there has been a manifold rise in fuel prices in the recent times. The multiple benefits associated with a shift toward EV stand to benefit not only the individuals, and the nation at large, but it can save the climate from further warming, and avoid future climatic catastrophes. Thus, transitioning towards low-carbon mobility by adopting EVs will intensify India's efforts in achieving Sustainable Development Goal 13[1] (SDG 13).

1.4.3 India's net-zero targets and decarbonization of road transport

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

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

FAME (Faster Adoption and Manufacturing of Electric Vehicles) scheme launched by the Indian government is such an initiative. To reach net zero by 2050, 80% of 2-wheelers and 30% of 4-wheelers in India will need to be electric (Dhar et al., 2017). This timeframe also seems unfruitful because coal is the main source of electricity production in India presently.

To cut down on the air pollution, the Government of India had also adopted policies on promotion of Bharat Stage (BS) emission standards. These emission standards are introduced by the government to scrutinize the output of air pollutants from motor vehicles. Since 2010, Bharat Stage –IV (BS-IV) emission norms were in place. Recognizing the urgency to reduce the vehicular emissions and promote cleaner air, the Government of India had skipped BS-V stage altogether and permitted the use of only BS-VI compliant vehicles from April 2020, which is said to be at par with Euro-VI norms, which is in place in several countries across Europe. BS-VI fuel is stated to reduce the sulphur content by 5 times in comparison to BS-IV levels. It is also stated to bring down the emissions of particulate matter by 80% and nitrogen oxide by 70%. India's fuel consumption standards are related to the corporate mean fuel efficiency. It is calculated as the average of the standard fuel consumed by all the vehicles sold by the manufacturers in a particular fiscal year, and not by the fuel consumed by any one vehicle model (Bharadwaj, 2022).

While the BS fuel norms are a welcome move, it has not been very successful to lower the vehicular emissions in India. Interestingly, it has been noted that light-duty vehicles (LDVs) which had a high share of India's personal vehicle market earlier, have shrunk since 2017, and SUVs have taken their place. Nevertheless, with a sales figure of 3.2 million in 2019, it still constitutes the 5th largest in the world's LDV markets. In terms of fuel consumption, the new LDV fleet was reported to consume around 5.7 liters of gasoline equivalent per 100 km (Lge/100 km) in 2019, as against 6.9 Lge/100km in 2005 (IEA, 2021b). This seems like a significant improvement, however, there lies a paradox. Large and small SUVs, whose sales have picked up in India, were reported to have consumed, respectively, an average of 3.7% and 2.6%, more fuel since 2017 (IEA, 2021b). The tailpipe CO_2emissions from an average passenger vehicle have dropped to 1.4% per year from FY 2009-10 to FY 2019-20, due to the stringent fuel consumption standards set by the Ministry of Power in FY 2017-18. However, there is still a long way to be covered to achieve its decarbonization targets. For instance, Maruti, which constitutes 47.2% of sales in passenger vehicle sales has been assigned a CO_2 emissions target of 123.1 g/km. The tailpipe CO_2 emissions target differs based on the vehicle's average curb weight. Considering Maruti's lighter curb weight than average, it needs to have a much lower emissions target. Also, the higher sales of SUVs and CNG vehicles have raised the average curb weight from 1068 kg in FY 2019-20 to 1081 kg in FY 2020-21 (Deo & German, 2021). The associated target carbon emissions will also be higher. The use of EVs directly reduces these carbon emissions into our environment. However, EV sales had a market share as low as 0.03% in FY 2015-16 and only increased to 0.2% in FY 2020-21.

1.4.4 EV promotion and sales: current policies and the need for a behavioral recourse.

EV promotion policies in India have been undertaken since 2013. The efforts have been tightened with the launch of the FAME scheme in 2019, which is continuing to date. It has also been observed that in India, the success of EV adoption has been rather mixed. Some regions in India have had relatively greater success in EV adoption rates, despite similar adoption and manufacturer incentives offered in these different regions. most of the EV sales in e-2 wheeler and e-4 wheeler segments, which constitute the personal vehicle segment are observed in states like western states like Gujarat, and Maharashtra, and southern states like Tamil Nadu, Karnataka, and Telangana (JMK Research & Analytics, 2023). The northeastern state of Assam has registered a dismal EV penetration record in both personal vehicle segments, despite having an incentive-based EV adoption scheme. This further highlights the role of behavioral differences in different regions and the need to analyze such differences. In this thesis, we consider Assam as the study context.

Assam is the gateway to the northeastern region of India (shown in Fig 1.1). It is also situated near several international borders. It is immediately bordered by Bhutan in the north, and Bangladesh in the southwest, and lies near China in the north, and Myanmar in the southeast. It has the potential to be directly connected to other Southeast Asian nations like Thailand, Laos, Vietnam, Cambodia, and Malaysia by road networks. Thus, it naturally emerges as a hub of industry, health care, and education and is a potential ground for the emergence of newer infrastructure, including electrification of the transportation system in the next couple of years. For instance, 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. This hints towards increased road traffic in the coming years with rising trade and people movement. With the increase in rural-urban migration, rising incomes, and aspirations of middle-income people, the demand for personal vehicles is only expected to increase as the middle-income group also constitutes the largest consumer market for automobiles (Deka et al., 2023).

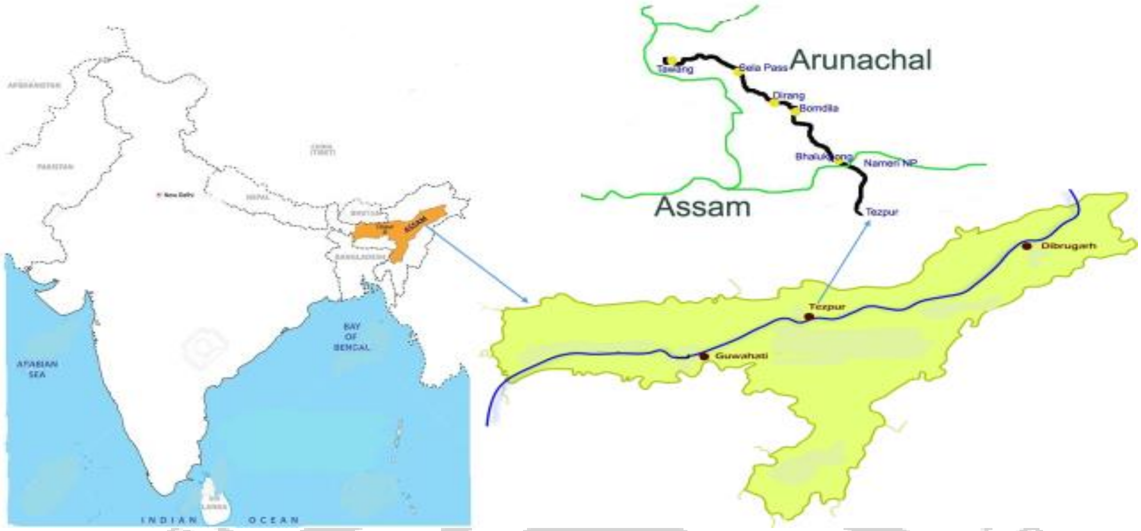

Figure 1.1 Study Site Assam in North East India (Map is not according to scale)

It is extremely crucial to prevent further vehicular emissions by replacing 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.

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 are only 1.16% of total passenger vehicle sales, while during the same period, petrol-fueled 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). 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. 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 full potential of the EV diffusion schemes and overall decarbonization of the transportation sector can take place only when people accept and adopt the same. Infact, for the full realization of the potential of government policies, it needs to be aligned with the consumer's psychological and attitudinal determinants of mobility choices and purchase decisions (Cui et al., 2021; Arts et al., 2011; Sun & Morwitz, 2010). With the heightened urgency for mitigating climate change issues, stakeholders and local leadership at various levels are working towards deep decarbonization of the carbon-intensive sectors, transportation being one of them (Linton et al., 2022). Holistic decarbonization of the transportation sector requires the deployment of solutions from both the supply as well as the demand side. Also, it is equally essential to consider peoples' mobility choices following decarbonization as it will directly impact their decisions, lifestyle, and consumption patterns (de Silva et al., 2022).

1.5 Statement of the Research Problem

With increasing extreme climatic events every year, the urgency for climate change mitigation and adaptation has increased tremendously. Governments around the world have taken several measures in light of addressing the climate change emergency. India's net zero by 2070 is an ambitious target announced by the Government of India during the COP26 Summit. Several demand and supply side policies have been initiated since then and even earlier to decarbonize the transportation sector, one of such initiatives being the promotion of EVs in the country. While some states have witnessed considerable success in the adoption of EVs, others like Assam have not yet transitioned towards EVs despite nearly similar demand and supply side EV promotion incentive schemes. The EV promotion schemes are mostly comprised of purchase subsidies, tax rebates, and other financial incentives. The low EV adoption rate in Assam indicates the negligible impact of economic incentives. The differences in transitioning towards EVs in several states then hint towards possible differences in how people think and feel about the low-carbon mobility transition process. An organically developed intention to adopt EVs can be well sustained in the long run without investing substantial money towards subsidies, tax rebates, etc. This thesis explores the behavioral pathways which can trigger a middle-income individual's intention to adopt EVs in Assam. Identifying the different behavioral pathways and nudges that can effectively help achieve the same in one's most influential stage of behavior can help policymakers and EV firms design customized EV promotion policies with little economic resources.

1.5.1 Objectives of the thesis

The broad objectives of the thesis are:

1) To examine the determinants of the intention to adopt EVs.

This broad objective will be studied by examining the following:

- 1A. To examine the role of gain, norm, and fear & protection motivation in influencing intention to adopt EVs.

- 1B. To examine the role of demographic factors in influencing intention to adopt EVs.

2)To examine the effect of nudges in stated choice for sustainable mobility

3)To analyze the intention and efficacy of nudges in different stages of behavior

Based on the requirement of the thesis, both research questions and research hypotheses have been used. There are considerable studies analyzing pro-environmental factors influencing the intention to adopt EVs, in many Western nations, and a few developing nations. Hence research hypotheses have been framed based on the findings in the literature and adapted to our study context. However, not many studies exist on the role of nudges in one's choice of sustainable vs non-sustainable mobility options. In addition, very few studies have examined an individual's pro-environmental intentions to adopt EVs in different stages of behavior. Considering the exploratory nature of these topics, we have framed research questions for the same.

The detailed research hypotheses/ research questions, the sampling framework, and the questionnaires used for data collection and analysis have been discussed in the respective chapters.

1.5.2 Measures of pro-environmental intentions and underlying theories

Pro-environmental behavior describes those actions of an individual or groups of individuals that promotes the sustainable or diminished use of resources (Halpenny, 2006). Individuals with greater pro-environmental orientations should have a more consistent association between their pro-environmental attitude and their actual pro-environmental behavior in comparison to an individual with lower pro-environmental orientations. The values (materialistic/ post-materialistic), belief systems, attitude, norms etc., which one acquires over time through their interaction between the natural and social system leads to the formation of an individual's pro-environmental orientations. Social norms stop individuals with lower pro-environmental orientations from making an honest estimation of their likelihood to engage in a specific pro-environmental behavior (Mahardika et al., 2020). Pro-environmental orientations are captured by socio-psychological theories like the Theory of Planned Behavior (TPB), the Norm Activation Model (NAM), the Value-Belief-Norm (VBN) model, the Technology Acceptance Model (TAM), etc. To systematically analyze pro-environmental EV adoption intentions, the socio-psychological factors are classified as gain motivations, norm motivations, and fear and protection motivations.

The TPB theory, NAM model, and PMT theory are used to analyze an individual's gain motivation, norm motivation, and fear and protection motivations respectively in the context of EV adoption. According to the TPB theory, attitude, subjective norms, and perceived behavioral control influence one's intention to engage or not engage in a particular behavior. The TPB explains volitional behavior, i.e., one in an individual's conscious control. The TPB encompasses self-interest behavior. Existing studies use established scales to measure socio-psychological variables like attitudes, beliefs, and norms. For instance, the scale for measuring the socio-psychological variable 'attitude' is borrowed and adapted from Ajzen (1991) in many studies. The scales can be adapted according to the context of the study. The NAM model stresses the impact of normative constructs on intention. It says that the presence of awareness of the consequences of an actions, and ascription of responsibility triggers one's personal norms to engage or not engage in a specific action. The PMT theory stresses on the role of fear appeals in influencing one's intention to engage or not engage in any particular behavior. According to this theory, two processes, threat appraisal (assessment of possible threats from engaging or not engaging in a particular behavior), and coping appraisal (assessment of the efficacy of one's actions undertaken to avert anticipated threats). The data for NAM constructs like awareness of consequences, ascription of responsibility, personal and subjective norms, environmental concern, and PMT theory constructs like perceived vulnerability, perceived behavioral control, response efficacy, and response costs are collected based on the scales used in existing studies. This thesis also examines the effectiveness of different nudges in an individual's stated choice for sustainable mobility options. The data for the same was collected through questionnaires designed in a gamified way using different storyline vignettes. According to Finch (1987), vignettes are brief stories created around hypothetical situations and/or characters in some specific situations, to which the respondent is invited to express his/her reaction. The participants had to pick their choices or complete the storyline provided in the questionnaire. We administered certain nudges like anchoring, information, default, framing, social recognition, symbolic appreciation, and interventions like monetary gains and studied their impact on people's stated choice of personal vehicle. Finally, the thesis examines people's pro-environmental intentions in different stages of behavior in accordance with the stage model of self-regulated behavior change (SRBC) model.

1.5.3 Methodology to analyze pro-environmental constructs and nudges.

The study is based on primary data. Structured questionnaire based on Likert scales, and interactive stated choice experiments were used to collect primary data. The final data collection has been completed in two phases. Structural equation modeling (SEM) and mediation analysis is used to determine the direct and indirect EV adoption intention formation pathways respectively. Multinomial logit regression is used to analyze the role of nudges in one's stated choice of sustainable mobility.

The data used in this thesis are behavioral data that cannot be observed directly, instead, these are latent variables or factors, which need to be defined in terms of behavior believed to represent the same. These unobserved variables are linked to something observable which make measurement of the behavioral latent constructs possible. The observed variable in our cases includes self-reported scores on scales measuring 'intention to adopt EVs', 'attitude', 'personal norm', 'perceived behavioral control', etc. Structural equation modeling (SEM) is a widely used method to measure such latent variables. In the context of SEM, such measured self-reported scores constitute observed or manifest variables, and these observed variables serve as indicators of the unobserved constructs that they represent. Multinomial logit regression is used to analyze the data obtained from the interactive vignette-based questionnaire that measures stated choice for sustainable mobility options.

1.6 Layout of the Thesis

The entire thesis is divided into eight chapters. Chapter 1, the present chapter is the introduction to the thesis. Chapter 2 presents a critical review of literature and the theoretical frameworks used in the study. The literature on factors influencing one's intention to adopt EVs is explored based on the TPB theory, NAM model, and the PMT theory. The gaps in the literature are also highlighted.

Chapter 3 describes the design of the study and sample characteristics. This chapter discusses in detail the reasons behind selecting the three study sites in the state of Assam. It also explains the sampling frame, sample characteristics and the process of data collection and the two phases of the data collection process. This is followed by a discussion of the sample profile for each of the phases of data collection process.

Chapter 4 and Chapter 5 discusses the objective 1 in detail. Chapter 4 is based on the first sub-objective, and Chapter 5 discusses the second sub-objective of objective 1. Chapter 4 begins with the theoretical foundations used to analyze objective 1, i.e., the definition of pro-environmental behavior, detailed discussions of the TPB theory, NAM model, and the PMT theory. This is followed by a discussion of the background of the personal mobility space for the new middle-class. The chapter then goes on to discuss the conceptual framework of the study with a detailed discussion of the hypotheses for first sub-objective of objective 1. It also outlines the structural equation modeling (SEM) method and its steps, and mediation analysis which are used to analyze the hypotheses outlined in this chapter. The chapter then goes on to describe the variables used in this study, the scales used to measure the variables, and brief descriptions of the variables. This chapter then concludes with a discussion of the results of confirmatory factor analysis (CFA), SEM, and mediation analysis, and the policy recommendations have been outlined.

As mentioned earlier, Chapter 5 addresses the second sub-objective of objective 1. It analyzes the impact of demographic factors (gender, age, and place) on pro-environmental EV adoption intention. It introduces the research hypotheses, followed by a description of the demographic groups. This is followed by a description of the data collection process and sample profile. The chapter finally goes on to discuss the results and concludes with a detailed discussion of the results.

Chapter 6 addresses the second objective of the thesis. It analyzes the role of nudges in one's stated choice for sustainable mobility. It begins with outlining the research questions, followed by a description of the experimental settings and nudges used in the study. This is followed by a detailed description of the interactive vignette-based questionnaire. The chapter then goes on to briefly highlight the method used for the analysis, followed by an exhaustive discussion of the results. The chapter finally concludes with a summarized discussion of the findings for the different experimental groups.

Chapter 7 addresses the third objective of the thesis, i.e., it analyzes the intention and efficacy of nudges in different stages of behavior. The chapter first outlines the research questions, followed by a description of the data, the survey process and the sample profile. This is followed by a description of the results of the analysis, and finally concludes with a description of the results of the analysis.

Chapter 8 is the last chapter of the thesis. It includes the discussion of the major outcomes of the thesis and concludes with the policy recommendations based on the outcomes of the thesis.

Chapter 2. Literature Review and Theoretical Framework

The transport sector in India is mostly powered by carbon-intensive fuels like petrol, diesel, etc., thus increasing dependency on fuel imports, and environmental degradation (Digalwar et al., 2022). With the increasing incomes and aspirations leading to the rise in the use of personal vehicles for daily mobility in cities and towns in India, GHG gases have increased manifold times. According to 2019 estimates, the transport sector uses about 4.4 million barrels of crude oil daily and produces about 305 Mt CO_2 emissions, constituting 21% of overall emissions in India. Direct evidence is the reduction in all types of pollutants during the time of COVID-19 pandemic. Dasgupta and Srikanth (2020) compared the levels of pollution during and before the pandemic in 8 Indian cities (including both metropolitan and emerging cities) and reported that pollutants significantly reduced during the pandemic. One reason for this difference is due to the restrictions on people's movement, drastically reducing the vehicles plying on the roads. Though governments in certain states like the national capital of Delhi had previously tried to implement policies to cut down the number of vehicles on the road, it could not effectively reduce the number of vehicles. The automobile sector in India also makes up about 6.81% of the Indian economy (Digalwar et al., 2022). To uplift this booming sector, reduce India's oil dependency and the extensive deterioration of the environment, shifting to electric vehicles is crucial. The Government of India has already made international commitments to lower the carbon emissions from its economic activities by 33-35% by the year 2030 compared to its 2005 levels, and to increase the share of renewables to 40% for the generation of electricity (Saraswat and Digalwar, 2021). Electric vehicles powered through electricity powered from renewables can go a long way in achieving the goal of net-neutrality by 2070.

To realize these commitments, the government in India has made efforts to promote EVs with huge investments in schemes like the National Electric Mobility Mission Plan (NEMMP) 2020, Faster Adoption and Manufacturing of Electric Vehicles (FAME) schemes in two phases FAME 1 and FAME 2, Vehicle Scrappage Policy, and EV purchase incentive schemes by seventeen state governments (Das and Bhat, 2022). These policies were proposed with the belief that it will generate increased demand for EVs, leading to replacing internal combustion engine (ICE) vehicles with EVs. However, despite these schemes, EV adoption at scale has failed to materialize in India, increasing social scientists' attention to behavioral adaptation required for climate change mitigation.

2.1 Behavioral theories for climate change mitigation

Mapping out the process of behavior formation to make sustainable choices, merely by observing people is a very complex task. It can be addressed at many different levels, and from a multitude of lenses; from physiological processes at one end to a focus on social and institutional processes at the other. Personality psychologists and social psychologists have tried to focus on an intermediate level of an individual, whose processing of available information mediates the influences of environmental and biological factors on behavior (Ajzen, 1988; Campbell, 1963; Sherman & Fazio, 1983). Various theories of change have been proposed to explain the process of behavior formation in individuals. In the context of understanding pro-environmental behavior like adoption of EVs, researchers have used various socio-psychological theories, behavioral interventions/nudges through various types of experiments, and stages of behavior change theories.

2.1.1 Socio-psychological theories

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 (Shalender and Sharma, 2021; Asadi et al., 2021; Shakeel, 2022; Yegin and Ikram, 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 individual's intention to buy EVs (Jansson et al., 2017; He and Zhan, 2018; Asadi et al., 2021; Hamzah and Tanwir, 2021). 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) (Jaiswal et al., 2021; Shanmugavel and Micheal, 2022; Vafaei-Zadeh et al., 2022; Zhang et al., 2023; Singh et al., 2023; Yuniaristanto et al., 2024); the protection motivation theory (PMT) (Bockarjova and Steg, 2014; Langbroek et al., 2016), the value-belief-norm (VBN) framework (Barbarossa et al., 2017; Simsekoglu, 2018; Okada et al., 2019; Zhang et al., 2022), 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 predicting environmental complaint actions in China (Zhang et al., 2017), Iranian farmer's intention to adopt integrated pest management

(Rezaei et al., 2019), binning behavior of tourists visiting the Yanchep National Park in Australia (Esfandiar et al., 2021), and Chinese contractor's intention to recycle wastes generated from construction and demolition activities (Ding et al., 2023). In the context of intention to use EVs, Lee et al., (2023) used the integrated VBN+TPB framework for China, Vafaei-Zadeh et al., (2022) used the integrated TAM+TPB framework; Asadi et al., (2021) and Hamzah and Tanwir (2021) used the TPB+NAM framework for Malaysia. Singh et al., (2023) applied the UTAUT2+NAM framework, Sahoo et al., (2022) used the integrated TRA+TPB+MT framework, Kumar (2022) used the 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, this 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). Using the NAM and VBN models enables the analysis of altruistic factors' impact on intention. The TAM is another popular model that is applied to analyze the intention to adopt newer technologies like EVs. This model, however, does not account for social and control variables (Vafaei-Zadeh et al., 2022). Another integrated model, the UTAUT+NAM analyzed the combined effect of self-interest, altruism & personal norms in technology acceptance like EVs (Singh et al., 2023). 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. Before we analyze how the components of these theories influence pro-environmental intentions, we will discuss the different pro-environmental theories that are used in this thesis in some more detail.

2.1.1 A Theory of Planned Behavior

The theory of planned behavior (TPB) is an extension of the theory of reasoned action (TRA) (Ajzen & Fishbein, 1980; Fishbein & Ajzen, 1975). The Theory of Reasoned Action explains volitional behavior. It does not explain behaviors that are impulsive, spontaneous, habitual, led by cravings, or that are scripted (Bentler & Speckart, 1979; Langer, 1989). The reason for the exclusion of such behaviors is that such behaviors may not be performed voluntarily, with the involvement of conscious decision-making on the part of the actor. The TRA also does not explain behaviors that require some specific skills, unique resources or opportunities, others' cooperation, etc. (Liska, 1984), as these conditions pose a barrier to voluntary engagement in any behavior. The TRA asserts that the strongest and closest predictor of volitional behavior is one's behavioral intention. Behavioral intentions are thought to be the outcome of both normative and attitudinal factors.

In its simplest form, the TRA is expressed using the following function:

BI = $((AB)w1 + (SN)w2$

where BI: behavioral intention

AB: one's attitude towards performing the behavior.

SN: one's subjective norm associated with engaging in the behavior

$w1$, $w2$: weights derived empirically (it reflects the importance of the factor, to the person)

The theory of planned behavior (TPB) was developed to address the limitations of the TRA in dealing with behaviors over which people do not have complete volitional control.

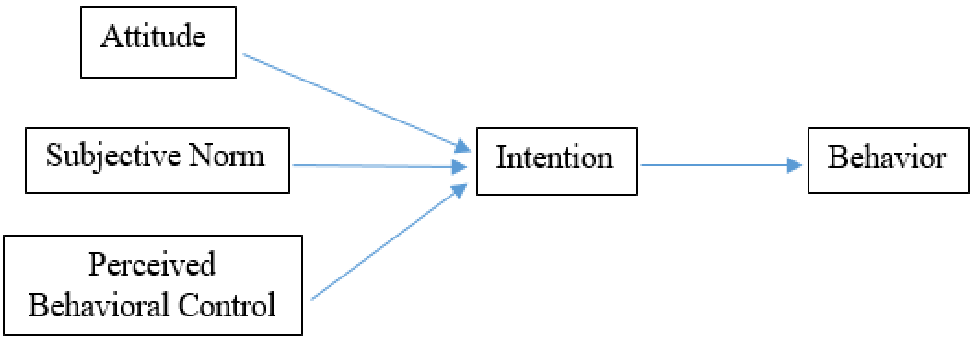

Figure 2.1 Theory of Planned Behavior (TPB)

The central element in the theory of planned behavior (TPB) is the individual's intention to engage in a particular behavior. This theory assumes that intention captures the motivational factors that influence behavior; it acts as an indicator of how hard people are willing to try, and the effort people are willing to exert to perform the behavior. A higher intention to engage in a volitional behavior is often found to be associated with a higher probability of actual realization of the behavior. The requirement of the behavior in question being a volitional behavior takes center stage here. While some behaviors satisfy this criterion quite well, several other types of behavior are influenced by non-volitional factors like the availability of opportunities and resources (skill, money, time, etc.), cooperation from others, and other determinants. Inclusively, all these factors determine an individual's actual control over the behavior. If an individual has actual control over a behavior, and a positive intention to engage in the behavior, he/she should be successful in doing so (Ajzen, 1985).

According to Fishbein and Ajzen (1975), attitude towards engaging in a volitional behavior is a function of beliefs an individual hold about engaging in the behavior. Mathematically, it is expressed as $AB = \Sigma biei$, where attitude towards the behavior is the summation of the strength of the belief (bi) and evaluation of the belief (ei) (Fishbein 1967a, 1967b). Belief strength is defined as the surety with which an individual holds the belief about engaging in a particular behavior, and evaluation of the belief is defined as the degree to which the attribute is appraised as positive or negative.

A subjective norm is a function of a normative belief and one's motivation to comply with that normative belief. A normative belief is the perception of what other important people around an individual expects about performing the volitional behavior. The motivation to comply can be defined as the real or imaginary pressure an individual feel to match their behavior with other's perceived expectation of the behavior. Subjective norm is mathematically expressed as SN = Σbjmj, where bj is the normative belief, and mj is the motivation to comply with other's perceived expectation.

Perceived behavioral control refers to an individual's perception of ease or difficulty in performing any behavior. The concept of perceived behavioral control as used in the theory of planned behavior is more aligned with Bandura's (1977, 1982) concept of perceived self-efficacy, which is defined as "judgments of how well one can execute courses of action required to deal with prospective situations" (Bandura, 1982, p. 122). Belief in one's self-efficacy influences the selection of activities, efforts to perform the behavior, and the individual's patterns of thoughts and behavior (Bandura, 1982, 1991). The theory of planned behavior positions the construct of perceived behavioral control or self-efficacy within a more generalized structure with attitudes, beliefs, intentions, and behavior.

2.1.1 B Norm Activation Model

Personal norms form the central component of Schwartz's (1977) norm activation model (NAM). Norms are found to be experienced as "feelings of moral obligation not as intentions" (Schwartz, 1977, p.227). Personal norms are stated to predict individual behavior in the NAM model. Two factors, namely, awareness of consequences (of performing or not performing the behavior), and a sense of responsibility towards engaging in the behavior influences personal norm. NAM is stated to be a mediator or moderator model. It is believed that ascription of responsibility acts as a mediator to lead awareness of consequences towards the formation of an intention to perform the behavior. NAM is stated to be a moderator model because both ascriptions of responsibility and awareness of consequence influences personal norm towards behavior formation. Again, awareness of consequences is the first prerequisite for the effectiveness of the NAM model. When an individual is aware of the consequences of performing or not performing the behavior, then develops the feeling of responsibility towards performing the behavior as the second step. After the ascription of responsibility becomes active, then personal norms form which guide an individual towards performing the behavior (De Groot & Steg, 2009). Several other normative factors like the anticipation of emotions like pride or guilt, environmental concern, subjective norms, etc., can be incorporated into the basic NAM framework to analyze behavior depending on the contextual requirements.

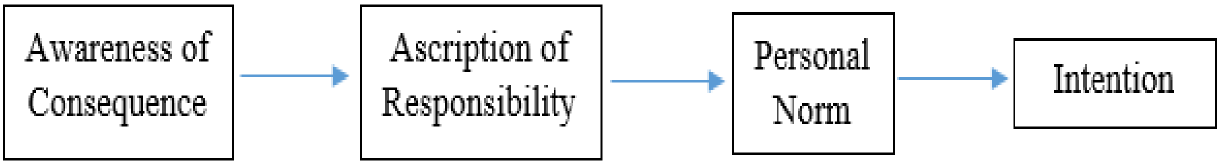

Figure 2.2 Norm Activation Model (NAM)

Personal norm is the most important variable of the NAM model. For an individual to be environmentally responsible, a mere presence of environmental concern and awareness is insufficient. The concerns and awareness of the ill consequences on the environment also needs the presence of a person's moral consciousness to act responsibly towards the environment (Kals and Maes, 2002). It has also been found that the decision to engage in a pro-environmental or pro-social behavior is determined by personal norms, instead of one's affect or assessment of costs and benefits (Harland et al., 2007). Personal norms can be defined as a group of "self-set moral standards on what should be done or not" (Perugini et al., 2003). While personal norms are found to directly affect behavior, several other studies have also found an indirect relation as well, which is mediated by intentions (Bamberg et al., 2007; Bamberg & Moser, 2007, Klockner, 2013).

Awareness of consequence is the second crucial component to analyze pro-environmental behavior in the NAM model. It is an expression of whether an individual is aware of the negative consequences for others or for other things he/she values in situations of not behaving pro-environmentally/pro-socially (De Groot & Steg, 2009). Ascription of responsibility is the third variable in the norm activation model, which is necessary to analyze pro-environmental behavior. Ascription of responsibility can be defined as feelings of accountability for the adverse outcomes of not engaging in pro-environmental/pro-social behavior (De Groot & Steg, 2009). It influences not only pro-environmental behavior but also the personal norms required to act pro-environmentally.

2.1.1 C Protection Motivation Theory

The protection motivation theory was proposed by Rogers (1975) to through light on the understanding of appeals to fear. PMT analyzes how people perceive threats and chooses responses to deal with the dangers associated with the threats. PMT framework was proposed to predict and comprehend protective actions against threat and fear (Zhao et al., 2016). This theory states that in the event of a threat, two cognitive processes are initiated: threat appraisal, and coping appraisal. A feeling of being threatened by a hazard or an event, in combination with a self-belief to control the cause of the hazard, will likely lead to protective actions on the part of individuals.

During threat appraisal, an individual assesses the factors that enhance or lower the chances of making a maladaptive response. The maladaptive behaviors could be actions like wasting electricity, misusing water, using personal vehicles with high emissions, etc. The factors that enhance the probability of undertaking actions against maladaptive behavior are intrinsic rewards (like self-satisfaction), or extrinsic rewards (such as praise by family or friends). Variables that lower the chances of the maladaptive response are the perceived severity of the threat, as well as the perception of vulnerability from the threat. Arousal of fear affects the perception of severity, but it does not have a direct impact on the final response. The aggregate appraisal of threat is a sum of the factors that enhance or lower the chances of maladaptive behavior.

In the process of coping appraisal, an individual conducts a mental evaluation of the effectiveness of a preventive response against the perceived hazard (response efficacy) along with an evaluation of one's capability to successfully begin and complete the adaptive response to mitigate the threat or hazard (self-efficacy). Evaluations of response efficacy and self-efficacy are variables raising the chances of making the adaptive response. Lowering that chance is response costs. Response cost may comprise of "inconvenience, expense, unpleasantness, difficulty, complexity, side-effects, disruption of daily life, and overcoming habit strength" (Rogers, 1984, p. 104). Coping appraisal is the aggregate of efficacy components less the costs of undertaking an adaptive response to mitigate the threat or hazard (Prentice-Dunn and Rogers, 1986).

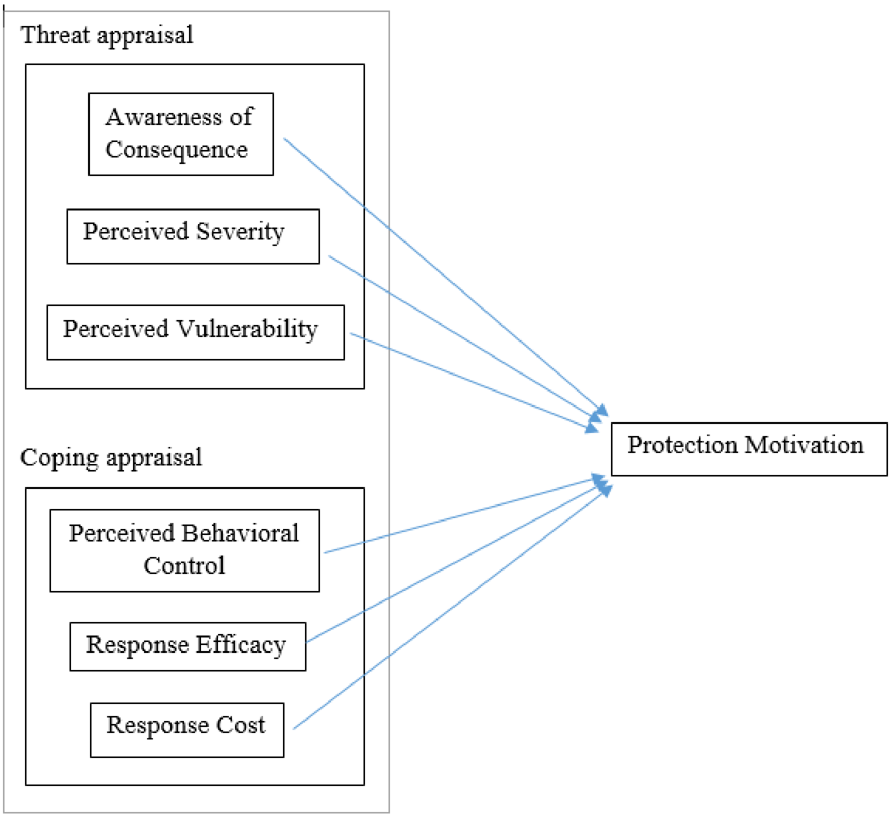

Figure 2.3 Protection Motivation Theory (PMT)

2.1.2 State of The Art Literature Review

We shall discuss the most recent findings on the intention to adopt EVs based on a framework provided by these theories. The review of literature has been arranged in the following themes.

2.1.2 A The theory of planned behavior (TPB) and the intention to adopt EVs

The TPB is a crucial socio-cognitive model that explains volitional behavioral changes (Ajzen, 1991). It is an extension of the Theory of Reasoned Action (TRA) (Fishbein & Ajzen, 1975). Behavior is considered voluntary in the TRA. This consideration, however, came in for criticism from Liao et al., (2007) who stated that behavior was not always completely voluntary. As a response, Ajzen (1985, 1991) incorporated the construct "perceived behavioral control" (PBC) into the TRA framework and renamed it the TPB model (Yazdanpanah & Forouzani, 2015). According to the TPB model, intention, the central determinant of behavior, has three main components: attitude, subjective norm, and perceived behavioral control. Attitude is defined as "the degree of a person's favorable or unfavorable evaluation or appraisal of the behavior in question" (Fishbein & Ajzen, 1975). Subjective norm is defined as "the perceived social pressure to perform or not to perform the behavior" (Ajzen, 1991). Fielding et al., (2008) define perceived behavioral control as “people’s perception of ease or difficulty in performing the behavior of interest”. PBC is “the perceived control over the performance of a behavior” (Ajzen, 2002).

The TPB model is highly flexible. It continues to evolve with several extensions having been formulated as required for different contexts to enhance the predictive power of the model (Yazdanpanah & Forouzani, 2015). Ajzen (1991) mentions that TPB was “in principle, open to the inclusion of additional predictors if it can be shown that they capture a significant proportion of the variation in intention or behavior”.

Based on a sample of 3505 people, Mohamed et al., (2016) found that a person’s attitude and perceived behavioral control have a significant and large influence on their willingness to purchase an EV. Studies have examined different components of attitude like awareness, use of EVs, the experience of riding an EV, social need, pro-environmental action, social message, fuel consumption, and carbon emissions, finding that these factors have a huge influence on the adoption of EVs (Jayaraman et al., 2015; Kaplan et al., 2016). A detailed analysis of the linkages between attitude and intention formation for EV adoption is still lacking in the literature (Singh et al., 2020). Some studies, however, have attempted to reflect how different components of attitude lead to attitude formation. For example, when a person considers EVs as necessary for society at large, then attitude toward EV adoption is found to be positive (Singh et al., 2020).

Perceived behavioral control is found not to consider intention toward EV adoption if this results from public opinion and an overly pumped-up desire for EV (Adnan et al., 2017; Mohamed et al., 2018). Afroz et al., (2015) find a strong impact of perceived behavioral control on EV purchase intention; however, its’ impact is still found to be smaller than the impact of attitude on intention to adopt EV. Exploring psychological variables at the level of emotions, Moons and Pelsmacker (2015) find that reflective emotions such as inter alia, aspects of eco-friendliness, cost economy, and fuel economy, are crucial drivers of the intention to use EVs. The study also reports that reflective emotions have a greater impact than behavioral ones like driving comfort, feeling of relaxation, and enjoyment. Visceral emotions, for example, the power and throb of the engine, appearance, and aesthetics of the vehicle interiors, maximum speed limit, and full digital information display on the car dashboard are not found to have any significant impact on the intention to use EV.

Singh et al., (2020) studied social determinants like peer pressure, effects of neighborhood, social responsibility, and empathy, belonging to social networks, being an acceptable member of society, collective efficacy, and external validation. According to the literature, newer technologies are adopted with the motivation of receiving external validation (Jayaraman et al., 2015; Liao et al., 2017). Kim et al., (2014), however, find social variables to be less important in terms of influencing intention towards using EV. Nevertheless, the subjective norm is always proposed as an important construct in most of the theories like the Theory of Planned Behavior, the Technology Acceptance Model, and the Diffusion of Innovation Theory. Studies support the significant impact of family, friends, relatives, and society on the intention to adopt EVs (Sang and Bekhet 2015; Liao et al., 2017).

Personal or moral norm is another determinant of intention that has been explored in literature. Self-interest, personal principles, pro-conservation to being open to change, and self-transcendence are some of the attributes encompassed by moral or personal norms (Singh et al., 2020). A greater level of morality at a personal level was found to be a common trait among the owners of alternative fuel vehicles compared to non-adopters of EVs (Jansson, 2011). Lending support to the influence of personal norms, Rezvani et al., (2015) stated that a higher level of personal norms is associated with a higher chance of adopting EVs. Going a step further, He and Zhan (2018) found that personal norms become active when the personal norm associated with the environment is activated. Adnan et al., (2018) also finds that personal norms have a significant impact on the formation of behavioral intention.

In addition to the above constructs, Indian EV adoption is considered in this study as an apt extension of the TPB theory in the context of contemporary trends in middle-class society, such as herd behavior. For example, the influence of social media on personal lives, social media stalking, social competitiveness, and the urge to keep up with friends and relatives have put pressure on everyone to varying degrees. The overload of information available through various authentic and inauthentic sources also makes decision-making a complex task, even more so when people are deciding to invest in durables like personal vehicles. People frequently tend to imitate social trends as these are a sign of popularity and thus a better choice. When people imitate, they forget to analyze their own needs and often overlook sustainability considerations. It is interesting to see the impact of this variable on the formation of intention. Studies have found evidence that social relations like neighborhood effects and herd behavior influence the decision to adopt EVs (Mau et al., 2008; Pettifor et al., 2017). It is stated that higher visibility of EVs in terms of increased purchases by others will further push EV sales (Mau et al., 2008). Infact, McCollum et al., (2017) also incorporated neighborhood effects into the global integrated assessment models (IAMs) as it is found to have strong evidence and a high policy impact as a behavioral determinant of vehicle choice.

Cost is another extension of the original TPB theory. Although the disposable income of the middle-class group is on the rise, price consciousness is still a big part of the Indian consumer mindset. People care about status signaling, but cost concerns still loom large in their minds. Specifically, the high upfront price of EVs acts as a demotivator, even though the operational cost of EVs over a period is lower than those of a gasoline/diesel vehicle. People still do not seem to consider the lower operational cost over time vis-à-vis the high upfront cost of purchase.

2.1.2 B The norm activation model (NAM) and the intention to adopt EVs

Javid et al., (2021) used the NAM model to analyze EV adoption behavior among travelers in Lahore, Pakistan. The study finds that awareness of consequence (AC), ascription of responsibility (AR), and social and economic values (SEV) influence personal norms (PN). Personal norms and personal preferences (PP) are in turn factors that influence travelers to adopt EVs. He and Zhan (2018) examined how moral norms can motivate EV adoption in China. Personal norms, moderated by the perception of price and complexity were found to influence intention to adopt EVs. In addition, AC, AR, and perceived effectiveness influences personal norms. In the context of Sweden, Norlund et al., (2016) found that the normative frame of owners owning alternate fuel vehicles (AFV), conventional fuel vehicles (CV), and hybrid/plugin/electric (HEV/PHEV/EV) differs. It found that owners of HEV/PHEV/EV displayed greater openness to change, were less conservative, had a greater awareness about the problems, self-efficiency, and a stronger personal norm. Another study in the Swedish context by Rezvani et al., (2018) examined, gain, norm, and hedonic motivations on EV adoption intention, and found that norms and hedonic motivations have a greater effect on intention in comparison to gain motivators. Jansson et al., (2017) also supports the strong influence of personal norms in the EV adoption intention in Sweden. In the context of Germany, the NAM model explained a higher proportion of variance in the intention to adopt EVs in comparison to the technology acceptance model (TAM) (Bobeth and Kastner, 2020). Asadi et al, (2021) examined the integrated NAM+TPB model in the context of EV adoption intention in Malaysia and found awareness of consequence, ascription of responsibility, personal and moral norms to be influencing norm motivators for developing an intention to adopt EVs. Singh et al., (2023) examined the intention to adopt EVs in the Himalayan state of Himachal Pradesh in India using the combination of NAM model and unified theory of acceptance and use of technology (UTAUT2). The study finds that of the norm-based constructs, personal norms significantly influence intention and social influence do not have much impact on intention. However, in the context of northeastern state of Assam, norms, and fear & coping were found to have more impact on intention in comparison to gain motivations (Deka, 2022). Huang et al., (2020) examined individuals' dockless bike-sharing behavior in China and reported that green intentions is influenced by personal norms, and the perception of green values and perception of pleasure mediates the association between personal norms and green intentions.

2.1.2 C The Protection Motivation Theory (PMT) and the Intention to Adopt EVs

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 & 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.

2.1.3 Review of the socio-psychological constructs

Attitude

Studies have categorized attitude into three types: affective, cognitive, and behavioral (Khurana et al., 2019). The cognitive aspect is based on an individual's belief system, thoughts, and the object's characteristics. Among the attitudinal factors, ownership of EVs and cost of operating EVs are mostly accounted for in existing studies. The high cost of EVs is found to pose a barrier to EV adoption, while a lower cost of EV encourages EV adoption (Jensen et al., 2013; Egbue and Long, 2012; Graham-Rowe et al., 2012; Lieven et al., 2011; Zhang et al., 2011; Caperello and Kurani, 2011; Sovacool and Hirsh, 2009). People are also not found to have the knowledge to calculate the real costs of EVs (Caperello and Kurani, 2011; Sovacool and Hirsh, 2009). Another attitudinal factor explored by studies is based on people's perception of policies and other contextual forces. Some studies reported that a high financial incentive provided either by the government or manufacturers favorably influences one's intention to adopt EVs (Krupa et al., 2014; Zhang et al., 2011). Frequent modifications in policies lead to uncertainties and poses a barrier to EV adoption (Stern et al, 1999). Some studies report a direct effect of attitude on people's intention (Beck et al., 2016; Plotz et al., 2017). Some studies also reported that attitude only acts as a mediator and has no direct effect on intention and/or behavior (Deka et al., 2023)

Subjective Norm

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 (Deka et al., 2023). Subjective norms have a very high influence on the intention to adopt EVs in the context of India (Deka et al., 2023). It also influenced intention in 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.

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, 2016), 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.

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., 2000; 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.

Ascription of Responsibility

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 Norms

Personal norm (PN) is the moral compulsion to engage or refrain from certain actions (Schwartz and Howard, 1981). A 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 the context of 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: Higher the personal norm, higher will be the intention to adopt EVs.

Environmental Concern

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 towards 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 (Nayum and Klockner, 2014; Petschnig et al., 2014; Paul et al., 2016; Norlund et al., 2016, Barth et al., 2016); buy EVs and other sustainable technologies in China (Thyroff and Kilbourne, 2017), lower sensitivity to 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). Inverse relation between environmental concern and intention to adopt EVs is also reported in some studies due to people's negative perceptions about the environmental impact from non-renewable energy used to produce electricity, and the harmful effects of lithium and other metals used in EV batteries (Egbue and Long, 2012; Grosjean et al., 2012).

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

Perceived Risk or Severity

Perceived risk can be defined as a person's unfavorable feeling towards adoption of a new technology or innovative products (Featherman et al., 2021; Wang et al., 2018). Perceived risk of climate change crisis evokes 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 (2016) 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.

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.

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.

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.

2.2 Understanding Pro-Environmental Intentions Through Behavioral Interventions.

Another strand of studies has used stated preference surveys and experiments administering behavioral interventions to study people's motivations to adapt their behavior towards low-carbon mobility options like the adoption of EVs. Under stated preference surveys, studies have been based on fiscal and financial interventions (Belgiawan et al., 2024, Jones et al., 2024), the effect of transport policies (Belgiawan et al., 2024), the effect of behavioral interventions like information (Filippini et al., 2021; Luo et al., 2021; Herberz et al., 2022), stated preference for fuel types (Jia and Chen, 2021), stated preference models based on technical attributes for EVs (Cirillo and Maness, 2017). Aravind et al., (2024) used emotional nudges like emoticons, color scale, normative nudging like information, gain nudging like monetary and health gains to analyze the effectiveness of nudges in encouraging the transition towards the use of public transport in the state of Tennessee, USA. Studies have examined the impact of contextual factors and behavioral interventions like framing, social norm, and gamification on people's optimal day/night EV charging decision in Ulm, Germany (Kramer and Petzoldt, 2022) and UK (Lagomarsino et al., 2022). Bao and Lim (2022) analyzed the impact of environmental nudge, health nudge, efficiency nudge, social influences, and framing on micro-mobility adoption decision among New York city residents. DellaValle and Zubaryeva (2019) examined the impact of norm-based intervention and salience intervention on people's EV adoption preferences in South Tyrol, Italy. Gunther et al., (2020) examined the effect of three persuasive nudges: feedback about consumption of energy, financial rewards, and gamification to study people's attitude towards eco-driving in Germany. Filippini et al., (2020) conducted a stated choice experiment in a developing country context in Kathmandu, Nepal to examine people's preference for electric mobility. The three information-based interventions used in this study are vehicle lifetime cost information, emoticons, and visual priming.

2.2.1 What is nudge?

According to Thaler and Sunstein (2009), individuals are not 'econs'. One can qualify to be termed as 'econ' only if he/she makes forecasts in the perfect and unbiased manner. Even if the forecast may be wrong, econs make no systematic error from their side in any anticipated direction. But people are humans, not econs. Hence, they make errors, and have quite a systematic tendency for it, unlike econs. Examples of such errors made by humans are the 'planning fallacy' and 'status quo bias'. 'Planning fallacy' error is seen when one displays a systematic inclination towards impractical optimism about the amount of time required to complete his/her targets. If a person has 'status quo bias' or inertia, he/she is inclined to choose the default option. The 'status quo' bias has seen many applications till date where desired actions are already selected as the default options, for example in food delivery apps where the default choice of not requiring cutlery is already pre-chosen in the app; in the online hotel or travel booking platforms where small donation towards social causes are already selected as the default choice. While such subtle cues may be identified be econs, humans are found to be responsive to such cues. These tendencies for behavioral lapses are made use of in designing nudges.

Nudges are features of choice architecture that modifies people's choices without removing any available choice options, yet inclining the person;s behavior towards the desired option. Such is the soft power of a nudge. People do respond to incentives but their choices and decisions also get influenced by nudges. Richard Thaler in his book titled 'Nudge: Improving

Decisions about Health, Wealth, and Happiness', published in 2009, provides the hypothetical example of nudging students in a school cafeteria to healthier food options. Without bringing any changes to the food menu, the Director of Food Services of a school in the USA tried to examine if the arrangement and display of food influence children's food selection. By simply rearranging the food on the cafeteria display shelf, some of the healthier food items saw a 25% increase in their consumption. Use of default nudge coupled with the 'opt-out' option has also found application in nudging people towards organ donation, to automatically enroll people in pension programs, etc. Since people have the option to opt-out, so it is an active conscious choice involving no coercion and has little chance of error (Beraldo and Karpus, 2021). The application of nudge is also seen in trying to increase the use of stairs rather than the elevator (Meiden et al., 2019). The study found that when images of footsteps are painted on the floor, employees are found to unconsciously follow the same and use the stairs instead of the elevator. Such images are found to induce a sense of playfulness and fun aspect, which leads to the desired changes in behavior. These examples reinstate the fact that by properly deploying both nudges and incentives, many social problems can be resolved while still preserving people's freedom of choice.

According to Thaler and Sunstein (2009), "A *nudge is any aspect of choice architecture that alters people's behavior in a particular way without forbidding any options or significantly changing their economic incentives. To count as a mere nudge, the intervention must be cheap and easy to avoid. Nudges are not mandates. Putting fruit at eye level (hoping that people then choose fruit over unhealthy alternatives) counts as a nudge. Banning junk food does not*".

A common argument between the proponents of tax versus the defenders of nudge is centered on whether a nudge is similar to paternalistic governmental regulation. Defenders of nudge assert that a nudge is a representation of libertarian paternalism, which is comparatively gentle, and non- intrusive, unlike the standard paternalism associated with government regulations. Nudges do not coerce people towards any choice, the freedom of choice remains with the people (Thaler and Sunstein, 2009).

Process of decision-making that operates in circumstances where decision-makers have only restricted attention and do not act fully rationally are the ideal situations for the application of nudges (Hansen, 2016). Nudges are designed based on people's behavioral shortcomings. People generally tend to lay more focus on facts that are readily visible, and they automatically and emotionally react to those immediate mental stimuli. Kahneman (2003) calls such mental processes- 'System 1'. Attention to the hidden and distant facts is assessed with some mental effort, i.e., by engaging ‘System 2’ as termed by Kahneman (2003). Engagement of System 2 leads to better decisions. Individuals tend to anchor present actions and decisions on information already received in the past, or on the facts that they want to think as true (Galle, 2014). Such behavioral shortcomings form the basis of most behavioral interventions or nudges.

While nudges like framing, social influences, default option, information, monetary allowances are tested in some countries in the context of low carbon mobility, yet these are mostly restricted to the developed nations. Socio economic contexts in the developing nations are very different from that of the western cultures and hence it would be interesting to study how the effect of nudges would vary with the variation in such socio-economic contexts. In addition, the impact of deep psychological biases created through behavioral economic tools like mental accounting has been hardly examined in the context of energy saving behavior. Thus, a lot of gaps exists in the literature regarding the scope and efficacy of nudges in the context of EV adoption in Indian context.

2.2.2. What is mental accounting?

Mental accounting theory was first proposed by Richard Thaler in the year 1980 to explain the psychological procedure of bounded rationality in events of intrinsic assessments and management of budgets and expenses (Thaler, 1980, 1999). Mental accounting describes the idea that people generate mental budgets to arrange their use of resources and to generate connection between particular acts of consumption and particular payments. The idea of mental accounts can be symbolized as saving jars that are set aside for some specific purpose like ‘saving for food’, ‘saving for rent’, ‘saving for leisure’, etc. Assigning specific expenses to specific mental accounts, helps people to keep a track of their revenue and expenses. In 1998, Prelec and Loewenstein introduced the theory of double-entry mental accounting. According to this theory, there are two processes that takes place when people make purchase decisions. One process account for the pain experienced on making payment for a product (the negative outcome of payment) and another process accounts for the feeling of happiness during consumption of the product (the positive outcome of consumption). When the negative outcome outweighs the positive, people may deem the act of consumption as ‘unworthy’. On the other hand, when the positive outcome outweighs the negative outcome, people experience pleasure in the act of consumption.

There are three central principles of mental accounting: ‘creating mental accounts’, ‘limiting mental accounts', and 'labelling mental accounts' (Hahnel et al., 2020).

2.2.2 A Principles of mental accounting

'Creating mental accounts' refers to the process of creating mental subaccounts which reflects the cognitive process used to intrinsically classify resources by utilizing multiple sub mental accounts. After a mental account gets created, it governs how the resources allotted on this account will be used up. One crucial outcome found in mental accounting research is that there is no fungibility between resources allotted to two different mental accounts. For instance, savings made due to reduction in gas price have a unreasonably greater probability to be used up on better grade fuel, regardless of the fact that economic considerations based on the maximization of utility would anticipate the money to be used up in other items that yield greater utility. The concept of non-fungibility is stated to be applicable to fields beyond money, like allocation of time. However, actions allotted to the same mental account such as preserving a forest and donation towards sustainable management of land will be thought as equivalent and fungible. The whole idea of fungibility within, but not between mental accounts have an important bearing on energy consumption decisions. For instance, an individual who undertakes some energy saving decisions at home like replace of efficient electric home appliances, he/she feels entitled to resort to other energy inefficient actions. The mental accounting theory says that due to the principle of non-fungibility between accounts, such mental compensatory behaviors can be averted when a more fine-grained mental representation of carbon-intensive behavior takes shape in the minds of people.

'Limiting mental accounts' refer to the way mental accounting process is used as a tool to regulate one's own behavior. Just like the way one's income level sets one's consumption limit, or a self-imposed resolution helps one to restrict consumption of fast food, any kind of budget has the capacity to regulate a wide range of behaviors starting from managing finances in a household to allotment of one's time between work and leisure. In terms of consumption of energy, when a limit is set for any specific account, people are inclined to keep a check on their energy budget limit and their energy consumption. Self-assignment of mental budgets helps to reduce one's consumption of energy. The effect of mental budgets in reducing energy consumption is even more effective when it is set in reference to some external reference point. In addition, the productive monitoring of mental budgets necessitates decision makers to be capable of associating specific acts of consumption with their respective mental accounts. People are able to form more realistic mental models of energy consumption when they are provided with continuous feedback about the impacts of their consumption which then triggers behavior change. Inefficient mental accounting which doesn't adapt to changes in external conditions may lead to rebound effects. Behavioral rebound effects caused due to non-adaptation of mental accounts can be averted by dynamically updating the respective mental account after investments in energy efficiency. For instance, after an individual purchases a fuel-efficient car, they may tend to over use the car in such a way that the efficiency gains are negated by the increased consumption of fuel.

'Labelling mental accounts' says that the features of the mental account on which an income is booked guides the way the income will be spent. Depending on the income source, people create distinct mental accounts. Money earned through windfall gains or as gift is likely to be spent on hedonistic products like vacations, luxury items. Money earned through hard work is more likely to be spent on utilitarian items. Similarly, money earned in gambles is more likely to be spent on dining in expensive restaurants and an income tax return will most likely be utilized for settling other bills. For instance, in the United Kingdom, a direct cash transfers to the elderly citizens termed as 'Winter Fuel Payment' increases spending on winter heating purpose to 42% as against only 3% when no labelling was made on the cash transfer. Thus, the theory says that mental accounting works as a guiding principle to determine how incomes are further invested. It suggests that revenue generated from energy efficiency devices/technologies/processes needs to be communicated by prioritizing the origin of the income source.

2.2.2 B Mental accounting in energy consumption

Mental accounting theory has seen a wide application in the domain of finance. Yet, its application in the field of energy and climate change is scarce. Hence, there is a gap that requires a more extensive understanding of energy-related decision making and the development of behavioral interventions to motivate people to save energy.

Yue et al., (2021) uses the perspective of double entry-mental accounting to empirically analyze the implications of perceived value and consumption sensitivity on intention for green consumption in the context of China. Due to the rise in incomes, personal consumption for Chinese people have shifted from the 'rational consumption' phase to the phase of 'emotional consumption' (Tian et al., 2016). Thaler (1985) stated that people cognitively split up wealth into a variety of mental accounts which have different methods for accounting and diverse mental operation rules. It was also found that people utilize mental accounting principles to strike a balance between luxury goods consumption and the consumption of necessities (Kivetz, 1999). Cheng and Cryder (2018) found that consumers usually mentally discount the benefit from their perceived cost, which gives consumers the feeling that their costs is lower than the actual and raises consumer spending. Earlier, Liaw and Le (2017) analyzed the implication of mental accounting on the intention to purchase among consumers and found that perception of risk has a significant effect on intention. Bi and Liu (2014) states that there is an important association between people's experience of the act of consumption being 'worthwhile' or 'unworthy' (as explained by the process of double-entry mental accounting) and their demand for products. Later Hossain (2018) found that there are differences in the way people display mental accounting principles through their consumption behavior based on the differences in their cognitive framework. A positive interrelationship between perception of benefit and people's willingness to pay for sustainable housing was found in a study by Li et al., (2019). It reports a higher willingness to pay when people experienced higher pain from payment and lower pleasure from consumption.

2.2.3. Role of nudges in EV adoption

Impact of informational intervention

Li et al., (2020) used informational interventions with Chinese participants to understand its impact on EV adoption. Two types of information were used: popular science propaganda consisting of environmental and economic value of EVs disseminated through digital and social media, and social discussion among people. The study finds that with the rising publicity about EVs from the governments and firms, the rate of EV adoption rises, which might be because when non-adopters are surrounded by friends who hold a positive attitude towards EV, then it alters non-adopter's attitude from negative to positive towards EV adoption. The effect of promotions on the rate of EV adoption gets lower if the promotional intensity increases beyond a certain threshold. The study also provides interesting insights on the size of friend circle and EV adoption. For instance, it finds when one's friend circle is small, then an increase in the number of members in one's social circle has a high impact on the rate of EV adoption. However, when the number of members in one's social circle is already large, then an additional increase in the number of members in the social circle poses a barrier in adoption of EVs. Filippini et al., (2021) examines the effect of three informational intervention on the stated choice for EV adoption in three districts of Nepal- Kathmandu, Bhaktapur, and Lalitpur. The first type of information was based on the operational cost of a petrol motorbike and a similar electric motorbike. The second type of information was based on illustrations of impacts of air pollutions using happy emoticon for electric motorbike and sad emoticon for petrol motorbikes.

The third type of information was based on pictorial display facts regarding mortality and effects of air pollution on health in Kathmandu. The higher stated choice of EV among participants administered with information type-1 may be due to cognitive limitations, limitations in attention, or imperfect information. It was found that because education has an impact on cognitive skills of an individual, participants with higher educational attainment respond more to information on lifetime costs of EVs versus a petrol bike. Women are found to respond more to emoticons as used in information type 2, in comparison to men, and express greater nervousness in expectation of negative outcomes. Again, among participants who were administered type-2 informational nudge, those with a history of respiratory illness, or those whose family and friends suffer from such illness are more likely to respond positively to such information. In the case of information type 3 containing emotional stimuli like that of pictorial display of air pollution impacts on children, it was found that people with more empathetic behavior like those previously engaged in voluntary service, donations, etc., respond more positively to information type 3. DellaValle and Zubaryeva (2019) examined the impact of salience-based intervention and norm-based intervention on EV adoption decision in South Tyrol in Austria. In the salience-based intervention, respondents were provided information about the technical characteristics of EV like autonomy, space, emissions, speed, fuel type, etc.; the lifetime costs of EV like fixed and variable cost, energy cost, charging infrastructure, etc., and the norm-based intervention also contained a descriptive norm about choice of EV made by the reference group (people of South Tyrol) members in the recent years. The study finds a positive impact of salience-based intervention on EV adoption, while norm-based intervention was found to have no impact on EV adoption. Ahmad and Rahul (2024) analyzed the impact of information intervention among clusters of consumers for EV diffusion in different cities of Punjab India. The study provided information like technical benefits of EV s like and found that participants belonging to clusters with a high or moderate pro-environmental behavior displayed a stronger intent to purchase EVs, whereas participants belonging to clusters with low pro-environmental behavior reported a weak intent to purchase EVs.

Impact of framing intervention

Decrinis et al., (2023) used message framing in an RCT to examine Porsche employee’s decision to choose electric vehicles in a German context. Three different frames were used: emotional frame, normative frame, and gain frame. Emotional framing can be described as the display of information in a manner that can give rise to feelings of alignment with the aspirations, passions, and desires of an individual (Giorgi, 2017, p. 717). Normative frames are built to encourage change in behavior by triggering one's beliefs about appropriateness (Lindenberg & Steg, 2007). Gain frames are built around an emphasis on the perception of benefits from a desirable choice (Lindenberg and Steg, 2007). The three message frames were administered either via email notification or pop-ups. The frames were administered in the form of visual messages with short written statements. The study finds that message frames when sent out via emails rather than as pop-ups, have a higher chance of influencing people towards EV adoption, provided people take a decision about EV adoption soon after receiving the emails. However, the effectiveness of such message framing reduces over time. Regarding the three different types of message frames, gain frames have the highest impact on one's decision to choose EVs.

Impact of subsidies versus operational facilities

Langbroek et al., (2016) conducted a stated choice experiment in the context of Stockholm and found that facilities like access to free parking, access to bus lanes, etc., are more effective in nudging people to choose EVs in comparison to expensive subsidies.

2.2.4 The behavior formation process

So far, we have discussed the socio-psychological theories that inform the process of intention formation. We also discussed the behavioral interventions used to nudge people towards sustainable actions like the adoption of an EV. However, several studies have it that intention is only a proxy of behavior, and that there exists a gap between attitude and behavior, or intention and behavior. No well-established method has been proposed yet to bridge the gap between intention and behavior. Also, to develop a behavioral intervention that can be sustained over time, one needs to understand the time and self-regulated features of behavior (Bamberg, 2013). Such deficiencies may explain the inconsistent effect of behavioral interventions based solely on the existing theories (Michie et al., 2009).

To effectively promote EVs among people, it is not sufficient to analyze the decision to purchase an EV. Developing an understanding of the decision-making process that precedes the purchase of an EV is also equally essential. The barriers and promoters of people's decision to purchase EVs can be utilized effectively only when the intricacy of the decision-making process is understood. Stage models of behavior change have been in use for a long time in the field of health psychology (Klockner, 2014). Of these, the transtheoretical model of behavior change is popularly used.

2.2.4 A The trans-theoretical model (TTM) of behavior change

The trans-theoretical model of behavior change assumes five stages of behavior change process namely: pre-contemplation, contemplation, preparation, action, and maintenance. In the first stage, i.e., the pre-contemplation stage, an individual is believed to have not given any thought to engaging in the behavior in question. In the second stage, i.e., contemplation phase, awareness about problems is developed in people. In the next stage, the preparation stage, people start preparing for the desired change in behavior. In the action stage, people perform the behavior. In the final maintenance stage, people attempt to prevent falling back to their original behavior (Klockner, 2014). Researchers have found mixed results for the TTM model. Several studies have debated its theoretical status as it has no specific findings about the factors that triggers a person's behavior to transition to the next stage, or the duration to which a person remains in each stage of behavior (Sutton, 2000). To overcome these theoretical loopholes, Bamberg (2007) suggested combining the TTM model's assumptions with Gollwitzer's action phase model (Gollwitzer, 1996; Heckhausen and Gollwitzer, 1987). The model of action phases has many similarities with the TTM model. Additionally, it proposes that action phase model has distinctly demarcated points of transition between different stages of behavior, defined by different types of intention, i.e., goal intention, behavioral intention, and implementation intention in different phases. Bamberg later extended this theory by incorporating insights from the TPB theory and the NAM model and explained how socio-psychological factors explain the transition to different stages.

2.2.4 B The Self-Regulated Behavior Change (SRBC) Model

Bamberg proposed a stage model of self-regulated behavioral change (SSBC), which is believed to provide a theoretical framework for systematically developing behavioral interventions. In this theory, behavior change is assumed to progress through a temporally ordered sequence of stages. The SSBC explicitly factors in the aspect of time. It also stresses the self-regulated nature of behavior. The behavior formation process is perceived as a process in which there is an active investment of effort by setting goals, developing and enacting strategies to achieve the goal, evaluating one's progress, and if required, revising and resetting one's strategies accordingly (Baumeister, 2005).

The central idea of the SRBC theory is that behavior change is best observed as a person's transition through temporally ordered, qualitatively different stages of behavior. It is based on the model of action phases (Gollwitzer, 1990). According to the SSBC theory, the time-regulated pathway of behavior change can be categorically arranged into four independent stages: pre-decision, pre-action, action, and post-action. In each of these behavior transition stages, an individual need to find solutions to specific tasks in order to change their behavior successfully. In the first stage, (pre-decision stage), individuals reflect on their competing desires and finally chooses some of those to convert them into binding goals. Their commitment to specific behavioral goals then guides their goal intentions. Once their intention is set, they transition into the second stage, called the pre-action stage. Several actions are used to achieve the goals. The primary task is to choose a behavioral strategy for the action, by weighing the pros and cons of all available behavioral strategies. With the formation of an explicitly behavioral intention, individuals transition into the third stage, called the action stage. In this stage, individuals then execute the behavioral strategy earlier chosen by them, in the form of implementable action. According to Gollwitzer (1999), the formation of a new behavioral strategy is made easier by the development of an implementation intention. In the fourth stage called the post action stage, individuals evaluate what they have achieved and whether there is a need for further actions. This evaluation is done by comparing the outcome that was desired to the outcome that is achieved. Another task in the post-action stage is to ensure that they do not go back to their old behavior.

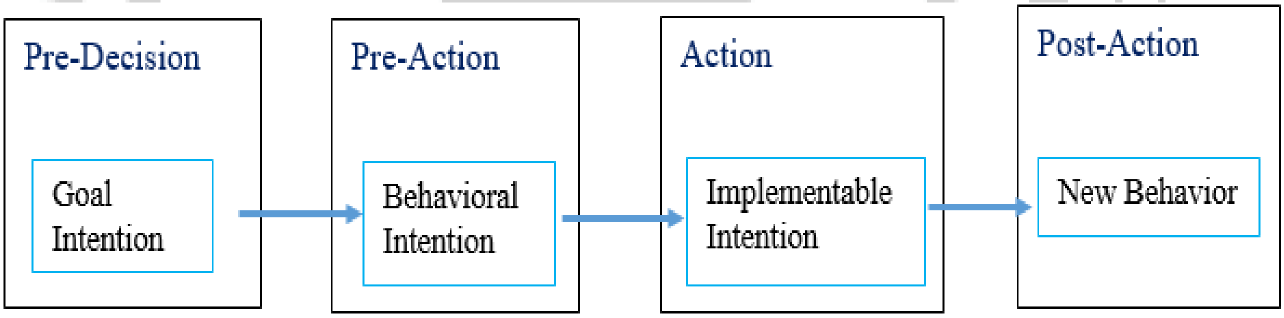

Figure 2.4 Stages of Behavior & Types of Intention

Figure 2.4 shows the different stages of behavior transition and three different types of intention in the stages of behavior. In the pre-decision stage, constructs based on the norm activation model (Schwartz and Howard, 1981) are used to explain the formation of goal intention. According to the assumption of the SSBC theory, once individuals gain awareness about the detrimental impact of their present behavior on the environment, their sense of personal responsibility for the harmful consequences develops. They begin to compare their behavior with what could be their ideal behavior. Such comparisons may lead to feelings of guilt or anxiety and perceived social norms. Fear of being disapproved socially and, the intensity of personal norms shapes their goal intention for fostering a change. In the second stage, the SSBC theory assumes that the constructs of the theory of planned behavior (TPB) get activated. Attitudes towards different possible behaviors and their perceived behavioral control about performing those behaviors influence goal intention to shape behavioral intention. In the third stage of behavior transition, that is the action phase, SSBC assumes the integration of additional factors like planning for action, coping, etc., which facilitates the formation of an intention. Coping planning involves the ability to visualize scenarios that may restrict the performance of behavior, and ways to manage such a challenging situation. Action planning considers the situational factors and the list of activities necessary to implement the new intended behavior. These are a few of the behavioral theories that form the backdrop of this thesis. In the next sections, we shall review the state-of-the-art findings of how these theories have influenced low-carbon behavior, particularly the adoption of electric vehicles (EVs).

2.2.5 Stage of behavior change and adoption of EVs.

Klockner (2014) used the stage model of behavior change to examine people's pro-environmental choice in terms of buying electric vehicles, with slight adjustments made according to the context. This study was conducted with 113 Norwegian individuals who were interested in buying an electric car but have not purchased yet. The study finds that most of the participants displayed a nearly phase-wise transition as suggested in the SRBC theory, with jumps limited to only one step forward or backward. Few participants displayed transitions in the behavioral phase with jumps skipping a stage of behavior entirely. Another group of participants did not change their stage of behavior and remained stable in one stage over the entire duration of the study. EVs being a high investment product, people were also found to stay in one phase of behavior for a relatively longer time. Using a stated choice experiment, Langbroek et al., (2016) combined the PMT theory with the TTM model to examine EV adoption in Stockholm. The study reports that the possibility of choosing EV increases when a person is in the advanced stages of behavior. Again, policy incentives are found to have a positive impact on EV adoption decision. A non-linear and positive association is found between EV adoption and the stage of behavior change, provided policy aspects are controlled for. The efficacy of subsidies is found to decrease for people who are in the advanced stages of decision-making towards EV adoption. Langbroek et al., (2019) examined the same theoretical framework is a slightly different context in an island called Gotland in Sweden. A network of

EV charging infrastructures and EV rental facilities was built around the island and the study compares use of electric rental vehicles vis-s-vis conventional rental vehicles. The study reports that people who choose to rent an EV are already in the advanced stages of decision-making towards EV adoption, and have better knowledge, and a more positive outlook about EVs.

Biehl et al., (2019) uses the TTM theory to examine how individual-level, community-level, and socio-psychological factors impact the chances of transitioning between various levels of readiness to engage in a bike sharing scheme, in the context of USA. The study suggests using stage specific behavioral interventions to make them transition forward into the different stages of behavior formation process. The intermediate stage of behavior transition is found to be more flexible to change as in this stage a person is not contained in any strong habitual orientation. People in the older age group are mostly found to belong to the two initial stages of behavior transition process, and the younger age group individuals in USA seem to be more open to collaborative consumption. People who already own a bike are found to belong to the action-maintenance stage of the behavior transition process. People who do not own any vehicle are mostly found to belong to the contemplation stage for the idea of bike-sharing. Students are found to display orientation of being in the preparation stage, while people employed in a full-time job, and those in the lower income groups are found to belong to the action-maintenance stage. From the perspective of location, people residing in the sub-urban locations are mostly found to have an orientation of being in the pre-contemplation or contemplation stage. People who are not content with their present mobility habits are also more likely to be in the later stages of behavior transition for adoption of bike sharing. From the perspective of socio-psychological indicators, the study finds that identity formation' with active forms of mobility is more likely associated with a stronger intensity in the contemplation stage as compared to the later stages of behavior transition, i.e. from preparation to maintenance. One possible reason that the author points out is that when there is a lower resistance to change one's travel behavior, starting from the contemplation stage, it shapes people's identity formation associated with active mobility which then influences the person's transition to the later stages of behavior. Norms are found to be more impactful in the preparation phase. Regarding contextual factors, presence of adequate biking infrastructures, a person's inherent interest technological innovation are more likely to be in the advanced stages of the behavior formation process. Bruckmann (2022) examined the intention to adopt new energy technology in four Swiss cantons of Aargau, Schwyz, Zug, and Zurich by using information and experience interventions. One group was provided information on battery EVs, and another group was provided with the same information along with a test-drive experience. The study finds that the group provided with dual interventions of information & experience reported a stronger intent to purchase BEV.

2.3 Gaps in the Literature

Recently, social scientists have increasingly begun to take a behavioral approach in addressing climate change and environmental concerns. For instance, in the context of low carbon mobility, earlier the focus was only on the development of EV batteries, improvement of driving range, and improvements of the other technical attributes. However, the adoption of any technology is rooted in a multitude of factors, other than simply its technical characteristics. One example is the stickiness of people's habit. To bring changes in existing habits, a deep understanding of one's pro-environmental intentions is essential. This understanding forms the background for further analysis into people's behavior. While intention to adopt EVs has been mostly analyzed in the developed nations, these insights will vary for developing nations. This is one gap in the literature that the thesis aims to address. In addition, while only norm motivation and gain motivation have been examined in existing studies, no study examines the impact of fear and protection motivation in determining intention in a developing country context. This is another gap in the literature. In addition, this study extends the theory of planned behavior (which encapsulates gain motivation) with two new context-specific constructs called 'herd behavior' and 'cost'. Existing studies have also not exclusively explored how male vs female, metropolitan vs non-metropolitan, and young vs middle-aged group individuals differ in their gain, norm, and fear & protection motivations. This thesis proposes to fill this gap. Regarding the use of nudges in the context of EV adoption, mostly studies have used different interventions like subsidies, monetary benefits, different forms of informational intervention, etc. Additionally, this thesis examines nudges like mental accounting principles, social recognition, defaults, etc. Very few studies have examined the role of socio-psychological variables in different stages of behavior towards EV adoption. This thesis attempts to provide more insights into this aspect as well. Based on these research gaps, we have outlined the research objectives and research questions which are discussed in Chapter 1, and further detailed in the respective chapter.

The next chapter outlines the design of the study, the sampling frame, data and variables, the sample characteristics, and a description of the experiment.

Chapter 3. Design of the Study and Sample Characteristics

In the previous chapter, we discussed the theoretical frameworks used in this thesis. It was followed by a literature review on EV adoption based on the theoretical frameworks, and the gaps in existing literature have been identified. The chapter describes the basis for the selection of the three study sites in Assam. It outlines in detail the sampling framework and the data collection process. It goes on to describe the sample profile of the participants of the study, the sample characteristics and an explanation of the samples used in the different objectives of this thesis.

3.1 Selection of the Study Sites in Assam

Chapter 1 briefly describes the rationale behind choosing Assam as the study location in this thesis. In this section, we explain the reasons behind selection of the three different study sites in Assam. Three cities that are selected in this study are: Guwahati in west Assam, Tezpur in central Assam, and Dibrugarh in east Assam. Guwahati is the primary urban center and the largest city in northeast India. Besides the locational significance of each of these three study sites, selecting these locations spatially covers the entire state of Assam. It spans from west Assam (Guwahati) to east Assam (Dibrugarh), and touches upon central Assam (Tezpur). While Guwahati is a metropolitan city, Tezpur and Dibrugarh are fast growing cities of Assam, with several city expansion plans, and ongoing road development projects, which directly determines the future of the mobility sector.

In recent years, Guwahati city has experienced a significant 18.34% increase in urban population in the period between 2001 to 2011, which is the latest available census. The population density according to the 2011 census is 4393 per square kilometer. In 2024, one can well imagine the magnitude of urban population growth, driven by increased rural-urban migration, economic opportunities, and infrastructure development, thereby transforming Guwahati as a large urban center (Choudhury et al., 2024). Government schemes like the Atal Mission for Rejuvenation and Urban Transformation and the Smart Cities Mission are expected to propel further growth for Guwahati city. This implies that the rate of migration and urban population growth will continue to increase. Guwahati city is also projected to be a major transport hub for regions as far as in Southeast Asia in the future. For instance, India's Act East Policy aims to increase trade across the borders by developing towns in the border areas like

Dawki, Champhai, Moreh, and Pangsau in Meghalaya. There are other international corridors proposed to connect Guwahati with the neighboring countries like the Guwahati-Chittagong and Guwahati-Kunming corridors. Such proposed international corridors aim to foster cooperation in the ASEAN, SAARC, and Greater Mekong sub-region Cooperation (GMS). Rapid development of roads, growth of industries, and migration in Guwahati has significantly altered the city's structure, especially around the primary commercial and trade routes around Guwahati city. This trend of rising investment along the commercial routes has begun to concentrate several other iconic projects and investments in other small towns near Guwahati city.

Owing to rapid urbanization, economic activities, vehicular emissions and dust, Guwahati city has emerged as one of the world's highest black carbon emitters (ENVIS Centre, Govt. of India). Over the last 10-12 years, the rapid unplanned urbanization has left the city with a scarce network of only two main roads connecting various parts of the city, while the bulk of the remaining residential and tertiary roads are dead ends, adding to traffic congestion (Hemani and Das, 2016). During monsoons, the road congestion further increases due to waterlogging in the city, drastically slowing down traffic, and increasing fuel consumption. Also, the city's poor system of public transportation makes personal vehicles the preferred mode for daily mobility.

Dibrugarh, located in the easternmost part of Assam, is quite far from Guwahati which is in the western part of Assam. It is an industrial hub with tea and oil industries as its major industrial sectors. With the completion of the Bogibeel Bridge construction, which is the longest rail-cum-road bridge in India, the travel time has significantly reduced between Assam and the neighboring state of Arunachal Pradesh. Since then, the flow of migrants to the city has increased, and so is the rate of urbanization. It being a hub for health care, tea industry, oil, and petrochemicals, it attracts a lot of skilled and unskilled workers from around the state as well as from other regions of the country. Industrial goods movement is also high around Dibrugarh. It is also a tourist center in Upper Assam, due to its tea gardens, temples, and proximity to eastern Arunachal Pradesh.

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, Housing & Urban Affairs, Government of Assam). Tezpur is also a significant base for the Armed Forces, which is responsible for securing the Tawang sector, India's northern border with China. After securing the semiconductor manufacturing plant in Jagiroad in Assam, the government in Assam is trying to attract foreign investment to establish a Defence Industrial Corridor (DIC) from Guwahati to Tezpur. Such existing DICs in Uttar Pradesh and Tamil Nadu has already been very successful in boosting indigenous production in the defense sector. Hence with such plans in place, Tezpur holds significant promise as a future defense industrial base in Northeast India. Such DICs help to create jobs and boost economic growth. The potential of increased growth, increased urbanization, also hints towards increased mobility in these potential urban hubs. Hence, it is crucial to develop EV friendly infrastructure in these urban hubs so that the increased mobility in the future does not lead to increased vehicular emissions.

Hence, these locations in Assam are considered for this study.

3.2 Sampling and Data Collection

3.2.1 Sampling

Since this thesis is based on individual behavior, hence primary, individual-level data is required. Primary data was collected through a mix of offline and online questionnaires. 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). 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 obtained, the offline questionnaires were distributed randomly to participants in the sampling locations. The selection of the universities and offices was based on convenience and the selection of the sample in the shortlisted universities/colleges and offices 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.

Students and office staff were approached for the study as these two groups fall in all the ages between 18-60 years of age. This is the age range when an individual is in their peak consumption decision making stage. In addition, it is convenient to find students and office staff in one static location.

The targeted sample for the study were individuals between the ages of 18 and 60 years. The lower limit of the age boundary is set at 18 years as this is the age when an individual is considered as an adult in India. 60 years is selected as an upper age boundary as it coincides with the retirement age in India. This age bracket comprised most of the people who make decision regarding the purchase of vehicles for themselves or in the household.

Since this thesis analyzes the adoption of EV in the personal vehicle segment, only 2-wheelers and 4-wheelers are considered in this study. Examining commercial vehicle segments like EV 3-wheelers is beyond the scope of this thesis. Most of the purchasers of electric 2-wheelers are the younger section of the population who are in college or are just employed. 4-wheelers are usually purchased by families with two or more members. Due to its higher costs, the buyers of 4-wheelers are usually in the employed pool. In some other cases, children have a say in the investment decisions made by parents, as big investments are generally made collectively in a household in India. Hence consideration of the psychological underpinnings of intention formation in both the younger and the older generation becomes important. Also, 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 the working population constitutes the potential consumers of commodities like personal vehicle. In the socio-psychological survey, both students (above 18 years), and office workers (within 60 years) were selected to have a better representation of the future potential consumers of personal EVs. For the low-carbon mobility stated choice experiment, however, the age category was restricted to 18-25 years only. This was because the experiment involved the interactive stated choice experiment, and it was designed specifically for students, who are not in the workforce yet. Inclusion of working individuals would have required a different set of experimental booklet and would add another layer of heterogeneity. 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 – INR 500,000; and ‘strivers’ whose annual earnings lie between INR 500,000 – INR 10,00000. In the year 2009-10, 28.4 million households earning annual income between INR 250,000 – INR 1,250,000 were classified as middle-class households (Aslany, 2019). According to Atsmon et al., (2012, cited in Javalgi et al., 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).

3.2.2 Data collection

The first step in the data collection process was a pilot survey. During the pilot study, a total of 220 questionnaires were distributed and 183 complete responses were received, yielding a response rate of 83.18% (=183/220). The main purpose of the pilot survey was to check the convergence of the socio-psychological model outlined in the conceptual framework of the study. In addition, the pilot data was analyzed to check for comprehensibility, wording errors, and comprehensibility of the statements used in the questionnaire. The pilot survey was conducted in Dec 2021 - Jan 2022.

The data collection was completed in two phases. The first phase began from February 2022 until May 2022. In this phase of data collection, the focus was on elicitation of intention, gain, norm, and fear & protection motivation. The questionnaire included items for all the constructs illustrated in the conceptual framework of the study. The second phase of data collection was carried out from June 2023 until September 2023. In the second phase, the questionnaire used in phase-1 was administered. In addition, another questionnaire in the form of an interactive booklet containing the stated choice experiment was also circulated.

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 seven-point Likert scale, where 1 indicated 'strongly agree' and 7 indicated 'strongly disagree'.

3.2.3 Sample profile

Phase-1 data

The data collected in phase-1 had total of 341 filled-in responses. 319 samples were retained for further analysis after the elimination of incomplete and redundant responses. The sample profile of the data set is provided in the table 3.1 below.

Table 3.1 Sample Profile for Phase 1 Data

Location	Profile	Size
Online		

HSS Dept., IIT Guwahati	PhD Research Scholars	30
Tezpur Central University	MSc Mathematics	18
Social Media Platform		180
Offline		
Tezpur Central University	Faculty	6
Darrang College, Tezpur	Faculty	21
Statistical Survey of India, Tezpur	Office Staff	7
Life Insurance Corporation of India (LIC), Guwahati	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
Total		341

Table 3.2 Sample Characteristics for Phase 1 Data

Demographic Characteristic	**Category**	**Count**	**Percentage**
Gender	Female	164	49.7%
	Male	163	49.4%
Age	18-25	87	26.4%
	26-35	131	39.7%
	36-45	46	13.9%
	46-60	64	19.4%
Education Level	School Level	9	2.7%
	Higher Secondary	24	7.3%
	Graduate	102	30.9%
	Post-Grad & above	193	58.5%
Annual Household Income (INR)	<2,50,000	84	25.4%
	2,50,000-500000	82	24.8%
	50,0000-7,50,000	37	11.2%
	7,50,000-10,00000	36	10.9%

	10,00000-12,50,000	19	5.7%
	12,50,000-15,00000	18	5.4%
	>15,00000	33	10%
Residence	Village	46	13.9%
	Town	190	57.6%
	City	89	26.9%
No. of Vehicles (2-wheelers and 4-wheelers) in Household	None	36	10.9%
	One	115	34.8%
	Two or more	169	51.2%
Avg. Daily Distance Travelled	<10 km	131	39.7%
	10-20 km	100	30.3%
	20-50 km	59	17.8%
	50-100 km	15	4.5%
	>100 km	10	3%

The data from phase-1 survey did not have enough representation in terms of the minimum sample size required for each demographic group. So, the questionnaire from phase- 1 survey was continued in phase-2 data collection round as well, along with the stated preference questionnaire. According to Sagan (2019), and Fan et al., (1999) a sample consisting of atleast 200 responses is required to conduct structural equation modeling. Another study by Anderson and Gerbing (1984) states that for a SEM model with three or more indicators for each factor, a minimum of 100 sample size ensures model convergence and a sample of size 150 ensures convergence as well as a reliable solution. Thus, in addition to the old sample with a total of 341 filled-in responses and 319 workable responses, a new sample is collected to supplement the previous data set from objective one.

As discussed in section 1.5.3 in Chapter 1, since the data is in the form of latent constructs, hence structural equation modeling is the method used for analyzing the data from the socio-psychological survey.

Phase-2 data

For the phase-2 round of data collection process, two questionnaires were provided to each participant: one questionnaire from objective 1 (to obtain a minimum sample size for the demographic groups) and a second questionnaire booklet consisting of an experiment required for analyzing objectives 3 & 4 of the study.

Table 3.3 Sample Profile for Phase 2 Data

Location	**Profile**	**Size**
Cotton University, Guwahati	MA Economics 1st year	36
	MA Economics 2nd year	10
	BA Economics 1st year	40
	BA Economics 2nd year	50
	BA Economics 3rd year	49
B Barooah College, Guwahati	BA Economics 2nd year	47
	BA Economics 1st year	45
North Guwahati College, North Guwahati	BSc Chemistry	80
Dibrugarh University, Dibrugarh	MA Economics 1st year	52
	MA Economics 2nd year	50
	MA History 1st year	44
	MA History 2nd year	48
	MA Geography (2nd & 3rd year)	56
Darrang College, Tezpur	BSc Mathematics (2nd & 3rd year)	42
	BSc Statistics (2nd & 3rd year)	34
	BA Economics (2nd & 3rd year)	30
	BA Political Science (2nd & 3rd year)	28
	B Com (2nd & 3rd year)	25
Tezpur College, Tezpur	B Com (2nd & 3rd year)	21
Total		787

Table 3.4 Sample Characteristics for Phase 2 Data

Demographic Characteristics	**Category**	**Count**	**Percentage**
Gender	Male	280	35.57%
	Female	509	64.67%
Location	Metropolitan	208	26.43%
	Non-metropolitan	581	73.82%
Monthly Disposable Cash	< 5000	610	77.51%

	5001 - 10000	126	16.01%
	10001 – 15000	36	4.57%
	> 15000	15	1.91%

For objective 1B, the data from both phase-1 and phase-2 were combined after a representative sample size for each demographic category was obtained. The new sample profile for the supplementary data required to analyze objective 1B is provided in the table below:

Table 3.5 Sample Profile of the Combined Phase 1 & 2 Data for Common Variables

Location	**Profile**	**Size**
Social Media Platform		180
Statistical Survey of India, Tezpur	Office Staff	7
Life Insurance Corporation of India (LIC), Guwahati	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

The samples used for the analysis of objectives 1A, 1B, 2 and 3 are shown in the table below.

Table 3.6 Surveys Used for Different Objectives and Analysis

Objective	**Analysis**	**Data Round**	**Sample Size**

1A	Overall determinants of intention to adopt EV Extended TPB models	Phase-1	341 (total) 319 (workable)
1B	Variation in intention pathways for gender groups: male vs female	Phase- 1+2	1112 (total); 368 (male workable), 641 (female workable)
1B	Variation in intention pathways for age groups: young vs middle age group	Phase- 1+2	1112 (total); 921 (young workable), 114 (middle workable)
1B	Variation in intention pathways for location groups: metropolitan vs non-metropolitan group	Phase- 2	787 (total); 253 (metropolitan workable), 470 (non-metropolitan workable)
2	Effect of nudges on stated choice for sustainable mobility	Phase- 2	787
3	Intention pathways and effect of nudges in different stages of behavior	Phase- 2	787

From the total responses received, incomplete and inconsistent responses were removed. The elimination of such redundant responses was not done for the overall data set, but separately for the sub-sets of the overall data set in each of the analysis indicated in Table 3.6.

Attention check questions were included in both the intention questionnaire and the stated choice questionnaire. Participants who failed to provide correct responses in the attention check question, their responses were eliminated from the final workable sample. The filled-in questionnaires with missing values are also eliminated from the final workable sample. Finally, inconsistent responses were also removed to obtain the workable sample. Attention check questions are commonly used to filter out respondent's inattentive responses and improve the quality of the data (Pei et al., 2020).

In this thesis, participants in the age groups between 18-35 are considered in the younger age group while participants in the age group between 36-60 are considered in the middle age group. The reason for this age demarcation is based on the fact that individuals above the age of 18 years are considered as adults in India. In addition, 35 years is the upper age limit for employment in India which indicates that individuals between ages 18-35 are mostly students or graduates looking for/entered employment. Again, the retirement age in India is 60 years for most of the jobs. People between the age 36-60 are either settled well in their job or have increased incomes in comparison to the individuals in the age group 18-35. This means the middle-aged group has a higher purchasing power and hence are potential consumers in the market for automobiles.

Cities with a population size of atleast 1 million are considered as metropolitan areas (Kundu et al., 2019). Whereas cities with population less than 1 million are considered as non-metropolitan areas.

The questionnaire and the experimental booklet used in this thesis are attached in Appendix 1.

In the subsequent chapters, we shall delve deeper into each of the objectives, sub-objectives, theoretical framework and hypothesis/ research questions, methods used for analysis, and the results & inferences for each objective of this thesis in details.

Chapter 4. Determinants of the Intention to Adopt an Electric Vehicle (EV): Role of Gain, Norms, and Fear & Protection Motivation.

This chapter focusses on identifying the socio-psychological factors that influences the psyche of an individual towards developing an intention to adopt an electric vehicle (EV). The broad aim is to contribute to the existing literature to list out the direct and indirect stepwise process affecting the formation of intention to adopt an EV in the minds of middle-class individuals in Assam, India. The preceding chapters, which reviews the state of art findings on the subject, elaborates the intent to adopt EVs in developed nations like USA, nations across Europe, and China. A few studies in the context of Malaysia have also been discussed. While in India, the infrastructure situation, and the social context is very different from the developed nations, yet the middle-income class in India is growing very fast, with rising incomes, aspirations, and so are their demands for luxury & status. The intention to adopt an EV is classified into different types like gain motivation, norm motivation, and fear & protection motivation. This chapter places the process of intention formation as against this background of new socio-economic context of the rising middle-income group.

Accordingly, this chapter is arranged as follows. It begins by elaborating the theoretical background, a brief discussion of the middle-class's perspectives of the personal mobility space, followed by conceptual framework. This will be followed by the objectives, research questions, data, and the sample profile. This chapter also briefly outlines the methodology, results, and analysis. Finally, the chapter concludes with a discussion of the results and possible policy implications.

4.1 Theoretical Foundations: Pro-Environmental Behavior

The 1970s sparked sufficient interest among environmental psychologists in the underlying factors of pro-environmental behavior. Various terms have been used by researchers to describe this range of behaviors like environmentally significant behavior, environmentally concerned behavior, environmentally responsible behavior, etc. (Lee et al., 2013). Pro-environmental behavior is defined as an individual's conscious actions performed in order to reduce the negative implications of anthropogenic activities on the environment or to enhance the environmental quality (Jensen, 2002; Kollmuss & Agyeman, 2002).

In the past couple of years, the significance of behavioral insights in mitigating climate change has been widely acknowledged. However, some gaps in knowledge regarding user behavior as a tool to mitigate climate change still exist at various levels (Stankuniene et al., 2020). Earlier, pro-environmental behavior was examined using socio-economic factors. However, with subsequent research, greater focus was laid on individual motivations behind pro-environmental behavior as it was established that human decisions are guided not only by rationality but also by intrinsic motivators (Yazdanpanah et al., 2021). Some commonly used theories to understand pro-environmental behavior are the theory of reasoned action (TRA theory), the theory of planned behavior (TPB theory), the norm activation theory (NAM theory), the value-beliefs-norms theory (VBN theory), etc.

4.1.1 The theory of planned behavior (TPB theory)

The Theory of Planned Behavior is a crucial socio-cognitive model which explains volitional behavior changes (Ajzen, 1991). The TPB theory states that greater the positive attitude towards a specific behavior, greater is the intention to engage in such behavior; the greater a person's positive subjective norm towards a specific behavior, greater the intention; and the greater a person's perception of his own behavior control, greater is the intention.

The TPB theory is extended from the Theory of Reasoned Action (TRA) (Fishbein & Ajzen, 1975). According to the TRA theory, behavior is directly guided by intention which is formed with the joint interaction of attitude and subjective norm. Attitude is defined as "the degree of a person's favorable or unfavorable evaluation or appraisal of the behavior in question" (Fishbein & Ajzen, 1975). Subjective norm is defined as "the perceived social pressure to perform or not to perform the behavior" (Ajzen, 1991). Hence, behavior is considered voluntary in the TRA theory, which was later criticized stating that behavior is not always completely voluntary (Liao et al., 2007). Ajzen (1985, 1991) incorporated the construct 'perceived behavioral control (PBC)' into the TRA framework as a response to the criticisms and called it the TPB model (Yazdanpanah & Forouzani, 2015). Fielding et al., (2008) define perceived behavioral control as "people's perception of ease or difficulty in performing the behavior of interest". In the words of Ajzen, PBC is "the perceived control over the performance of a behavior" (Ajzen, 2002).

As already discussed, the TPB model has been successfully applied across different contexts to understand the formation of intention. However, it continues to evolve with several extensions as required in different contexts to enhance the predictive power of the model (Yazdanpanah & Forouzani, 2015). Ajzen's TPB model is open to extensions, as Ajzen mentions that TPB was "in principle, open to the inclusion of additional predictors if it can be shown that they capture a significant proportion of the variation in intention or behavior" (Ajzen, 1991).

Based on a sample of 3505 people, Mohamed et al., (2016) found that a person's attitude and perceived behavioral control have a significant and large influence on the willingness to purchase EVs. Studies have examined different components of attitude like awareness, use of EVs, the experience of riding EVs, social need, pro-environmental action, social message, fuel consumption, and carbon emission and found that these factors have a huge influence on the adoption of EVs (Chen et al., 2016; Kaplan et al., 2016; Morton et al., 2016a; Jayaraman et al., 2015). However, a detailed analysis of the linkages between attitude and intention formation for EV adoption is yet to be filled in the literature (Singh et al., 2020). However, some studies attempted to resonate how different components of attitude lead to intention formation. When a person considers EVs as necessary for society, attitude towards EV adoption is found to be positive (Singh et al., 2020).

Perceived behavioral control is not found to take into account EV adoption intention that results from opinion and excitement led desire for EV (Mohamed et al., 2018; Adnan et al., 2017a, b). Afroz et al., (2015) finds strong impact of perceived behavioral control on EV purchase intention, however, its' impact is still found to be lesser than the impact of attitude on EV adoption intention. Exploring psychological variables at the level of emotions, Moons and Pelsmacker (2015) find that reflective emotions like aspects of eco-friendliness, cost economy, fuel economy, etc., are crucial drivers of EV use intention. The study also reports reflective emotions to have a greater impact than behavioral emotions like driving comfort, feeling of relaxation, and enjoyment. Visceral emotions like power and throb of the engine, appearance and aesthetics of the interiors, maximum speed limit, availability of full information on the car dashboard, etc., are not found to have any significant impact on the EV use intention.

Social determinants like peer pressure, effects of neighborhood, social responsibility, empathy for the society, social networks, acceptability in the society, collective efficacy, external validation, etc., have been studied (Singh et al., 2020). Literature has it that newer technologies are adopted with the motivation of receiving external validation (Liao et al., 2017; Sovacool, 2017; Rasouli and Timmermans, 2016; Jayaraman et al., 2015). On the contrary, Kim et al., (2014) finds lesser importance of social variables on influencing intention towards EVs. Nevertheless, subjective norm is always proposed as an important construct in most of the theories like Theory of Planned Behavior, Technology Acceptance Model, Diffusion of Innovation Theory. Studies support the significant impact of family, friends, relatives, and society on the intention to adopt EVs (Liao et al., 2017; Sang and Bekhet 2015b; Jeon et al., 2013).

In addition to examining the role of attitude towards EVs, subjective norms around adoption of EVs, and one's perceived behavioral control on the use of EVs, this study also extended the TPB theory with two additional constructs, namely 'herd behavior' and 'cost'. This study considered cost as an extension to the TPB theory as Indian consumers are seen to be quite cost-conscious, and hence it is hypothesized that given the higher upfront cost of EVs, people's intention to adopt an EV may be low. 'Herd behavior' is described as a social situation, where other people's decisions influence an individual's decision, and they are found to imitate one another (Chen, 2008). Herd behavior as an extension was considered in this study due to the prevalence of excessive social influence of people's activities through social media platforms. It was interesting to examine how cost and herd behavior influenced sustainability decision-making in a country like India, where cost and society play a huge role in people's lives.

4.1.2 The norm activation theory (NAM theory)

In the late 1960s, Schwartz originally proposed the NAM theory (Schwartz, 1968a; Schwartz, 1968b), which was later refined in a series of studies in the 1970s (Schwartz, 1970; Schwartz 1973; Schwartz, 1977). The three determinants of pro-social behavior outlined by Schwartz in the NAM theory are the awareness of consequence, the ascription of responsibility, and personal norms. According to the NAM theory, 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 would take some pro-environmental/pro-social action to stop environmentally/socially harmful action. This model is based on behavioral interventions which apply only in the context of existing events that might potentially lead to harmful consequences to oneself or collectively to society. The intensity of the degree to which an individual ascribes responsibility to himself/herself, the intensity of awareness, and the components of personal norm assume centrality in this theory as these forms the basis of the rationality of the NAM theory. It argues that the higher the intensity of these core components, the higher the probability of norms leading to intention for pro-environmental behavior (Sawitri et al., 2015).

NAM theory has found wide application in contexts like the choice of the travel model (Wall et al., 2007), people's behavior towards recycling (Do Valle et al., 2005), food ordering habits in restaurant (Yu et al., 2021). In the context of adoption of EVs, Asadi et al., (2021) argues that it is a mix of pro-environmental concern and pro-social concern.

Personal or moral norm is another determinant of intention that has been explored in literature. Self-interest, principles, conservation, openness to change, self-transcendence are some of the attributes which are encompassed by moral or personal norm (Singh et al., 2020). 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 EV (Jansson, 2011). Lending support to personal norms, Rezvani et al., (2015) stated that higher level of personal norm is associated with a higher chance of adopting an EV. Going a step further, He and Zhan (2018) found that personal norms become active when personal norm associated with environment is activated. Adnan et al., (2018) also finds that personal norms have a significant impact on the formation of behavioral intention. Personal norms are found to be positively influenced by awareness of consequence. Asadi et al., (2018) reports that environmentally sustainable behaviors result from greater awareness of undesirable outcomes from environmentally dangerous activities. Zhang et al., (2013) found that when employees were aware of the damages caused to the ecology, by electricity consumption, then a feeling of commitment develops in the minds of the employees.

Personal norms are also found to be positively impacted by ascription of responsibility (Nordfjaern & Rundmo, 2018; He and Zhan, 2018; Zhao et al., 2019; Sang et al., 2019). When people have an awareness of the undesirable outcomes that might happen from not engaging themselves in environmentally sustainable behaviors, they feel a sense of personal responsibility towards it, and develop a moral obligation to engage in the sustainable behavior (He & Zhan, 2018). Jayaraman et al., (2015) reports that a greater ascription of responsibility also impacts the intention to purchase hybrid vehicles directly.

Several studies have pointed out that intention and behavior being complex psychological outcomes, single application of either the TPB model, or the NAM model is not sufficient to explain the formation of intention towards pro-environmental behavior (Zhang et al., 2018; He and Zhang, 2018; Liu et al., 2017). Both these theories explain intention towards pro-environmental behavior from different perspectives. While NAM states that personal norm activates the altruistic motivations of the consumer, thus influencing an individual's decisions; TPB states that pro-environmental behavior is most likely to take place under the conditions of presence of favorable attitude towards the behavior, presence of external validation from their social circles, and a presence of self-belief in the performance of the behavior (Hamzah & Tanwir, 2021). Thus, NAM is skewed towards personal moral obligations, and personal sustainability motivations while the TPB is inclined towards social validations and self-interest motivations.

4.1.3 The protection motivation theory (PMT theory)

While the interrelationships between self-interest motives and altruistic motives have generated sufficient interest in literature, the consideration of the cognitive assessments of autonomic nervous system will provide an interesting perspective on the process of intention formation. More so, because, ultimately most of the decisions are also formed by the interaction of the conscious and unconscious process of the mind. Roger's (1975) Protection Motivation Theory (PMT) outlines the role of persuasion and fear on changes in attitude. In the process of spreading environmental awareness, or the probable dangerous consequences of driving/riding petrol or diesel operated 4-wheelers/2-wheelers, a person may be exposed to persuasive communications that hints towards personal harm to the individual. The intensity of the same may also be dependent on the framing of the message or the way in which it is communicated. The communication of such message is usually also followed by suggestions of sustainable actions that can stop such dangerous consequences, provided, the sustainable actions are adopted. Stimuli that arouse fear then begins to eliminate actions that might lead to the undesirable consequences or begins to guide towards sustainable actions that can prevent the occurrence of the undesirable consequences. In this way intention for sustainable action develops. Thus, the PMT theory uses fear as a motivation leading to the formation of intention, and is a fear appeals theory (De Steur et al., 2015).

According to the PMT, when an individual faces a threat, he/she makes two evaluations: threat appraisal and coping appraisal (Zhao et al., 2016). They assess how severe the threat may be and how vulnerable they are from the risk of the threat. Then in the coping appraisal phase, an individual tries to evaluate his ability to handle the severity of the threat, and his/her vulnerability from the risk associated with the threat (Pakmehr et al., 2020).

At present, researchers stress the use of integrated theories to analyze pro-environmental behavior. This study analyzed the process of intention formation in the Indian middle-class mindset by using single theories, as well as a combination of different theories (TPB, NAM), and Protection Motivation Theory (PMT)). In addition to that, this study also analyzed intention formation through two additional constructs: herd behavior, and cost, and incorporated the same with the extended TPB. The theories discussed above offer only a general explanation of the process of intention formation. Depending on the contextual specifications, these theories might operate differently. Various significant determinants have been found for every theory in different contexts, and for different countries.

Hence, this study analyzed the background of the mobility sector in India, so that the conceptual framework can be built by considering the psychological underpinnings of middle-class way of decision-making in India.

4.2 Background: 'New Middle-Class' & Personal Mobility Space

The middle-income group, or the 'middle-class' as it is commonly called, has gained widespread interest among businesses, as well as within the scholarly community (Liechty, 2003; Crow & Pope, 2008), owing to their increasing group size, and interesting economic characteristics. The term 'middle-class' is used to refer to a consolidated, heterogeneous bunch of population to stress their joint identity with reference to the upper income group. According to sociologists, the middle class is placed between the working class and the capitalists in a hierarchical manner (Mathur, 2010). The 'old middle-class is often compared with the 'new-middle class'. The latter group comprises of educated people from all social castes, employed in white-collar positions. The consumption practices of the 'new middle-class' is reported to have increased considerably as they share the experience of upward social mobility (Saavala, 2010). They depict remarkably enhanced aspirations for a better lifestyle, and other materialistic privileges which further strengthens their social identity (Conroy, 1998). This group tries to build their identity through the status of their employment and by acquiring status symbols like personal vehicles, and other branded goods. This trend is not limited to only urban centers but has equally swept across in the smaller cities and towns in India. Infact, many western brands and corporations now view this emerging group as the object of their marketing strategies.

In the 1980s, there was an element of frugality in the middle-class consumption pattern. Two-wheelers were the dominant mode of personal mobility. Products were designed, keeping in mind the aspects of functionality, durability, and practicality. Until the 1990s, the home-produced 'Ambassador' was the ruling car on the Indian roads, and it was far from affordable for the general masses (D'Costa, 2005). The car was used by a handful size of the upper-middle-class society like the ministers, political leaders, civil servants, and the like. Hence, it was the symbol of social status, which only the richer sections could aspire for (Nielsen & Wilhite, 2015). After the de-licensing of the passenger car industry in 1993, a greater variety of cars entered the Indian market (Mazumdar, 2012). That period was also marked by the beginning of continuous high growth of the economy for the next two decades, and growth in the proportion of the middle-class population (Fernandes, 2006). A greater majority of the Indian population had begun to aspire for the increasing comforts like air-conditioning homes, modern appliances like microwave ovens, washing machines, computers, mobile phones, etc.

Due to the increasing reach of options for luxury and its variety, frugality in consumption began to wane off. Ownership of a personal 4-wheeler was an important dimension of this enhanced luxury, and it replaced the 2-wheeler motorbike as the only dominant mobility option for the middle-class population. Today, in a rush to signal higher social status, utility or necessity is not the only driver of consumption in the luxury goods category. Consumption now is driven by an urge to keep up with the latest trends, fear of missing out (FoMO), inherent social competition, etc. Households now have begun to purchase more 4-wheelers that their requirement in an attempt to maintain variety in their car stock (such as, sedan, sports-utility vehicle (SUV), a small car, etc.), apart from the possession of 2-wheelers. While urban-dwellers living in limited space are restricted in their possession of multiple vehicles due to paucity of parking area, this trend is increasingly seen in many of the three-tier cities & towns, where private parking space is still not restricted.

An interesting observation is that, though India is a difficult market when it comes to cost of goods, people do not wish to accept it as a criterion driving their capability to purchase a good. Tata's Nano is a case in point to justify this phenomenon. It was positioned as 'people's car' or a common man's car which was made available at a price of just INR 100000. Nano was launched to eradicate the dangerous condition in which people travelled during the time (4-5 members in one 2-wheeler) when 4-wheelers were unaffordable to many. Though the Nano car itself delivered many utilities as compared to people's 2-wheelers at an extremely less cost, but its sales failed to make the mark and the low cost later proved to be a disadvantage, when technical complaints begun to crop up due to its low-cost manufacturing. Apart from that, the reputation of the Nano being the world's cheapest car soon begun to attach a stigma to it (Dhume, 2011; cited in Nielsen & Wilhite, 2015).

The question then arises regarding the use of public transportation which solves both the problem of affordability as well as mitigation of GHG emissions. In India, the use of public transportation was never a choice, but the only choice left in many instances. Due to the lower number of public transportation available per capita, those were very crowded and rendered a very uncomfortable travel experience. Added to the discomfort were the irregular schedules, prolonged waiting time at stops, and overall safety issues reported by women. Hence, with the rise in income, there is a natural tendency to shift towards a cleaner, reliable, and safer mode of transport, which is private mobility. Today, with the increasing government investments in public transport systems, the comfort aspect is improved by replacing the traditional buses with AC buses and increasing the fleet size. In terms of sustainability, in cities like Bangalore, and New Delhi, electric bus fleets have also become operational. However, the public transportation system is almost non-existent in most of the three-tier cities, and large towns, which also house a vast majority of the middle-class population in India. Given the background conditions, the demand for private mobility will continue to increase in India in the coming years.

In this study, since the target sample included people from both towns and a city, hence we have considered the intention to shift to electric vehicles as a sustainable mobility option and did not consider the intention to shift from private to public mobility option. At present, EV sales are negligible in India. As shown in figure 4.1, though the sales (in units of EV sold) have increased for the majority of the states in India from 2020 to 2021, EV sales are extremely minimal in comparison to the sale of petrol and diesel vehicles (see fig 4.2) even after a series of large-scale investments from the government of India. As shown in fig 4.2, the red bars indicate the units of EV sold in 2021 as against the green bars which indicate the units of internal combustion engine (ICE) vehicles sold in 2021. Even in 2020, the same contrasting picture is seen as indicated by the grey bars (EV sales) Vs the black bars (ICE).

Hence, there was no sufficient data to study the characteristics of early adopters of EVs as it is explored by some studies like Higueras-Castillo et al., (2020); Trommer et al., (2015); Hardman et al., (2019); Vassileva & Campillo (2017); Plotz et al., (2014); Chu et al., (2019); Mohamed et al., (2016); Campbell et al., (2012); Priessner et al., (2018), etc. In addition, this study attempted to explore the underlying pathways of intention formation of the general masses in India, rather than a specific group. This study was restricted to 2-wheelers and 4-wheelers as this study is limited to the passenger vehicle segment. Commercial EVs and public EVs are outside the purview of this study.

Figure 4.1 Monthly EV Sales Trend (Source: JMK Research)

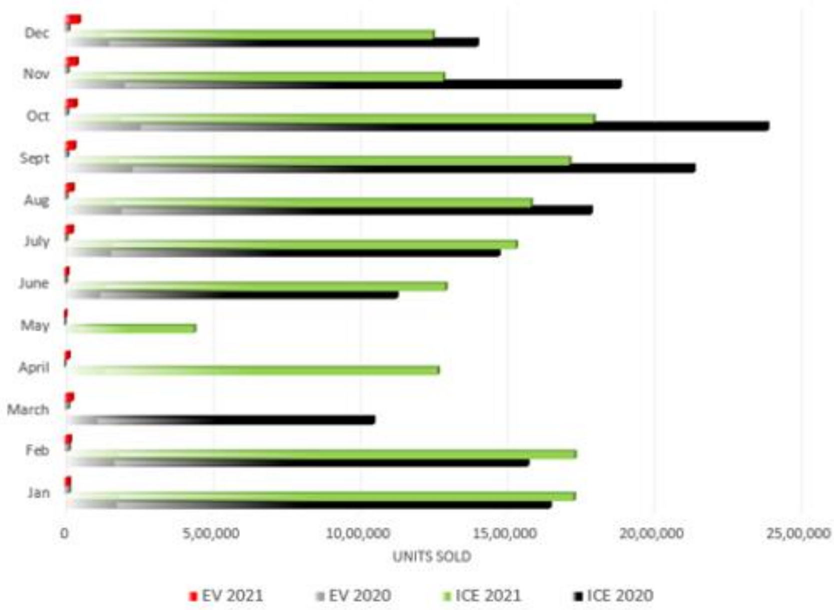

Figure 4.2 A Comparison: Monthly Sales of EV vs. ICE Vehicles (2020-2021) (Source: Society of Indian Automobile Manufacturers(SIAM))

4.3 The Conceptual Framework and Hypotheses of the Study

Rising aspirations, the quest for luxury, as much for signaling social status as for utility, and the inherent, deep-rooted social competition among the members of the social circle, are some of such characteristics of the middle-income group in India. However, at the same time, the climate extremes experienced across the entire country have created a consensus among the people regarding the need for urgent climate action. These two different perspectives in every individual then pose the question: how willing an individual is to trade-off status-signaling consumption for climate change mitigation? Do people fear the undesirable outcomes from climate change extremes or do present aspirations matter more? Do people really care about environmental benefits to be realized in the future vis-à-vis their immediate consumption?

To find answers to such questions, the primary objective of the study is to examine the determinants of intention to adopt EV.

Objectives of the Study

To examine the determinants of intention to adopt EVs

- To examine the gain motivators of intention to adopt EVs.
- To examine the norm motivators of intention to adopt EVs.

- To examine the fear & protection motivators of intention to adopt EVs.

Based on the findings in the literature, and the contextual background of personal mobility choices among the Indian middle-class population, the conceptual framework of the study has been built as shown in figure 4.3.

The blue arrows indicate the hypothesized pathways of intention formation. The three grey arrows represent mediated pathways facilitating intention formation, as stated in literature. The numbers against the arrows represent the hypothesis. The same has been listed in Table 4.1.

The components of gain motivators (as encompassed by the TPB model components), norm motivators (encompassed by the components of NAM model), and the fear and protection motivators (encompassed by the components of PMT theory) are indicated in three separate compartments. Some constructs are common to different socio-psychological theories. For instance, subjective norm is common to both the TPB and the NAM theory; the PBC is common to both TPB and PMT theory; and the AC is common to both NAM and PMT theory.

In addition to gain, norm, and fear & protection motivator components, the conceptual framework also consists of three extensions to the original TPB model: TPB + cost (TPB+CO), TPB + herd behavior (TPB+HB), and TPB + personal norm (TPB+PN). These extensions are hypothesized keeping in view the contemporary factors influencing everyday decisions among the Indian middle-class people.

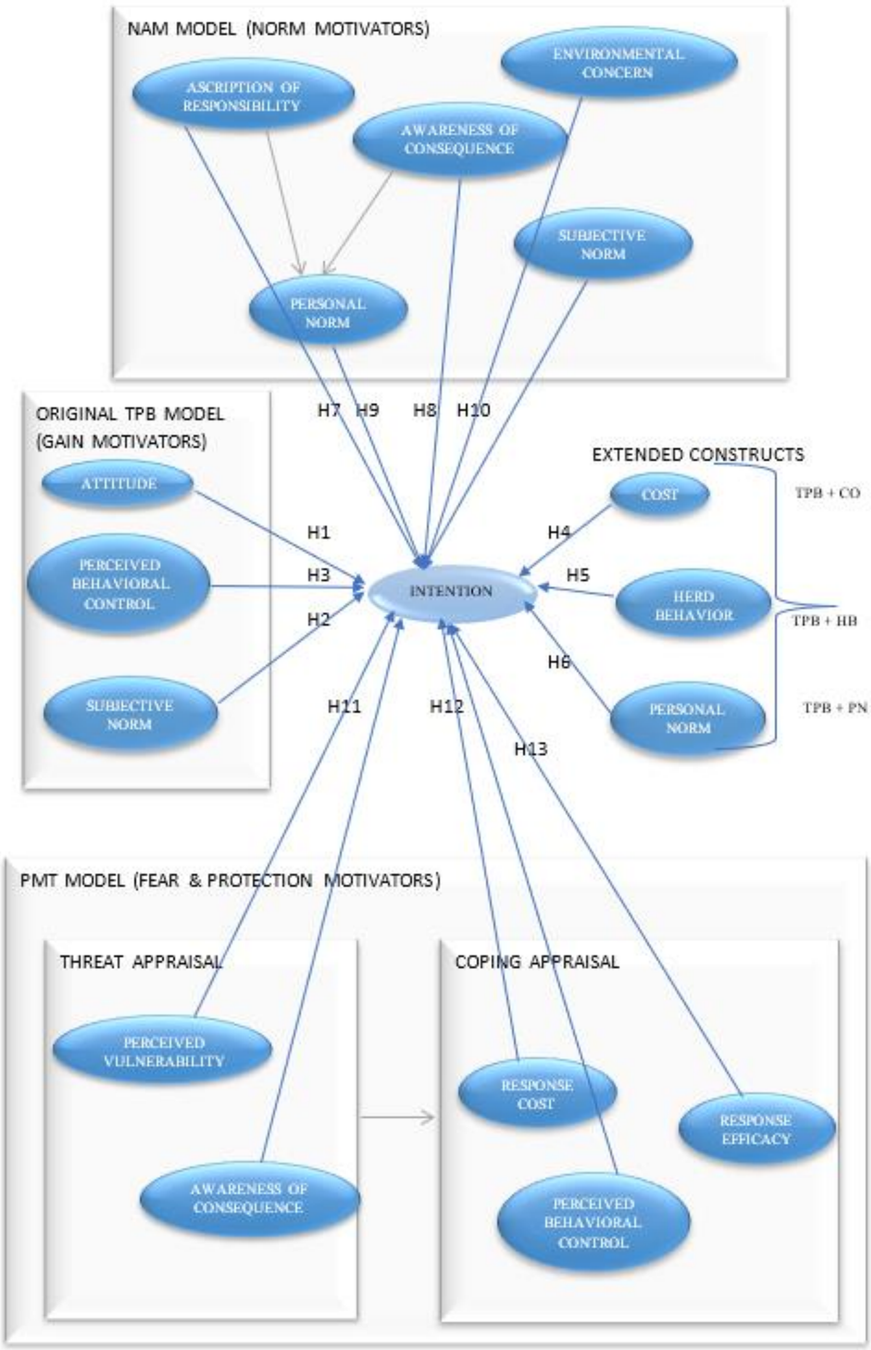

Figure 4.3 Conceptual Framework of the Study

Table 4.1 lists out the hypotheses of the study illustrated in Fig 4.3.

Table 4.1 The Hypotheses of the Study

Hypotheses
TPB Model

H1: Favorable attitude towards the use of EV → Intention to adopt EV in the future
H2: Higher subjective norm → Higher intention
H3: Higher perceived behavioral control → Greater is the intention to adopt EV in the future
Extended TPB Model
H4: Higher cost of EV → Lower intention
H5: Positive herd behavior → Higher intention
H6: Strong personal norm → Higher intention
NAM Model
H6: Strong personal norm → Higher intention to adopt EV in the future
H7: Higher is the ascription of responsibility → Greater is the intention to adopt EV in the future
H8: Higher is the awareness of consequence → Higher is the intention to adopt EV in the future
H9: Higher is the personal norm → Higher is the intention to adopt EV in the future
H10: Higher is the environmental concern → Higher is the intention to adopt EV in the future
H2: Higher subjective norm → Higher intention
PMT Model
H11: Higher is the perception of vulnerability → Higher is the intention to adopt EV in the future
H8: Higher is the awareness of consequence → Higher is the intention to adopt EV in the future
H12: Higher is the response cost → Lower is the intention to adopt EV in the future
H13: Higher is the response efficacy → Higher is the intention to adopt EV in the future
H3: Higher perceived behavioral control → Greater is the intention to adopt EV in the future

4.4 Methodology for Data Analysis

The analytical method used in this study are Structural Equation Modelling (SEM), and Mediation Analysis.

4.4.1 Structural equation modeling (SEM)

The term SEM does not encompass a single statistical technique, but a group of related methods. Some other terminologies like covariance structure analysis, analysis of covariance structures, or covariance structure modeling are also used in some literature to categorize these techniques under a single umbrella. SEM can be defined as a method of causal inference, wherein feeding in three inputs (I) leads to the generation of three outputs (O) (Pearl, 2012).

The three inputs of SEM are:

I-1. A set of qualitative causal hypotheses which are formed based on the theory or outcomes of empirical work based on SEM analysis

I-2. A set of questions about the causal relationships among the variables of the study, such as, what is the size of the direct impact of X on Y (denoted as X □ Y), keeping all other presumed variables affecting Y as constant?

I-3. Usually, SEM applications are designed in a non-experimental way, but experimental and quasi-experimental data can also be analyzed.

The outputs of SEM are:

O-1. Numerically estimated values for the parameters of the model for hypothesized effects, for example, value for the relation X □ Y, given data is available.

O-2. A group of logical implications of the model which might not correspond to a particular parameter directly, but which is still testable with the data.

O-3. The degree to which the testable results of the model are also supported by the data collected for the study.

The quality of the outputs from a SEM analysis is dependent on the soundness of the researcher's inputs. SEM examines a theory by first specifying a model which represents the projections of the theory among probable constructs that are then measured with suitable observed variables (Hayduk et al., 2007).

In SEM, there is a clear distinction between latent variables and observed variables. Observed variables refer to the indicators for which the data is collected using the survey questionnaire. Latent variables can be defined as constructs that are hypothetical in nature or explanatory units that are assumed to reflect a continuum that cannot be observed directly. For example, attitude is a latent construct. There is no well-set definition or measure of attitude. Rather researchers use different aspects of behavior to measure attitude.

The possibility to analyze both latent constructs and observed variables differentiates SEM from other standard statistical procedures such as multiple regression analysis, ANOVA, etc., in which only observed variables can be analyzed.

SEM places less stress on significance testing. This is because SEM evaluates entire models, which provides a high-level approach to the analysis. In a way, it can be stated that in SEM, the analysis of the overall model takes precedence over the representation of specific effects in the model (Kline, 2016).

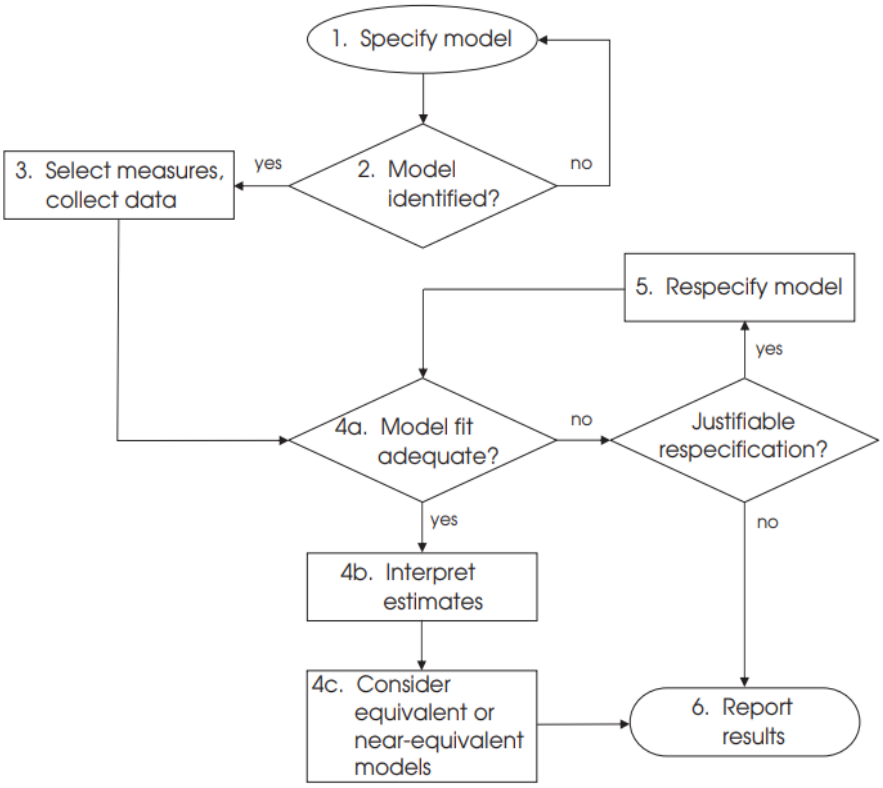

Figure 4.4 Steps Involved in Structural Equation Modeling (SEM) (Kline, 2016)

SEM involves the following steps:

(i) Specification of the model

In this step, researchers illustrate their hypothesis with graphical conceptual models, thus providing a visual representation of theoretical variables considered in the study and hypothesized relations among them.

Although graphical conceptual models serve as a useful heuristic for systematizing knowledge and the hypothesized relations between constructs, it must also be translated into a series of statistical equations to analyze them.

(ii) Model identification

A model is said to be identified if it is theoretically possible for the software to obtain a unique estimate for every parameter of the model. Identification is not a property of the data, but of the model. If a model fails to be identified, it will remain so and changing the sample size cannot help. Such models must be re-specified by returning to step (i).

(iii) Selection of measures, and collection of data

(iv) Estimation

In this step, the data collected in the previous step is statistically analyzed. The model-fit needs to be evaluated first. If the fit is not adequate, then re-specification of the original model must be tried to increase model fit, provided there is a justification behind the re-specification. If the model-fit is adequate, then the parameter estimates can be interpreted. This is followed by consideration of equivalent or near-equivalent models. An equivalent model explains the same data as well as the preferred theoretical model but with a contradicting pattern of causal relations among the same variables. There may exist many different equivalent or near-equivalent models. The researcher needs to justify the reasons behind selecting any model over the other equivalent models.

(v) Re-specification

One arrives at this stage if the initial model has a poor fit. In the context where a model is being generated, this is the time to consider the list of theoretically justifiable possible changes at the time of specification of the initial model. This step is guided by rationality rather than just statistical estimates. A re-specified model must again be identified, else the researcher remains stuck in this step until an estimable model has been generated.

(vi) Reporting the results

In this final step, researcher illustrates and explains the analysis in written report.

4.4.2 Mediation analysis

Mediated effects or indirect effects are a commonly occurring relationship pattern in social sciences research. A focus exclusively on the direct effects, and not considering the mediated effects can heavily bias the inference of the results. Mediation has become almost necessary in contemporary literature. The centrality of mediation analysis is that it assumes a sequence of relationships in which a precursor variable influences a mediating variable, which in turn influences a dependent variable. “Mediation is one way in which a researcher can explain the process or mechanism by which one variable affects another” (MacKinnon et al., 2007).

The requirement of a mediator variable in a model needs to be raised explicitly and justified upfront by asking the following questions: ‘why is a mediator variable required?’, and ‘which variable should be considered as a mediator variable and why?

Conceptualization of a mediation connection requires forethought regarding the interrelation between the variables of interest and the theoretical meaning behind those interrelations. Among the other matters, the validity and reliability of the instrument, and sample size are the crucial issues one must be cognizant of prior to administering a mediation analysis.

The following effects are seen in a mediation relationship:

Total effect: total effect denotes the influence of the independent variable on the dependent variable in the absence of the mediating variable. The total effect is denoted by the relation ‘c’ in figure 4.5. Direct effect: direct effect denotes the influence of the independent variable on the dependent variable in the presence of a mediator variable in the model. The direct effect is denoted by (c'). Indirect effect: indirect effect denotes the influence of an independent variable on the dependent variable through the mediator variables. Indirect effects are denoted by the relation ‘a’ and ‘b’.

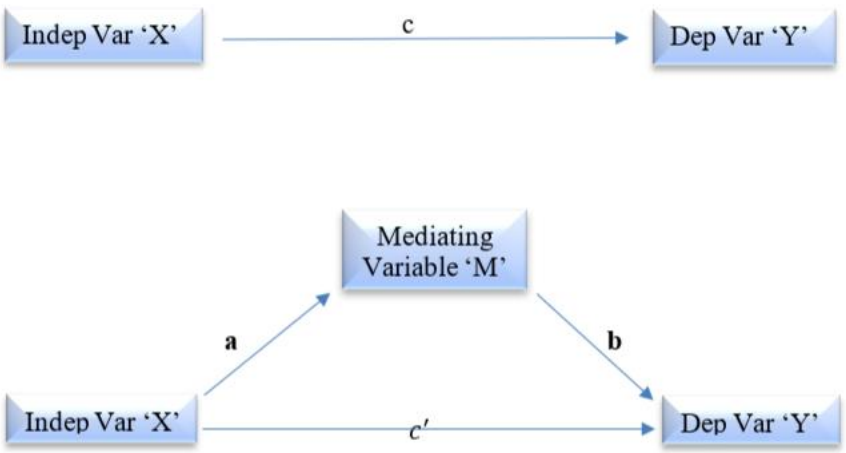

Figure 4.5 Mediation Model Basic Structure

In the figure, we see that ‘a’ indicates total effect ‘c’ of the causal association between variables X & Y. ‘b’ indicates a mediated effect in which X exerts an indirect interrelation ‘a x b’ through M on Y.

According to Baron & Kenny (1986), when we develop a hypothesis for mediation, we lay focus on how an independent variable ‘X’ affects a dependent variable ‘Y’ by an intervening variable ‘M’. As Preacher & Hayes (2008) summarizes, variable ‘M’ has a mediating effect if ‘X’ has a significant influence on ‘Y’ and on ‘M’; and if ‘M’ significantly considers the variability in ‘Y’. The influence of ‘X’ on ‘Y’ reduces when ‘M’ is entered simultaneously with ‘X’ as a predictor of ‘Y’.

Recently, Baron & Kenny's causal-step process for establishing a mediating effect have met with considerable challenges. For instance, it is argued that the first condition that 'X' needs to display a significant effect 'c' on 'Y' requires the necessary existence of an effect 'c'. At the outset, it seems unwarranted to further examine if there is a mediated effect if the effect 'c' does not exist. However, this argument holds only when complementary mediation exists (Zhao et al., 2010), which exists only when the relation path 'c' and the indirect relation 'a x b' has the same direction (i.e., positive, or negative). In the instances of competitive mediation, wherein the indirect effect 'a x b' and total effect 'c' are different, Baron & Kenny's 1st condition ceases to hold good.

In complex structural models, this can become crucial because the same model may have different mediation mechanisms at the same time. In such a case, it is possible that the direct effect 'c'' is not significant even when mediation is present and is therefore deceptive as a precondition for mediation analysis. Because of this precondition, many mediating associations were rejected prematurely in many studies (Hayes, 2009).

On the basis of this shortcoming, Preacher & Hayes (2008), Shrout & Bolger (2002), and Zhao et al., (2010) provides the following recommendations for consideration in a mediation analysis.

1st the need to test the indirect effect 'a x b' provides researchers with all the information for testing mediation.

2nd the strength of the indirect effect 'a x b' should determine the size of the mediation.

3rd, a bootstrap test needs to be used to examine the significance of the indirect effect 'a x b'

This development doesn't suggest stopping the examination of the direct relationship between X & Y, given by 'c'' altogether, but rather suggests that testing 'c'' with the intent to confirm a simple mediation effect is not necessary and can pose a barrier to theory building.

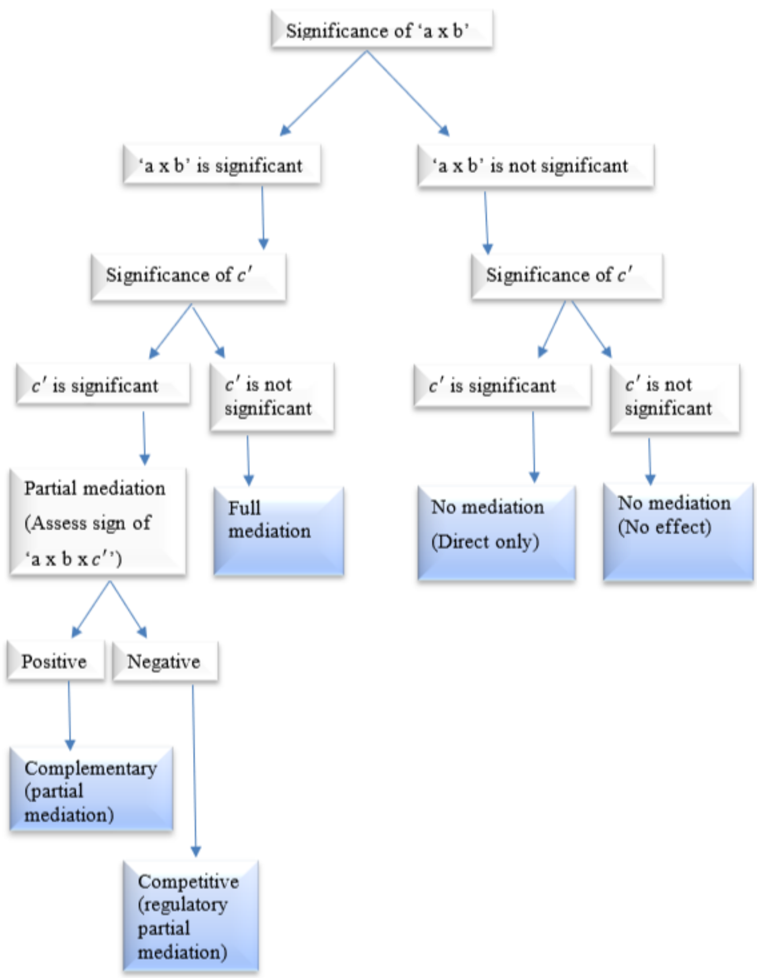

Figure 4.6 Steps Involved in Mediation Model (Zhao et al., 2010)

4.5 Data and Variables

This study is centered on the process of intention formation to adopt EVs among the middle-class people in Assam, India. 'Intention' is a subjective, latent construct. Analysis of intention and its determinants required primary data. The target population was the middle-income group in India. The middle-income group was considered in this study as this group comprised of the most important market in India at present, and it will be the potential consumer of EVs in the future. The study sample comprised of participants between the age 18-60 years. The lower limit of the age boundary is set at 18 years as this is the age when an individual is considered as an adult in India. 60 years is selected as an upper age boundary as it coincides with the retirement age in India. This age bracket comprised most of the people who make decision regarding the purchase of vehicles for themselves or in the household. Most of the purchasers of electric 2-wheelers are the younger section of the population who are in college or are just employed. Sometimes investments in the purchase of vehicles are also made by the parents. While in some other cases, children have a say in the investment decisions made by parents, as big investments are generally made collectively in a household in India. Hence consideration of the psychological underpinnings of intention formation of both the younger and the older generation becomes important. This need justified the age boundary of the selected sample in this analysis.

The intention to adopt EV is the dependent variable. Since gain motivation, norm motivation, and protection motivation are compared for their impact on intention, hence all the latent constructs measuring gain motivation, norm motivation, and protection motivation and their respective indicators constitute the independent variables of the study (see Fig 4.7). A sample of the questionnaire is attached in the appendix A.

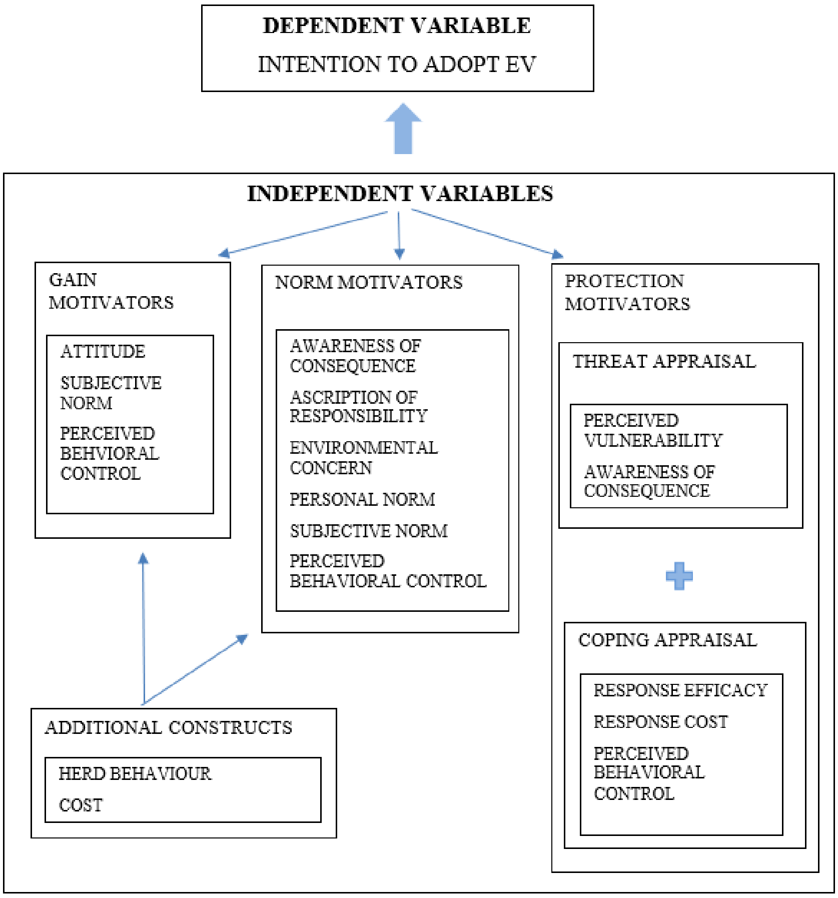

Figure 4.7 Variables Used in the Analysis

All the independent variables listed in the table above and the dependent variables are latent constructs, as these cannot be defined or measured objectively. The indicators for the latent constructs are borrowed from literature (see table 4.2). The indicators for two additional latent constructs namely herd behavior and cost are newly developed in this study. The responses to these indicators are measured by using a 7-point Likert scale.

Table 4.2: Scales used for the latent construct.

LATENT CONSTRUCT	**SCALE SOURCE**
Attitude (AT)	Lopes et al., (2019); Matsumori et al. (2019)
Ascription of Responsibility (AR)	Han et al., (2016); Rosenthal & Ho, (2020)
Awareness of Consequence (AC)	Han & Hyun, (2017); Han et al., (2016); Shin et al., (2018); Zhang et al., (2018); Wang et al., (2019); Rosenthal & Ho (2020)
Subjective Norm (SN)	Zhang et al., (2020a)
Perceived Behavioral Control (PBC)	Han & Hyun (2017); Han et al, (2016); Shi et al., (2017); Zhang et al., (2018); Lopes et al., (2019); Shahangian et al., (2021); Jiang et al., (2020); Joanes et al., (2020); Ahmmadi et al., (2021)
Personal Norm (PN)	Zhang et al., (2018); Shin et al., (2018); Rosenthal & Ho (2020); Zhang et al., (2020a); Zhang et al., (2020b)
Environmental Concern (EVC)	Shi et al., (2017); Ananno et al., (2021)
Perception of Risk (PR)	Savari & Gharechaee (2020); Shahangian et al., (2021); Ahmmadi et al., (2021)
Perceived Vulnerability (PV)	Pakmehr et al., (2020); Delfiyan et al., (2020)
Response Efficacy (RE)	Pakmehr et al., (2020); Delfiyan et al., (2020)
Response Cost (RC)	Pakmehr et al., (2020); Delfiyan et al., (2020)
Intention (INT)	Ajzen (1991)

The scales borrowed from literature have already been established in different context. The results, however, have been mixed. The scales for herd behavior and cost have been newly developed for the purpose of this study, and hence is not included in the above table.

Table 4.3: Brief descriptions of the latent constructs

LATENT CONSTRUCT	**BRIEF DESCRIPTION**
Attitude	"the degree to which an individual has a desirable or undesirable appraisal or assessment of the behavior" (Ajzen, 1991)
Ascription of Responsibility	"feelings of responsibility for the adverse consequences of not performing pro-socially" (De Groot and Steg, 2009)
Awareness of Consequence	"whether individuals are aware of the negative outcomes for others or for other things one values when not performing pro-socially" (De Groot and Steg, 2009)
Subjective Norm	"the realized social pressure to engage or not engage in a behavior" (Ajzen, 1991)
Environmental Concern	"an individual's general orientation towards the environment" (Kim & Choi, 2005; Shi et al., 2017)
Perceived Behavioral Control	"perceived ease or difficulty of performing a particular behavior" (Ajzen, 1991)
Personal Norm	"feeling a moral obligation to do or refrain from particular actions" (Schwartz & Howard, 1981)
Perceived Vulnerability	"the extent to which a person believes, personally, that she will suffer from, or be vulnerable to, the negative impacts of the threat" (Grothmann & Patt, 2005; Rainear & Christensen, 2017)
Response Efficacy	"one's assessment of recommended responses to prevent or reduce the negative effects of a threat" (Delfiyan et al., 2021)
Response Cost	"the costs of implementing recommended responses to reduce the negative effects of threats" (Delfiyan et al., 2021)

Table 4.3 describes the general meaning of the latent constructs as it has been used in literature.

However, each latent construct can measure multifaceted aspects. Based on the presence of common aspects among the constructs, and based on the theories, these have been used to measure gain motivation, norm motivation, and fear & protection motivation.

The primary data for this study was based on a convenience and random sampling framework. A similar sampling frame was used in prior literature (Jiang et al., 2020; Han et al., 2017). Data was collected by a combination of online and field survey. Online questionnaires were sent out through emails and WhatsApp groups using a convenience sampling frame. Offline questionnaires were randomly distributed to office-goers and students in selected offices and colleges, where we had the permission to conduct the survey. Students and office staff were also used as behavioral study sample in previous literature (Liu et al., 2019; Astuti et al., 2019). Dual mode of data collection was used to ensure efficient, and timely collection of data. Both student and office goers were surveyed to have participants in the targeted age group of 18-60 years. It also makes a better representation of the future potential consumers of personal vehicles.

Prior to the formal data collection process, a pilot study was conducted with around 183 samples. This was the first wave of data collection which began in January 2022. We sent out a total of 220 questionnaires and received around 183 filled in questionnaires by the mid-February, with a response rate of 83.18% (=183/220). This pilot data was analyzed to check for comprehensibility, wording errors, and most importantly to check the reliability and validity of the scales used in this study. The responses obtained in the pilot round were not carried forward for the final analysis.

The second and the formal round of data collection began in March 2022 and continued until May 2022. We received a total of 330 filled-in responses. After eliminating for incomplete questionnaires, the survey was closed with a total 317 valid responses for further analysis, out a total of 400 distributed questionnaires, leading to a response rate of 79.25% (= 317/400).

4.5.1 Sample description

Table 4.4: Summary of demographic characteristics of the sample in phase 2 (n = 330)

Demographic Characteristic	**Category**	**Count**	**Percentage**

Gender	Female	164	49.7%
	Male	163	49.4%
Age	18-25	87	26.4%
	26-35	131	39.7%
	36-45	46	13.9%
	46-60	64	19.4%
Education Level	School Level	9	2.7%
	Higher Secondary	24	7.3%
	Graduate	102	30.9%
	Post-Grad & above	193	58.5%
Annual Household Income (INR)	<2,50,000	84	25.4%
	2,50,001-500000	82	24.8%
	50,0001-7,50,000	37	11.2%
	7,50,001-10,00000	36	10.9%
	10,00001-12,50,000	19	5.7%
	12,50,001-15,00000	18	5.4%
	>15,00000	33	10%
Residence	Village	46	13.9%
	Town	190	57.6%
	City	89	26.9%
No. of Vehicles in Household	None	36	10.9%
	One	115	34.8%
	Two or more	169	51.2%
Avg. Daily Distance Travelled	<10 kms	131	39.7%
	10-20 kms	100	30.3%
	20-50 kms	59	17.8%
	50-100 km	15	4.5%
	>100 kms	10	3%

Table 4.4 provides a summary of the characteristics of the sample used in the study. The study sample had an equal distribution of genders, with 49.4% males, and 49.7% females. 0.6% of the sample did not disclose their gender. There were more participants (26.4%) in the younger age group 18-25, and 39.7% in the age group 26-35 than the older age group, 36-45 (13.9%), and 19.4% between the age 46-60) in the sample. Most of the sample were highly educated with 58.5% of them having a post-graduate or higher level of education, and 31% had a graduate degree. With regards to the average monthly household income, the sample was widely distributed. 25.4% earned an annual income less than INR 2,50,000, an equal proportion (25%) also earned an annual income between INR 2,50,001-INR 500000. Therefore, almost half of the sample earns an income less than 5 lakhs (INR) annually. One reason mighty be that a significant proportion of population are still students and yet to enter the job market. Hence it should not pose a financial hindrance to the vehicle purchase decisions in the future. 22.2% sample earns an annual income between INR 50,0001-INR 10,00000. Almost a quarter of the sample (21.15%) earns a higher income between INR 10,00001 to an income greater than INR 15,00000 annually. The study found that 27.8% of the sample did not use any personal vehicle at the time of survey. 16% were personal car users, 28.8% rode bikes/scooters, and 25.4% used multiple personal vehicles. In terms of vehicle ownership in the household, 51.2% owned multiple personal vehicles, 34.8% owned atleast one vehicle, and 10.9% owned none. The middle-class sample owned many vehicles despite more than a majority (69.99%) required total travel less than 20 kms daily. The remaining 17.8% travelled a distance between 21-50 kms daily, and a small proportion, 4.5% travelled 51-100 kms daily, and 3% travelled a distance greater than 100 kms on a daily basis. This also indicates the use of personal vehicles more for luxury and within city travel. Hence, some current concerns like range anxiety as pointed out in several studies, should not be an issue in the eastern region in India. A majority of the sample (57.6%) resides in big towns, 27% residents of cities, and 14% belongs to rural areas.

4.6 Results and Discussions

This section presents the main results of the SEM analysis. The discussion of the results is made in two parts. First, the results of the confirmatory factor analysis (CFA) are discussed, which is also the first part of the SEM process. This is followed by the parallel discussion of the results of fitting the structural models (2^{nd} part of SEM) and mediation analysis.

We begin the discussion of the results with a brief overview of the sample description.

4.6.1 Results of CFA

This scales for the latent construct borrowed from literature, along with the scales for herd behavior & cost which are newly developed in this study are examined for its reliability and validity in the Indian context. The analysis is conducted using AMOS trial version 26 of IBM SPSS.

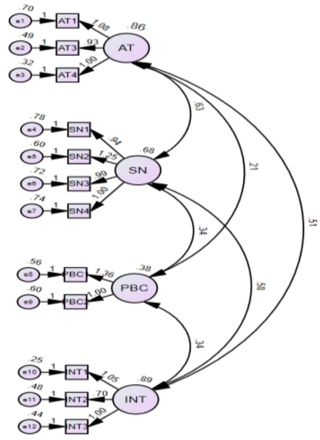

Figure 4.8 Example of TPB Measurement Model

Figure 4.8 presents a sample measurement model (the TPB measurement model). There are 3 indicators for attitude (AT1, AT3, AT4), 4 for subjective norms (SN1, SN2, SN3, SN4), 2 for perceived behavioral control (PBC1, PBC2), and 3 for intention (INT1, INT2, INT3). Indicators are observed variables that are used as an indirect measure of a latent construct (Kline, 2016). Indicators for each of the latent variables are found to have a significantly high factor loading. A factor loading indicates the extent to which the indicator is associated with the latent construct. A factor loading indicates the variance explained by the indicator on that specific latent construct. A rule of thumb goes that a factor loading of 0.7 or above indicates that the indicator extracts enough variance from the latent construct (Kilic et al., 2020). The indicator AT2 for attitude is eliminated from further analysis due to its lower factor loading than the specified benchmark.

In CFA models, one of the factor loadings is usually fixed to any number, generally 1. In doing so, the scales of the scores on the latent construct are some multiple of that specific indicator. This is done to identify the CFA model. A CFA model is identified when for a given set of data, and for a specified research problem, enough constraints are imposed so that a single parameter estimate is generated by the analysis (Alhija, 2010).

For instance, the indicator 'AT1' is associated with the latent construct 'AT' with a factor loading of 1.08. 'AT3' is associated with the construct 'AT' with a factor loading of 0.93. Thus 'AT1' explains a higher proportion of variance in AT than 'AT3'; though individual each of indicators of AT have a high factor loading. Similarly, we can observe the explanatory power of all other indicators to their respective latent constructs. We see that all the constructs in the TPB model have indicators with a factor loading of 0.7 and above. Hence the indicators explain a significant proportion of variance in the latent constructs in the TPB model. The double-headed arrows indicate covariance between the latent constructs.

The convergent validity and internal reliability of the indicators are examined by the composite reliability (CR) value, Cronbach's alpha value, the average variance extracted (AVE), and the factor loadings of all the indicators.

Table 4.5: Reliability & validity assessment of TPB model

CONSTRUCT	**AVERAGE VARIANCE EXTRACTED(AVE)**	**COMPOSITE RATIO (CR)**
Attitude (AT)	0.640	0.842
Perceived Behavioral Control (PBC)	0.469 ≈ 0.5	0.637
Subjective norm (SN)	0.511	0.806
Personal Norm (PN)	0.542	0.775
Awareness of Consequence (AC)	0.580	0.804
Ascription of Responsibility (AR)	0.597	0.815
Environmental Concern (EVC)	0.596	0.745
Perceived Vulnerability (PV)	0.577	0.803
Response Efficacy (RE)	0.503	0.669
Response Cost (RC)	0.546	0.782
Herd Behavior (HB)	0.542	0.823
Cost (CO)	0.611	0.823
Intention (INT)	0.648	0.846

As can be seen from table 4.5, the CR values of all the constructs are close to 0.7 or higher. This indicates the presence of good internal consistency reliability or construct reliability. A high value of composite reliability indicates that all indicators constantly measure the same construct. In other words, it can be said that the value of CR describes the extent to which a set of indicators in a model relate to a given latent construct.

The AVE value is an indicator of validity of the measurement model. An AVE value of atleast 0.5 is recommended. AVE measures the amount of variance that is recorded by a latent construct with respect to the variance from measurement error (dos Santos & Cirillo, 2021). For example, the AVE for INT is 0.648. It means that INT manages to explain 64.8% of variance in its indicators (INT1, INT2, INT3). From the table above, we see that the AVE values of the latent constructs meet the desired range of 0.5. Hence the validity of the constructs in the TPB model is established.

Table 4.6: Goodness of fit indicators for TPB measurement model

	Chisq/Dof	**Cronbach α**	**RMSEA**	**SRMR**	**AGFI**	**GFI**	**CFI**	**NFI**	**TLI**
TPB	2.23	0.896	0.062	0.038	0.912	0.946	0.967	0.942	0.954
NAM	2.22	0.911	0.062	0.047	0.883	0.918	0.947	0.909	0.933
PMT	2.55	0.846	0.070	0.050	0.881	0.922	0.933	0.896	0.910
TPB+HB	2.65	0.914	0.072	0.040	0.876	0.915	0.939	0.907	0.922
TPB+CO	2.51	0.903	0.069	0.055	0.883	0.922	0.947	0.916	0.931
TPB+PN	1.88	0.915	0.053	0.038	0.928	0.955	0.976	0.951	0.967
TPB+HB+CO	2.78	0.930	0.075	0.057	0.850	0.892	0.921	0.883	0.902
TPB+HB+CO+PN	2.52	0.928	0.069	0.054	0.845	0.885	0.924	0.881	0.907
TPB+NAM	2.28	0.926	0.064	0.049	0.869	0.907	0.938	0.896	0.921
TPB+PMT	2.34	0.912	0.065	0.051	0.848	0.889	0.922	0.872	0.902
NAM+PMT	2.26	0.924	0.063	0.052	0.827	0.870	0.911	0.854	0.890
TPB+NAM+PMT	2.32	0.934	0.065	0.051	0.811	0.855	0.903	0.844	0.881
TPB.E+NAM+PMT	2.29	0.944	0.064	0.054	0.780	0.826	0.885	0.816	0.862

Table 4.6 presents the goodness of fit indices of the measurement models. The Chisq value of

the model examines the overall fit of the model, and the divergence between the sample and the fitted covariance matrices. But since Chisq statistic is affected by larger sample size, hence the ratio Chisq/Dof is preferred. A ratio in the range 2-2.5 is considered a good fit and a ratio < 2 indicates a superior fit.

Cronbach's **α** measures scale reliability, i.e., it shows how closely a set of indicators are related as a group. Closer the value of Cronbach's **α** is to 1, the higher is the scale reliability. A high value of 0.896 indicates that the scales for AT, SN, PBC, and INT have a good reliability.

RMSEA (Root Mean Square Error of Approximation) is a model misfit indicator that also shows the effect size. Infact, it is the single index of goodness-of-fit for which SEM software gives a p value for testing close fit (Pavlov et al., 2021). It is a parsimony-adjusted index. The closer the value of RMSEA is to 0, the better the fit. RMSEA values between 0.05 and 0.08 are considered to be an acceptable fit (Easystats). SRMR (Standardized Root Mean Square Residual) is another index that is used to measure the size of model misfit. However, SRMR gives accurate results in the contexts of small models only (Pavlov et al., 2021). An RMSEA value of 0.062 is in acceptable range for the TPB model. Hence, we have a good model parsimony.

GFI/AGFI (Goodness/Adjusted Goodness of Fit) explains the proportion of variance considered by the calculated population covariance. It is similar to R squared (Easystats). The values of GFI and AGFI should be >0.95 and >0.90 respectively.

The NFI (Normed Fit index) and TLI (Tucker-Lewis Index) are relative fit indices that compares the chi-square value for the model with a baseline model or the null model. The baseline model is one that has uncorrelated measured variables (Newsom, 2020). A value above 0.90 was used as a cutoff for good fitting models earlier, but later it was agreed to increase the value to approximately 0.95 (Hu & Bentler, 1999).
CFI (Comparative Fit Index) is an updated form of NFI. It is not much sensitive to sample size (Fan et al., 1999). This index compares the fit of the model to that of a null, independent model. A CFI value >0.90 is considered as good (Easystats).

4.6.2 Results of the structural models (2nd part of SEM) + mediation analysis

In accordance with the hypothesis proposed in the conceptual framework (Fig 4.3), the established measurement models from CFA analysis are fit into SEM models in AMOS. The maximum likelihood estimation method is used to fit the SEM model.

We shall now discuss the results of each of the structural model in some detail:

4.6.2A The TPB model & its extensions

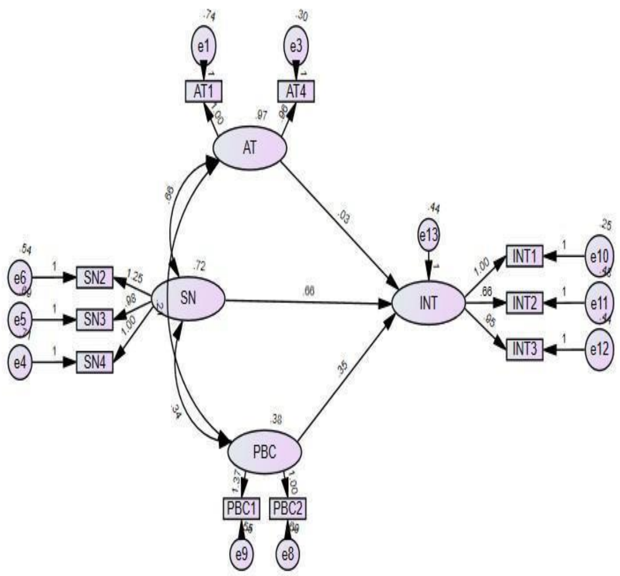

Figure 4.9 Original TPB Structural Model

Table 4.7: Intention formation pathways in the TPB model & its extensions

Hypothesized paths	**Standardized estimates**	**p-value**	**Conclusion**
Original TPB model pathways			
H1: Favorable attitude towards use of EV → Intention to adopt EV in the future	0.107	0.383	Rejected
H2: Higher subjective norm → Higher intention	0.484	0.005	Supported
H3: Higher perceived behavioral control → Greater is the intention to adopt EV in the future	0.235	0.028	Supported
Extensions[2]			

[2] Original TPB model has been extended with three different latent constructs: cost (TPB + CO), herd behavior

H4: Higher cost of EV → Lower intention	0.124	0.267	Rejected
H5: Positive herd behavior → Intention	-0.053	0.751	Rejected
H6: Strong personal norm → Intention	-0.103	0.715	Rejected

The standardized β coefficients for the hypothesized paths leading to intention formation are indicated in table 4.7. Subjective norm has a positive and significant influence on intention formation towards EV adoption (β = 0.484, p = 0.005). This supports hypothesis H2. Perceived behavioral control is another significant factor influencing intention (β = 0.235, p = 0.028), thus supporting hypothesis H3. Attitude however is not found to be a significant construct influencing the formation of intention (β = 0.107, p = 0.383). Hence, hypothesis H1 is not supported.

In the first extension of the TPB, TPB + CO model, subjective norm is found to be significant (β = 0.509, p = 0.009), thus supporting H2. H4 is not supported by data in the direct formation of intention to adopt an EV in the future. In the second extension, TPB + HB model, H2 was found to be positive and significant at 5% level of significance (β = 0.613, p = 0.044). H3 is also supported as perceived behavioral control is a significant pathway for intention formation at 10% level of significance (β = 0.209, p = 0.089). H5 is not found to be a significant pathway in directly influencing intention. In the third extension of the TPB model, TPB + PN two significant pathways influencing intention are found. Perceived behavioral control is found to be significant at the 5% level, (β = 0.233, p = 0.045) and subjective norm is also found to be a significant pathway in the formation of intention at 5% level of significance (β = 0.512, p = 0.037). Personal norm again is not found to directly have an influence in the formation of intention. In the combined extended model, TPB + HB + CO model, H3 is supported at 5% level of significance (β = 0.560, p = 0.012), and H1 is supported at 10% level of significance (β = 0.625, p = 0.070). H4 & H5 are again rejected as a direct pathway for intention formation.

Mediated Pathways: TPB model & its extensions

From the results of the structural models, we find that all the three extended constructs: cost, herd behavior, and personal norm have no direct influence in the formation of intention to adopt

(TPB + HB), and personal norm (TPB + PN).

an EV in the future. This by no means imply that we can ignore the extended constructs. The results of the mediation analysis explain why. The central tenet of the mechanism of mediation is that it engages a third variable which acts as an intermediary in the association between the independent variable and the dependent variable by transmitting the impact of the former on the latter (MacKinnon et al., 2010).

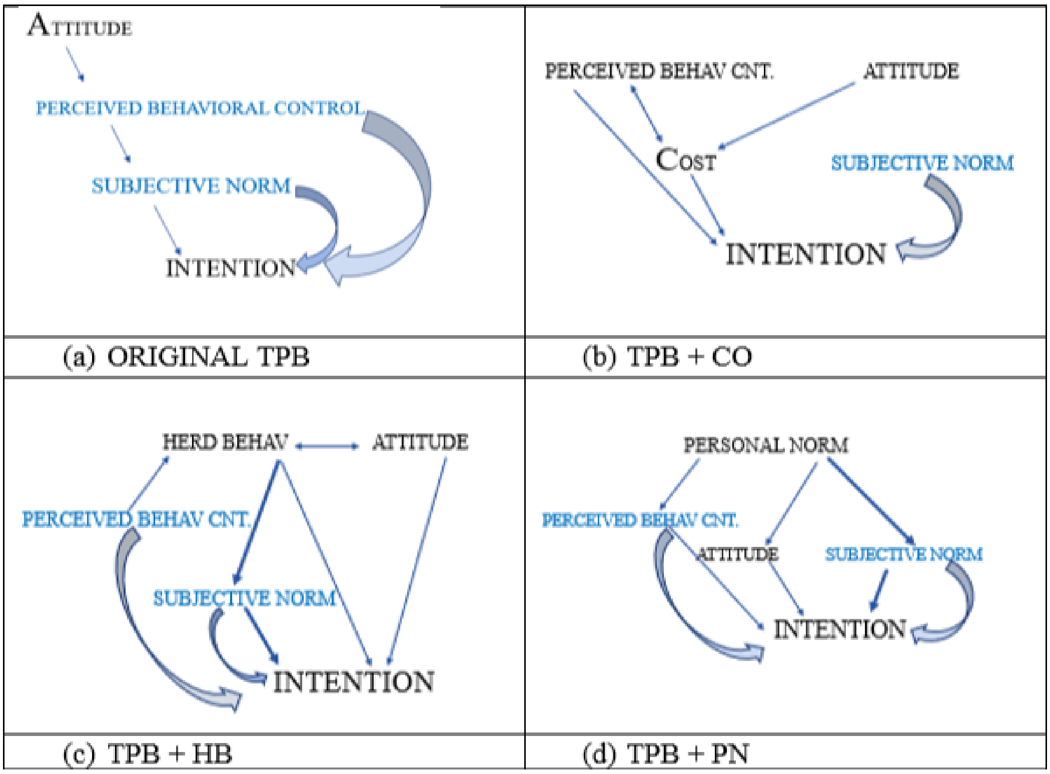

Figure 4.10 TPB Model Mediated Intention Pathways

Figure 4.10 illustrates the step-wise mechanism of the intention formation process in the context of decision to adopt an EV. The constructs in blue also have a direct effect on intention while the ones in black do not have a direct effect on intention. The curved arrows indicate a direct effect and straight arrows indicate mediated pathway. The thicker the arrows, the stronger the effect size.

In the original TPB model (fig 4.10a), though attitude has no direct effect on intention formation, it is mediated by perceived behavioral which in turn is mediated by subjective norm. In the TPB + CO extended model (fig 4.10b), cost is found to be partially mediated by perceived behavioral control. Cost also acts as a mediator for attitude and perceived behavioral control. The effect sizes of these mediated pathways are indicated in Table 4.8. The earlier structural model analysis indicated no direct impact of herd behavior on intention, but as seen in the TPB + HB model (fig 4.10c), herd behavior is fully mediated by subjective norm with an effect size 0.3977. Herd behavior also partially mediates perceived behavioral control with effect size 0.1529 and attitude with effect size 0.1878. Personal norm is also found to be fully mediated by subjective norm with effect size 0.3967, and partially mediated by perceived behavioral control with size 0.1034 in the TPB + PN model (fig 4.10d). Personal norm is also partially mediated by attitude with an effect size 0.1831.

Table 4.8: Mediation pathways leading to formation of intention for adoption of EV.

Pathways	**Mediator**	**Effect**	**Size**
TPB			
Attitude → Intention	Perceived behavioral control *	Partial	0.0969
Perceived behavioral control → Intention	Subjective norm ***	Partial	0.2688
TPB + HB			
Herd behavior → Intention	Subjective norm **	Full	0.3977
Herd behavior → Intention	Attitude **	Partial	0.1615
Attitude → Intention	Herd behavior **	Partial	0.1879
Perceived behavioral control → Intention	Herd behavior **	Partial	0.1529
TPB + CO			
Cost → Intention	Perceived behavioral control **	Partial	0.1495
Perceived behavioral control → Intention	Cost **	Partial	0.1500
Attitude → Intention	Cost **	Partial	0.1069
TPB + PN			
Personal norm → Intention	Subjective norm **	Full	0.3967
Personal norm → Intention	Perceived behavioral control **	Partial	0.1034
Personal norm → Intention	Attitude **	Partial	0.1831

***significant at 1% level of significance, **significant at 5% level of significance, *significant at 10% level of significance

4.6.2B The NAM model

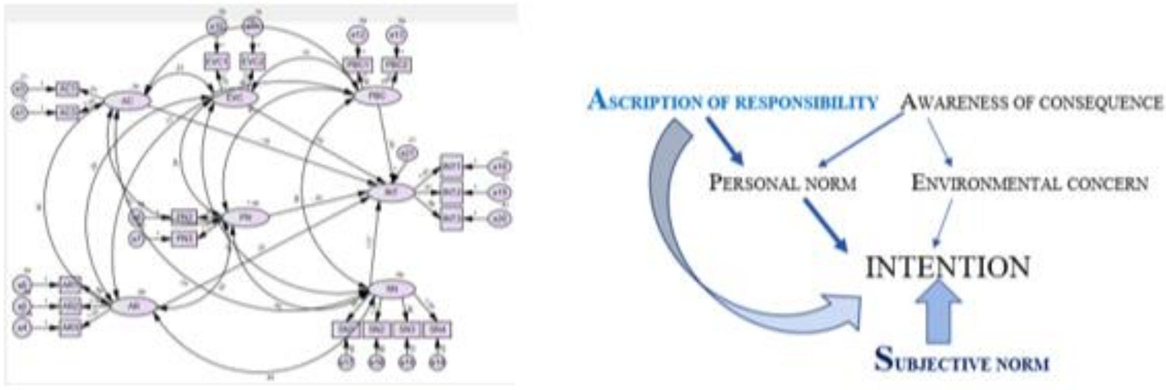

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Figure 4.11 NAM Structural Model & Mediation Pathways

Table 4.9: Intention formation pathways in the NAM model

Hypothesized paths	**Standardized estimates**	**p-value**	**Conclusion**
H2: Higher subjective norm → Higher intention	1.075	0.045	Supported
H7: Higher ascription of responsibility → Higher intention	0.281	0.035	Supported
H8: Higher awareness of consequence → Higher intention	-0.099	0.395	Rejected
H9: Higher personal norm → Higher intention	-0.532	0.278	Rejected
H10: Higher environmental concern → Higher intention	-0.002	0.989	Rejected

Ascription of responsibility and subjective norms are found to have a direct impact on formation of intention. As shown in table 4.9, subjective norm has a positive and a significant effect ($\beta = 1.075$, $p = 0.045$) on the intention. This supports hypothesis H2. Ascription of responsibility is another construct that has a positive and significant effect on the intention formation process ($\beta = 0.281$, $p = 0.035$), thus supporting H7. In the Indian context, awareness of consequence, personal norm, and environmental concern has no direct effect on intention formation.

As it is described in the NAM theory, the presence of ascription of responsibility and awareness of consequence activates personal norms which then leads to the formation of intention. But since personal norm does not have a significant pathway towards intention, hence it can be said that NAM theory does not necessarily work through the usual mechanisms in the context of India. However, the usual mechanism can work in some mediated cases.

Mediated Pathways: NAM model

Fig 4.11 A & B illustrates the mediated pathways leading to intention formation in the NAM model. As seen from the figure, the effect of personal norm on intention cannot however be ignored despite it having no direct effect on intention, as it acts as an important mediator for both awareness of consequence and ascription of responsibility. Personal norm partially mediates the effect of ascription of responsibility on intention with an effect size of 0.245, and it mediates the effect of awareness of consequence on intention with an effect size of 0.1887. Environmental concern has no direct impact on intention but it mediates the effect of awareness of consequence on intention with an effect size of 0.1198.

As can be seen from the mediation path diagram in figure 4.11B, the construct names in blue are the direct determinants of intention formation for India, while the names in black require mediation or are mediators themselves. The thicker the arrows, the stronger the impact size. Table 4.10 summarizes the significant mediated intention formation pathways.

Table 4.10: Mediation pathways leading to formation of intention for adoption of EV.

Pathways	**Mediator**	**Effect**	**Size**
Ascription of Responsibility → Intention	Personal Norm**	Partial	0.2456
Awareness of Consequence → Intention	Personal Norm**	Partial	0.1887
Awareness of Consequence → Intention	Environmental Concern**	Partial	0.1198

**Significant at 5% level of significance

4.6.2C The PMT model

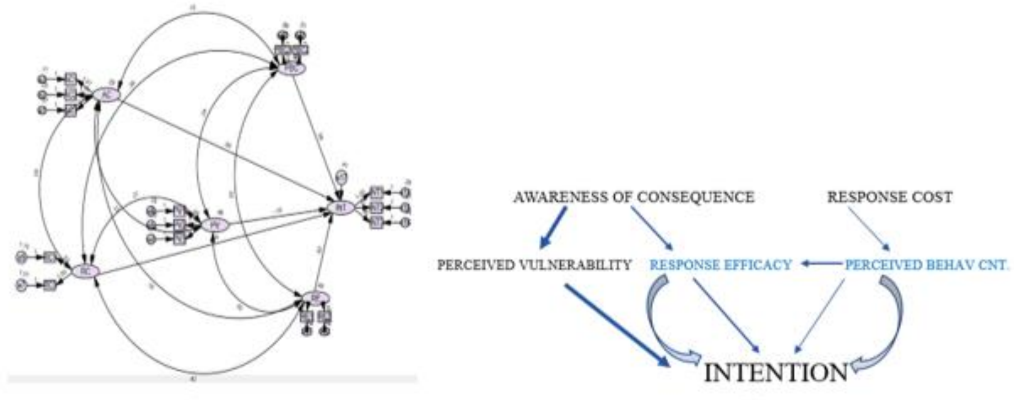

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Figure 4.12 PMT Structural Model & Mediation Pathways

Table 4.11 Intention formation pathways in the PMT model

Hypothesized paths	Standardized estimates	p-value	Conclusion
H11: Greater perception of vulnerability → Higher intention to adopt EV	-0.103	0.580	Rejected
H8: Higher awareness of consequence → Higher intention	0.030	0.715	Rejected
H12: Higher response cost → Lower intention	-0.048	0.617	Rejected
H13: Higher response efficacy → Lower intention	0.651	0.004	Supported
H3: Higher perceived behavioral control → Greater is the intention to adopt EV in the future	0.294	0.003	Supported

Perceived behavioral control and response efficacy have a direct impact on the formation of intention to adopt EV in India. PBC has a positive and significant effect on intention ($\beta = 0.294$, $p = 0.003$) (significant at 1%). Thus, hypothesis H3 is supported. Response efficacy has a positive and significant effect on intention ($\beta = 0.651$, $p = 0.004$) (significant at 1%), thus supporting hypothesis H13.

The PMT model does not work only through the usual mechanism in the context of India. According to the theory, when an individual faces a threat looming upon him/her because of certain ongoing actions/events, he/she tries to evaluate the severity & vulnerability from the threat, and then tries to assess his/her capacity to mitigate the threat, leading to formation of intention for a desirable action. On the contrary, some paths are observed in this study, for instance, where the components of threat appraisal like awareness of consequence and perceived vulnerability do not necessarily work together to trigger the components of coping appraisal such as response cost, perceived behavioral control, and response efficacy to finally lead to the formation of intention for EV adoption. Rather, the treat appraisal and coping appraisal mechanism also work independently within themselves to influence the formation of intention. For instance, elements of threat appraisal, awareness of consequence & perceived vulnerability work together to influence intention without involving coping appraisal mechanisms.

Mediated Pathways: PMT model

Perceived vulnerability acts as a full mediator to mediate the impact of awareness of consequence on intention with a high effect size of 0.2230. On the other hand, the study finds that perceived behavioral control also partially mediates the impact of response cost on intention with an effect size of 0.1137.

Response efficacy is found to be an important mediator as it mediates the impact of three latent constructs namely response cost, awareness of consequence, and perceived behavioral control, thus involving both threat appraisal and coping appraisal mechanism. Response efficacy is the only mediator through which the usual process of operation of the PMT theory is realized in the Indian context.

Table 4.12: Mediation pathways leading to formation of intention for adoption of EV.

Pathways	**Mediator**	**Effect**	**Size**
Awareness of consequence → Intention	Perceived vulnerability**	Full	0.2230
Awareness of consequence → Intention	Response efficacy**	Partial	0.1810
Response cost → Intention	Perceived behavioral control**	Partial	0.1137
Response cost → Intention	Response efficacy**	Partial	0.1853
Perceived behavioral control → Intention	Response efficacy**	Partial	0.1610

4.6.2D Structural Models TPB+NAM, TPB+PMT, and NAM+PMT

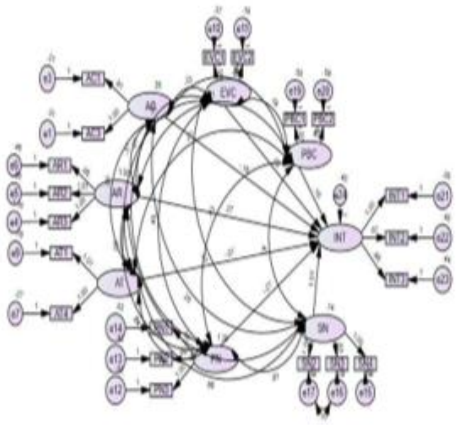
So far, this study discussed the mechanisms of formation of intention for adoption of EV by a middle-class individual in India. In doing so, the impacts of gain motivation, norm motivation, and protection motivation have been analyzed using single models like the TPB model, NAM model, and the PMT model respectively.

This study also combines the base models TPB, NAM, and PMT and attempts to analyze the intention formation mechanism by the interaction of gain, norm, and fear & protection motivation. From these different combinations of structural models, we will briefly discuss the different pathways of intention formation in the sections that follow.

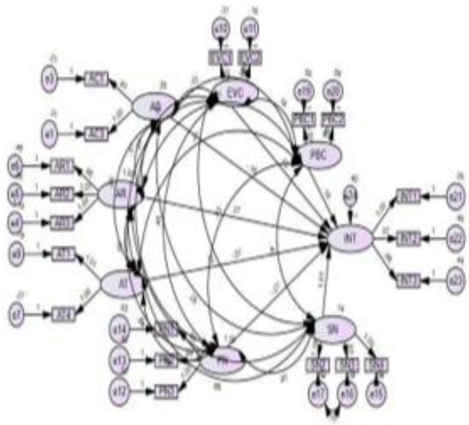
The significant intention formation pathways from each of these three combinations are indicated in Table 4.13.

Table 4.13: Significant intention formation pathways in combined models

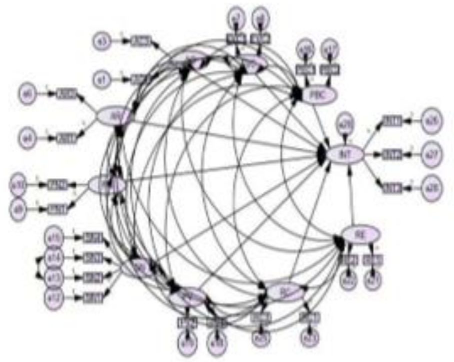
Hypothesized paths	**Standardized estimates**	**p-value**
TPB + NAM		
H12: Higher ascription of responsibility → Higher intention to adopt EV	0.269	0.067
TPB + PMT		
H2: Higher subjective norm → Higher intention	0.697	0.027
NAM + PMT		
H10: Higher environmental concern → Higher intention	-0.284	0.056
H2: Higher subjective norm → Higher intention	0.671	0.050
H11: Greater perception of vulnerability → Higher intention to adopt EV	0.490	0.019



TPB+NAM STRUCTURAL MODEL



TPB+PMT STRUCTURAL MODEL



NAM+PMT STRUCTURAL MODEL

Figure 4.13 Combined Structural Models

TPB+NAM Model

TPB+NAM model reveals only one direct determinant of intention (INT) formation, namely ascription of responsibility. AR is seen to have a direct effect of size 0.269 (significant at 10%) on INT. Though this model does not provide many pathways for intention, yet its importance cannot be questioned as it throws light on a way to activate EVC through PN and lead it towards INT. We will see this shortly in the mediation analysis. Until now, EVC was not found to have any impact on INT either directly or indirectly.

Another observation in this model is that, in the context of India, when there is an interaction of gain and norm motivators, then the norm-based constructs are found to be more active in leading to intention formation pathways, as compared to the gain-based constructs.

TPB+PMT Model

In this model again, only one direct determinant of intention is found, which is subjective norm. It is found to have a direct effect of size 0.697 (significant at 5%) on intention.

NAM+PMT Model

This model represents a complex interplay of norm and protection motivation mechanisms. Subjective norm, perceived vulnerability, and environmental concern have a direct impact on intention to adopt EV. Subjective norm has an effect size of 0.671 (significant at 5%), perceived vulnerability has an effect size of 0.490 (significant at 1%), and environmental concern has a negative effect size of 0.284 (significant at 5%).

Mediated Pathways of Intention Formation: Combined Models

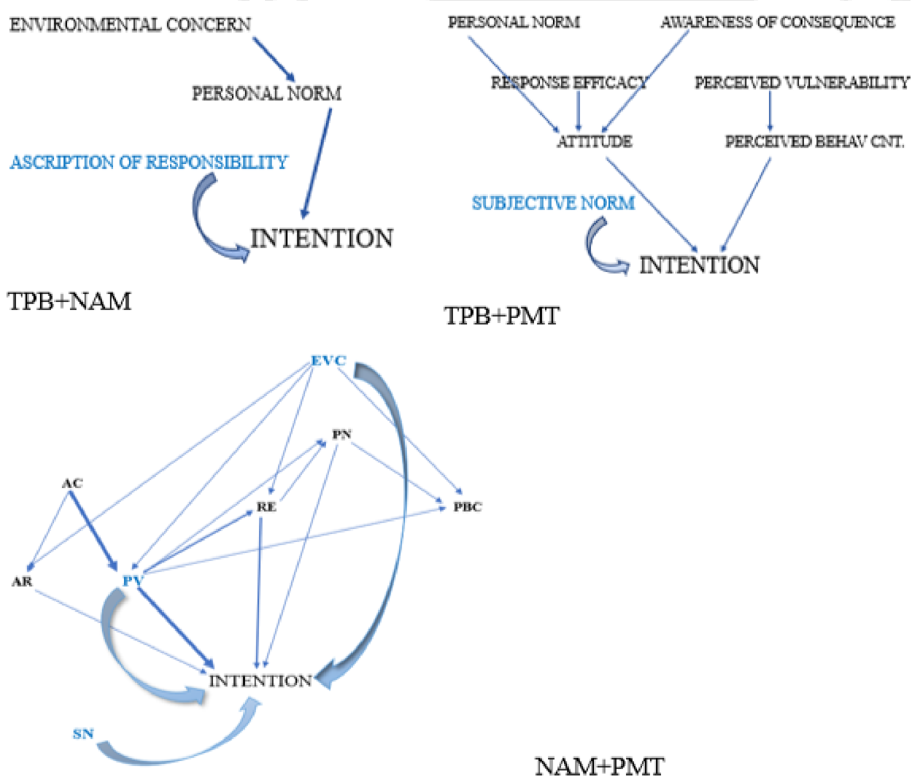


Figure 4.14 Combined Model Mediated Pathways

TPB+NAM model provides one full mediated pathway of intention formation. Personal norm is found to fully mediate the effect of environmental concern on intention, with an effect of size 0.2610.

In the TPB+PMT model, attitude is seen to mediate the effect of personal norm, response efficacy, and awareness of consequence. Attitude partially mediates effect of personal norm on intention with an effect size of 0.1478, effect of response efficacy on intention with an effect size of 0.1490, and effect of awareness of consequence on intention with an effect size of 0.1601.

Several different mediated pathways of Intention formation are found in the NAM+PMT model, indicating the complex interplay of norm and fear & protection motivators. For instance, the effect of awareness of consequence on intention is fully mediated by personal norm with an effect size of 0.2230, and partially mediated by ascription of responsibility with an effect size of 0.1496. The impact of environmental concern on intention is fully mediated by perceived vulnerability with an effect size of 0.2511, partially mediated by ascription of responsibility with an effect size of 0.1226, partially mediated by perceived behavioral control with an effect size of 0.1036, and partially mediated by response efficacy with an effect size of 0.2244. The effect of perceived vulnerability on intention is partially mediated by personal norm with an effect size of 0.1762, partially mediated by perceived behavioral control with an effect size of 0.1107, and partially mediated by response efficacy with an effect size of 0.2353. perceived behavioral control also mediates the effect of personal norm on intention partially with an effect size 0.1034, and personal norm in turn, partially mediates the effect of response efficacy on intention with an effect size 0.1696.

Table 4.14 summarizes the mediated pathways of intention formation in the combined models: TPB+NAM, TPB+PMT, and NAM+PMT.

Table 4.14: Mediated pathways of intention formation

Pathways	**Mediator**	**Effect**	**Size**
TPB+NAM			
Environmental concern → Intention	Personal norm	Full	0.2610
TPB+PMT			
Perceived vulnerability → Intention	Attitude	Partial	0.1478
Perceived vulnerability → Intention	Perceived behavioral control	Partial	0.1107
Awareness of consequence → Intention	Attitude	Partial	0.1601
Response efficacy → Intention	Attitude	Partial	0.1490
NAM+PMT			
Awareness of consequence → Intention	Perceived vulnerability	Full	0.2230
Awareness of consequence → Intention	Ascription of responsibility	Partial	0.1496
Environmental concern → Intention	Ascription of responsibility	Partial	0.1226

Environmental concern → Intention	Perceived behavioral control	Partial	0.1036
Environmental concern → Intention	Perceived vulnerability	Partial	0.2511
Environmental concern → Intention	Response efficacy	Partial	0.2244
Personal norm → Intention	Perceived behavioral control	Partial	0.1034
Response efficacy → Intention	Personal norm	Partial	0.1696
Perceived vulnerability → Intention	Personal norm	Partial	0.1762
Perceived vulnerability → Intention	Perceived behavioral control	Partial	0.1107
Perceived vulnerability → Intention	Response efficacy	Partial	0.2353

4.7 Discussion

From the CFA analysis this study establishes that all the latent constructs have met the criteria of reliability and validity. The newly developed constructs of herd behavior and cost have also been established. All the models are parsimonious and have a good fit of the indicators with the latent constructs.

An analysis of all the structural models indicates that subjective norms are the strongest determinant of intention in Assam, India, for a middle-income individual. Two other direct determinants of intention in Assam are ascription of responsibility, and perceived behavioral control. Herd behavior and personal norm being directly and fully mediated by subjective norm, these also becomes impactful indirect determinant of intention to adopt an EV.

India is a collective society rather than an individualistic society. Hence, external validation of the society is very crucial as it unconsciously drives behavior. This is more so, when it comes to the middle-class group residing in towns or small cities. Though an individual would straightly deny as requiring society's input for his decisions, or imitating others' decisions, these parameters feed in unconsciously in an individual's decision-making process. This might be because of the social competition, or because of an individual's race to enhance his standing in the ladder of social status. Social media can be the big driver to influence people's attitude towards using an EV.

Another inference from the results is that if an individual can be made to feel responsible or important agent in the change process, that might trigger their intention to adopt an EV as well.

Often people feel they are too small an entity to cause any harm or bring any positive change in the society. People often fail to consider the macro view where everyone thinks similarly. No anxiety related to EV infrastructure in India in the future is found from the analysis. People are open to adapting the new technology, provided the governments' plan of laying down EV related facilities are realized according to the roadmap already laid out.

An interesting observation is the inverse relationship with environmental concern and people's intention to adopt an EV. This might be because greater the environmental concern, more they are worried about the use of an EV given the present status of electricity generation in India. Since electricity is mostly generated from coal at the present time, hence use of an EV can bring about a positive environmental change only after the share of renewables is increased in the electricity generation mix, for which the government has set a target of 50% power from renewable sources by 2030.

This chapter covers the first part of objective 1. It analyzes the different direct and indirect EV adoption intention formation pathways. The next chapter, - Chapter 5 covers the second part of objective 1. It analyzes how the intention formation pathways to adopt EVs differ in different demographic groups like gender (male vs female), age group (young vs middle age group), and location (metropolitan vs. non-metropolitan), and thus fills another gap in the literature. The intention formation pathways are analyzed based on gain motivations, norm motivations, and fear & protection motivations.

Chapter 5. EV Adoption Intention Pathways for Different Demographic Categories

This chapter is the second part of objective 1. It delves deeper into the factors outside of an individual's cognitive and psychological framework that has an impact on one's pro-environmental intention to adopt an electric vehicle (EV), like location, gender, and age. The broad goal of this chapter is to contribute to the existing literature on how EV adoption intention varies in different demographic groups like gender, age, and location. The pro-environmental intention for sustainable mobility is again organized under gain motivation, norm motivation, and fear & protection motivation for facilitating systematic analysis. The study uses the same theoretical framework as in Chapter 4, i.e., the theory of planned behavior (TPB), the norm activation model (NAM), and the protection motivation theory (PMT). So, we would not discuss the theoretical frameworks in this chapter.

The remaining chapter is arranged as follows. First, we begin with a brief outline of this chapter's major objective and sub-objectives. This is followed by a description of the demographic categories considered in this study. The chapter then goes on to illustrate the conceptual framework for this study, and the detailed study hypotheses. Subsequently, we outline the data and the sample used in the analysis. This is followed by analysis of the results. The chapter concludes with a discussion of the insights derived from objective 1B.

5.1 Objectives of This Chapter

The overarching objective of this chapter is to examine the variation in intention pathways in different demographic groups. It is further sub-divided into the following objectives:

- To analyze variations in the impact of gain motivators on EV adoption intention in males and females
- To analyze variations in the impact of norm motivators on EV adoption intention in males and females
- To analyze variations in the impact of fear & protection motivators on EV adoption intention in males and females
- To analyze variations in the impact of gain motivators on EV adoption intention in the young and the middle age group people

- To analyze variations in the impact of norm motivators on EV adoption intention in the young and the middle age group people
- To analyze variations in the impact of fear & protection motivators on EV adoption intention in the young and the middle age group people
- To analyze variations in the impact of gain motivators on EV adoption intention in the metropolitan and non-metropolitan people
- To analyze variations in the impact of norm motivators on EV adoption intention in the metropolitan and non-metropolitan people
- To analyze variations in the impact of fear & protection motivators on EV adoption intention in the metropolitan and non-metropolitan people

5.2 Description of the Demographic Groups

The demographic groups considered in this analysis are gender (male Vs female), age (younger age group Vs middle age group), and location (metropolitan Vs non-metropolitan).

In this thesis, participants in the age groups between 18-35 are considered in the younger age group while participants in the age group between 36-60 are considered in the middle age group. The reason for this age demarcation is based on the fact that individuals above the age of 18 years are considered as adults in India. In addition, 35 years is the upper age limit for employment in India which indicates that individuals between ages 18-35 are mostly students or graduates looking for/entered employment. Again, the retirement age in India is 60 years for most of the jobs. People between the age 36-60 are either settled well in their job or have increased incomes in comparison to the individuals in the age group 18-35. This means the middle-aged group has a higher purchasing power and hence are potential consumers in the market for automobiles. Students are included in the student as this thesis studies the intention to adopt an EV in the near future. Students now, are expected to be in the job market after a few years and are potential customers in the market for automobiles in the future.

Regarding location, cities with a population size of atleast 1 million are considered as metropolitan areas (Kundu et al., 2019). Whereas cities with population lesser than 1 million are considered as non-metropolitan areas. In this thesis we consider three study locations: Guwahati, Tezpur, and Dibrugarh. Guwahati city has a population estimate of 1,365,000 in the year 2024 (Census, 2022). This is calculated based on the current rate of population growth calculated on the last census conducted in the year 2011. Since its population estimate is more than 1 million, hence we consider the samples collected in Guwahati city as the metropolitan group. Similarly, population estimated for Tezpur city in the year 2024, based on the growth rate calculated based on 2011 census is 144,000, and the estimated population for Dibrugarh city is 218,000. We consider the samples collected from Tezpur and Dibrugarh city are the non-metropolitan group in the thesis.

5.3 Conceptual Framework of the Analysis

The same theoretical frameworks used in chapter 4 are also used in this chapter, i.e., the theory of planned behavior (TPB), the norm activation model (NAM), and the protection motivation theory (PMT). However, unlike in chapter 4, here, we will only use the original version of the TPB model. Examining the extensions of the TPB model (TPB + HB, TPB + CO, and TPB + PN) is beyond the scope of this chapter. The conceptual framework used in this study is illustrated in Fig 5.1.

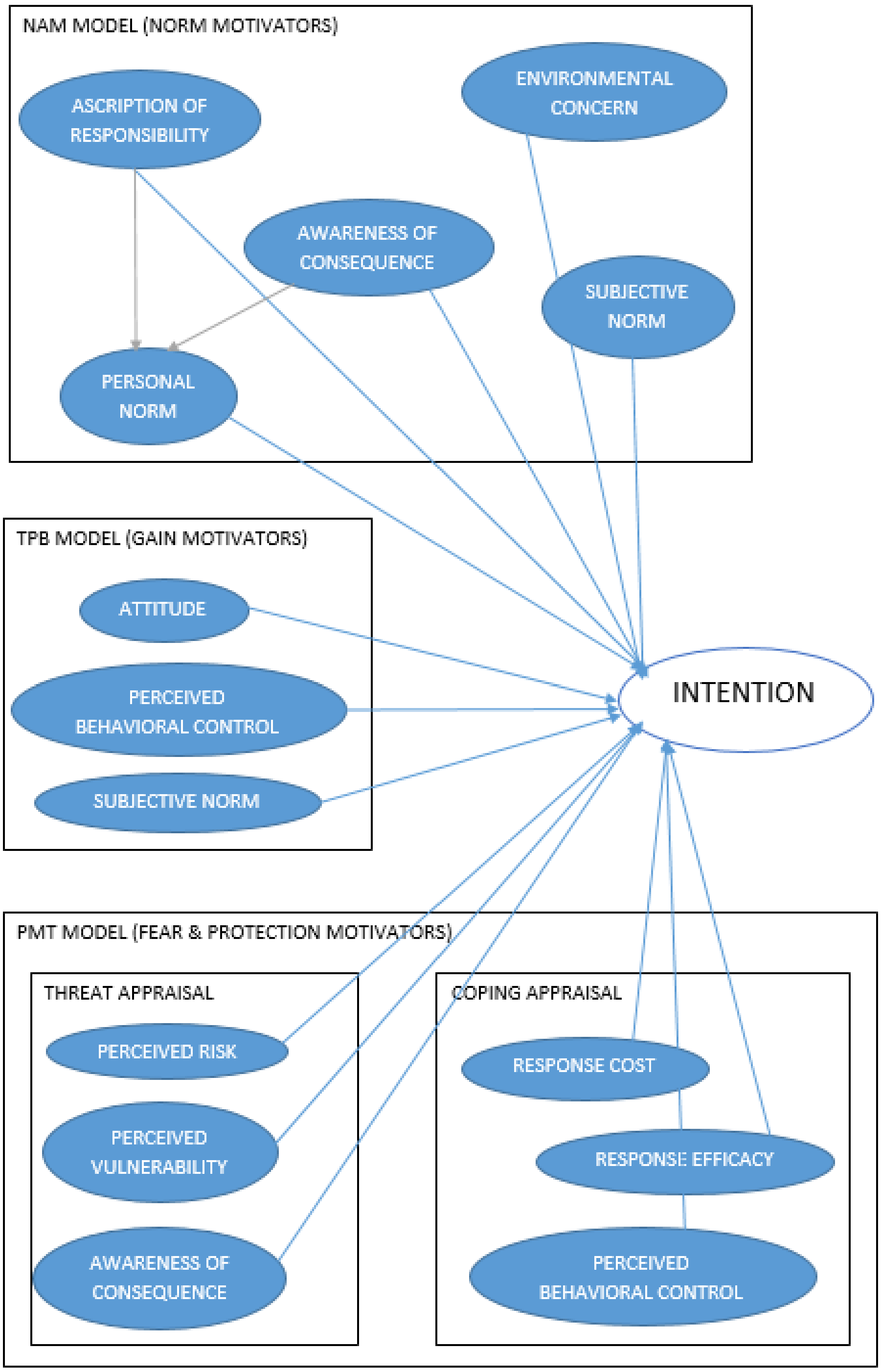


Figure 5.1 Conceptual Framework of the Analysis

5.4 Study Hypotheses

The various demographic categories considered in this study are analyzed and discussed separately for each of the three models.

Model 1: Theory of Planned Behavior

- H1: there is no significant difference between males and females in having a favorable attitude towards climate change mitigation on development of an intention to adopt an EV
- H2: there is no difference between young and middle age groups in having a favorable attitude towards climate change mitigation on development of an intention to adopt an EV
- H3: there is no difference between metropolitan and non-metropolitan area people in having a favorable attitude towards climate change mitigation on development of an intention to adopt an EV
- H4: there is no significant difference between males and females in feeling a presence of subjective norm on development of an intention to adopt an EV
- H5: there is no difference between young and middle age groups in feeling a presence of subjective norm on development of an intention to adopt an EV
- H6: there is no difference between metropolitan and non-metropolitan area people in feeling a presence of subjective norm on development of an intention to adopt an EV
- H7: there is no significant difference between males and females in having a favorable perceived behavioral control on development of an intention to adopt an EV
- H8: there is no difference between young and middle age groups in having a favorable perceived behavioral control on development of an intention to adopt an EV
- H9: there is no difference between metropolitan and non-metropolitan area people in having a favorable perceived behavioral control on development of an intention to adopt an EV

Model 2: Norm Activation Model (NAM)

- H10: there is no significant difference between males and females in having an awareness of consequence about climate change on development of an intention to adopt an EV
- H11: there is no difference between young and middle age groups in having an awareness of consequence about climate change on development of an intention to adopt an EV
- H12: there is no difference between metropolitan and non-metropolitan area people in having an awareness of consequence about climate change on development of an intention to adopt an EV

- H13: there is no difference between males and females in feeling an ascription of responsibility towards climate change mitigation on development of an intention to adopt an EV
- H14: there is no difference between young and middle age groups in feeling an ascription of responsibility towards climate change mitigation on development of an intention to adopt an EV
- H15: there is no difference between metropolitan and non-metropolitan area people in feeling an ascription of responsibility towards climate change mitigation on development of an intention to adopt an EV
- H16: there is no significant difference between males and females in having environmental concern on development of an intention to adopt an EV
- H17: there is no difference between young and middle age groups in having environmental concern on development of an intention to adopt an EV
- H18: there is no difference between metropolitan and non-metropolitan area people in having environmental concern on development of an intention to adopt an EV
- H19: there is no significant difference between males and females in feeling a presence of personal norm on development of an intention to adopt an EV
- H20: there is no significant difference between young and middle age groups in feeling a presence of personal norm on development of an intention to adopt an EV
- H21: there is no significant difference between metropolitan and non-metropolitan area people in feeling a presence of personal norm on development of an intention to adopt an EV

Model 3: Protection Motivation Theory (PMT)

- H22: there is no significant difference between males and females on the impact of their perception of risk on the development of an intention to adopt an EV
- H23: there is no significant difference between young and middle age groups on the impact of their perception of risk on the development of an intention to adopt an EV
- H24: there is no significant difference between metropolitan and non-metropolitan area people on their perception of risk on the development of an intention to adopt an EV
- H25: there is no significant difference between males and females on the impact of their perception of vulnerability on the development of an intention to adopt an EV

- H26: there is no significant difference between young and middle age groups on the impact of their perception of vulnerability on the development of an intention to adopt an EV
- H27: there is no significant difference between metropolitan and non-metropolitan area people on the impact of their perception of vulnerability on the development of an intention to adopt an EV
- H28: there is no significant difference between males and females on the impact of their response efficacy on the development of an intention to adopt an EV
- H29: there is no significant difference between young and middle age groups on the impact of their response efficacy on the development of an intention to adopt an EV
- H30: there is no significant difference between metropolitan and non-metropolitan area people on the impact of their response efficacy on the development of an intention to adopt an EV
- H31: there is no significant difference between males and females on the impact of their response cost on the development of an intention to adopt an EV
- H32: there is no significant difference between young and middle age groups on the impact of their response cost on the development of an intention to adopt an EV
- H33: there is no significant difference between metropolitan and non-metropolitan area people on the impact of their response cost on the development of an intention to adopt an EV

5.5 Data Collection and Sample

Data was collected in two phases after the pilot survey. In most of the demographic groups the data that were collected in two phases were combined for the purpose of analysis. Pilot survey was conducted in Dec 2021 - Jan 2022. The Questionnaire used for data collection is attached in appendix B.

Data for Gender Category

For the gender demographic category, the data from phase- 1 survey had a lower number of male samples. Hence phase- 1 data was combined with phase- 2 data. The combination of the data from the two phases of survey provided the sample size required for reliable results from the SEM method.

Table 5.1: Demographic features and Sample Size for Gender Category

Model	Groups	Count	Percentage
TPB	Male	368/1009	36.47
	Female	641/1009	63.53
NAM	Male	337/927	36.35
	Female	590/927	63.65
PMT	Male	350/975	35.89
	Female	625/975	64.10

Data for Age Category

Data for the age category was also based on both phase- 1 and phase- 2 rounds of survey. This was because a higher sample size was available after the conclusion of phase- 2 survey. A total of 114 workable sample was obtained for the middle age group. The phase-2 round of survey had two questionnaires- the intention survey and the stated preference survey. The later was designed only for the young age group (18-35 years) and hence, more sample for the middle age could not be obtained, which is a limitation of this thesis.

Table 5.2: Demographic features and Sample Size for Age Category

Model	Groups	Count	Percentage
TPB	Young Age Group	921/1035	88.98
	Middle Age Group	114/1035	11.01
NAM	Young Age Group	903/1017	88.79
	Middle Age Group	114/1017	11.21
PMT	Young Age Group	888/1002	88.62
	Middle Age Group	114/1002	11.38

Data for Location Category

Data for the location category was based only on phase-2 survey.

Table 5.3: Demographic features and Sample Size for Location Category

Model	Groups	Count	Percentage
TPB	Metropolitan	253/723	34.99
	Non-Metropolitan	470/723	65.01

NAM	Metropolitan	254/724	35.08
	Non-Metropolitan	470/724	64.92
PMT	Metropolitan	255/726	35.12
	Non-Metropolitan	471/726	64.88

A combination of convenience and random sampling framework is used for this empirical research. Data were collected through primary survey; wherein both online and offline questionnaires were distributed to the participants. 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. The shortlisting of the location for the offline questionnaire distribution was based on convenience sampling framework. However, the questionnaires were distributed randomly among the participants in each of the sampling location.

This study targeted middle-class individuals between the age of 18-60 in the sample pool. The data was collected from one metropolitan city called Guwahati, and two non-metropolitan cities called Tezpur, and Dibrugarh of Assam, in northeastern region of India. 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 can be expected to be in the working pool and also consumers for 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 survey, a total of 1400 questionnaires were distributed to the sample. 1112 filled responses were received, yielding a response rate of 79.42%.

The sample profile is described in the table below:

Table 5.4: Sample Profile

Location	**Profile**	**Size**
Social Media Platform		180
Statistical Survey of India, Tezpur	Office Staff	7
Life Insurance Corporation of India (LIC), Guwahati	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

From the total responses received, incomplete and inconsistent responses were removed.

5.6 Results of Confirmatory Factor Analysis

Factor loadings

Assessment of factor loadings of the indicators is the first step for the assessments of reflective models. Factor loadings above 0.708 is recommended. Loadings between 0.4 and 0.7 can be accepted if other indicators like convergent validity and discriminant validity of the model is within the recommended values. High loadings indicate that a significant amount of variance in the indicator is being accounted for by the construct.

Table 5.5A: Factor loadings of the indicators for the latent constructs (TPB model)

Construct	Indicator	Standardized Loadings			
		Male (Female)	Younger (Middle) Age Grp	Metropolitan (Non-Metropolitan)	City (Town) Identity
Attitude (AT)	AT1	0.831 (0.792)	0.789 (0.820)	0.763 (0.791)	0.823 (0.802)
	AT2	0.433 (NA)	0.466 (0.666)	0.411 (0.363)	0.552 (0.372)
	AT3	0.878 (0.829)	0.848 (0.803)	0.842 (0.838)	0.876 (0.841)
	AT4	0.862 (0.863)	0.859 (0.789)	0.859 (0.844)	0.850 (0.857)
Subjective	SN1	0.751 (0.625)	0.670 (0.785)	0.646 (0.700)	0.644 (0.705)

Norm (SN)					
	SN2	0.859 (0.846)	0.844 (0.879)	0.838 (0.817)	0.837 (0.855)
	SN3	0.787 (0.804)	0.819 (0.844)	0.822 (0.785)	0.766 (0.816)
	SN4	0.767 (0.710)	0.740 (0.744)	0.741 (0.685)	0.752 (0.723)
Perceived Behavioral Control (PBC)	PBC1	0.810 (0.771)	0.795 (0.641)	0.801 (0.722)	0.730 (0.781)
	PBC2	0.747 (0.817)	0.809 (0.795)	0.727 (0.815)	0.800 (0.791)
	PBC3	NA (NA)	NA (0.596)	NA (NA)	NA (NA)
	PBC4	0.581 (0.666)	0.642 (0.631)	0.638 (0.658)	0.659 (0.628)
Intention (INT)	INT1	0.910 (0.898)	0.910 (0.896)	0.897 (0.904)	0.913 (0.895)
	INT2	0.810 (0.813)	0.827 (0.814)	0.812 (0.810)	0.835 (0.808)
	INT3	0.877 (0.844)	0.875 (0.817)	0.864 (0.852)	0.871 (0.858)

As it can be seen in table 5.3A, majority of the indicators of all constructs used in the TPB model have loadings greater than 0.708 which is above the recommended benchmark. Indicator AT2 in the construct attitude has a low factor loading of 0.433 for males while the same is eliminated for the female group, due to loadings below 0.40. The indicator PBC3 is removed from the PBC construct in both males and females. Another construct PBC4 for both males and females and SN1 for females is lower than the desired benchmark of 0.708. However, these are not removed as these are still within the acceptable range and the other indicators of reliability and validity are in the desired ranges despite loadings being in the acceptable range.

Table 5.5B: Factor loadings of the indicators for the latent constructs (NAM model)

Construct	**Indicator**		**Standardized**	**Loadings**	
		Male (Female)	**Younger (Middle) Age Group**	**Metropolitan (Non-Metropolitan)**	**City (Town) Identity**
Awareness of Consequence (AC)	AC1	0.784 (0.737)	0.811 (0.760)	0.838 (0.771)	0.865 (0.686)
	AC2	0.844 (0.782)	0.800 (0.694)	0.865 (0.753)	0.822 (0.805)
	AC3	0.686 (0.754)	0.754 (0.876)	0.613 (0.786)	0.797 (0.696)
Ascription of	AR1	0.884 (0.870)	0.858 (0.831)	0.871 (0.827)	0.921 (0.845)

Responsibility (AR)					
	AR2	0.804 (0.880)	0.869 (0.873)	0.901 (0.806)	0.895 (0.811)
	AR3	0.672 (0.681)	0.737 (0.836)	0.713 (0.627)	0.723 (0.688)
Environmental Concern (EVC)	EVC1	0.861 (0.887)	0.881 (0.874)	0.914 (0.876)	0.907 (0.868)
	EVC2	0.791 (0.822)	0.821 (0.901)	0.854 (0.727)	0.893 (0.770)
Personal Norm (PN)	PN1	0.523 (NA)	0.524 (0.658)	NA (0.506)	0.432 (0.464)
	PN2	0.894 (0.843)	0.888 (0.845)	0.897 (0.869)	0.900 (0.868)
	PN3	0.849 (0.896)	0.877 (0.858)	0.902 (0.856)	0.899 (0.861)
Subjective Norm (SN)	SN1	0.723 (0.569)	0.675 (0.785)	0.649 (0.695)	0.602 (0.679)
	SN2	0.850 (0.839)	0.852 (0.879)	0.837 (0.818)	0.828 (0.850)
	SN3	0.771 (0.797)	0.821 (0.844)	0.824 (0.788)	0.761 (0.806)
	SN4	0.734 (0.673)	0.732 (0.744)	0.741 (0.685)	0.726 (0.694)
Intention (INT)	INT1	0.906 (0.893)	0.909 (0.898)	0.895 (0.906)	0.913 (0.890)
	INT2	0.791 (0.786)	0.828 (0.811)	0.815 (0.788)	0.820 (0.789)
	INT3	0.872 (0.842)	0.883 (0.817)	0.863 (0.852)	0.878 (0.854)

As it can be seen in table 5.3B, majority of the indicators of all constructs used in the NAM model have loadings greater than 0.708 which is above the recommended benchmark. The indicator PN1 is removed for the female group and for the metropolitan group as it's loading was sufficiently lower than the benchmark value. Also, its removal significantly improves the reliability and validity of the model. PN1 is also low for the city identity group. However, it is not removed as the reliability, convergent validity, and discriminant validity are still in the desired range. This may be because the lower loading in one indicator (PN1) is compensated for by the higher loadings in the other two indicators (PN2 & PN3).

Table 5.5C: Factor loadings of the indicators for the latent constructs (PMT model)

Construct	**Indicator**	**Standardized Loadings**			
		Male (Female)	**Younger (Middle) Age Group**	**Metropolitan (Non-Metropolitan)**	**City (Town) Identity**

Awareness of Consequence (AC)	AC1	0.816 (0.775)	0.815 (0.761)	0.839 (0.770)	0.866 (0.760)
	AC2	0.810 (0.749)	0.831 (0.696)	0.866 (0.754)	0.821 (0.751)
	AC3	0.735 (0.775)	0.743 (0.875)	0.616 (0.777)	0.801 (0.740)
Perceived Risk (PR)	PR1	NA (0.881)	0.884 (0.775)	NA (0.963)	NA (NA)
	PR2	NA (0.587)	0.634 (0.732)	NA (0.351)	NA (NA)
	PR3	NA (0.611)	0.491 (0.774)	NA (NA)	NA (NA)
Perceived Vulnerability (PV)	PV1	0.802 (0.825)	0.826 (0.880)	0.844 (0.794)	0.853 (0.804)
	PV2	0.851 (0.843)	0.768 (0.851)	0.849 (0.806)	0.868 (0.834)
	PV3	0.666 (0.682)	0.634 (0.837)	0.599 (0.625)	0.753 (0.648)
Perceived Behavioral Control (PBC)	PBC1	0.806 (0.766)	0.793 (0.641)	0.800 (0.713)	0.722 (0.781)
	PBC2	0.750 (0.819)	0.689 (0.797)	0.730 (0.814)	0.803 (0.792)
	PBC3	NA (NA)	NA (0.596)	NA (NA)	NA (NA)
	PBC4	0.539 (0.656)	0.702 (0.630)	0.643 (0.659)	0.648 (0.627)
Response Efficacy (RE)	RE1	0.899 (0.864)	0.907 (0.961)	0.849 (0.913)	0.858 (0.894)
	RE2	0.774 (0.857)	0.776 (0.951)	0.866 (0.730)	0.852 (0.801)
Response Cost (RC)	RC1	0.835 (0.856)	0.892 (0.838)	0.727 (0.936)	0.882 (0.830)
	RC2	0.710 (0.887)	0.796 (0.876)	0.692 (0.739)	0.914 (0.825)
	RC3	0.739 (0.637)	0.650 (0.861)	0.846 (0.457)	0.484 (0.703)
Intention (INT)	INT1	0.899 (0.895)	0.899 (0.884)	0.891 (0.896)	0.909 (0.889)
	INT2	0.817 (0.823)	0.829 (0.815)	0.825 (0.805)	0.841 (0.822)
	INT3	0.869 (0.834)	0.869 (0.829)	0.858 (0.841)	0.866 (0.850)

As it can be seen in table 5.3C, majority of the indicators of all constructs used in the PMT model have loadings greater than 0.708 which is above the recommended benchmark. The construct perceived risk (PR) had lower loadings in two of its indicators. Even after elimination of the indicator with the lowest loadings, the reliability and validity indicators have not improved significantly. Hence the construct PR has been removed completely from the model in both the gender and location by identity categories, and in the middle age group and the metropolitan group. Except for the middle age group, the indicator PBC3 for perceived behavioral control has lower loadings in all other demographic categories and hence PBC3 is removed from further analysis.

Internal Consistency Reliability

Second step in the assessment of measurement models involves the examination of internal consistency reliability. Indicators of a construct are said to be reliable when it accurately measures the true value and minimizes the value of error factor. The Joreskog's (1971) composite reliability (CR) value have been used to evaluate internal consistency reliability. CR values of 0.7 or above is considered to be significant (Hajjar, 2018).

Table 5.6A: Internal Consistency Reliability Assessment of Constructs (TPB model)

Construct		Composite Reliability (CR)		
	Male (Female)	Younger (Middle) Age Group	Metropolitan (Non-Metropolitan)	City (Town) Identity
AT	0.849 (0.868)	0.837 (0.854)	0.821 (0.815)	0.863 (0.823)
PBC	0.759 (0.797)	0.795 (0.763)	0.767 (0.777)	0.775 (0.779)
SN	0.870 (0.836)	0.854 (0.887)	0.849 (0.836)	0.838 (0.858)
INT	0.900 (0.888)	0.904 (0.880)	0.893 (0.892)	0.906 (0.890)

As it can be seen from table 5.4A, the CR values for all constructs in the TPB model lie above the recommended value of 0.70. Hence the constructs are found to have significant internal consistency reliability in all the demographic groups.

Table 5.6B: Internal Consistency Reliability Assessment of Constructs (NAM model)

Construct	Composite Reliability (CR)			
	Male (Female)	Younger (Middle) Age Group	Metropolitan (Non-Metropolitan)	City (Town) Identity
AC	0.817 (0.802)	0.831 (0.822)	0.821 (0.814)	0.868 (0.774)
AR	0.833 (0.855)	0.863 (0.884)	0.870 (0.801)	0.886 (0.826)
EVC	0.812 (0.845)	0.841 (0.881)	0.878 (0.785)	0.895 (0.805)
PN	0.810 (0.861)	0.818 (0.833)	0.895 (0.798)	0.806 (0.788)
SN	0.854 (0.815)	0.855 (0.887)	0.849 (0.835)	0.822 (0.845)

INT	0.893 (0.879)	0.906 (0.880)	0.893 (0.886)	0.904 (0.882)

As it can be seen from table 5.4B, the CR values for all constructs in the NAM model lie above the recommended value of 0.70. Hence the constructs are found to have significant internal consistency reliability in all the demographic groups.

Table 5.6C: Internal Consistency Reliability Assessment of Constructs (PMT model)

Construct	**Composite Reliability (CR)**			
	Male (Female)	**Younger (Middle) Age Group**	**Metropolitan (Non-Metropolitan)**	**City (Town) Identity**
AC	0.831 (0.810)	0.839 (0.823)	0.839 (0.811)	0.869 (0.794)
PR	NA (0.742)	0.719 (0.804)	0.719 (0.645)	NA (NA)
PV	0.819 (0.829)	0.789 (0.892)	0.789 (0.788)	0.866 (0.808)
PBC	0.746 (0.793)	0.772 (0.763)	0.772 (0.774)	0.769 (0.780)
RE	0.825 (0.851)	0.832 (0.955)	0.832 (0.810)	0.845 (0.837)
RC	0.806 (0.840)	0.827 (0.894)	0.827 (0.768)	0.818 (0.830)
INT	0.897 (0.888)	0.900 (0.881)	0.900 (0.885)	0.905 (0.890)

As it can be seen from table 5.4C, the CR values for all constructs in the PMT model lie above the recommended value of 0.70. Hence the constructs are found to have significant internal consistency reliability in all the demographic groups.

Validity Assessments of Constructs

Validity assessment of constructs is the third step in the evaluation of measurement model. Validity of a construct indicates its accuracy. It indicates the extent to which the indicators of the construct measure the theoretical construct that it proposes to measure. Construct validity has two parts: convergent validity and discriminant validity.

<u>Convergent validity</u>

Convergent validity is widely used to assess behavioral science models. It is a measure of the extent to which two or more indicators of a construct that are theoretical associated are indeed associated to one another. In other words, convergent validity of a construct indicates the high theoretical correlation between the scales used and the measures of the other constructs. For instance, to demonstrate high convergent validity of a construct called attitude, the scores for attitude must be correlated with other constructs that also measures values similar to attitude.

Table 5.7A: Convergent Validity Assessment of Constructs (TPB model)

Construct	Average Variance Extracted (AVE)			
	Male (Female)	Younger (Middle) Age Group	Metropolitan (Non-Metropolitan)	City (Town) Identity
AT	0.598 (0.687)	0.574 (0.596)	0.550 (0.543)	0.618 (0.556)
PBC	0.517 (0.568)	0.566 (0.450)	0.526 (0.539)	0.536 (0.543)
SN	0.628 (0.564)	0.595 (0.664)	0.586 (0.561)	0.567 (0.604)
INT	0.751 (0.727)	0.759 (0.711)	0.737 (0.733)	0.764 (0.729)

Table 5.5A indicates the convergent validity scores which is measured through average variance extracted. The average variance extracted (AVE) which explains the amount of variance accounted for by the indicators of a latent construct. Values for AVE atleast 0.50 is recommended. We see that the AVE values for all the constructs in each demographic category lies above the desired range. Hence convergent validity is said to have been achieved. PBC has an AVE value of 0.450 which is slightly below the desired range. However, we still include the same in the model as its internal consistency reliability was achieved.

Table 5.7B: Convergent Validity Assessment of Constructs (NAM model)

Construct	Average Variance Extracted			
	Male (Female)	Younger (Middle) Age Group	Metropolitan (Non-Metropolitan)	City (Town) Identity
AC	0.599 (0.574)	0.622 (0.609)	0.609 (0.593)	0.686 (0.534)
AR	0.627 (0.665)	0.678 (0.717)	0.693 (0.576)	0.724 (0.615)
EVC	0.684 (0.731)	0.725 (0.788)	0.782 (0.648)	0.810 (0.674)
PN	0.598 (0.757)	0.611 (0.628)	0.810 (0.581)	0.601 (0.570)
SN	0.595 (0.529)	0.598 (0.664)	0.810 (0.561)	0.539 (0.578)
INT	0.736 (0.708)	0.764 (0.711)	0.736 (0.722)	0.759 (0.714)

From Table 5.5B, we see that the AVE values for all the constructs in each demographic category lies above the desired range (0.50). Hence convergent validity is said to have been achieved for all constructs in the NAM model.

Table 5.7C: Convergent Validity Assessment of Constructs (PMT model)

Construct	Average Variance Extracted (AVE)			
	Male (Female)	Younger (Middle) Age Group	Metropolitan (Non-Metropolitan)	City (Town) Identity

AC	0.621 (0.588)	0.636 (0.610)	0.636 (0.588)	0.688 (0.563)
PR	NA (0.498 ~ 0.5)	0.474 ~ 0.5 (0.578)	0.474 ~ 0.5 (0.525)	NA (NA)
PV	0.604 (0.619)	0.558 (0.733)	0.558 (0.557)	0.683 (0.587)
PBC	0.501 (0.563)	0.532 (0.450)	0.532 (0.535)	0.528 (0.544)
RE	0.703 (0.741)	0.713 (0.914)	0.713 (0.683)	0.731 (0.720)
RC	0.582 (0.642)	0.618 (0.737)	0.618 (0.544)	0.616 (0.621)
INT	0.744 (0.725)	0.751 (0.711)	0.751 (0.720)	0.761 (0.730)

From table 5.5C, we see that the AVE values for all the constructs in each demographic category lies above the desired range (0.50). Hence convergent validity is said to have been achieved for all constructs in the PMT model. The construct PR which was earlier found to have no internal consistency reliability for most of the demographic categories, is found to have discriminant validity through small margins, except for the middle age group, and for the non-metropolitan group which have achieved convergent validity (with AVE > 0.50). Hence, PR needs to be used with restraint and careful scrutiny in further analysis.

<u>Discriminant validity</u>

Discriminant validity is used to examine the uniqueness between the latent constructs in a model. When the distinctiveness of the different constructs from each other is proved, discriminant validity is said to have been established. Different approaches are used to examine discriminant validity using PLS-SEM in a reflective measurement model, like the Heterotrait-Monotrait (HTMT) ratio, Fornell-Larcker criterion, and cross-loadings (Henseler et al., 2015; Rasoolimanesh et al., 2017). We have used the HTMT ratio to assess discriminant validity. According to Henseler et al., (2015), HTMT values need to be lower than the cut-off value of either 0.85 or 0.9 for the construct to achieve discriminant validity.

Table 5.8A: Discriminant Validity Assessment (TPB model)

	Heterotrait Monotrait Ratio (HTMT)			
	Male (Female)	**Younger (Middle) Age Group**	**Metropolitan (Non-Metropolitan)**	**City (Town) Identity**
INT <-> AT	0.774 (0.712)	0.795 (0.763)	0.696 (0.845)	0.779 (0.755)
PBC <-> AT	0.698 (0.573)	0.598 (0.650)	0.667 (0.695)	0.707 (0.578)
PBC <-> INT	0.681 (0.619)	0.636 (0.653)	0.723 (0.662)	0.736 (0.587)
SN <-> AT	0.869 (0.806)	0.856 (0.916)	0.834 (0.898)	0.873 (0.845)

SN <-> INT	0.819 (0.822)	0.846 (0.786)	0.830 (0.872)	0.880 (0.808)
SN <-> PBC	0.868 (0.781)	0.771 (0.878)	0.732 (0.838)	0.870 (0.746)

Table 5.8A illustrates the HTMT ratio for all the constructs used in the TPB model for the various demographic categories. We see that all the constructs for most of the demographic categories are less than the benchmark value. Hence most of the constructs have distinctiveness with reference to the other constructs. However, for the middle age group, the combination of construct SN<->AT is slightly over the 0.90 benchmark. Hence the combination of these two constructs will be exercised with caution in the further analysis.

Table 5.8B: Discriminant Validity Assessment (NAM model)

	Heterotrait Monotrait Ratio (HTMT)			
	Male (Female)	**Younger (Middle) Age Group**	**Metropolitan (Non-Metropolitan)**	**City (Town) Identity**
AR <-> AC	0.622 (0.376)	0.531 (0.663)	0.282 (0.598)	0.463 (0.520)
EVC <-> AC	0.590 (0.707)	0.711 (0.654)	0.605 (0.686)	0.679 (0.630)
EVC <-> AR	0.404 (0.434)	0.454 (0.405)	0.292 (0.598)	0.321 (0.518)
INT <-> AC	0.382 (0.382)	0.443 (0.422)	0.337 (0.466)	0.506 (0.306)
INT <-> AR	0.341 (0.373)	0.416 (0.487)	0.253 (0.554)	0.330 (0.415)
INT <-> EVC	0.404 (0.492)	0.497 (0.478)	0.525 (0.527)	0.446 (0.449)
PN <-> AC	0.582 (0.385)	0.537 (0.663)	0.393 (0.521)	0.557 (0.480)
PN <-> AR	0.649 (0.494)	0.647 (0.803)	0.445 (0.757)	0.667 (0.624)
PN <-> EVC	0.744 (0.532)	0.697 (0.804)	0.541 (0.669)	0.633 (0.709)
PN <-> INT	0.691 (0.796)	0.770 (0.742)	0.786 (0.828)	0.726 (0.752)
SN <-> AC	0.510 (0.415)	0.485 (0.408)	0.460 (0.532)	0.577 (0.405)
SN <-> AR	0.433 (0.449)	0.511 (0.496)	0.361 (0.706)	0.465 (0.483)
SN <-> EVC	0.515 (0.459)	0.507 (0.668)	0.531 (0.497)	0.585 (0.452)
SN <-> INT	0.797 (0.824)	0.848 (0.786)	0.829 (0.883)	0.892 (0.799)
SN <-> PN	0.897 (0.903)	0.941 (0.887)	0.953 (0.985)	0.939 (0.919)

Table 5.8B illustrates the HTMT ratio for all the constructs used in the NAM model for the various demographic categories. We see that all the constructs for most of the demographic categories are less than the benchmark value. Hence most of the constructs have distinctiveness with reference to the other constructs. However, for the younger age group, the combination of

construct SN<->PN is slightly over the 0.90 benchmark. Similarly, both the location groups by jurisdiction and identity have HTMT value higher than the benchmark for the association SN<->PN. Hence the combination of these two constructs will be exercised with caution in the further analysis.

Table 5.8C: Discriminant Validity Assessment (PMT model)

	Heterotrait Monotrait Ratio			
	Male (Female)	**Younger (Middle) Age Group**	**Metropolitan (Non-Metropolitan)**	**City (Town) Identity**
INT <-> AC	0.442 (0.432)	0.378 (0.422)	0.337 (0.456)	0.517 (0.387)
PBC <-> AC	0.532 (0.388)	0.462 (0.259)	0.387 (0.466)	0.467 (0.410)
PBC <-> INT	0.662 (0.613)	0.635 (0.653)	0.726 (0.658)	0.731 (0.589)
PR <-> AC	NA (NA)	0.518 (0.451)	NA (0.717)	NA (NA)
PR <-> INT	NA (NA)	0.319 (0.507)	NA (0.548)	NA (NA)
PR <-> PBC	NA (NA)	0.477 (0.682)	NA (0.551)	NA (NA)
PV <-> AC	0.728 (0.678)	0.568 (0.693)	0.666 (0.696)	0.776 (0.641)
PV <-> INT	0.650 (0.517)	0.564 (0.699)	0.479 (0.663)	0.532 (0.597)
PV <-> PBC	0.713 (0.431)	0.441 (0.651)	0.358 (0.620)	0.588 (0.466)
PV <-> PR	NA (0.598)	0.715 (0.711)	NA (1.272)	NA (NA)
RC <-> AC	0.096 (0.146)	0.109 (0.080)	0.131 (0.050)	0.108 (0.125)
RC <-> INT	0.183 (0.173)	0.189 (0.416)	0.113 (0.142)	0.069 (0.204)
RC <-> PBC	0.329 (0.326)	0.403 (0.766)	0.254 (0.370)	0.349 (0.313)
RC <-> PR	NA (0.436)	0.424 (0.449)	NA (0.636)	NA (NA)
RC <-> PV	0.303 (0.146)	0.187 (0.278)	0.151 (0.218)	0.177 (0.174)
RE <-> AC	0.557 (0.384)	0.390 (0.571)	0.391 (0.528)	0.505 (0.457)
RE <-> INT	0.658 (0.747)	0.650 (0.708)	0.602 (0.766)	0.732 (0.700)
RE <-> PBC	0.719 (0.582)	0.526 (0.712)	0.534 (0.620)	0.716 (0.571)
RE <-> PR	NA (0.319)	0.510 (0.663)	NA (0.596)	NA (NA)
RE <-> PV	0.866 (0.679)	0.744 (0.817)	0.672 (0.922)	0.712 (0.810)
RE <-> RC	0.424 (0.245)	0.323 (0.297)	0.322 (0.267)	0.338 (0.274)

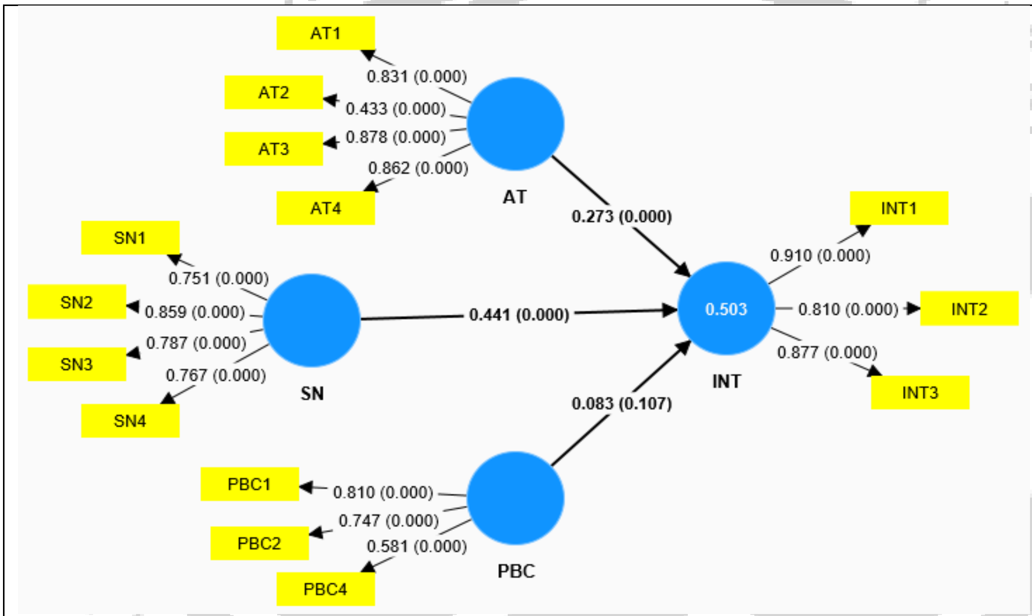
Table 5.8C illustrates the HTMT ratio for all the constructs used in the PMT model for the various demographic categories. We see that HTMT ratio of all the constructs for most of the demographic categories are less than the benchmark value. Hence most of the constructs have distinctiveness with reference to the other constructs. However, for the non-metropolitan

group, the combination of construct RE<->PV is above the 0.90 benchmark. Hence the combination of these two constructs will be exercised with caution in the further analysis. In addition, except for the age demographic categories and the non-metropolitan group, the construct PR is not found to achieve discriminant validity.

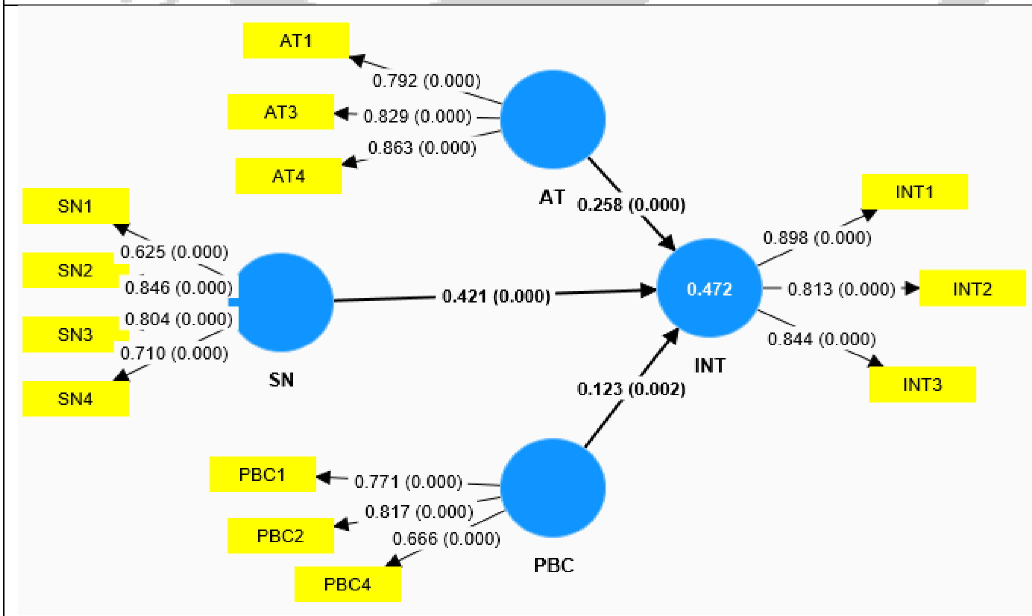
5.7 Results of Structural Equation Model & Mediation Analysis

5.7.1 TPB Structural Models

5.7.1A Male Vs Female



A: Structural Model (Male)



B: Structural Model (Female)

Figure 5.2 TPB Structural Model (Gender Demographic Group)

Table 5.9A: Results of the structural equation model (TPB model significant pathways leading to an intention to adopt EV in males Vs females)

Hypothesized paths	Standardized estimates	p-value
H1: AT → INT	0.273*** (0.258***)	0.000 (0.000)
H4: SN → INT	0.441*** (0.421***)	0.000 (0.000)
H7: PBC → INT	0.083 (0.123**)	0.107 (0.002)

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

() parentheses represent values for female group

Attitude and subjective norms significantly influence intention to adopt EV in males. For females, perceived behavioral control also influences intention directly in addition to attitude and subjective norm. Subjective norm has the highest effect size in both males (44%) and in females (42%). Perceived behavioral control is not found to have any direct effect on the intention to adopt an EV in males. This may be because males do not consider electric vehicles any more difficult compared to the usual ICE vehicles, in terms of its use and operation. In addition, they are also quite used to driving / riding vehicles to a much larger extent than females on a regular basis in the study locations. Hence certain assessments regarding their ability to use and manage an EV seem to be taken as granted in the case of males.

Mediation Analysis

Table 5.9B: Mediated pathways with their effect and size (TPB; male Vs. female)

Pathways	Effect	Size	P-value
Male			
AT → SN → INT	Partial	0.303***	0.000
PBC → SN → INT	Full	0.244***	0.000
Female			
SN → PBC → INT	Partial	0.054**	0.006
PBC → SN → INT	Partial	0.220***	0.000
AT → SN → INT	Partial	0.258***	0.000

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

In males, attitude (AT) has a direct influence on intention (INT) with an effect size of 27.3%.

Attitude is also partially mediated by subjective norms (SN) to lead towards pro-environmental intention for EV adoption. The mediated pathway has a higher effect size (30.3%). Perceived behavioral control (PBC) has no direct effect on intention. However, PBC is fully mediated by SN to lead to an intention to adopt EV. This fully mediated pathway has an effect size of 24.4%. For the female group all the three constructs: AT, SN and PBC has direct impact on intention to adopt an EV. Like in the male group, SN also acts as a mediator for AT and PBC to create two partially mediated pathways towards intention formation. SN is also found to be mediated by PBC. However, out of these mediated relationships, AT→ INT mediated pathway has no much significance, as the direct unmediated intention pathway also has the same effect size (25.8%). SN has a strong direct effect size (42.1%) on intention in comparison to its mediated effect on intention formation pathway via PBC with effect size (5.4%). Hence the SN → PBC → INT partial mediation pathway also do not hold much significance. However, PBC is found to have a significantly better effect on intention (22%) when it is mediated by SN, compared to the direct effect of PBC on INT (12.3%).

5.7.1B Young Age Group Vs. Middle Age Group

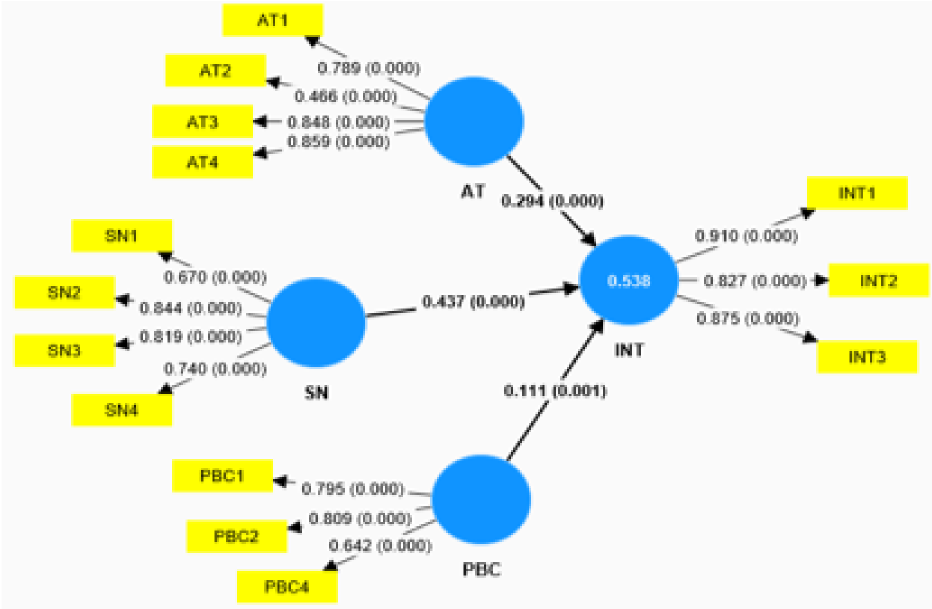


Fig 5.3A: Structural Model (Younger Age Group)

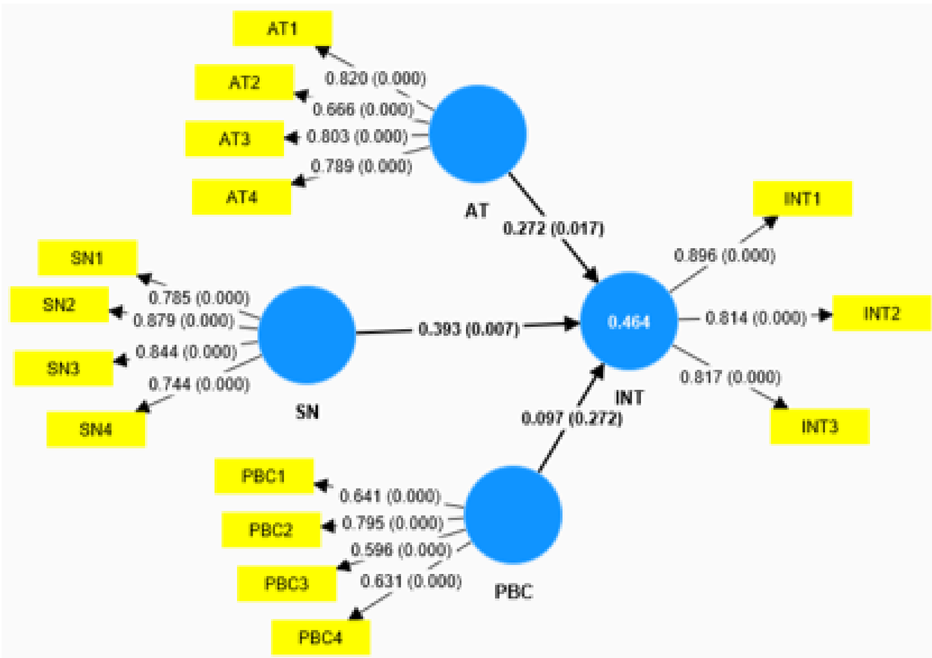


Fig 5.3B: Structural Model (Middle Age Group)

Figure 5.3 TPB Structural Model (Age Demographic Group)

Table 5.10A: Results of the structural equation model (TPB model significant pathways leading to an intention to adopt EV in younger age group Vs middle age group)

Hypothesized paths	**Standardized estimates**	**p-value**
H2: AT → INT	0.294*** (0.272**)	0.000 (0.017)
H5: SN → INT	0.437*** (0.393**)	0.000 (0.007)

H8: PBC → INT	0.111*** (0.097)	0.001 (0.272)

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

() parentheses represent values for the middle age group

All three constructs, attitude, subjective norm, and perceived behavioral control are found to have a significant influence on the formation of an intention to adopt EVs in the younger age group. However, for the middle age group, only attitude and subjective norm are found to have a significant influence on intention formation for EV adoption. While attitude has nearly equal effect size on intention in both the younger and middle age groups, but subjective norm is found to have a higher effect on intention in the younger age group (43.7%) in comparison to the middle age group (39.3%). This indicates that younger age group experiences higher social pressure to act or not act in a certain way. This might be because of their higher involvement in social media platforms, leading to self-comparison with others, and a higher pressure to compete and maintain the status quo. Perceived behavioral control is not found to have a significant effect on the formation of an intention to adopt an EV in the middle age group. This hints towards a possibility that middle age group individuals do not think much about their abilities to comfortably use an EV or their abilities to address operational challenges if any, while deciding about adopting the same.

Mediation Analysis

Table 5.10B: Mediated pathways with their effect and size (TPB; young Vs. middle age groups)

Pathways	Effect	Size	P-value
Younger Age Group			
PBC → SN → INT	Partial	0.229***	0.000
AT → SN → INT	Partial	0.290***	0.000
Middle Age Group			
SN → AT → INT	Partial	0.198**	0.039
AT → SN → INT	Partial	0.294**	0.015
PBC → SN → INT	Partial	0.248**	0.015

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

The younger age group is found to have several partially mediated intention formation pathways. However, none of the mediated pathways are found to have much significance as the effect sizes of the mediated pathways are less than the effect size of the direct impact that the constructs have on intention (see table 5.10A). For the middle age group, attitude and perceived behavioral control is found to have a higher effect size on intention when mediated by subjective norms. Direct AT → INT has an effect size 27.2% which slightly increases to 29.4% when mediated by SN. Similarly, direct PBC → INT has an effect size 9.7% which rises to 24.8% when mediated by SN and combination of SN+AT respectively. Mediated association of SN on INT through AT can be ignored as it has a lower effect size compared to the direct effect of SN on INT.

5.7.1C Metropolitan Vs Non-Metropolitan

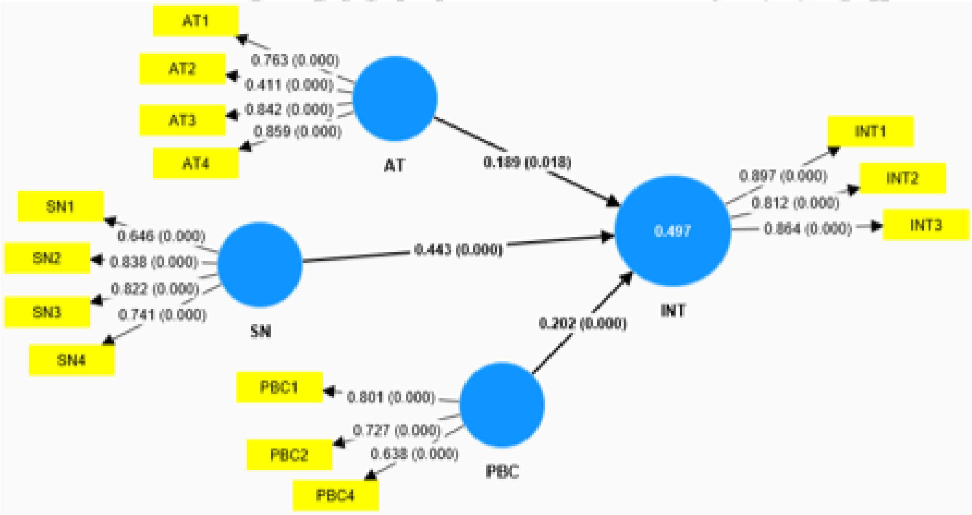


Fig 5.4A: Structural Model (Metropolitan)

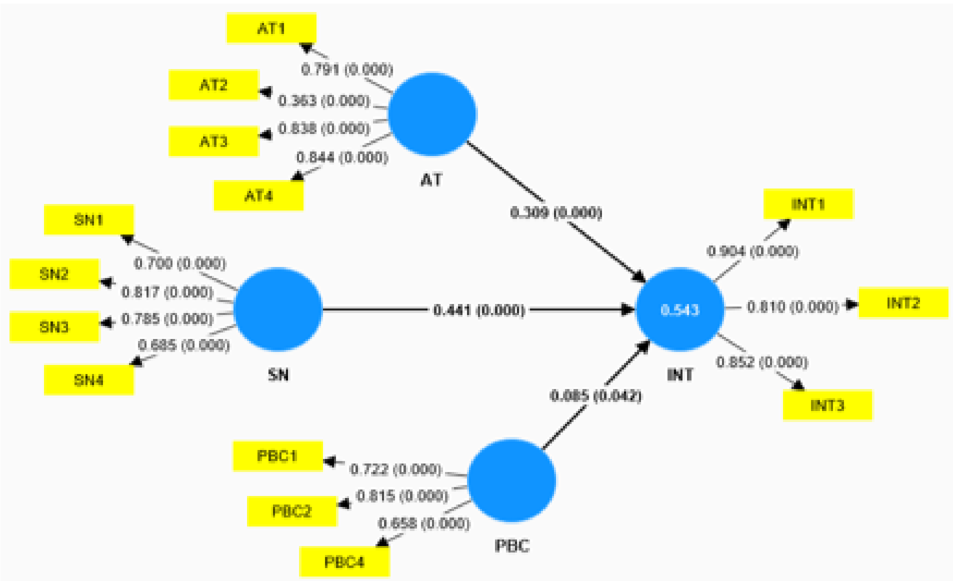


Fig 5.4B: Structural Model (Non-metropolitan)

Figure 5.4 TPB Structural Model (Location Demographic Group)

Table 5.11A: Results of the structural equation model (significant pathways leading to an intention to adopt EV in metropolitan Vs non-metropolitan)

Hypothesized paths	Standardized estimates	p-value
H3: AT → INT	0.189** (0.309***)	0.018 (0.000)
H6: SN → INT	0.443*** (0.441***)	0.000 (0.000)
H9: PBC → INT	0.202*** (0.085**)	0.000 (0.042)

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

() parentheses represent values for the non-metropolitan group

All the three constructs, namely attitude, subjective norm, and perceived behavioral control are found to have a significant effect on the intention to adopt an EV in both metropolitan areas and non-metropolitan areas. However, there are some differences in effect size for attitude and perceived behavioral control in the two groups. Attitude is found to have a higher influence (30.9%) on intention in the non-metropolitan areas compared to its effect (18.9%) in metropolitan areas. Non-metropolitan area people seem to care more about being able to stop further damage to the environment through their actions, like the act of buying an EV. Being able to undertake such an act seem to provide them greater satisfaction than the extent to which it would satisfy people in the metropolitan areas. Perceived behavioral control on the other hand, has a higher effect (20.2%) on intention to adopt an EV in metropolitan areas compared to its effect (8.5%) in the non-metropolitan areas. This indicates higher self-belief and stronger will on themselves in the metropolitan areas compared to people in the non-metropolitan areas.

Mediation Analysis

Table 5.11B: Mediated pathways with their effect and size

Pathways	Effect	Size	P-value
Metropolitan Jurisdiction			
PBC → SN → INT	Partial	0.214***	0.000
AT → SN → INT	Partial	0.284***	0.000
Non-metropolitan Jurisdiction			
PBC → SN → INT	Partial	0.236***	0.000
PBC → SN → AT → INT	Partial	0.103***	0.000
AT → SN → INT	Partial	0.291***	0.000

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

Subjective norm (SN) is found to act as a strong mediator for both the metropolitan and non-metropolitan areas. In metropolitan areas, SN mediates the relationship from PBC and AT towards formation of intention to adopt EV. However, the mediated PBC → INT relation through SN has only a minimal increase in effect size (21.4%) in comparison to the effect size (20.2%) of the direct PBC → INT relation. The mediated AT → INT relation through SN has a significant increase in effect size (28.4%) in comparison to the effect size (18.9%) of the direct AT → INT relation. In addition to that, the AT → INT relation is also partially mediated by PBC. However, its effect size is very small (4.1%) in comparison to the direct intention formation pathway and hence do not hold much significance.

In the non-metropolitan areas, the direct relation between PBC → INT was found to have a very small effect size (8.5%). However, when the same is partially mediated by SN, its effect size increases significantly (23.6%). PBC → INT is also found to have some increase in effect size (10.3%) when mediated by both SN and AT in comparison to the direct intention formation pathway.

5.7.2 NAM structural models

5.7.2A Male Vs Female

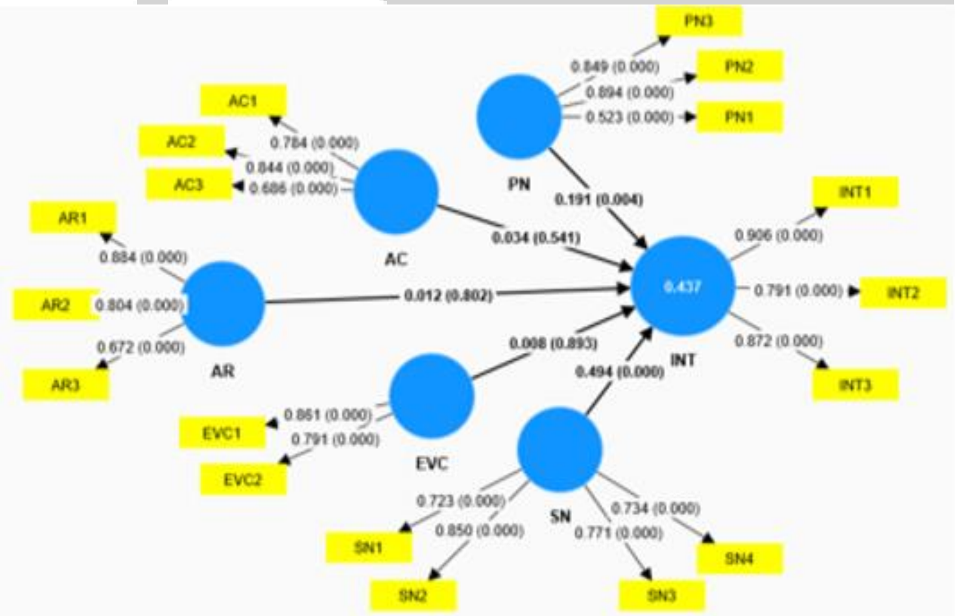


Fig 5.5A Structural Model (Male)

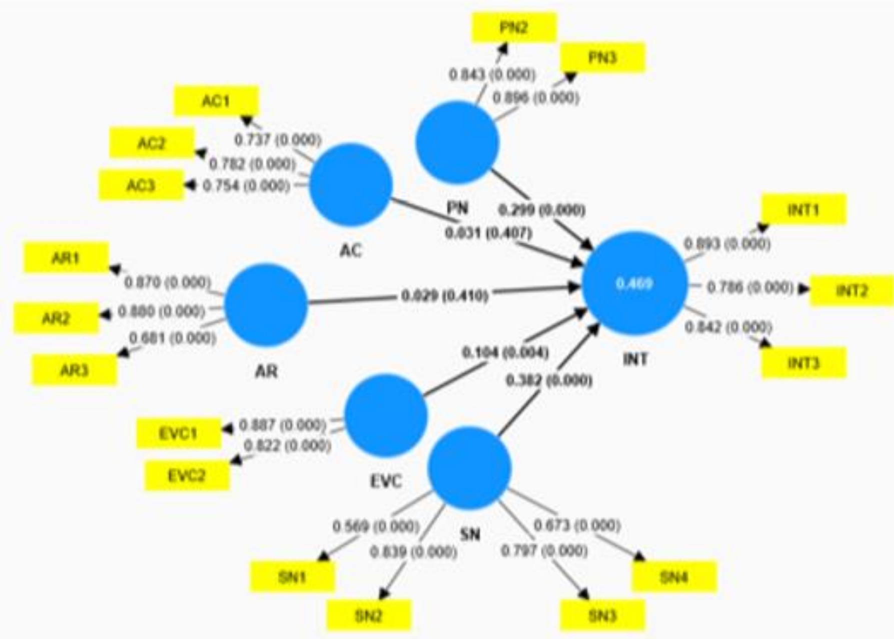


Fig 5.5B Structural Model (Female)

Figure 5.5 NAM Structural Model (Gender Demographic Group)

Table 5.12A: Results of the structural equation model (significant NAM pathways leading to an intention to adopt EVs in male Vs female)

Hypothesized paths	**Standardized estimates**	**p-value**
H10: AC → INT	0.034 (0.031)	0.541 (0.407)
H13: AR → INT	0.012 (0.029)	0.802 (0.410)
H16: EVC → INT	0.008 (0.104**)	0.893 (0.004)
H19: PN → INT	0.191** (0.299***)	0.004 (0.000)
H4: SN → INT	0.494*** (0.382***)	0.000 (0.000)

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

() parentheses represent values for female group

For males, only personal norm and subjective norm are found to have a direct effect on the formation of intention to adopt an EV. Subjective norms have a higher effect size (49.4%) compared to personal norms (19.1%). For females, environmental concern is also found to have a significant direct impact on intention along with personal norm and subjective norm. Subjective norm again has the higher effect size on intention (38.2%), followed by personal norm (29.9%) and environmental concern (10.4%). On comparing the two groups, pro-environmental intentions in males are found to be more influenced by subjective norm compared to females. Pro-environmental intentions in females on the other hand are more influenced by personal norms in comparison to males.

Mediation Analysis

Table 5.12B: Mediated pathways with their effect and size

Pathways	**Effect**	**Size**	**P-value**
Male			
PN → SN → INT	Partial	0.312***	0.000
AC → SN → INT	Full	0.059**	0.033
Female			
AC → SN → PN → INT	Full	0.024**	0.003
AC → SN → INT	**Full**	**0.057****	**0.002**
AC → EVC → INT	**Full**	**0.042****	**0.006**
AC → AR → PN → INT	Full	0.011**	0.014
AC → AR → SN → INT	Full	0.024***	0.001
AR → SN → INT	**Full**	**0.088*****	**0.000**
AR → PN → INT	Full	0.042**	0.007
AR → EVC → INT	Full	0.020**	0.022
EVC → SN → PN → INT	Partial	0.028***	0.000
EVC → PN → INT	Partial	0.041**	0.004
EVC → SN → INT	**Partial**	**0.066*****	**0.000**

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

In males, though awareness of consequence (AC) has no direct effect on intention (INT) formation, it is however mediated by subjective norms (SN) towards INT. This full mediated pathway has an effect size of 5.9%. Personal norm (PN) has a direct effect (19.1%) on the intention to adopt EVs, however, when PN is partially mediated by SN, its effect size increases to 31.2%.

In females, AC is found to be fully mediated by SN with an effect size 5.7% and by environmental concern (EVC) with effect size of 4.2%. In addition, the intention formation pathway AC → AR → PN → INT as specified in the original NAM model by Schwartz (1968) is found to be present in females. It is a fully mediated pathway with effect size 1.1%. The anomaly found in this normative pathway is that when PN is replaced with SN, then the partial mediated pathway AC → AR → SN → INT is found to have a slightly higher effect size of

2.4% compared to the earlier. Ascription of responsibility (AR) is found to be fully mediated by all the three direct norm motivators SN, PN, and EVC with effect sizes 8.8%, 4.2%, and 2.2% respectively. Though EVC has a direct intention formation pathway with size 10.4%, yet it is also found to be partially mediated by SN with effect size 6.6% and partially mediated by PN with effect size 4.1%.

Younger Age Group Vs Middle Age Group

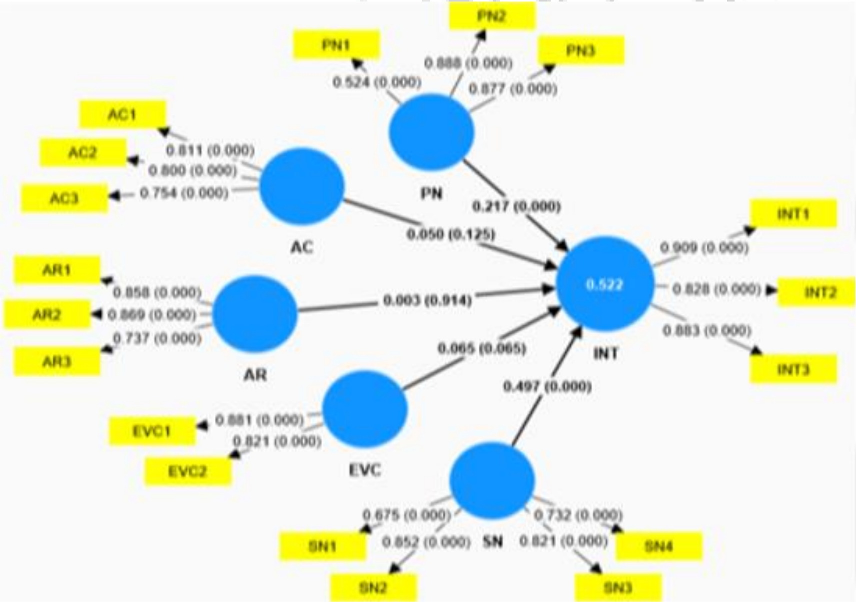


Fig 5.6A Structural Model (Younger Age Group)

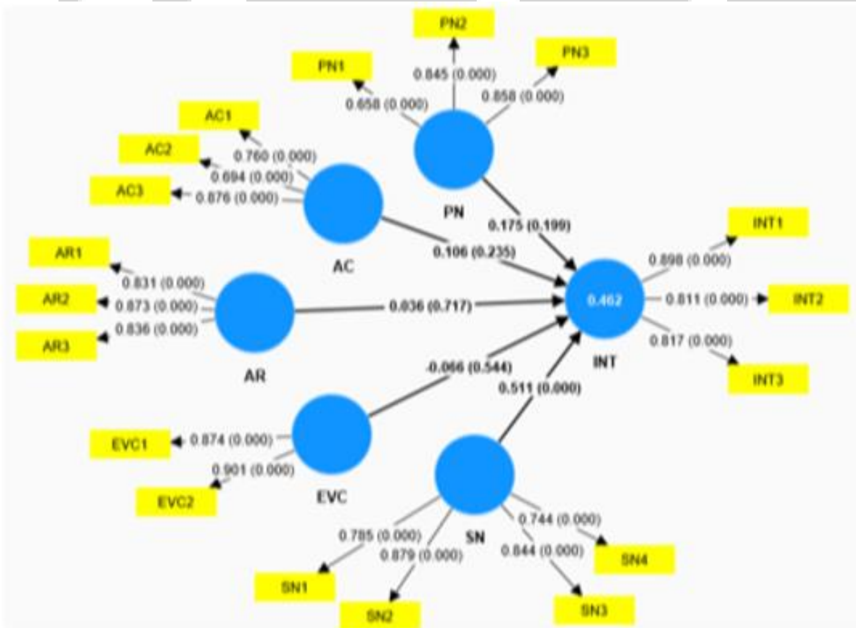


Fig 5.6B Structural Model (Middle Age Group)

Figure 5.6 NAM Structural Model (Age Demographic Group)

Table 5.13A: Results of the structural equation model (significant NAM pathways leading to an intention to adopt EVs in younger age group Vs middle age group)

Hypothesized paths	Standardized estimates	p-value
H11: AC → INT	0.050 (0.106)	0.125 (0.235)
H14: AR → INT	0.003 (0.036)	0.914 (0.717)
H17: EVC → INT	0.065* (-0.066)	0.065 (0.544)
H20: PN → INT	0.217*** (0.175)	0.000 (0.199)
H5: SN → INT	0.497*** (0.511***)	0.000 (0.000)

***significant at 1%, *significant at 10%

() parentheses represent values for middle age group

In the younger age group, intention to adopt an EV is found to be directly influenced by SN with an effect of size 49.7%, by PN with an effect of size 21.7, and by EVC with an effect of size 6.5%. Middle aged group is found to be directly influenced only by subjective norms in developing their intentions to adopt an EV. This direct intention formation pathway has a high effect of size 51.1%.

Mediation Analysis

Table 5.13B: Mediated pathways with their effect and size

Pathways	Effect	Size	P-value
Younger Age Group			
AC →AR → SN → INT	Full	0.052***	0.000
AC →EVC → SN → INT	Full	0.040***	0.000
AC → SN → INT	Full	0.084***	0.000
EVC → SN → INT	Partial	0.098***	0.000
EVC → PN → INT	Partial	0.037***	0.000
AR → SN → INT	Full	0.134***	0.000
AR → PN → INT	Full	0.034***	0.000
Middle Age Group			
AC → SN → PN → INT	**Partial**	**0.024****	**0.003**
AC → EVC → SN → INT	Partial	0.027***	0.001
AC → AR → SN → INT	Partial	0.024***	0.001
AC → AR → PN → INT	Partial	0.011**	0.014

AC → SN → INT	**Partial**	**0.057****	**0.002**
AC → EVC → INT	**Partial**	**0.042****	**0.006**
AR → EVC → SN → INT	Partial	0.013**	0.005
AR → EVC → PN → INT	Partial	0.008**	0.015
AR → SN → INT	**Partial**	**0.088*****	**0.000**
AR → PN → INT	**Partial**	**0.042****	**0.007**
AR → EVC → INT	**Partial**	**0.020****	**0.022**
EVC → SN → PN → INT	Partial	0.028***	0.000
EVC → PN → INT	**Partial**	**0.041****	**0.004**
EVC → SN → INT	**Partial**	**0.066*****	**0.000**

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

In the younger age group, AC has no direct impact on intention. However, it is found to be fully mediated by SN, EVC, and AR. AC when mediated by SN has an effect of size 8.4%. The effect size of the fully mediated pathway AC →AR → SN → INT is 5.2%, while the effect size of the fully mediated pathway AC →EVC → SN → INT is 4%. Ascription of responsibility (AR) is found to be fully mediated by SN with a high effect size of 13.4%. AR is fully mediated by PN with an effect size of 3.4%. AR is also fully mediated by EVC in combination with SN, though it has a small effect of size 1.5%. Though EVC has a direct intention formation pathway, it is partially mediated by SN with an effect of size 9.8%, and by PN with an effect of size 3.7%.

5.7.2C Metropolitan Vs Non-Metropolitan

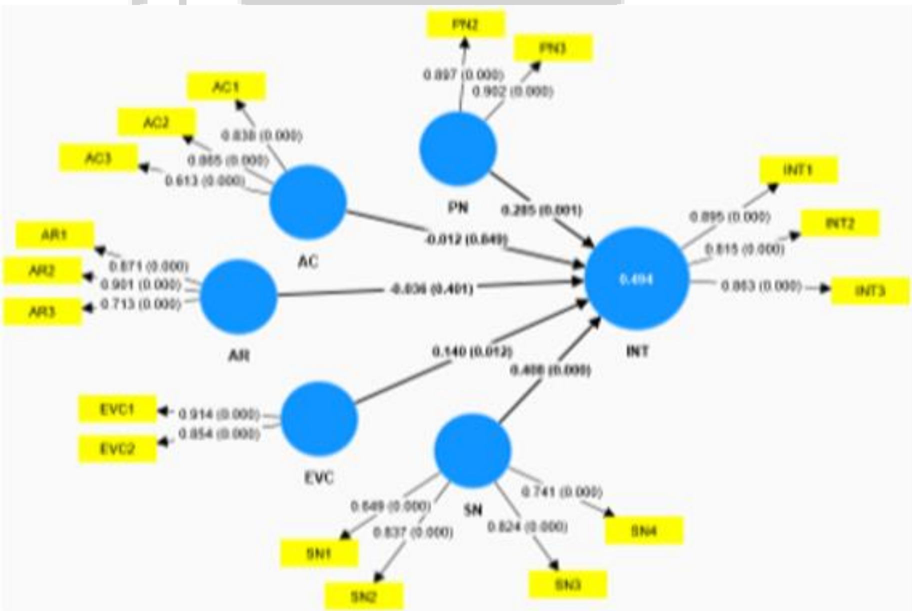


Fig 5.7A Structural Model (Metropolitan)

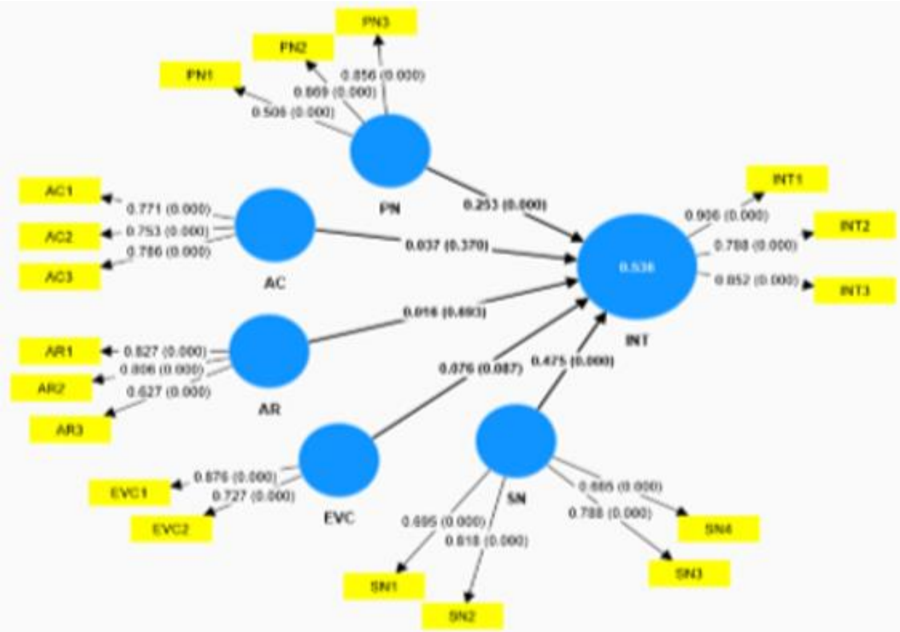


Fig 5.7B Structural Model (Non-Metropolitan)

Figure 5.7 NAM Structural Model (Location Demographic Group)

Table 5.14A: Results of the structural equation model (significant NAM pathways leading to an intention to adopt EVs in metropolitan Vs non-metropolitan

Hypothesized paths	**Standardized estimates**	**p-value**
H12: AC → INT	-0.012 (0.037)	0.849 (0.370)
H15: AR → INT	-0.036 (0.016)	0.401 (0.693)
H18: EVC → INT	0.140** (0.076*)	0.012 (0.087)
H21: PN → INT	0.285*** (0.253***)	0.001 (0.000)
H6: SN → INT	0.408*** (0.475***)	0.000 (0.000)

***significant at 1%, **significant at 5%, *significant at 10%

() parentheses represent values for non-metropolitan group

For both metropolitan and non-metropolitan areas, EVC, PN, and SN are found to have direct effect on intention to adopt EV. However, the size of their effect varies between the two groups. EVC is more likely to influence metropolitan area residents to develop an intention to adopt an EV. Its effect size is 14%. For the non-metropolitan area residents EVC has an effect size of 7.6% to trigger pro-environmental intentions to adopt an EV. PN has a more or less similar effect on intention. Its effect size on metropolitan area residents is 28.5%, while its effect on non-metropolitan residents is 25.3%. SN has a slightly higher effect on non-metropolitan residents compared to metropolitan area residents. While the effect size for non-metropolitan area residents is 47.5%, for metropolitan area residents, the effect size is 40.8%.

Mediation Analysis

Table 5.14B: Mediated pathways with their effect and size

Pathways	Effect	Size	P-value
Metropolitan			
AC → SN → PN → INT	Full	0.031*	0.061
AC →EVC → SN → INT	Full	0.050**	0.014
AC → SN → INT	Full	0.071**	0.030
AC → EVC → INT	Full	0.059**	0.023
AR →SN → PN → INT	Full	0.032**	0.034
AR → PN → INT	Full	0.039*	0.082
AR → EVC → INT	Full	0.020*	0.094
AR → SN → INT	Full	0.071**	0.016
EVC → SN → INT	Partial	0.124**	0.005
EVC →SN → PN → INT	Partial	0.055**	0.016
Non-Metropolitan			
AC → AR → SN → INT	Full	0.094***	0.000
AR → SN → PN → INT	Full	0.072***	0.000
AR → SN → INT	Full	0.233***	0.000

***significant at 1%, **significant at 5%, *significant at 10%

AC has no direct effect on development of intention in the metropolitan group. However, AC is found to lead towards the formation of intention when it is fully mediated by EVC and SN. EVC fully mediates AC towards INT with an effect of size 5.9%. SN fully mediates AC towards INT with an effect of size 7.1%. PN and EVC in combination with SN are also found to fully mediate AC towards INT with effect sizes of 3.1% and 5% respectively. AR is found to be fully mediated by PN, SN, and EVC towards INT. Of these mediated intention formation pathways, AR → SN → INT has an effect size of 7.1%, AR → PN → INT has an effect size of 3.9%, and AR → EVC → INT has an effect size of 2%. SN and PN in combination also fully mediates AR towards INT with an effect of size 3.2%. EVC is partially mediated by SN with an effect of size 12.4%, while SN and PN in combination partially mediates EVC towards INT with an effect of size 5.5%.

In the non-metropolitan areas, AR and SN in combination fully mediates AC towards INT with an effect size of 9.4%. AR is also found to be fully mediated by SN towards INT with a high effect of size 23.3%. AR is also found to be fully mediated by a combination of SN and PN towards INT with an effect size of 7.2%.

5.7.3 PMT Structural Models

5.7.3A Male Vs Female

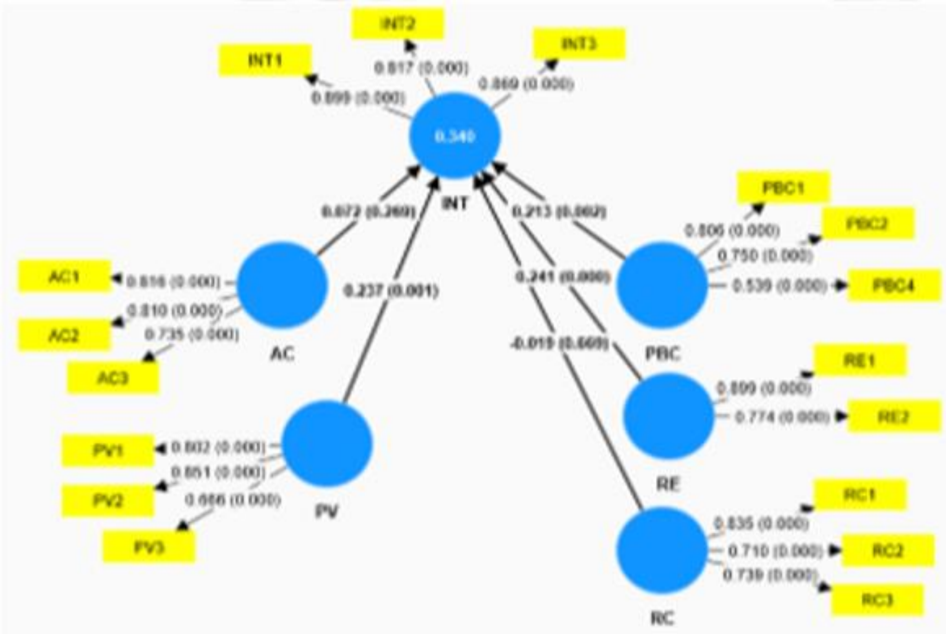


Fig 5.8A Structural Model (Male)

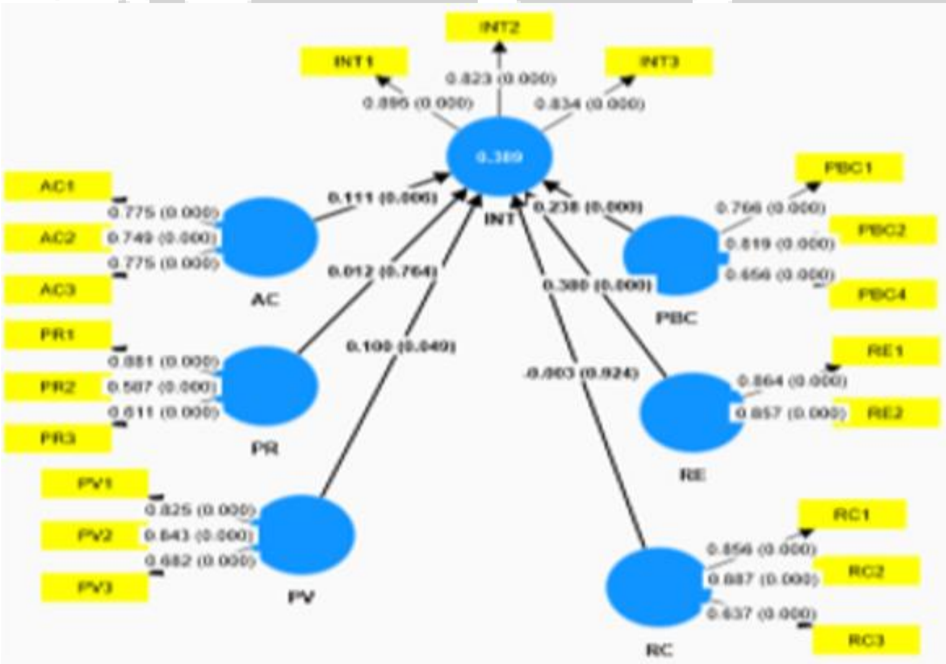


Fig 5.8B Structural Model (Female)

Figure 5.8 PMT Structural Model (Gender Demographic Group)

Table 5.15A: Results of the structural equation model (significant PMT pathways leading to an intention to adopt EVs in male Vs female)

Hypothesized paths	Standardized estimates	p-value
H10: AC → INT	0.072 (0.111**)	0.269 (0.006)
H22: PR → INT	NA (0.012)	NA (0.764)
H25: PV → INT	0.237*** (0.100**)	0.001 (0.049)
H7: PBC → INT	0.213** (0.238***)	0.002 (0.000)
H28: RE → INT	0.241*** (0.380***)	0.000 (0.000)
H31: RC → INT	-0.019 (-0.003)	0.669 (0.924)

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

() parentheses represent values for female group

In males, only perceived vulnerability (PV) has an effect on threat appraisal which can directly impact intention (INT) to adopt an EV. It has an effect size of 23.7%. Out of the coping appraisal variables, perceived behavioral control (PBC), and response efficacy (RE) are found to have a direct effect on intention with effect sizes of 21.3% and 24.1% respectively.

In females, awareness of consequence (AC) and perceived vulnerability (PV) are both found to lead to threat appraisal which can directly impact intention. Effect sizes of AC and PV on INT are 11.1% and 10% respectively. Among the coping appraisal constructs, PBC and RE are found to have a direct effect on intention with effect sizes of 23.8% and 38% respectively.

Mediation Analysis

Table 5.15B: Mediated pathways with their effect and size

Pathways	Effect	Size	P-value
Male			
AC → PV → INT	Full	0.123**	0.002
PV → RE → INT	Partial	0.106**	0.002
Female			
AC → PV → RE → INT	Partial	0.052***	0.001
PV → RE → INT	Partial	0.143***	0.000
PR → PV → RE → INT	Full	0.047***	0.000
PR → PV → INT	Full	0.033*	0.055
PBC → RE → INT	Partial	0.098***	0.000

***significant at 1%, **significant at 5%, *significant at 10%

In males, AC was not found to have any direct effect on INT. However, AC is fully mediated by PV to trigger one's intention to adopt an EV with an effect size 12.3%. PV is also found to be partially mediated by RE to trigger INT with an effect size of 10.6%.

In females, AC is partially mediated by a combination of PV and RE to trigger INT. The effect size of this mediated pathway is 5.2%. PV in turn is partially mediated by RE to lead to INT, with an effect size of 14.3%. PR is fully mediated by PV alone with an effect size of 3.3% and also fully mediated by combination of PV and RE with an effect size of 4.7%. PBC is found to be partially mediated by RE with an effect size of 9.8%.

5.7.3B Younger Age Group Vs Middle Age Group

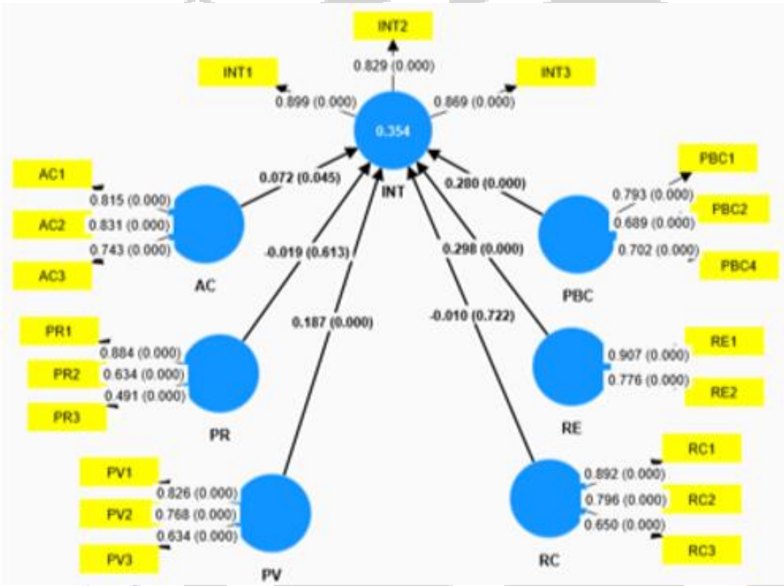


Fig 5.9A Structural Model (Younger Age Group)

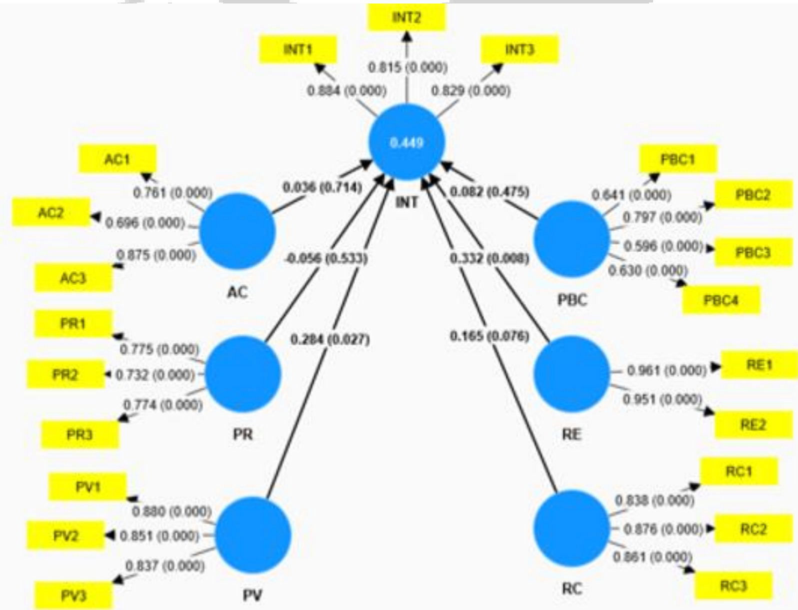


Fig 5.9B Structural Model (Middle Age Group)

Figure 5.9 PMT Structural Model (Age Demographic Group)

Table 5.16A: Results of the structural equation model (significant PMT pathways leading to an intention to adopt EVs in younger age group Vs middle age group

Hypothesized paths	**Standardized estimates**	**p-value**
H11: AC → INT	0.072** (0.036)	0.045 (0.714)
H23: PR → INT	-0.019 (-0.056)	0.613 (0.533)
H26: PV → INT	0.187*** (0.284**)	0.000 (0.027)
H8: PBC → INT	0.280*** (0.082)	0.000 (0.475)
H29: RE → INT	0.298*** (0.332**)	0.000 (0.008)
H32: RC → INT	-0.010 (0.165*)	0.722 (0.076)

***significant at 1%, **significant at 5%, *significant at 10%

() parentheses represent values for middle age group

In the younger age group, awareness of consequence (AC), perceived vulnerability (PV) are found to cause threat appraisal, leading to an intention to adopt an EV. Effect sizes of AC and PV on INT are 7.2% and 18.7% respectively. Perceived behavioral control (PBC) and response efficacy (RE) are found to cause coping appraisal leading to an intention to adopt an EV. Effect sizes of PBC and RE on INT are 28% and 29.8% respectively.

In the middle age group, PV is found to cause appraisal of threat which then leads to intention formation. PV has an effect of size 28.4% on intention. RE and response cost (RC) are found to cause coping appraisal leading to an intention to adopt an EV. RE and RC has effect sizes of 33.2% and 16.5% respectively on INT.

Mediation Analysis

Table 5.16B: Mediated pathways with their effect and size

Pathways	**Effect**	**Size**	**P-value**
Younger Age Group			
AC → PV → INT	Partial	0.050***	0.001
AC → PBC → INT	Partial	0.054***	0.000
PR → PV → RE → INT	Full	**0.036*** **	**0.000**
PR → PBC → INT	Full	**0.051*** **	**0.000**
PV → RE → INT	Partial	0.103***	0.000

PBC → RE → INT	Partial	0.058***	0.000
Middle Age Group			
PR → PV → INT	Full	**0.121***	**0.070**
PBC → RE → INT	Full	**0.087****	**0.031**

***significant at 1%, **significant at 5%, *significant at 10%

In the younger age group, AC is found to be partially mediated by PV and PBC with effect sizes of 5% and 5.4% respectively. PV in turn is partially mediated by RE with an effect size of 10.3%, and PBC is partially mediated by RE with an effect size of 5.8%. PR is found to be fully mediated by PBC with an effect size of 5.1%, and by a combination of PV and RE with an effect size of 3.6%.

In the middle age group, PR is found to be fully mediated by PV with an effect size of 12.1%. PBC is fully mediated by RE with an effect size of 8.7%.

Metropolitan Vs Non-Metropolitan

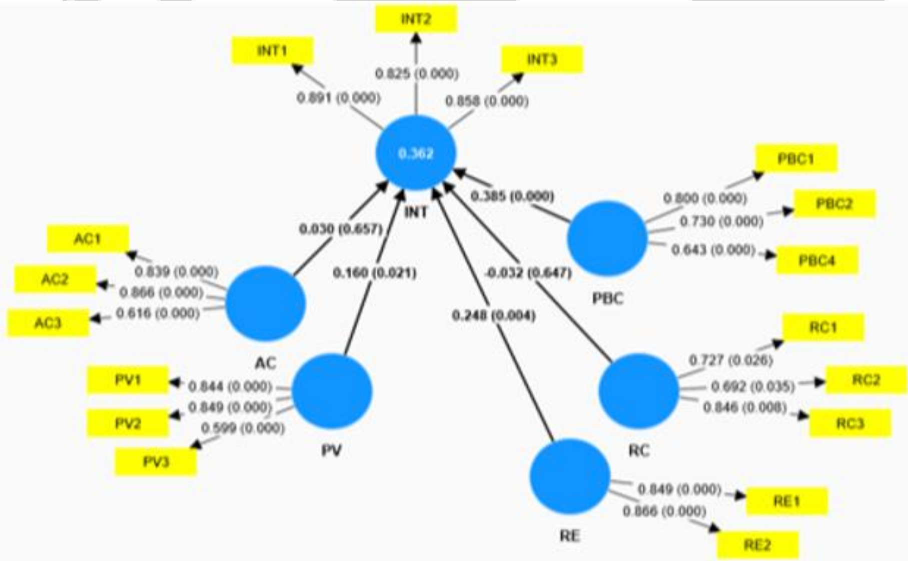


Fig 5.10A Structural Model (Metropolitan)

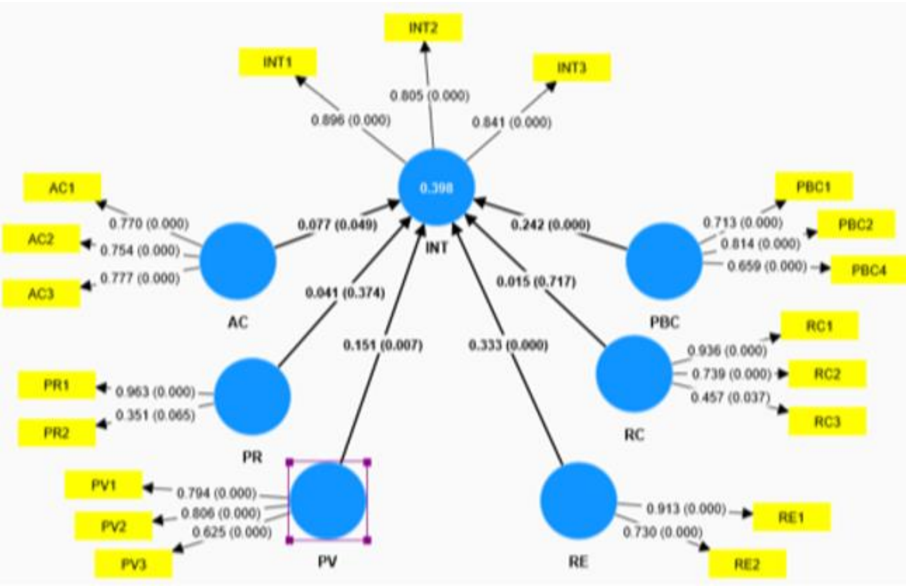


Fig 5.10B Structural Model (Non-Metropolitan)

Figure 5.10 PMT Structural Model (Location Demographic Group)

Table 5.17A: Results of the structural equation model (significant PMT pathways leading to an intention to adopt EVs in metropolitan Vs non-metropolitan group

Hypothesized paths	**Standardized estimates**	**p-value**
H12: AC → INT	0.030 (0.077**)	0.657 (0.049)
H24: PR → INT	NA (0.041)	NA (0.374)
H27: PV → INT	0.160** (0.151**)	0.021 (0.007)
H9: PBC → INT	0.385*** (0.242***)	0.000 (0.000)
H30: RE → INT	0.248** (0.333***)	0.004 (0.000)
H33: RC → INT	-0.032 (0.015)	0.647 (0.717)

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

() parentheses represent values for non-metropolitan group.

For the metropolitan group, perceived vulnerability (PV) is found to cause threat appraisal which then leads to the formation of intention to adopt an EV. Its effect size is 16%. Perceived behavioral control (PBC) and response efficacy (RE) are found to cause coping appraisal which then leads to intention. PBC has an effect size of 38.5% on INT and RE has an effect size of 24.8% on INT.

For the non-metropolitan group, awareness of consequence (AC) and PV are found to trigger one's threat appraisal leading to an intention to adopt an EV. PBC and RE are found to trigger one’s coping appraisal leading to an intention to adopt an EV. PBC has an effect size of 24.2% and RE has an effect size of 33.3% on INT.

Mediation Analysis

Table 5.17B: Mediated pathways with their effect and size

Pathways	**Effect**	**Size**	**P-value**
Metropolitan			
AC → PV → RE → INT	Full	0.042**	0.019
AC → PV → INT	Full	0.074*	0.064
AC → PBC → INT	Full	0.066**	0.032
PV → RE → INT	Partial	0.093**	0.006
PBC → RE → INT	Partial	0.052**	0.034
RC → RE → INT	Full	0.034*	0.073
Non-Metropolitan			
PR → PV → PBC → INT	Full	0.024***	0.001
PR → PV → INT	Full	0.047**	0.018
AC → PV → RE → INT	Partial	0.058***	0.001
RC → RE → INT	Full	0.031*	0.086

***significant at 1%, **significant at 5%, *significant at 10%

In the metropolitan group, AC is found to be fully mediated by PV with an effect size 7.4%, and by PBC with an effect size 6.6%. RE in combination with PV also fully mediate AC towards INT with an effect size of 4.2%. RE is found to partially mediate PV and PBC towards INT with an effect size of 9.3% and 5.2% respectively. RE is also found to fully mediate RC towards INT with an effect size of 3.4%.

PR and RC are found to have no direct impact on intention in the non-metropolitan group. However, these are found to be fully mediated towards intention formation for this group. For instance, PV fully mediates PR towards INT with an effect size 4.7%. Also, PV in combination with PBC fully mediates PR with an effect size of 2.4%. RC on the other hand is fully mediated by RE towards INT, with an effect of size 3.1%. AC is found to have a direct impact on INT with effect size 7.7%. In addition to that, AC is also partially mediated by combination of PV and RE towards INT. The effect size of this partially mediated intention pathway is 5.8%.

5.8 Discussion of the Results

This analysis outlines how the pathways for intention to adopt EVs vary in different demographic groups. It finds gender-based differences in motivations for adopting electric vehicles (EVs). Women are found to place higher priority on personal confidence and comfort in using an EV. Perception of the ease of using EVs is found to be a significant factor for females as at the present time, women are less used to using a personal vehicle compared to men. Women are also more likely to be influenced by moral obligations and environmental concerns rather than social expectations. Men on the other hand, are found to be more likely to respond to a favorable social impression about using EVs in their social circle, rather than their personal moral beliefs. This might be due to higher frequency of social engagement among men compared to women in the context of Assam. Using only awareness campaigns about the ill effects of using a petrol/diesel vehicle is unlikely to motivate an individual of either gender to adopt an EV. Awareness campaigns when combined with reinforcement of existing environmental concern, it is found to motivate women towards EV adoption. Presence of a perception of threat due to environmental pollution caused from using petrol/ diesel vehicles motivates both men and women towards EV adoption, but it has a higher effect on men. Both men and women are found to be influenced by coping appraisal factors like perceived behavioral control, and belief in the effectiveness of using EVs. However, these coping appraisal factors are found to have a slightly higher effect on motivating women to adopt EVs. Younger age group and middle age group individuals are found to be similarly influenced by positive attitudes and social norms. However, social norms are found to have a higher effect size on younger aged individuals than attitudes. Personal confidence in using an EV is found to be important in the younger aged individuals while middle aged individuals are primarily found to be motivated by society's favorable perceptions about the use of EVs. Infact, presence of a strong societal endorsement of EVs will likely influence the impact of environmental awareness on the intention to adopt EVs. This might be due to higher societal engagement and practice of interpersonal communication among the middle-aged group. The younger aged group on the other hand, are more engaged in digital communications, social media communication, and reduced interpersonal communication. Awareness of consequences of using petrol/ diesel vehicles alone isn't very effective, but when it is reinforced with favorable social norms, it is found to strengthen intention to adopt EVs in both young and middle-aged groups. Efficacy of using EVs in mitigating ill environmental effects is also found to be crucial factor that motivates the middle-aged individuals to adopt EVs.

Presence of a positive attitude towards the use of EVs is found to have a higher effect on the non-metropolitan areas' residents compared to metropolitan areas. The latter is likely to be impacted more confident about the use of EVs. This is probably due to the experience of better infrastructures in bigger cities. Metropolitan residents also display a higher perception of control over the use of EVs compared to the non-metropolitan counterparts. Societal validation is found to motivate all individuals irrespective of the residential location. Similarly, environmental concern and personal norms are found to have some impact on both groups. A nuanced difference to be noted here is that combination of social approval and environmental concern will likely motivate metropolitan area residents towards EV adoption. But for non-metropolitan area residents, social approval alone is a sufficient motivator. Like in gender and age demographic groups, awareness of consequences of not using EVs alone doesn't motivate people from any locations to adopt EVs, unless it is combined with a sense of personal vulnerability or social support. In the non-metropolitan areas, people can be motivated by instilling in them a sense of control over the use of EVs. This analysis highlights the significance of social influence and infrastructure in encouraging the adoption of EVs across regions. Consideration of some behavioral aspects based on gender, age, and location will help policymakers design micro-level policies to target EV adoption among people, rather than a one-size-fits-all policy for EV promotion.

In the subsequent chapter, we shall analyze in detail, the effect of different behavioral interventions like information, social comparison, anchoring, default option, framing, etc., on an individual's choice of sustainable mobility options.

Chapter 6. The Role of Nudges in One's Stated Choice for Sustainable Mobility.

In the previous chapters, we discussed the different pathways based on gain, norm, and fear & protection motivations through which pro-environmental intentions to adopt electric vehicles (EVs) take shape in people's minds. Several direct, as well as mediated pathways have been outlined. We also analyzed how these pathways differ in the way they shape intention to adopt EV for different demographic categories like gender (male vs female), age (young vs middle age groups), and location (metropolitan vs non-metropolitan). However, studies have pointed out that intention does not necessarily translate to actual behavior (Kruijf et al., 2024; Nieto-Garcia and Viglia, 2024; Echegaray and Hansstein, 2017). Researchers often use intention or self-reported attitudes and behaviors as the closest proxy for actual behavior. While these measures provide useful insights and advance knowledge into the thought processes of individuals (Morales et al., 2017), they might lack real-life implications. Nieto-Garcia and Viglia (2024) provide various data extraction methods that might be closest to actual behavior. This study uses stated choice based on a hypothetical survey experiment as a proxy for actual behavior, thus presenting a step closer to actual behavior. The use of a hypothetical survey experiment is warranted in this study context, as electric vehicles are the latest development in sustainable mobility, and their supporting infrastructures are still not available at a scale that can be used by the masses in Assam. It is being developed for widespread adoption in the near future.

The remaining chapter is arranged as follows. First, we begin with an outline of this chapter's research questions. This is followed by a discussion of the experimental setting and the types of nudges used in the study. The chapter then goes on with a detailed discussion of the experiment. We then discuss the analytical method, and the results of the analysis. This chapter finally concludes with a summarized discussion of the insights gained from objective 2.

6.1 Research Questions of the Study

The overarching objective of this paper is to analyze the impact of nudges in one's stated choice for sustainable mobility. We pose two research questions in this chapter:

- Do mental accounting principles (fungibility, diversified mental account, labelling mental account) drive one's stated choice for sustainable mobility?

- How do the nudges (reference point, information, social recognition, higher monetary rewards, symbolic rewards, default option, and framing) influence one's stated choice for sustainable mobility?

6.2 Experimental Setting and Nudges

A stated choice experiment is designed to examine the above outlined research questions. The same is attached in appendix C. The questionnaires were designed to obtain participants' stated choice of personal vehicles without stating the interviewer's objectives explicitly. For the same, the questionnaire was designed in a gamified way using different storyline vignettes. According to Finch (1987), vignettes are brief stories created around hypothetical situations and/or characters in some specific situations, to which the respondent is invited to express his/her reaction. Though vignettes share a lot of similarities to other methods used in social sciences, their application in surveys provides it with a definite character. The most evident relation is with statements involving 'attitude'. Though such statements are commonly used, they are criticized for trying to extract data on normative variables. While statements on attitude represent one move away from the basic mode of direct questioning about one's values, beliefs, etc., they are still disapproved of for attempting to extract such information without placing it in context. Vignettes move farther away from a direct and abstract approach and permits the specification of the contextual characteristics, in a way that the respondent is being asked to make normative statements on some social situations, rather than asking them to express their values or beliefs in vacuum.

The participants in each study site (Guwahati, Tezpur, and Dibrugarh) were randomly distributed into a control group (group A) and three intervention groups: group B, group C and group D. Table 6.1 lists the sample sizes obtained for each experimental group.

Table 6.1: Sample size of the experimental groups

Experimental Group	**Sample Size**
Group A (Control)	199
Group B (Intervention 1)	193
Group C (Intervention 2)	199
Group D (Intervention 3)	196

As indicated in Table 6.2, the three intervention groups were administered with nudges like anchoring, information, default, framing, social recognition, symbolic appreciation, and interventions like monetary gains and studied their impact on people's stated choice of personal vehicle.

Table 6.2: Nudges administered to different experimental group.

Nudge	Types	Group
Anchor/Reference Point	Classmate (high acquaintance)	B
	Stranger (low acquaintance)	C
	Neighbor (medium acquaintance)	D
Information	General information	B
	Carbon footprint information	C
	Visual information	D
Social Recognition	Print media visibility	B
	Social media visibility	C
Higher monetary rewards	Higher monetary rewards	D
Symbolic reward and combinations	Symbolic reward + social competition	B
	Symbolic reward + side benefits	C
	Monetary exemptions	D
Default		B & C
Framing		D

6.3 The Experiment (7-Month Vignettes)

The experiment is designed for a young adult whose monthly income source is pocket money, and how they would plan on spending their monthly pocket money between sustainable and unsustainable choices over the period of 7 months from January to July 2023. It is to be noted here that the data is collected at one-time point wherein different situations are arranged in each of the 7 months (all within one questionnaire booklet) and participant's reaction to those hypothetical situations are sought. Though this analysis was open for participants in the age group 18-35 years, yet the final pool of participants was between the ages of 18-25 years. This was because the participants were students enrolled in graduation and post-graduation courses, and those who were not into the job market at the time of the study. To observe their sustainability decisions in spending behavior out of their monetary resources, a mental accounting exercise is designed.

<u>January</u>

In the month of January, a new year's resolution is proposed to the participants that they would attempt to manage their pocket money in a more responsible manner. To facilitate the same, they ae provided with the idea of 'saving jars' labelled for expenses under different categories like 'food jar', 'travel jar', 'education jar', 'housing jar', and 'shopping + entertainment jar'. To incur expenses related to food, one must spend money out of the savings in the food jar only. Similarly, to incur expenses related to travel, one must spend money out of the savings in the travel jar only. This is in line with the principle of fungibility between mental accounts. According to the principle of fungibility, resources booked on the same account are fungible, resources booked on different mental accounts are not. The different types of behavior that are 'grouped' onto one mental account are considered equivalent and are thus fungible (Hahnel et al., 2020). The participants were first asked to allocate their monthly pocket money into the different 'saving jars'. This is done so that participants assign their own mental accounts. A situation is described wherein the savings available in the travel jar is running out of money. Participants are asked to indicate if they would want to transfer some money to the 'travel jar' from any other saving jars. They were also asked to indicate the jar from which they would want to transfer if at all. If a participant agrees to allocate money from non-travel jar to the travel jar, then the principle of fungibility gets violated.

<u>February</u>

As another betterment move to manage the participant's pocket money efficiently in the next month of February, the 'travel saving jar' is further subdivided into different sub-categories like 'city bus jar', 'fuel expense jar', 'Ola/Uber/Rapido jar', 'vacation jar', and 'savings for own vehicle purchase'. The participants were asked to allocate the total money from the travel jar into the different sub-jars. In this stage, diversified mental accounts are created. This is stated to prevent compensatory allocation of resources from one account to another, by highlighting the distinctiveness of different consumption behaviors. In doing so, the distinctiveness of the different types of travel behavior are highlighted. In addition, the reference point nudge at different levels of affinity is administered to the different treatment groups. Treatment Group-B is provided his/her classmates' choice as the reference point.

Treatment Group-C provides information about the decision made by an average person from his/her city as the reference point. Treatment Group-D provides information about the decision made by his/her neighbor uncle's choice as the reference point. The table 6.3 below shows the reference information provided to the different treatment groups.

Table 6.3 Reference information for different treatment groups

Diversified mental accounts for 'travel jar'	Amount to be saved in each of the Sub-jar (in %)		
	Treatment Group-B	Treatment Group-C	Treatment Group-D
City Bus	20	10	5
Fuel Expense	20	25	40
Ola/Uber/Rapido	10	30	5
Vacation	30	30	30
Savings to buy personal vehicle	20	5	20

After introducing the reference points, the participants in each of the different treatment groups are asked to create their own diversified mental accounts. The control group, or Group-A is not provided with any reference information. They are simply asked to create their own diversified mental accounts.

<u>March</u>

The participants are provided with a situation wherein they won a lottery amount of INR 1,00000. They are then asked to indicate where they would want to allocate that windfall earning. Various sustainable as well as non-sustainable options are provided to them. During the analysis, the options are further categorized as necessity, indulgence, sustainable items & cool gadgets, and savings for the future. Allocation of windfall earning to education, food, and housing jar is placed under 'necessity'. Allocation towards buying luxury items, saving for a vacation, and for buying a petrol/diesel vehicle is placed under one category. This basically represents a non-necessity, unsustainable category. Allocation of windfall earning towards buying an electric personal vehicle or cool electronic gadgets are placed under one category. This category represents a sustainable category. Savings for the future or investment in mutual funds are placed in the savings category. This task is based on the principle of labeling mental accounts. It is stated that people create definite mental accounts based on the source from which income is earned. For instance, Hahnel et al., (2019) states that income earned as windfall earning or as gift is likely to be spent on luxury goods, vacation, etc. Again, it is believed that income earned from green sources is more likely to be spent on sustainable goods and services. To test the validity of the latter, another situation is administered in the month of April.

April

The hypothetical situation goes as follows: due to the participants' good performance in their previous exam, the government has provided them with a green cheque worth INR 1,00000, to buy a personal 2-wheeler. Since it is a green cheque, it is suggested to buy electronic 2-wheelers, which however are not binding, and they are not accountable to report to anyone about the use of the green cheque. The participants are provided with different saving jars and are asked to indicate the jar/jars to which they would want to allocate the earnings from the green cheque. It is expected that participants would allocate the earnings from green cheque to the different saving jars which are categorized under 'necessity', 'indulgence', 'energy-saving goods', and 'cool gadgets' for the purpose of analysis.

Here the treatment groups B and C are administered with a nudge called default option. They are said that the government automatically provides electric bike/scooty to all students unless they specifically want to opt out. The participants have two options to react: either to go with the government choice, or to specifically take measures to opt out and seek the cash instead.

Treatment Group-D is administered with a nudge called framing. They were given the following message: "***A few days back you also came across an SOS cry given out by an island nation to all other countries of the world.*** *It is an 800 sq.km small island nation in the Pacific with a population of 2000 people. Their country is in danger of sinking sometime soon in the future unless the people of the world help them out by reducing their carbon emissions and bringing down the global temperature.*"

The participants of group D were then given two courses of action, and they were asked to select their choice of action that they would want to take.

Action A says- "If you take action A, there is 66.67% chance of reducing the global temperature by 2° Celsius and thus saving 267 sq. km of the island area".

Action B says- "If you take action B, there is 33.33% chance of not mitigating carbon emissions to the required extent and 2/3rd of the island area will sink."

May

The hypothetical situation presented in this month is as follows: it is supposed that the students have got the new personal two-wheeler. They are provided with pictorial mobility options and asked which one/ones they would choose to use to travel from their home to the university.

Here the information nudge is administered to the 3 treatment groups. Treatment Group B is provided with general information about the use of petrol/diesel vehicles and how this is contributing to the warmer days that they are experiencing in the month of May. The information goes as: "*The temperature and pollution are increasing tremendously in your city. The temperature has increased by around 5-6 degrees as compared to how the temperature in May used to be about 5 years back. It is said that reducing the use of vehicles or atleast using cleaner vehicles like electric vehicles can help reduce emissions. This will bring down both the number of hot days as well as the temperature sufficiently. Reducing carbon emissions can also strop the ill effects of climate change like glacier melts in the polar regions, decreased agricultural productivity, erratic monsoons, and extreme climatic events*".

Treatment Group-C is provided with carbon footprint information for different mobility options. They are made to feel two scenarios. On one hand, it is extremely hot and humid feeling in the mid-May season. Then they are provided with carbon footprint information for mobility options like walking/cycling, city bus, 2-wheeler, 4-wheeler, electric 2-wheeler, and electric 4-wheeler. The footprint information for city buses is calculated on a per capita basis.

Treatment Group-D is provided with pictorial depiction of the sufferings faced by people due to the extreme climatic situations. For instance, sufferings from dry lands due to droughts, water crisis, heat stroke, etc., is depicted and participants are made to feel that they are equally vulnerable to such situations as well.

After feeding the treatment groups with this information, the participants in each of the treatment groups are again provided with a situation that they need to go to a friend's birthday party which is hosted in a café located 2-3 kilometers from them. They are then provided with the pictorial mobility options again and are asked to pick which one/ones they would want to use for travelling to the same. It is to be noted here that attempts have been made such that the general information and the hypothetical situation are kept as two unrelated tasks within the vignette. Yet it is expected that general information will have some impact on their mind which will henceforth influence their subsequent choices.

June

5th June marks the occasion of world environment day. The vignette for the month of June is designed around that. The following scenario is provided: the government is said to have announced a scheme to help students tackle the rising prices, especially the prices of fuel. A pocket money card, called 'Junio card' which is credited with INR 2500. This card is linked with the participants google pay account and is meant for using to pay personal vehicle fuel expenses only. When one purchases petrol/diesel, the expenses are recorded in the card. A participant may wish to use less of their personal vehicles and maintain savings in the Junio card instead. A competitive scenario is made inherent in this vignette wherein top 50 students in their city who can accumulate maximum savings in the Junio card by buying less fuel gets tagged as a 'sustainable user'. To reward the 'sustainable users', their Junio card gets credited with INR 3000 instead of INR 2500 next month. The top 50 'sustainable users' of the second month further gets their Junio card credited with extra INR 500 in the third month. So, if participant-A becomes the top 50 'sustainable user' in both 1st and 2nd month, then their Junio card in the 3rd month gets credited with INR 3500. Another participant B who is not a top 50 'sustainable user' in the 1st month but becomes one in the 2nd month, then their Junio card gets credited with INR 3000 in the 3rd month., i.e., top 50 'sustainable users' gets additional increment of INR 500 in the next month. Such an incentive continues for 6 months. Finally, the first 50 students who can save upto INR 10,000 earns that amount as a cash prize which they can then use in for any purpose and not limited to only travel and fuel related expenses. Some constraints were attached to the use of the Junio card. For instance, one could not take out the Junio card savings unless they become the top 50 savers of INR 10,000 in their city. If one feels that they might not make it to the top 50 list, then they may spend the entire monthly allowance in the Junio card towards travel and fuel expenses only. Also, one has no idea of how others are managing their Junio credit. Hence one must decide their own Junio credits based on their assumption about other's decisions.

The treatment groups B and C are administered with nudge called social recognition. Different forms of social recognition nudge are provided. Treatment Group-B is administered social recognition via print media visibility. It says- "*In addition, the first 50 savers of INR 10,000 also become the final 'Sustainable Champions' of the state!!! They get featured in newspapers and city hoardings for their sustainability effort!*"

The treatment group -C is administered social recognition nudge via social media visibility. It says- "*In addition, the first 50 savers of INR 10,000 also become the final 'Sustainable Champions' of the state!!! They get to be the government's official sustainability promoters on social media. They get to make Instagram reels for sustainability in collaboration with the government and other celebrities of the state. Hence Government pays for higher visibility of these Champion's Instagram accounts!!*"

The treatment group –D is administered with higher monetary rewards instead of social recognition nudge. Instead of the initial credit of INR 2500 on Junio card, this group is said that the initial credit allowance in Junio card is INR 5000 per month. The increment for the top 50 'sustainable users' is the same, i.e., INR 500 in the next consecutive month. The ultimate saving goal in the 6-month incentive plan is INR 20,000 instead of INR 10,000.

The participants were then said that if they were the top 50 savers of INR 10,000 (for groups B & C) or INR 20,000 (for group D) wins the same as cash prize, in which saving jar they would want to allocate the same. Several different options were provided which were then categorized into few groups for the purpose of analysis like necessity (food, education, and housing jar), luxury/ vacation/ new petrol + diesel vehicle (unsustainable consumption category), electric vehicle (sustainable mobility group), and savings for future group.

Also, in case the participants decided to save for the future, they were asked for what purposes they would want to use the savings for. Different saving jar options were presented again to observe participant's choice.

<u>July</u>

The vignette presented this month says that the participant's parents are happy with them as they have been trying to manage their pocket money in a better way over the past 6 months. As a reward for their responsible behavior, their parents have decided to buy a new car for their family. They were presented with a scenario where they went to a Tata car showroom. Pictures of 4 different cars were presented to them: Tata Tiago (ICE hatchback), Tata Tiago (EV hatchback), Tata Nexon (ICE SUV) and Tata Nexon (EV SUV). They were asked to pick which of these cars they would want their family to purchase. Some information was provided like- though the upfront price of an EV is higher than that of an ICE car, but the operational expense over the years is lower. Secondly, they were informed that though the price of fuel is rising, there is hope for decrease in electricity rates in the future with increase in the share of renewables in power generation mix. They were also asked to assume that EV charging facilities are available in designated parking areas in their city as well as regular intervals in the highways. The purpose of providing this information is that since this study aims to study EV adoption in the near future and not immediately, hence there is optimism on the fact that the charging infrastructure and renewables based electricity will be present after a few years. Hence these factors should not act as a deterrent in their stated choice of personal vehicles.

Here some nudge called symbolic reward was also administered to the treatment groups B &

C. Treatment group D was provided with a nudge called monetary exemptions. For instance, treatment group- B was said- "*Choosing an EV will make you an example for advocating the cause of mitigating climate change. Your family gets the "Responsible Family" tag from the district authority on buying an electric car. One of your neighbors already got the tag!*" Here symbolic reward is used in combination with social competition as a nudge.

Treatment Group- C was said- "*Choosing an EV will earn your family a "Responsible Family" badge from the district authority on buying an electric car. This badge provides benefits like no toll tax, no pollution control certificate requirements, and no parking fees.*" Here symbolic reward is used in combination with other side benefits.

Treatment Group- D was said- "*Choosing an EV earns some monetary benefits like no toll tax, no pollution control certificate, and no parking fees.*"

6.4 Method

To analyze the research questions, we use multinomial logistic regression model. We run the models for each of the four groups of participants: group A, B, C, and D. The dependent variable is stated choice of personal vehicle. It has four categories: Hatchback internal combustion engine (Hatchback ICE), Hatchback (EV), SUV (ICE), and SUV (EV).

Stated Choice = *f* (Gender, Place, Monthly Disposable Cash, Fungibility, Diversified Mental Account, Windfall Earning, Green Labelled Earning, Mobility Habit, Allowance Savings, Allocation of Allowance Savings, Intention)

Robustness checks for the multinomial logit regression have been conducted by eliminating different variables from the model. The results are however found to remain almost the same. The results can be found in the appendix D.

6.5 Results

6.5.1 Participant group A (no intervention group)

Table 6.4.1: Case Processing Summary

Variables	Categories	Marginal Percentage
Stated Choice	1 (Hatchback ICE)	15.2%
	2 (Hatchback EV)	20.1%
	3 (SUV ICE)	28.7%
	4 (SUV EV)	36.0%

Gender	0 (Male)	37.2%
	1 (Female)	62.8%
Place	0 (Metropolitan)	29.9%
	1 (Non-metropolitan)	70.1%
Monthly Disposable Cash	1 (<= 5000)	76.2%
	2 (5001- 10,000)	18.9%
	3 (10,001- 15,000)	2.4%
	4 (> 15,000)	2.4%
Fungibility	1 (No)	53.0%
	2 (Yes- E&S)	32.9%
	3 (Yes- Necessity)	14.0%
Diversified Mental Account	1 (Public transport)	29.3%
	2 (Personal vehicle)	19.5%
	3 (Vacay /Luxury/ Cool gadgets)	14.0%
	4 (Saving for future)	18.9%
	5 (Mixed response)	18.3%
Windfall Earning	1 (Necessity)	26.2%
	2 (Vacay/ Luxury/ Own vehicle)	14.0%
	3 (E-vehicles/ Cool gadgets)	2.4%
	4 (Saving for future)	34.1%
	5 (Mixed response)	23.2%
Green Labelled Earning	1 (Necessity)	56.1%
	2 (Vacay/ Luxury/ New vehicle)	14.6%
	3 (E-vehicle/ Energy saving gadget)	10.4%
	4 (Cool gadgets)	1.8%
	5 (Mixed response)	17.1%
Mobility Habit	1 (Walk/ City bus)	47.6%
	2 (Pvt cab/ Own vehicle)	25%
	3 (E-vehicle)	25.6%
	4 (Mixed response)	1.8%
Allowance savings	1 (<= 1000)	50.6%
	2 (1001 – 2000)	42.1%
	3 (> 2000)	7.3%
Allocation of allowance savings	1 (Necessity)	43.9%
	2 (Vacay/ Luxury/ New vehicle)	16.5%

	3 (E-vehicle)	1.2%
	4 (Future savings)	22.0%
	5 (Mixed response)	16.5%
INT1	1 (Strongly agree)	31.7%
	2 (Agree)	29.9%
	3 (More or less agree)	14.6%
	4 (Undecided)	15.9%
	5 (More or less disagree)	1.8%
	6 (Disagree)	2.4%
	7 (Strongly disagree)	3.7%
INT2	1 (Strongly agree)	37.2%
	2 (Agree)	36.6%
	3 (More or less agree)	14.6%
	4 (Undecided)	8.5%
	5 (More or less disagree)	1.2%
	6 (Disagree)	0.6%
	7 (Strongly disagree)	1.2%
INT3	1 (Strongly agree)	26.2%
	2 (Agree)	38.4%
	3 (More or less agree)	11.0%
	4 (Undecided)	16.5%
	5 (More or less disagree)	2.4%
	6 (Disagree)	2.4%
	7 (Strongly disagree)	3.0%

The dependent variable- stated choice of personal vehicle has 4 different categories: 1 represents hatchback (ICE), which is also the reference category; 2 represents hatchback (EV), 3 represents SUV (ICE), and 4 represents SUV (EV). From the table we see that 199 participants belonged to group A (no nudges administered), of whom15.2% chose hatchback (ICE), 20.1% chose hatchback (EV), 28.7% chose SUV (ICE) and 36% chose SUV (EV).

Table 6.4.2: Model Fitting Information

	Model Fitting Criteria			Likelihood Ratio Test		
Model	AIC	BIC	-2 Log Likelihood	Chi-Square	df	Sig
Intercept Only	443.980	453.279	437.980			

Final	525.095	962.176	243.095	194.885	138	0.001

The log-likelihood is an estimate of how much unexplained variation is there in the data. Therefore, the difference or the change in log-likelihood emphasizes the improvement in the final model over the intercept only model. The chi-square test evaluates the decrease in unexplained variance from the baseline model (intercept only model) to the final model. If the change is significant then it can be said that the final model explains a significant amount of the original variability.

The model here refers to the parameters of the model for which the fit of the model is estimated. 'Intercept only' model represents a model which doesn't control for independent variables and simply fits an intercept to make prediction about the dependent variable. The 'Final' model considers the independent variables and has been arrived at through an iteration process which maximizes the log likelihood of the outcome observed in the dependent variable. Here, the likelihood ratio chi-square of 194.885 with a p-value <0.001 indicates that the model used in the study fits significantly better than the intercept only model.

Table 6.4.3: Pseudo R-Square

Cox and Snell	0.695
Nagelkerke	0.747
McFadden	0.445

The pseudo-R-square is roughly analogous to the R-squared value in OLS regression models, which indicates the proportion of variance explained by the multinomial logistic regression model. We see that Nagelkerke pseudo-R-squared value of 0.747 indicates 74.7% association between stated choice of sustainable mobility and the other independent variables used in the model.

Table 6.4.4: Significant parameter estimates

Ref Grp: Hatchback (ICE)	**B**	**Sig**	**Exp(B)**
Stated Choice: Hatchback (EV)			
Gender (Male)	-1.950	0.096	0.142
Gender (Female)	.	.	.
Place (Metropolitan)	3.453	0.011	31.593
Place (Non-metropolitan)	.	.	.
Diversified Mental Account (DMA)	-3.154	0.048	0.043

(Vacay/ Luxury/ Cool gadget)			
Diversified MA (Mixed Response)	.	.	.
Mobility Habit (Walk & Public Transport)	-12.433	<0.001	3.984E - 6
Mobility Habit (Pvt Cab/ Own Vehicle)	-12.759	<0.001	2.876E - 6
Mobility Habit (E-vehicle)	-12.667	<0.001	3.155E - 6
Mobility Habit (Mixed Response)	.	.	.
Allocation of allowance savings (AAS) (Necessity)	2.579	0.062	13.188
Allocation of allowance savings (Saving for Future)	3.656	0.028	38.710
Allocation of allowance savings (Mixed Response)	.	.	.
Stated Choice: SUV (ICE)			
Diversified MA (Public transport)	-2.818	0.051	0.060
Diversified MA (Personal vehicle)	-3.347	0.036	0.035
Diversified MA (Vacay/ Luxury/ Cool gadget)	-3.928	0.012	0.020
Diversified MA (Saving for future)	-4.440	0.006	0.012
Diversified MA (Mixed response)	.	.	.
Stated Choice: SUV (EV)			
Place (Metropolitan)	3.502	0.007	33.181
Place (Non-metropolitan)	.	.	.
Mobility Habit (Walk & Public Transport)	-10.723	<0.001	2.202E - 5
Mobility Habit (Pvt Cab/ Own Vehicle)	-11.300	<0.001	1.238E - 5
Mobility Habit (Mixed Response)	.	.	.
Allocation of allowance savings (Saving for Future)	3.228	0.035	25.218
Allocation of allowance savings (Mixed Response)	.	.	.

Choice of hatchback (EV) over hatchback (ICE)

The odds of males buying a hatchback (EV) rather than hatchback (ICE) is 0.142 times lower than the odds for females. The odds of people from metropolitan areas buying a hatchback

(EV) rather than hatchback (ICE) are 31.59 times higher than the odds for people from non-metropolitan areas. The odds of people in DMA3 (who prioritize vacation/luxury/purchase of cool gadgets after creation of diversified travel expense mental account) buying a hatchback (EV) rather than a hatchback (ICE) is 0.043 times lower than people in DMA5 (mixed priority on allocation of travel expenses after creation of diversified mental accounts). The odds of people with definite mobility habit (walking/ taking public transport/ using private vehicle/ cabs, etc. for daily commute) buying a hatchback (EV) rather than a hatchback (ICE) is lower than people who use a mix of travel options. However, the effect size is very small. The odds of people in AAS1(those who prefer to allocate sustainability allowance into necessity expense mental accounts) buying a hatchback (EV) rather than hatchback (ICE) is 13.19 times higher than the odds of people in AAS5 (those who have mixed preferences regarding allocation of sustainability allowance). The odds of people in AAS4 (those who prefer to allocate sustainability allowance as savings for the future, rather than spend in the present) buying a hatchback (EV) rather than hatchback (ICE) is 38.71 times higher than the odds of people in AAS5 (those who have mixed preferences regarding allocation of sustainability allowance).

Choice of SUV (EV) over hatchback (ICE)

Odds of people in metropolitan area buying an SUV (EV) rather than hatchback (ICE) is 33.181 times higher than the odds of people in non-metropolitan areas. The odds of people with definite mobility habit buying an SUV (EV) rather than hatchback (ICE) are lower than the odds of people without a fixed mobility habit for their daily commute. However, this effect size is very small. The odds of people in AAS4 (those who prefer to allocate sustainability allowance as savings for the future, rather than spend in the present) buying an SUV (EV) rather than hatchback (ICE) is 25.22 times higher than the odds of people in AAS5 (those who have mixed preferences regarding allocation of sustainability allowance).

6.5.2 Participant group B (intervention group)

Table 6.5.1: Case Processing Summary

Variables	Categories	Marginal Percentage
Stated Choice	1 (Hatchback ICE)	10.2%
	2 (Hatchback EV)	21.5%
	3 (SUV ICE)	19.8%
	4 (SUV EV)	48.6%

Gender	0 (Male)	41.8%
	1 (Female)	58.2%
Place	0 (Metropolitan)	29.4%
	1 (Non-metropolitan)	70.6%
Monthly Disposable Cash	1 (<= 5000)	76.3%
	2 (5001- 10,000)	15.8%
	3 (10,001- 15,000)	6.8%
	4 (> 15,000)	1.1%
Fungibility	1 (No)	52.0%
	2 (Yes- E&S)	35.6%
	3 (Yes- Necessity)	12.4%
Diversified Mental Account	1 (Public transport)	28.2%
Nudge: Anchor (Classmate)	2 (Personal vehicle)	21.5%
	3 (Vacay /Luxury/ Cool gadgets)	14.1%
	4 (Saving for future)	20.9%
	5 (Mixed response)	15.3%
Windfall Earning	1 (Necessity)	22.6%
	2 (Vacay/ Luxury/ Own vehicle)	15.3%
	3 (E-vehicles/ Cool gadgets)	1.1%
	4 (Saving for future)	36.2%
	5 (Mixed response)	24.9%
Green Labelled Earning	1 (Necessity)	45.8%
	2 (Vacay/ Luxury/ New vehicle)	15.8%
	3 (E-vehicle/ Energy saving gadget)	9.0%
	4 (Cool gadgets)	4.5%
	5 (Mixed response)	24.9%
Default	0 (Yes)	63.8%
	1 (No)	36.2%
Mobility Habit	1 (Walk/ City bus)	41.2%
	2 (Pvt cab/ Own vehicle)	26.0%
	3 (E-vehicle)	30.5%
	4 (Mixed response)	2.3%
General Info MC	1 (Walk & public transport)	34.5%
	2 (Personal vehicle)	39.5%
	3 (E-vehicle)	25.4%

	4 (Mixed response)	0.6%
Print Media Visibility (PMV) Allowance savings	1 (<= 1000)	42.9%
	2 (1001 – 2000)	46.3%
	3 (> 2000)	10.7%
Allocation of allowance savings	1 (Necessity)	35.6%
	2 (Vacay/ Luxury/ New vehicle)	14.1%
	3 (E-vehicle)	4.0%
	4 (Future savings)	30.5%
	5 (Mixed response)	15.8%

Table 6.5.2: Model Fitting Information

	Model Fitting Criteria			Likelihood Ratio Test		
Model	AIC	BIC	-2 Log Likelihood	Chi-Square	df	Sig
Intercept Only	442.825	452.353	436.825			
Final	501.979	816.417	303.979	132.846	96	0.008

The log-likelihood is an estimate of how much unexplained variation is there in the data. Therefore, the difference or the change in log-likelihood emphasizes the improvement in the final model over the intercept only model. Here, the likelihood ratio chi-square of 132.846 with a p-value <0.05 indicates that the model used in the study fits significantly better than the intercept only model.

Table 6.5.3: Pseudo R-Square

Cox and Snell	0.528
Nagelkerke	0.577
McFadden	0.304

The pseudo R-square is roughly analogous to the R-squared value in OLS regression models, which indicates the proportion of variance explained by the multinomial logistic regression model. We see that Nagelkerke pseudo R-squared value of 0.577 indicates 57.7% association between stated choice of sustainable mobility and the other independent variables used in the model.

Table 6.5.4: Likelihood Ratio Test

Variable	AIC of	BIC of	-2 Log Likelihood	Chi-Square	df	Sig.

	Reduced Model	Reduced Model	of Reduced Model			
Monthly Disposable Cash	500.100	785.954	320.100	16.122	9	0.064*
Fungibility	506.002	801.384	320.002	16.024	6	0.014**
Diversified MA CRF	497.118	773.443	323.118	19.139	12	0.085*
Windfall Earning	497.074	773.399	323.074	19.096	12	0.086*
Mobility Habit	510.134	795.988	330.134	26.156	9	0.002***

***significant at 1% level, **significant at 5% level, *significant at 10% level

From the likelihood ratio test table, we see that monthly disposable cash, fungibility, diversified mental account with classmates as anchor, windfall earning, and mobility habit are found to significantly improve the final model in comparison to the intercept only model.

Table 6.5.5: Significant parameter estimates

Ref Grp: Hatchback (ICE)	**B**	**Sig**	**Exp(B)**
Stated Choice: Hatchback (EV)			
General Info (Walk & public transport)	6.819	<0.001	914.854
General Info (Personal vehicle)	7.707	<0.001	2224.077
General Info (Mixed Response)	.	.	.
Stated Choice: SUV (ICE)			
Gender (Male)	-1.850	0.046	0.157
Gender (Female)	.	.	.
Fungibility (Yes E&S)	3.914	0.028	50.102
Fungibility (Yes Necessity)	.	.	.
General Info (Walk & public transport)	5.810	<0.001	333.639
General Info (Personal vehicle)	7.459	<0.001	1735.246
General Info (Mixed response)	.	.	.
Stated Choice: SUV (EV)			
Diversified MA CRF (Saving for future)	-3.077	0.049	0.046
Diversified MA CRF (Mixed response)	.	.	.
Mobility Habit (E-vehicle)	6.740	0.027	845.983
Mobility Habit (Mixed response)	.	.	.
PMV Allowance Savings (1001-2000)(INR)	3.236	0.070	25.429
PMV Allowance Savings (>2000)(INR)	.	.	.

Choice of hatchback (EV) over hatchback (ICE)

The odds of an individual with GIMC1 (who chooses to walk or use public transport for daily commute after receiving general information about climate change problem) to buy a hatchback (EV) rather than a hatchback (ICE) is 914.85 times higher than the odds of an individual with GIMC5 (who still has mixed response to the daily commute options after receiving general information about climate change problem). The odds of an individual with GIMC2 (who chooses to use personal vehicle for daily commute after receiving general information about climate change problem) to buy a hatchback (EV) rather than a hatchback (ICE) is 2224.077 times higher than the odds of an individual with GIMC5 (who still has mixed response to the daily commute options after receiving general information about climate change problem).

<u>Choice of SUV (ICE) over hatchback (ICE)</u>

The odds of males buying an SUV (ICE) rather than a hatchback (ICE) is 0.157 times lower than the odds of females. The odds of an individual resorting to fungibility (E&S) buying an SUV (ICE) rather than a hatchback (ICE) is 50.102 times higher than the odds of an individual resorting to fungibility (necessity). The odds of an individual with GIMC1 (who chooses to walk or use public transport for daily commute after receiving general information about climate change problem) to buy an SUV (ICE) rather than a hatchback (ICE) is 333.639 times higher than the odds of an individual with GIMC5 (who still has mixed response to the daily commute options after receiving general information about climate change problem). The odds of an individual with GIMC2 (who chooses to use personal vehicle for daily commute after receiving general information about climate change problem) to buy an SUV (ICE) rather than a hatchback (ICE) is 1735.246 times higher than the odds of an individual with GIMC5 (who still has mixed response to the daily commute options after receiving general information about climate change problem).

<u>Choice of SUV (EV) over hatchback (ICE)</u>

The odds of people in DMA CRF4 (priority on saving for the future out of travel expenses after creation of diversified mental sub-accounts and administration of classmates as anchor) buying an SUV (EV) rather than hatchback (ICE) is 0.046 times lower than the odds of people in DMA CRF5 (those with mixed response about allocation of travel expenses after creation of diversified mental sub-accounts and administration of classmates as anchor). Odds of individual with e-vehicle mobility habit to buy an SUV (EV) rather than a hatchback (ICE) is 845.983 times higher than the odds of an individual with mixed mobility habits. The odds of an individual with moderate PMV allowance savings buying an SUV (EV) rather than a hatchback (ICE) is 25.429 times higher than the odds of an individual with higher PMV allowance savings.

6.5.3 Participant Group C (Intervention Group)

Stated Choice = *f* (Gender, Place, Monthly Disposable Cash, Fungibility, Diversified Mental Account, Windfall Earning, Green Labelled Earning, Mobility Habit, Allowance Savings, Allocation of Allowance Savings, Intention)

Table 6.6.1: Case Processing Summary

Variables	**Categories**	**Marginal Percentage**
Stated Choice	1 (Hatchback ICE)	15.7%
	2 (Hatchback EV)	26.4%
	3 (SUV ICE)	18.0%
	4 (SUV EV)	39.9%
Gender	0 (Male)	30.9%
	1 (Female)	69.1%
Place	0 (Metropolitan)	26.4%
	1 (Non-metropolitan)	73.6%
Monthly Disposable Cash	1 (<= 5000)	80.3%
	2 (5001- 10,000)	16.3%
	3 (10,001- 15,000)	2.8%
	4 (> 15,000)	0.6%
Fungibility	1 (No)	61.2%
	2 (Yes- E&S)	27.0%
	3 (Yes- Necessity)	11.8%
Diversified MA ARF	1 (Public transport)	22.5%
	2 (Personal vehicle)	30.3%
	3 (Vacay /Luxury/ Cool gadgets)	12.4%
	4 (Saving for future)	18.5%
	5 (Mixed response)	16.3%
Windfall Earning	1 (Necessity)	27.5%
	2 (Vacay/ Luxury/ Own vehicle)	9.6%
	3 (E-vehicles/ Cool gadgets)	2.2%
	4 (Saving for future)	34.8%
	5 (Mixed response)	25.8%

Green Labelled Earning	1 (Necessity)	55.1%
	2 (Vacay/ Luxury/ New vehicle)	16.9%
	3 (E-vehicle/ Energy saving gadget)	10.1%
	4 (Cool gadgets)	2.8%
	5 (Mixed response)	15.2%
Default	0 (Yes)	65.7%
	1 (No)	34.3%
Mobility Habit	1 (Walk/ City bus)	43.3%
	2 (Pvt cab/ Own vehicle)	27.5%
	3 (E-vehicle)	27.5%
	4 (Mixed response)	1.7%
Carbon Footprint Info	1 (Walk & public transport)	43.3%
	2 (Personal vehicle)	36.5%
	3 (E-vehicle)	19.7%
	4 (Mixed response)	0.6%
SMV Allowance savings	1 (<= 1000)	47.8%
	2 (1001 – 2000)	43.3%
	3 (> 2000)	9.0%
Allocation of Allowance Savings	1 (Necessity)	43.8%
	2 (Vacay/ Luxury/ New vehicle)	15.2%
	3 (E-vehicle)	2.8%
	4 (Future savings)	30.3%
	5 (Mixed response)	7.9%

Table 6.6.2: Model Fitting Information

	Model Fitting Criteria			Likelihood Ratio Test		
Model	AIC	BIC	-2 Log Likelihood	Chi-Square	df	Sig
Intercept Only	475.090	484.635	469.090			
Final	525.290	1012.103	219.290	249.800	150	< 0.001

The log-likelihood is an estimate of how much unexplained variation is there in the data. Therefore, the difference or the change in log-likelihood emphasizes the improvement in the final model over the intercept only model. Here, the likelihood ratio chi-square of 249.800 with a p-value <0.001 indicates that the model used in the study fits significantly better than the intercept only model.

Table 6.6.3: Pseudo R-Square

Cox and Snell	0.754
Nagelkerke	0.812
McFadden	0.533

The pseudo-R-square is roughly analogous to the R-squared value in OLS regression models, which indicates the proportion of variance explained by the multinomial logistic regression model. We see that Nagelkerke pseudo-R-squared value of 0.812 indicates 81.2% association between stated choice of sustainable mobility and the other independent variables used in the model.

Table 6.6.4: Likelihood Ratio Test

Variable	AIC of Reduced Model	BIC of Reduced Model	-2 Log Likelihood of Reduced Model	Chi-Square	df	Sig.
Gender	528.457	1005.725	228.457	9.168	3	0.027
Place	534.237	1011.505	234.237	14.948	3	0.002
Monthly Disposable Cash	533.864	992.041	245.864	26.574	9	0.002
Fungibility MA	525.960	993.682	231.960	12.670	6	0.049
Diversified MA ARF	524.008	972.639	242.008	22.718	12	0.030
Green Labelled Earning	546.948	995.580	264.948	45.659	12	<0.001
Default	527.436	1004.703	227.436	8.146	3	0.043
Mobility Habit	526.547	984.724	238.547	19.257	9	0.023
Carbon Footprint Info	537.917	996.093	249.917	30.627	9	<0.001
SMV Allocation Savings	531.306	999.028	237.306	18.016	6	0.006
Allocation of Allowance Savings	532.631	981.262	250.631	31.341	12	0.002
INT1	528.393	957.933	258.393	39.103	18	0.003
INT3	515.603	945.144	245.603	26.314	18	0.093

As it can be seen from the likelihood ratio test table, gender, place, monthly disposable cash, fungibility MA, diversified MA ARF (anonymous reference point), green labelled earning, default, mobility habit, carbon footprint information, SMV (social media visibility) allocation savings, INT1 and INT3 are found to significantly improve the final model over the intercept only model.

Table 6.6.5: Significant parameter estimates

Ref Grp: Hatchback (ICE)	B	Sig	Exp(B)
Stated Choice: Hatchback (EV)			
Gender (Male)	-3.920	0.031	0.020
Gender (Female)	.	.	.
Place (Metropolitan)	4.969	0.020	143.853
Place (Non-metropolitan)	.	.	.
Fungibility (Yes E&S)	-3.987	0.052	0.019
Fungibility (Yes Necessity)	.	.	.
Windfall Earning (Vacay/ Luxury/ Own Vehicle)	6.190	0.020	487.733
Windfall Earning (Savings for Future)	2.884	0.090	17.885
Windfall Earning (Mixed Response)	.	.	.
Green Labelled Earning (Vacay/ Luxury/ Own Vehicle)	8.860	0.014	7043.998
Green Labelled Earning (E-vehicle/ Energy saving gadgets)	8.516	0.010	4994.377
Green Labelled Earning (Mixed Response)	.	.	.
Stated Choice: SUV (ICE)			
Gender (Male)	-3.360	0.080	0.035
Gender (Female)	.	.	.
Place (Metropolitan)	6.139	0.005	463.751
Place (Non-metropolitan)	.	.	.
Windfall Earning (Saving for Future)	4.710	0.016	111.075
Windfall Earning (Mixed Response)	.	.	.
Green Labelled Earning (Vacay/ Luxury/ Own Vehicle)	9.159	0.010	9498.653
Green Labelled Earning (Mixed Response)	.	.	.
Default (Yes)	3.093	0.036	22.044
Default (No)	.	.	.
Stated Choice: SUV (EV)			
Place (Metropolitan)	6.006	0.005	405.964

Place (Non-metropolitan)	.	.	.
Fungibility (No)	-4.569	0.058	0.010
Fungibility (Yes Necessity)	.	.	.
Diversified MA ARF (Public Transport)	3.676	0.078	39.492
Diversified MA ARF (Personal Vehicle)	3.657	0.054	38.748
Diversified MA ARF (Mixed Response)	.	.	.
Windfall Earning (Vacay/ Luxury/ Own Vehicle)	4.747	0.064	115.283
Windfall Earning (Saving for Future)	3.306	0.046	27.281
Windfall Earning (Mixed Response)	.	.	.
Green Labelled Earning (Necessity)	4.989	0.012	146.742
Green Labelled Earning (Vacay/ Luxury/ Own Vehicle)	10.183	0.005	26437.474
Green Labelled Earning (E-Vehicle/ Energy Saving Gadget)	11.299	<0.001	80780.373
Green Labelled Earning (Mixed Response)	.	.	.

Choice of hatchback (EV) over hatchback (ICE)

The odds of male buying a hatchback (EV) rather than hatchback (ICE) is 0.020 times lower than the odds for females. The odds of an individual from metropolitan area buying a hatchback (EV) rather than a hatchback (ICE) are 143.85 times higher than the odds for people from non-metropolitan areas. The odds for people resorting to fungibility (E&S) to buy a hatchback (EV) rather than a hatchback (ICE) is 0.019 times lower than the odds for people resorting to fungibility (necessity). The odds for people with 'windfall earning 2' (those allocating windfall earning to vacation/ luxury/ own vehicle) buying a hatchback (EV) rather than a hatchback (ICE) is 487.73 times higher than the odds for people with 'windfall earning5' (no clear preference for allocation of windfall earning). The odds for people with 'windfall earning4' (those allocating windfall earnings into savings for future) buying a hatchback (EV) rather than a hatchback (ICE) is 17.885 times higher than the odds for people with 'windfall earning5' (no clear preference for allocation of windfall earning). The odds of people with GLE2 (those allocating earning from sustainable source to vacation /luxury/ own vehicle) buying a hatchback (EV) rather than a hatchback (ICE) is 7043.998 time higher than the odds of people with GLE5 (no clear preference for allocation of earning from sustainable source). The odds for people with GLE3 (those allocating earning from sustainable source to e-vehicle/ energy saving gadgets) buying a hatchback (EV) rather than a hatchback (ICE) is 4994.377 times higher than the odds of people with GLE5 (no clear preference for allocation of earning from sustainable source).

<u>Choice of SUV (EV) over hatchback (ICE)</u>

The odds of person from metropolitan area buying an SUV(EV) rather than a hatchback (ICE) is 405.96 times higher than the odds for people from non-metropolitan area. The odds for people not resorting to fungibility to buy an SUV (EV) rather than a hatchback (ICE) is 0.010 times lower than the odds for people resorting to fungibility (necessity). The odds for people with 'windfall earning 2' (those allocating windfall earning to vacation/ luxury/ own vehicle) buying an SUV(EV) rather than a hatchback (ICE) is 115.283 times higher than the odds for people with 'windfall earning5' (no clear preference for allocation of windfall earning). The odds for people with 'windfall earning 4' (those allocating windfall earning to savings for future) buying a SUV(EV) rather than a hatchback (ICE) is 27.281 times higher than the odds for people with 'windfall earning5' (no clear preference for allocation of windfall earning).The odds for people with GLE1 (those allocating earning from sustainable source to buy necessity items) buying an SUV (EV) rather than a hatchback (ICE) is 146.742 times lower than the odds for people with GLE5 (no clear preference for allocation of earning from sustainable source). The odds of people with GLE2 (those allocating earning from sustainable source to vacation /luxury/ own vehicle) buying an SUV (EV) rather than a hatchback (ICE) is 26437.47 times higher than the odds of people with GLE5 (no clear preference for allocation of earning from sustainable source). The odds for people with GLE3 (those allocating earning from sustainable source to e-vehicle/ energy saving gadgets) buying an SUV (EV) rather than a hatchback (ICE) is 80780.373 times higher than the odds of people with GLE5 (no clear preference for allocation of earning from sustainable source).

6.5.4 Participant Group D (Intervention Group)

Stated Choice = *f* (Gender, Place, Monthly Disposable Cash, Fungibility, Diversified Mental Account, Windfall Earning, Green Labelled Earning, Mobility Habit, Allowance Savings, Allocation of Allowance Savings)

Table 6.7.1: Case Processing Summary

Variables	**Categories**	**Marginal Percentage**
Stated Choice	1 (Hatchback ICE)	8.6%
	2 (Hatchback EV)	24.1%
	3 (SUV ICE)	23.6%

	4 (SUV EV)	43.7%
Gender	0 (Male)	31.0%
	1 (Female)	69.0%
Place	0 (Metropolitan)	28.2%
	1 (Non-metropolitan)	71.8%
Monthly Disposable Cash	1 (<= 5000)	75.3%
	2 (5001- 10,000)	16.7%
	3 (10,001- 15,000)	5.7%
	4 (> 15,000)	2.3%
Fungibility	1 (No)	60.9%
	2 (Yes- E&S)	28.2%
	3 (Yes- Necessity)	10.9%
Diversified MA MRF	1 (Public transport)	19.5%
	2 (Personal vehicle)	13.8%
	3 (Vacay /Luxury/ Cool gadgets)	25.9%
	4 (Saving for future)	29.9%
	5 (Mixed response)	10.9%
Windfall Earning	1 (Necessity)	32.2%
	2 (Vacay/ Luxury/ Own vehicle)	12.1%
	3 (E-vehicles/ Cool gadgets)	
	4 (Saving for future)	34.5%
	5 (Mixed response)	21.3%
Green Labelled Earning	1 (Necessity)	51.7%
	2 (Vacay/ Luxury/ New vehicle)	16.1%
	3 (E-vehicle/ Energy saving gadget)	10.3%
	4 (Cool gadgets)	1.7%
	5 (Mixed response)	20.1%
Framing	0 (B)	12.1%
	1 (A)	87.9%
Mobility Habit	1 (Walk/ City bus)	56.3%
	2 (Pvt cab/ Own vehicle)	21.3%
	3 (E-vehicle)	20.1%
	4 (Mixed response)	2.3%
Visual Info	1 (Walk & public transport)	51.1%
	2 (Personal vehicle)	22.4%

	3 (E-vehicle)	24.7%
	4 (Mixed response)	1.7%
Higher Allowance savings	1 (<= 2000)	44.3%
	2 (2001 – 4000)	40.8%
	3 (> 4000)	14.9%
Allocation of Allowance Savings	1 (Necessity)	36.8%
	2 (Vacay/ Luxury/ New vehicle)	19.0%
	3 (E-vehicle)	3.4%
	4 (Future savings)	27.6%
	5 (Mixed response)	13.2%
INT1	1 (Strongly agree)	29.9%
	2 (Agree)	43.7%
	3 (More or less agree)	8.6%
	4 (Undecided)	13.2%
	5 (More or less disagree)	1.1%
	6 (Disagree)	1.1%
	7 (Strongly Disagree)	2.3%
INT2	1 (Strongly agree)	37.4%
	2 (Agree)	40.8%
	3 (More or less agree)	13.2%
	4 (Undecided)	4.6%
	5 (More or less disagree)	1.1%
	6 (Disagree)	1.1%
	7 (Strongly Disagree)	1.7%
INT3	1 (Strongly agree)	31.6%
	2 (Agree)	40.2%
	3 (More or less agree)	8.0%
	4 (Undecided)	13.8%
	5 (More or less disagree)	1.7%
	6 (Disagree)	2.9%
	7 (Strongly Disagree)	1.7%

Table 6.7.2: Model Fitting Information

	Model Fitting Criteria			Likelihood Ratio Test		
Model	AIC	BIC	-2 Log Likelihood	Chi-Square	df	Sig

Intercept Only	443.361	452.838	437.361			
Final	560.691	1034.549	260.691	176.670	147	0.048

The log-likelihood is an estimate of how much unexplained variation is there in the data. Therefore, the difference or the change in log-likelihood emphasizes the improvement in the final model over the intercept only model. Here, the likelihood ratio chi-square of 176.670 with a p-value <0.05 indicates that the model used in the study fits significantly better than the intercept only model.

Table 6.7.3: Pseudo R-Square

Cox and Snell	0.638
Nagelkerke	0.694
McFadden	0.404

The pseudo-R-square is roughly analogous to the R-squared value in OLS regression models, which indicates the proportion of variance explained by the multinomial logistic regression model. We see that Nagelkerke pseudo-R-squared value of 0.694 indicates 69.4% association between stated choice of sustainable mobility and the other independent variables used in the model.

Table 6.7.4: Likelihood Ratio Test

Variable	**AIC of Reduced Model**	**BIC of Reduced Model**	**-2 Log Likelihood of Reduced Model**	**Chi-Square**	**df**	**Sig.**
Gender	561.453	1025.834	267.453	6.762	3	0.080
Place	564.895	1029.276	270.895	10.204	3	0.017
Monthly Disposable Cash	570.136	1015.563	288.136	27.445	9	0.001
Windfall Earning	562.591	1008.018	280.591	19.900	9	0.019
Green Labelled Income	569.756	1005.705	293.756	33.065	12	<0.001
Mobility Habit	559.501	1004.928	277.501	16.810	9	0.052
Visual Information	576.495	1021.921	294.495	33.804	9	<0.001
Higher Allowance Savings	564.497	1019.401	276.497	15.806	6	0.015
INT3	551.757	968.752	287.757	27.066	18	0.078

From the likelihood ratio test we see that gender, place, monthly disposable cash, windfall earning, green labelled income, mobility habit, visual information, higher allowance saving, and INT3 significantly improved the fitted model over the intercept only model.

Table 6.7.5: Significant parameter estimates

Ref Grp: Hatchback (ICE)	**B**	**Sig**	**Exp(B)**
Stated Choice: Hatchback (EV)			
Monthly Disposable Cash (<=5000)	12.372	0.098	236209.109
Monthly Disposable Cash (5001 - 10000)	20.125	0.057	549996235.54
Monthly Disposable Cash (>15000)	.	.	.
Fungibility (No)	5.875	0.058	356.021
Fungibility (Necessity)	.	.	.
Windfall Earning (Saving for Future)	7.229	0.043	1379.508
Windfall Earning (Mixed Response)	.	.	.
Green Labelled Income (Necessity)	-15.243	0.066	2.399E - 7
Green Labelled Income (Vacay/ Luxury/ New Vehicle)	-18.187	0.047	1.263E - 8
Green Labelled Income (Mixed Response)	.	.	.
Higher Allowance Savings (<= 2000)	-6.409	0.046	0.002
Higher Allowance Savings (>4000)	.	.	.
Stated Choice: SUV (ICE)			
Monthly Disposable Cash (INR)(< = 5000)	12.491	0.086	266060.818
Monthly Disposable Cash (INR)(5001 - 10000)	21.097	0.042	1452764920.4
Monthly Disposable Cash (INR)(> 15000)	.	.	.
Fungibility (No)	6.272	0.056	529.375
Fungibility (Yes E&S)	5.654	0.064	285.407
Fungibility (Necessity)	.	.	.
Windfall Earning (Saving for Future)	7.936	0.029	2931.698
Windfall Earning (Mixed Response)	.	.	.
Green Labelled Income (Necessity)	-16.034	0.054	1.087E - 7
Green Labelled Income (Vacay/ Luxury/ New Vehicle)	-18.734	0.043	7.313E - 9
Green Labelled Income (Mixed Response)	.	.	.
Visual Info (Walking & Public Transport)	-22.325	<0.001	2.016E - 10
Visual Info (Pvt Cab/ Own Vehicle)	-20.335	<0.001	1.475E - 9
Visual Info (Mixed Response)	.	.	.
Higher Allowance Savings (<=2000)	-7.602	0.018	0.000

Higher Allowance Savings (2001- 4000)	-7.712	0.030	0.000
Higher Allowance Savings (>4000)	.	.	.
Stated Choice: SUV (EV)			
Monthly Disposable Cash (INR)(< = 5000)	14.132	0.051	1372457.081
Monthly Disposable Cash (INR)(5001 - 10000)	21.532	0.037	2244505439.1
Monthly Disposable Cash (INR)(> 15000)	.	.	.
Fungibility (No)	5.779	0.065	323.489
Fungibility (Yes E& S)	5.057	0.080	157.117
Fungibility (Yes Necessity)	.	.	.
Windfall Earning (Vacay/ Luxury/ Own Vehicle)	8.419	0.096	4534.512
Windfall Earning (Saving for Future)	7.176	0.044	1307.510
Windfall Earning (Mixed Response)	.	.	.
Green Labelled Earning (Necessity)	-16.192	0.052	9.288E - 8
Green Labelled Earning (Vacay/ Luxury/ New Vehicle)	-18.152	0.048	1.309E - 8
Green Labelled Earning (Mixed Response)	.	.	.
Higher Allowance Savings (<= 2000)	-6.958	0.028	0.001
Higher Allowance Savings (2001 – 4000)	-6.518	0.061	0.001
Higher Allowance Savings (> 4000)	.	.	.

Choice of hatchback (EV) over hatchback (ICE)

The odds of people with ‘Fungibility1’ (not resorting to fungibility) buying a hatchback (EV) rather than a hatchback (ICE) is 356.021 times higher than the odds of people with ‘Fungibility3’ (resorting to fungibility for necessity commodities). The odds for people with ‘windfall earning4’ (those allocating windfall earnings into savings for future) buying a hatchback (EV) rather than a hatchback (ICE) is 1379.508 times higher than the odds for people with ‘windfall earning5’ (no clear preference for allocation of windfall earning). The odds of buying a hatchback (EV) rather than a hatchback (ICE) decreases when income from sustainable source is allocated to necessity items or indulgence like luxury/ vacation/ new vehicle. However, the effect size is very small. The odds of people with HAS1 (those who have tendency to save less out of a sustainable travel allowance) buying a hatchback (EV) rather than a hatchback (ICE) is 0.002 times lower than the odds of people who have a tendency to save more out of a sustainable travel allowance.

Choice of SUV (EV) over hatchback (ICE)

The odds of people with lower monthly disposable cash buying an SUV (EV) rather than hatchback (ICE) is multiple times higher than the odds for people with higher monthly disposable cash. This effect size is found to be very high. The odds of people with 'Fungibility1' (not resorting to fungibility) buying an SUV (EV) rather than a hatchback (ICE) is 323.489 times higher than the odds of people with 'Fungibility3' (resorting to fungibility for necessity commodities). The odds of people with 'Fungibility2' (resorting to fungibility for entertainment & shopping) buying an SUV (EV) rather than a hatchback (ICE) is 157.117 times higher than the odds of people with 'Fungibility3' (resorting to fungibility for necessity commodities). The odds for people with 'windfall earning2' (those allocating windfall earnings into vacation/ luxury/ own vehicle) buying an SUV (EV) rather than a hatchback (ICE) is 4534.512 times higher than the odds for people with 'windfall earning5' (no clear preference for allocation of windfall earning). The odds for people with 'windfall earning4' (those allocating windfall earnings into savings for the future) buying an SUV (EV) rather than a hatchback (ICE) is 1307.519 times higher than the odds for people with 'windfall earning5' (no clear preference for allocation of windfall earning). The odds of people with GLE1 and GLE2 (those allocating income from sustainable sources into necessity commodity or indulgence respectively) buying an SUV (EV) rather than ICE (hatchback) is lower than the odds of people with GLE5 (no clear preference for allocation of income from a sustainable source). However, the odds are very small. The odds of people with HAS1 (those who save less out of sustainable travel allowance) and people with HAS2 (those who save moderately out of sustainable travel allowance) buying an SUV (EV) rather than a hatchback (ICE) is lower than the odds of people who save more. However, the size of these odds is very small.

6.6 Conclusion

Control Group

Females are more likely to buy EV hatchbacks. Metropolitan people are more likely to buy EV hatchbacks and SUVs than people from non-metropolitan areas. People who do not invest in sustainability after the diversification of mental accounts and are still into consumerism are less likely to adopt an EV hatchback compared to people who still do not have clear plans about the allocation of their resources after the diversification of their mental accounts. People with clear mobility habits are less likely to adopt EV hatchbacks and EV SUVs than people who have no clear mobility habits. People who allocate income earned from green sources to the consumption of necessities are more likely to buy an EV in comparison to people who do not have clear patterns of allocation of resources earned from green sources. People who allocate income earned from green sources into savings to be spent in the future rather than today are more likely to buy EV hatchbacks and EV SUVs than those who do not have clear patterns of allocation of resources earned from green sources.

Intervention Group B

After providing general information about climate change problem, people who chose to walk or use public transport are more likely to buy an EV hatchback than those who still had mixed priorities about using different transportation options after receiving general information about climate change. Also, people who chose to use their personal vehicle for daily commute after receiving general information about climate change problem are more likely to adopt an EV hatchback than those who had no clear mobility preferences.

In the case of EV SUV, people who prioritized allocating travel funds to savings for future use after diversification of their mental accounts are less likely to buy EV SUV than those who had no clear priorities regarding allocation of their travel funds. Again, people who already uses an EV, they are highly likely to buy an EV SUV than those who had no clear priorities about travel fund allocation. People who were moderately influenced by print media visibility incentives are more likely to buy EV SUVs than those who were highly influenced by print media visibility incentives.

Intervention Group C

Females are more likely to buy EV hatchbacks. People from metropolitan area are more likely to buy EV hatchbacks and EV SUVs than people from non-metropolitan areas. People who did not satisfy the principle of fungibility of mental accounts and transfer resources from luxury expenses fund to travel fund are less likely to buy an EV hatchback than people who didn't fulfill the principle of fungibility and chose to transfer resources from necessity funds. In the case of EV SUV, people who satisfied the principle of fungibility of mental accounts are found to be less likely to buy EV SUVs than people who didn't satisfy the principle of fungibility. Thus, the fungibility principle of mental accounting behavior is not found to hold true in the case of energy saving behavior. People who use income earned from green sources to purchase energy saving products are highly likely to buy EV hatchbacks and EV SUVs than people who has no clear preference regarding the allocation of income earned from green source. Hence, we see that the third principle of mental accounts, i.e., labelling mental accounts can effectively nudge an individual towards the adoption of EV hatchbacks.

Intervention Group D

People who satisfied the principle of fungibility are more likely to buy EV hatchbacks and EV SUVs than people who didn't satisfy the principle of fungibility and chose to transfer resources from the necessity fund. Also, it is found that people who didn't satisfy the principle of fungibility and chose to transfer resources from the entertainment and shopping funds are more likely to buy EV SUVs than people who didn't satisfy the principle of fungibility and chose to transfer resources from the necessity fund. Thus, the fungibility principle of mental accounting behavior is not found to hold true in the case of energy saving behavior. People who chose to save windfall incomes are more likely to buy EV hatchbacks than those who had no clear priorities about allocation of windfall incomes. After receiving a higher travel allowance, people who wish to spend more and save less of it a less likely to buy EV hatchbacks and EV SUVs than people who wished to save more from the travel allowance. However, the magnitude of this effect is very small. Hence, the magnitude of monetary allowance is not found to significantly nudge one towards choosing sustainable mobility options.

This chapter analyzed the efficacy of different nudges in stated choice for sustainable mobility. In the next chapter, we shall discuss how pro-environmental intentions and efficacy of nudges differ in different stages of behavior.

Chapter 7. Intention Formation Process and Efficacy of Nudges in Different Stages of Behavior

This chapter engages with the analysis of the different stages of behavior in the behavior formation process. In the previous chapters we have identified the various socio-psychological factors that lead to the formation of intention to adopt an EV. The process of intention formation for EV purchase was also found to vary with differences in demographic factors like gender, age, and location. The impact of the different nudges like information, social comparison, social recognition, framing, default options, etc., have also been analyzed. However, so far, the discussion was limited to intention. Whether intention translates into actual behavior can be questioned. Considering the state of development of electric vehicle supporting infrastructure in the study area of this study, Assam, it is difficult to observe the actual EV purchase behavior. To address this limitation, this study used stated choice of sustainable mobility as the nearest proxy to probable actual behavior. This chapter delves further into how socio-psychological factors influence the intention and efficacy of behavioral nudges at the different stages of the behavior transformation process. Using Bamberg's (2007) Stage Regulated Behavior Change (SRBC) theory as a theoretical background, we identify the participant's present stage of behavior in the continuum of stages in the behavior formation process.

The remainder of this chapter is arranged as follows: We begin with outlining the research questions, the sample, data, and method. We subsequently discuss the results of the EV adoption intention pathways for individuals in different stages of behavior. This is followed by a discussion of the results of effect of nudges in different stages of behavior. Finally, we conclude the chapter with a summarized discussion of the main findings of objective 3, the last objective of this thesis.

7.1 Research Questions

We pose the following research questions:

- How do gain, norm, and fear motivation influence sustainable mobility intention in the different stages of the behavior?
- How does the effect of nudges differ in the different stages of the behavior formation process?

7.2 Sample, Data and Method

The sample for the analysis in this chapter is only considered from phase-2 of the data collection process.

For this analysis, a total of 1000 questionnaires were distributed, of which 787 have been received. The questionnaires were of four different types: type A with no nudges, type B, type C, and type D. Each of the groups is presented with the same activity that seeks to obtain information about the stage of behavior. This is the same group of respondents who have participated in the experiment discussed in the previous chapter. The sample profile is described in the table below:

Table 7.1: Sample profile of the responses used in objective 3.

Location	**Profile**	**Size**
Cotton University, Guwahati	MA Economics 1st year	36
	MA Economics 2nd year	10
	BA Economics 1st year	40
	BA Economics 2nd year	50
	BA Economics 3rd year	49
B Barooah College, Guwahati	BA Economics 2nd year	47
	BA Economics 1st year	45
North Guwahati College, North Guwahati	BSc Chemistry	80
Dibrugarh University, Dibrugarh	MA Economics 1st year	52
	MA Economics 2nd year	50
	MA History 1st year	44
	MA History 2nd year	48
	MA Geography (2nd & 3rd year)	56
Darrang College, Tezpur	BSc Mathematics (2nd & 3rd year)	42
	BSc Statistics (2nd & 3rd year)	34
	BA Economics (2nd & 3rd year)	30
	BA Political Science (2nd & 3rd year)	28
	B Com (2nd & 3rd year)	25
Tezpur College, Tezpur	B Com (2nd & 3rd year)	21
Total		787

7.3 Results of the Measurement Model

7.3.1 TPB model

Table 7.2A: Internal Consistency Reliability Assessment of Constructs (TPB model)

Construct	Composite Reliability (CR)			
	PDNI	**PDUS**	**PRA**	**A&POA**
AT	0.897	0.834	0.801	0.826
PBC	0.740	0.784	0.729	0.765
SN	0.852	0.850	0.815	0.771
INT	0.903	0.890	0.849	0.810

As can be seen in table 7.2A, the CR values for all constructs in the TPB model lie above the recommended value of 0.70. Hence the constructs are found to have significant internal consistency reliability in all the behavior stages.

Table 7.2B: Convergent Validity Assessment of Constructs (TPB model)

Construct	Average Variance Extracted (AVE)			
	PDNI	**PDUS**	**PRA**	**A&POA**
AT	0.743	0.570	0.575	0.613
PBC	0.488 ~ 0.5	0.549	0.488 ~ 0.5	0.521
SN	0.593	0.592	0.531	0.462 ~ 0.5
INT	0.756	0.731	0.652	0.588

Table 7.2B indicates the convergent validity scores which is measured through average variance extracted. The average variance extracted (AVE) which explains the amount of variance accounted for by the indicators of a latent construct. Values for AVE atleast 0.50 is recommended. We see that the AVE values for all the constructs in each category lies above the desired range. Hence convergent validity is said to have been achieved. PBC has an AVE value of 0.488 in the PDNI and PRA group, which is approximately 0.5. Similarly, SN has an AVE value of 0.462, which is approximately close to 0.5 for the A&POA group. Hence, we include the same in the model as its internal consistency reliability was still achieved.

Table 7.2C: Results of the structural equation model (significant pathways leading to an intention to adopt EVs)

Hypothesized paths	Standardized Estimates			
	PDNI	PDUS	PRA	A&POA
H1: AT → INT	0.316*** (0.000)	0.312***(0.000)	0.156*(0.063)	0.075(0.390)
H5: SN → INT	0.533*** (0.000)	0.381***(0.000)	0.386***(0.000)	0.518*** (0.000)
H9: PBC → INT	-0.049 (0.373)	0.131**(0.030)	0.221**(0.002)	0.178** (0.009)

Values in parenthesis indicate the p-value.

In the early stages of behavior, specifically when an individual is in the pre-decision stage and has no interest in EVs, a favorable attitude (effect size of 31.6%) and subjective norms (effect size of 53.3%) can influence the development of intention to adopt EVs. In the PDUS stage, when an individual is unsure about EVs but doesn't have a lack of interest unlike in the PDNI stage, perceived behavioral control also has a significant influence on intention. In PDUS stage, attitude has an effect size of 31.2%, subjective norm has an effect size of 38.1%, and perceived behavioral control has an effect size of 13.1%. The influence of all three constructs of attitude, subjective norm, and perceived behavioral control on intention continues in the pre-action stage as well, with effect sizes of 15.6%, 38.6%, and 22.1% respectively. Finally, after the individual purchases an EV, attitude has no role in influencing the intention to maintain and continue using EVs. Only subjective norms (effect size of 51.8%) and perceived behavioral control (effect size of 17.8%) influence intention in the final stage of behavior.

We see that the effect of attitude on intention is highest in the initial stages of behavior and gradually reduces as the stage of behavior progresses. Subjective norm influences intention to adopt EVs at all stages of behavior, with its highest effect sizes in the PDNI and A&POA stages. Perceived behavioral control does not affect intention in the earliest PDNI stage. It starts to influence intention in the later stages of behavior.

Table 7.2D: Mediated pathways with their effect and size (TPB model)

Pathways	Effect	Size	P-value
PDNI			
AT → SN → INT	Partial	0.258***	0.000
PBC → AT → INT	**Partial**	**0.152*** **	**0.000**
PBC → SN → INT	**Partial**	**0.182*** **	**0.000**
PDUS			
SN → AT → INT	Partial	0.202**	0.002

PRA			
AT → SN → INT	**Partial**	**0.201*** **	**0.001**
AT → PBC → INT	Partial	0.071**	0.028
A&POA			
AT → SN → INT	**Partial**	**0.202*** **	**0.000**
AT → PBC → SN → INT	Partial	0.054**	0.003
PBC → SN → INT	Partial	0.154***	0.001

***significant at 1%, **significant at 5%, *significant at 10%

Even though perceived behavioral control is not found to influence intention in the early PDNI stage of behavior directly, it is partially mediated by attitude with an effect size of 15.2%, and by subjective norms with an effect size of 18.2%. Attitude directly influences intention but is also partially mediated by subjective norms with an effect size of 25.8% in the PDNI stage. The mediated effects in the PDUS stage are insignificant as their effect size is less than the direct effect. In the PRA stage of behavior, when attitude is partially mediated by subjective norm, its effect size (20.1%) is higher than the direct effect of attitude on intention (15.6%). In the final stage of behavior, A&POA, attitude which otherwise has no direct effect on intention is found to be partially mediated by subjective norms with an effect size of 20.2%.

7.3.2 NAM model

Table 7.3A: Internal Consistency Reliability Assessment of Constructs (NAM model)

Construct	Composite Reliability (CR)			
	PDNI	**PDUS**	**PRA**	**A&POA**
AC	0.752	0.878	0.795	0.741
AR	0.801	0.844	0.769	0.778
EVC	0.796	0.873	0.862	0.873
PN	0.767	0.810	0.767	0.808
SN	0.826	0.852	0.811	0.744
INT	0.893	0.891	0.848	0.769

As can be seen from table 7.3A, the CR values for all constructs in the NAM model lie above the recommended value of 0.70. Hence the constructs are found to have significant internal consistency reliability in all the different stages of behavior.

Table 7.3B: Convergent Validity Assessment of Constructs (NAM model)

Construct	Average Variance Extracted (AVE)			
	PDNI	**PDUS**	**PRA**	**A&POA**
AC	0.517	0.708	0.565	0.495
AR	0.578	0.642	0.546	0.550
EVC	0.667	0.775	0.759	0.774
PN	0.554	0.600	0.623	0.506
SN	0.547	0.595	0.526	0.459
INT	0.736	0.731	0.650	0.584

Table 7.3B indicates the convergent validity scores which is measured through average variance extracted. The average variance extracted (AVE) which explains the amount of variance accounted for by the indicators of a latent construct. Values for AVE atleast 0.50 is recommended. We find that the AVE values for all the constructs in each demographic category lie above the desired range. Hence convergent validity is said to have been achieved. AC has an AVE value of 0.495, and SN has an AVE value of 0.459 in the A&POA stage, which is approximately equal to 0.5. Hence, we include the same in the model as its internal consistency reliability was still achieved.

Table 7.3C: Results of the structural equation model (significant pathways leading to an intention to adopt EVs)

Hypothesized paths	Standardized Estimates			
	PDNI	**PDUS**	**PRA**	**A&POA**
H13: AC → INT	-0.019 (0.811)	0.034 (0.541)	0.267***(0.000)	-0.017 (0.834)
H17: AR → INT	-0.079 (0.100)	0.012 (0.802)	-0.039 (0.554)	0.116 (0.136)
H21: EVC → INT	0.096 (0.112)	0.008 (0.893)	0.103 (0.184)	0.113 (0.105)
H25: PN → INT	0.269*** (0.000)	0.191**(0.004)	0.204**(0.022)	0.216*** (0.001)
H5: SN → INT	0.519*** (0.000)	0.494***(0.000)	0.334***(0.001)	0.390*** (0.000)

Values in parenthesis indicate the p-value

We see from the Table 7.3C that in every stage of behavior, personal norm (PN) and subjective norm (SN) have a direct influence on intention. The effect size of both PN and SN is highest in the earliest stage of behavior, in PDNI stage. Awareness of consequence has a direct impact on intention, only in the PRA stage of behavior.

Table 7.3D: Mediated pathways with their effect and size (NAM Model)

Pathways	**Effect**	**Size**	**P-value**
PDNI			
AC → AR → PN → INT	Partial	0.037**	0.039
AC → AR → PN → SN → INT	**Partial**	**0.045****	**0.008**
AR → PN → INT	Partial	0.121**	0.006
AR → SN → INT	Partial	0.062*	0.076
AR → PN → SN → INT	**Partial**	**0.147*****	**0.000**
PN → SN → INT	Partial	0.326***	0.000
PDUS			
EVC → PN → INT	Partial	0.054**	0.023
EVC → SN → INT	**Partial**	**0.079***	**0.064**
EVC → SN → PN → INT	Partial	0.035*	0.082
SN → PN → INT	Partial	0.160**	0.034
PRA			
AC → EVC → AR → SN → INT	Partial	0.010*	0.079
AC → AR → SN → INT	Partial	0.031*	0.054
AR → SN → INT	**Partial**	**0.120****	**0.004**
EVC → AR → SN → INT	Partial	0.024*	0.080
SN → PN → INT	**Partial**	**0.078***	**0.052**
A&POA			
AC → EVC → PN → INT	Partial	0.026**	0.026
AC → EVC → SN → INT	**Partial**	**0.063****	**0.023**
AR → PN → INT	Partial	0.048*	0.084
EVC → PN → INT	Partial	0.077**	0.005
EVC → SN → INT	**Partial**	**0.187*****	**0.001**

***significant at 1%, **significant at 5%, *significant at 10%

Though very few constructs from the NAM model directly influence intention in every stage of behavior, several of the constructs have indirect intention formation pathways in different stages of behavior. For instance, in the early stage of behavior during PDNI, the usual intention formation route suggested by the NAM theory, i.e., awareness followed by ascription of responsibility triggers personal norms is found to hold. It has a minimal effect size of 3.7%.

The presence of favorable subjective norms along with awareness, ascription of responsibility, and personal norms slightly increases the effect size on intention (4.5%).

In the PDUS stage of behavior, which is another early stage of behavior formation, environmental concern (EVC) is found to be partially mediated by subjective norms toward intention with an effect size of 7.9%. In the PRA stage of behavior, ascription of responsibility (AR) is found to be partially mediated by subjective norms (SN) towards intention (INT) with an effect size of 12%. SN in turn is found to be partially mediated by personal norms (PN) towards intention with an effect size of 7.8%. In the final stage of behavior, the A&POA stage, environmental concern (EVC) is found to be partially mediated by SN with an effect size of 18.7%. The presence of favorable EVC and SN is also found to partially mediate awareness of consequence (AC) towards intention (INT) with an effect size of 6.3%.

7.3.3 PMT model

Table 7.4A: Internal Consistency Reliability Assessment of Constructs (PMT model)

Construct	**Composite Reliability (CR)**			
	PDNI	**PDUS**	**PRA**	**A&POA**
AC	0.807	0.879	0.796	0.742
PR	NA	NA	NA	0.754
PV	0.752	0.876	0.776	0.790
PBC	0.740	0.786	0.729	0.764
RE	0.826	0.832	0.828	0.806
RC	0.829	0.736	0.823	0.778
INT	0.902	0.889	0.848	0.810

As can be seen from Table 7.4A, the CR values for all constructs in the PMT model lie above the recommended value of 0.70. Hence the constructs are found to have significant internal consistency reliability in all the different stages of behavior.

Table 7.4B: Convergent Validity Assessment of Constructs (PMT model)

Construct	**Average Variance Extracted (AVE)**			
	PDNI	**PDUS**	**PRA**	**A&POA**
AC	0.583	0.709	0.567	0.499

PR	NA	NA	NA	0.513
PV	0.508	0.704	0.554	0.560
PBC	0.488	0.552	0.488	0.520
RE	0.705	0.713	0.709	0.675
RC	0.620	0.595	0.703	0.555
INT	0.755	0.728	0.651	0.589

Table 7.4B indicates the convergent validity scores which are measured through the average variance extracted. The average variance extracted (AVE) explains the amount of variance accounted for by the indicators of a latent construct. Values for AVE atleast 0.50 is recommended. We find that the AVE values for all the constructs in each category lie above the desired range. Hence convergent validity is said to have been achieved. PBC has an AVE value of 0.488 in the PDNI and PRA stages, and AC has an AVE value of 0.499 in the A&POA stage, which is approximately equal to 0.5. Hence, we include the same in the model as its convergent validity is said to have been achieved.

Table 7.4C: Results of the structural equation model (significant PMT pathways leading to an intention to adopt EVs in male Vs female)

Hypothesized paths		**Standardized**	**Estimates**	
	PDNI	**PDUS**	**PRA**	**A&POA**
H13: AC → INT	0.036 (0.530)	0.266**(0.007)	0.254***(0.000)	0.151 (0.058)
H29: PR → INT	NA	NA	0.070 (0.418)	0.034 (0.686)
H33: PV → INT	0.141*(0.069)	-0.018 (0.869)	0.093 (0.268)	0.183** (0.034)
H9: PBC → INT	0.156**(0.022)	0.256***(0.000)	0.263*** (0.000)	0.221** (0.003)
H37: RE → INT	0.476***(0.000)	0.342***(0.000)	0.334*** (0.000)	0.341*** (0.000)
H41: RC → INT	-0.001 (0.991)	-0.191**(0.003)	-0.009 (0.866)	0.029 (0.751)

Values in parenthesis () indicates the p-value; ***significant at 1%, **significant at 5%

From Table 7.4C, we find that out of the threat appraisal constructs, perceived vulnerability (PV) directly influences intention in the PDNI stage (with an effect size of 14.1%), and the A&POA stage (with an effect size of 18.3%). Awareness of consequence (AC) directly influences intention in the PDUS stage (with an effect size of 26.6%) and the PRA stage (with an effect size of 25.4%). Out of the coping appraisal phase constructs, perceived behavioral control (PBC) and response efficacy (RE) influence intention in every stage of behavior. The effect of PBC on intention is less in the initial PDNI stage compared to the later stages of behavior. On the other hand, the effect of RE on intention is highest in the initial PDNI stage and decreases in the later stage of behavior. In addition, response cost (RC) influences intention only in the PDUS stage. It has a negative effect size of 19.1%.

Table 7.4D: Mediated pathways with their effect and size (PMT Model)

Pathways	**Effect**	**Size**	**P-value**
PDNI			
AC → PV → RE →INT	**Partial**	**0.103****	**0.003**
PV → RE → INT	**Partial**	**0.249*****	**0.000**
PV → RE → PBC →INT	Partial	0.030**	0.048
RE → PBC → INT	Partial	0.056**	0.041
RC → RE →INT	Partial	0.053*	0.052
PDUS			
AC → PBC → INT	Partial	0.088**	0.002
PV → RE → INT	**Partial**	**0.186*****	**0.001**
PRA			
AC → PBC → INT	Partial	0.060**	0.007
PV → RE → INT	**Partial**	**0.106****	**0.005**
PV → PBC → INT	Partial	0.067**	0.012
A&POA			
PR → RC → RE →INT	**Partial**	**0.017***	**0.090**
PV → RE → INT	Partial	0.104*	0.076
PBC → RE → INT	Partial	0.084**	0.026
RC → RE →INT	Partial	0.047**	0.045
RC → PBC → RE →INT	Partial	0.023*	0.062

***significant at 1%, **significant at 5%, *significant at 10%

Several indirect intention pathways are found for each stage of behavior. For instance, in the PDNI stage of behavior, perceived vulnerability (PV) is partially mediated by response efficacy (RE) towards intention (INT) with an effect size of 24.9%, which is higher than the direct effect of PV on intention (14.1%). The presence of PV and RE also partially mediates awareness of consequences (AC) towards intention with an effect size of 10.3%. Again, in the PDUS and PRA stages, PV is found to be partially mediated by RE towards intention with an effect size of 18.6% and 10.6% respectively. In the final stage of behavior, we observe an interesting outcome. Perceived risk (PR) was not found to have any influence on intention in any of the stages of behavior, except in the final A&POA stage, where PR is found to be partially mediated by response cost (RC) and RE towards intention with a minimal effect size of 1.7%.

7.4 Results of the Efficacy of Nudges in Different Stages of Behavior Formation Process

To analyze this research question, we use a multinomial logistic regression model. We run the models for each of the four groups of participants: groups A, B, C, and D. The dependent variable is the stage of behavior. It has four categories: pre-decision no interest (PDNI), pre-decision unsure (PDUS), pre-action (PRA), action (A), post-action (POA), and combined/ no clear preference.

Stage of Behavior = *f* (Gender, Place, Monthly Income, Fungibility MA, MA Sub-Account, Windfall Earning, Income from Green Source, Default, Mobility Habit, Information, Allowance Savings, Allocation of Allowance Savings)

7.4.1 Participant group A (no intervention group)

Table 7.5: Case Processing Summary

Variables	**Categories**	**Marginal Percentage**
Behavior Stage	1 (Pre-Decision No Interest) (PDNI)	30.9%
	2 (Pre-Decision Unsure) (PDUS)	22.3%
	3 (Pre-Action) (PRA)	20.6%
	4 (Action) (A)	12.6%
	5 (Post-Action) (POA)	5.7%
	6 (Combined/ No-clear Stage)	8.0%
Gender	0 (Male)	37.1%
	1 (Female)	62.9%
Place	0 (Metropolitan)	28.6%
	1 (Non-metropolitan)	71.4%
Monthly Disposable Cash	1 (<= 5000)	77.1%
	2 (5001- 10,000)	18.3%
	3 (10,001- 15,000)	2.3%
	4 (> 15,000)	2.3%

Fungibility	1 (No)	52.6%
	2 (Yes- E&S)	33.1%
	3 (Yes- Necessity)	14.3%
Diversified Mental Account	1 (Public transport)	28.0%
	2 (Personal vehicle)	19.4%
	3 (Vacay /Luxury/ Cool gadgets)	14.3%
	4 (Saving for future)	20.0%
	5 (Mixed response)	18.3%
Windfall Earning	1 (Necessity)	29.1%
	2 (Vacay/ Luxury/ Own vehicle)	13.1%
	3 (E-vehicles/ Cool gadgets)	3.4%
	4 (Saving for future)	32.0%
	5 (Mixed response)	22.3%
Green Labelled Earning	1 (Necessity)	55.4%
	2 (Vacay/ Luxury/ New vehicle)	16.6%
	3 (E-vehicle/ Energy saving gadget)	9.7%
	4 (Cool gadgets)	2.3%
	5 (Mixed response)	16.0%
Mobility Habit	1 (Walk/ City bus)	48.0%
	2 (Pvt cab/ Own vehicle)	24.6%
	3 (E-vehicle)	25.7%
	4 (Mixed response)	1.7%
Allowance savings	1 (<= 1000)	51.4%
	2 (1001 – 2000)	41.7%
	3 (> 2000)	6.9%
Allocation of allowance savings	1 (Necessity)	45.7%
	2 (Vacay/ Luxury/ New vehicle)	16.6%
	3 (E-vehicle)	1.1%
	4 (Future savings)	21.1%
	5 (Mixed response)	15.4%

The dependent variable, stage of behavior has 6 categories: 1 represents pre-decision no interest (PDNI), 2 represents pre-decision unsure (PDUS), 3 represents pre-action (PRA), 4 represents action (A), 5 represents post-action (POA), and 6 represents no clear stage of behavior. While 30.9% participants in the control group belong to pre-decision no interest (PDNI), 22.3% of participants belong to pre-decision unsure (PDUS), 20.6% belong to the pre-action (PRA) group, 12.6% belong to the action group, 5.7% belong to post-action, and 8% does not display clear belongingness to any particular group. The first independent variable group includes basic participant information like gender, place, and monthly disposable cash. The second independent variable group includes behavioral interventions.

Table 7.6: Model Fitting Information

	Model Fitting Criteria			Likelihood Ratio Test		
Model	AIC	BIC	-2 Log Likelihood	Chi-Square	df	Sig
Intercept Only	584.370	600.194	574.370			
Final	674.729	1133.623	384.729	189.640	140	0.003

The log-likelihood is an estimate of how much unexplained variation is there in the data. Therefore, the difference or the change in log-likelihood emphasizes the improvement in the final model over the intercept only model. The chi-square test evaluates the decrease in unexplained variance from the baseline model (intercept only model) to the final model. If the change is significant then it can be said that the final model explains a significant amount of the original variability. The model here refers to the parameters of the model for which the fit of the model is estimated. 'Intercept only' model represents a model which doesn't control for independent variables and simply fits an intercept to make prediction about the dependent variable. The 'Final' model takes into account the independent variables and has been arrived at through an iteration process that maximizes the log-likelihood of the outcome observed in the dependent variable. Here, the likelihood ratio chi-square of 189.640 with a p-value of 0.003 indicates that the model used in the study as a whole fits significantly better than the intercept-only model.

Table 7.7: Pseudo R-Square

Cox and Snell	0.662
Nagelkerke	0.687
McFadden	0.329

The pseudo R-square is roughly analogous to the R-squared value in OLS regression models, which indicates the proportion of variance explained by the multinomial logistic regression model. We see that the Nagelkerke pseudo R-squared value of 0.687 indicates 68.7%

association between the stated choice of sustainable mobility and the other independent variables used in the model.

Table 7.8: Significant parameter estimates

Ref Grp: Pre-Decision No Interest (PDNI)	B	Sig	Exp(B)
Behavior Stage: Pre-Decision Unsure (PDUS)			
Fungibility (No)	1.679	0.096	5.359
Fungibility (Yes- Necessity)	.	.	.
Windfall Earning (Save for Future)	-1.297	0.066	0.273
Windfall Earning (Mixed Response)	.	.	.
Allocation of allowance savings (Vacay/ Luxury/ New vehicle)	1.565	0.096	4.783
Allocation of allowance savings (Saving for Future)	1.612	0.072	5.015
Allocation of allowance savings (Mixed Response)	.	.	.
Behavior Stage: Pre-Action (PRA)			
Diversified MA (Public transport)	2.480	0.005	11.947
Diversified MA (Mixed response)	.	.	.
Behavior Stage: Action (A)			
Monthly Disposable Cash 1 (<= 5000)	-3.526	0.060	0.029
Monthly Disposable Cash 4 (> 15,000)	.	.	.
Fungibility 1 (No)	-2.483	0.017	0.083
Fungibility 2 (Yes- E&S)	-2.274	0.047	0.103
Fungibility 3 (Yes- Necessity)	.	.	.
Windfall Earning (Vacay/ Luxury/ Own Vehicle)	3.199	0.026	24.508
Windfall Earning (Mixed Response)	.	.	.
Behavior Stage: Post-Action (POA)			
Place 0 (Metropolitan)	-6.268	0.054	0.002
Place 1 (Non-metropolitan)	.	.	.

Fungibility 1 (No)	-5.236	0.067	0.005
Fungibility 3 (Yes- Necessity)	.	.	.
Diversified MA (Vacay/ Luxury/ Cool gadget)	4.642	0.035	103.776
Diversified MA (Mixed response)	.	.	.
Behavior Stage: No clear stage			
Diversified MA (Public transport)	2.827	0.024	16.888
Diversified MA (Mixed response)	.	.	.
Windfall Earning (Vacay/ Luxury/ Own Vehicle)	-3.009	0.087	0.049
Windfall Earning (Save for Future)	-2.599	0.023	0.074
Windfall Earning (Mixed Response)	.	.	.
Mobility Habit 1 (Walk/ City bus)	-5.529	0.061	0.004
Mobility Habit 3 (E-vehicles)	-6.280	0.041	0.002
Mobility Habit 4 (Mixed response)	.	.	.
Allowance savings 2 (1001 – 2000)	4.679	0.083	107.706
Allowance savings 3 (> 2000)	.	.	.
Allocation of allowance savings (Saving for Future)	2.593	0.054	13.371
Allocation of allowance savings (Mixed Response)	.	.	.

The text discusses the odds of individuals transitioning between different stages of decision-making or action related to financial behavior, specifically in relation to mental accounting and resource allocation, using various criteria like fungibility, windfall earnings, and travel funds. It compares individuals in four key stages: Pre-Decision Unsure (PDUS), Pre-Action (PRA), Action (A), and Post-Action (POA) against the baseline stage of Pre-Decision No Interest (PDNI).

Pre-Decision Unsure (PDUS) vs. Pre-Decision No Interest (PDNI)

The odds of being in the PDUS stage rather than the PDNI stage increase for individuals who follow the fungibility principle for necessary items. Such individuals are 5.36 times more likely to be in the PDUS stage. In contrast, those who allocate their windfall earnings to savings for the future are less likely (0.273 times lower) to be in the PDUS stage compared to those with no preference for allocating windfall earnings. Individuals who allocate allowance savings for indulgence are 4.783 times more likely to be in the PDUS stage than those without clear preferences, while those saving allowance for the future are 5.015 times more likely to remain in the PDNI stage.

Pre-Action (PRA) vs. Pre-Decision No Interest (PDNI)

In the transition to the PRA stage, the odds increase significantly for individuals who prefer public transportation after diversifying mental accounts. Their likelihood of being in the PRA stage is 11.95 times higher than those who have no clear preference for allocating travel funds.

Action (A) vs. Pre-Decision No Interest (PDNI)

Individuals with low disposable income are much less likely (0.029 times) to transition to the Action stage compared to those with high disposable income. Similarly, individuals who adhere to the fungibility principle for necessary items are 0.083 times less likely to be in the Action stage. On the other hand, people who allocate windfall earnings toward indulgence are 24.508 times more likely to move into the Action stage than those with no clear preference.

Post-Action (POA) vs. Pre-Decision No Interest (PDNI)

People from metropolitan areas are less likely to move to the POA stage compared to those 1

7.4.2 Participant group B (intervention group)

Table 7.9: Case Processing Summary

Variables	Categories	Marginal Percentage
Behavior Stage	1 Pre-Decision No Interest (PDNI)	30.9%
	2 Pre-Decision Unsure (PDUS)	20.2%
	3 Pre-Action (PRA)	20.2%
	4 Action (A)	12.9%
	5 Post-Action (POA)	5.6%
	6 No clear stage of behavior	10.1%
Gender	0 (Male)	42.1%
	1 (Female)	57.9%
Place	0 (Metropolitan)	29.8%
	1 (Non-metropolitan)	70.2%
Monthly Disposable Cash	1 (<= 5000)	75.8%
	2 (5001- 10,000)	15.7%
	3 (10,001- 15,000)	7.3%

	4 (> 15,000)	1.1%
Fungibility	1 (No)	51.7%
	2 (Yes- E&S)	35.4%
	3 (Yes- Necessity)	12.9%
Diversified Mental Account	1 (Public transport)	28.1%
Nudge: Anchor (Classmate)	2 (Personal vehicle)	21.3%
	3 (Vacay /Luxury/ Cool gadgets)	14.0%
	4 (Saving for future)	20.8%
	5 (Mixed response)	15.7%
Windfall Earning	1 (Necessity)	22.5%
	2 (Vacay/ Luxury/ Own vehicle)	15.2%
	3 (E-vehicles/ Cool gadgets)	1.1%
	4 (Saving for future)	36.5%
	5 (Mixed response)	24.7%
Green Labelled Earning	1 (Necessity)	46.1%
	2 (Vacay/ Luxury/ New vehicle)	15.7%
	3 (E-vehicle/ Energy saving gadget)	9.0%
	4 (Cool gadgets)	4.5%
	5 (Mixed response)	24.7%
Default	0 (Yes)	64.0%
	1 (No)	36.0%
Mobility Habit	1 (Walk/ City bus)	41.0%
	2 (Pvt cab/ Own vehicle)	25.8%
	3 (E-vehicle)	30.9%
	4 (Mixed response)	2.2%
General Info MC	1 (Walk & public transport)	34.3%
	2 (Personal vehicle)	39.3%
	3 (E-vehicle)	25.8%
	4 (Mixed response)	0.6%
PMV Allowance savings	1 (<= 1000)	42.7%
	2 (1001 – 2000)	46.6%
	3 (> 2000)	10.7%
Allocation of allowance savings	1 (Necessity)	35.4%
	2 (Vacay/ Luxury/ New vehicle)	14.0%
	3 (E-vehicle)	3.9%

	4 (Future savings)	30.9%
	5 (Mixed response)	15.7%

The dependent variable, stage of behavior has 6 categories: 1 represents pre-decision no interest (PDNI), 2 represents pre-decision unsure (PDUS), 3 represents pre-action (PRA), 4 represents action (A), 5 represents post-action (POA), and 6 represents no clear stage of behavior. While 30.9% participants in the intervention group-B belong to pre-decision no interest (PDNI), 20.2% of participants belong to pre-decision unsure (PDUS), 20.2% belong to the pre-action (PRA) group, 12.9% of participants belong to the action group, 5.6% belong to post-action, and 10.1% does not display clear belongingness to any behavior stage. The first independent variable group includes basic participant information like gender, place, and monthly disposable cash. The second independent variable group includes behavioral interventions namely: mental accounting, reference point- close affinity, default option, general information, and social recognition- print media visibility.

Table 7.10: Model Fitting Information

	Model Fitting Criteria			Likelihood Ratio Test		
Model	AIC	BIC	-2 Log Likelihood	Chi-Square	df	Sig
Intercept Only	603.544	619.453	593.544			
Final	668.122	1193.117	338.122	255.421	160	0.000

The log-likelihood is an estimate of how much unexplained variation is there in the data. Therefore, the difference or the change in log-likelihood emphasizes the improvement in the final model over the intercept-only model. Here, the likelihood ratio chi-square of 255.421 with a p-value of 0.000 indicates that the model used in the study as a whole fits significantly better than the intercept-only model.

Table 7.11: Pseudo R-Square

Cox and Snell	0.762
Nagelkerke	0.790
McFadden	0.430

The pseudo-R-square is roughly analogous to the R-squared value in OLS regression models, which indicates the proportion of variance explained by the multinomial logistic regression model. We obtain a Nagelkerke pseudo R-squared value of 0.790 indicates 79% association between the stated choice of sustainable mobility and the other independent variables used in the model.

Table 7.12: Likelihood Ratio Test

Variable	Model Fitting Criteria			Likelihood Ratio Tests		
	AIC of Reduced Model	BIC of Reduced Model	-2 Log Likelihood of Reduced Model	Chi-Square	df	Sig.
Intercept	668.122	1193.117	338.122	.000	0	.
Gender	675.228	1184.313	355.228	17.105	5	.004
Place	667.950	1177.035	347.950	9.827	5	0.080
Monthly Disposable Cash	664.154	1141.422	364.154	26.032	15	0.038
Fungibility	666.782	1159.959	356.782	18.660	10	0.045
Diversified MA CRF	655.541	1116.900	365.541	27.419	20	0.124
Windfall Earning	653.005	1114.364	363.005	24.883	20	0.206
Green Label Income	680.548	1141.907	390.548	52.426	20	0.000
Default	676.330	1185.416	356.330	18.208	5	0.003
Mobility Habit	670.206	1147.473	370.206	32.083	15	0.006
Mobility Habit Gen Info	662.530	1139.798	362.530	24.408	15	0.058
PMV Allowance Saving	677.329	1170.506	367.329	29.207	10	0.001
Allocation of allowance savings	667.939	1129.298	377.939	39.817	20	0.005

***significant at 1% level, **significant at 5% level, *significant at 10% level

From the likelihood ratio test table, we see that gender, place, monthly disposable cash, fungibility, green labelled income, default option, mobility habit, general information, and print media social recognition are found to significantly improve the final model in comparison to the intercept-only model.

Table 7.13: Significant parameter estimates

Ref Grp: Pre-Decision No Interest (PDNI)	B	Sig	Exp(B)

Behavior Stage: Pre-Decision Unsure (PDUS)			
Fungibility (No)	2.058	0.081	7.830
Fungibility (Yes- Necessity)	.	.	.
Green Label Income 2 (Vacay/ Luxury/ New vehicle)	-3.942	0.015	0.019
Green Label Income 5 (Mixed response)	.	.	.
Default 0 (Yes)	-1.276	0.065	0.279
Default 1 (No)	.	.	.
PMV Allowance Savings 1 (<= 1000)	-2.160	0.083	0.115
PMV Allowance Savings 3 (> 2000)	.	.	.
Behavior Stage: Pre-Action (PRA)			
Monthly Disposable Cash 3 (10,001- 15,000)	-4.450	0.063	0.012
Monthly Disposable Cash 4 (> 15,000)	.	.	.
Diversified MA CRF 4 (Saving for future)	-1.956	0.077	0.141
Diversified MA CRF 5 (Mixed response)			
Green Label Earnings 1 (Necessity)	-1.801	0.037	0.165
Green Label Earnings 2 (Vacay/ Luxury/ New vehicle)	-3.051	0.007	0.047
Green Label Earnings 5 (Mixed response)	.	.	.
General Info MC 1 (Walk & public transport)	-15.851	0.000	1.306E-7
General Info MC 2 (Personal vehicle)	-14.649	0.000	4.345E-7
General Info MC 4 (Mixed response)	.	.	.
Behavior Stage: Action (A)			
General Info MC 1 (Walk & public transport)	-17.975	0.000	1.562E-8
General Info MC 2 (Personal vehicle)	-15.506	0.000	1.845E-7
General Info MC 4 (Mixed response)	.	.	.
PMV Allowance Savings 1 (<= 1000)	-3.242	0.021	0.039
PMV Allowance Savings 2 (1001 – 2000)	-3.813	0.008	0.022
PMV Allowance Savings 3 (> 2000)	.	.	.
Allocation of allowance savings 2 (Vacay/ Luxury/ New vehicle)	3.438	0.041	31.124
Allocation of allowance savings 4 (Future savings)	3.307	0.022	27.293

Allocation of allowance savings 5 (Mixed response)	.	.	.
Behavior Stage: Post-Action (POA)			
Windfall Earning 4 (Savings for future)	-6.504	0.062	0.001
Windfall Earning 5 (Mixed response)	.	.	.
General Info MC 1 (Walk & public transport)	-19.566	0.000	3.181E-9
General Info MC 2 (Personal vehicle)	-15.423	0.000	2.003E-7
General Info MC 4 (Mixed response)	.	.	.
PMV Allowance Savings 1 (<= 1000)	-6.461	0.059	0.002
PMV Allowance Savings 3 (> 2000)	.	.	.
Behavior Stage: No clear stage			
Gender 0 (Male)	-2.972	0.007	0.051
Gender 1 (Female)	.	.	.
General Info MC 1 (Walk & public transport)	-16.224	0.000	8.999E-8
General Info MC 2 (Personal vehicle)	-14.470	0.000	5.197E-7
General Info MC 4 (Mixed response)	.	.	.
PMV Allowance Savings 1 (<= 1000)	-3.193	0.085	0.041
PMV Allowance Savings 2 (1001 – 2000)	-4.349	0.021	0.013
PMV Allowance Savings 3 (> 2000)	.	.	.
Allocation of allowance savings 1 (Necessity)	3.864	0.036	47.660
Allocation of allowance savings 2 (Vacay/ Luxury/ New vehicle)	4.266	0.054	71.210
Allocation of allowance savings 4 (Saving for Future)	3.893	0.037	49.049
Allocation of allowance savings 5 (Mixed Response)	.	.	.

Pre-Decision Unsure (PDUS) over Pre-Decision No Interest (PDNI)

The odds of an individual satisfying the principle of fungibility being in the PDUS stage rather than the PDNI stage is 7.83 times higher than the odds for an individual who doesn't fulfill the fungibility principle for the sake of necessity items. The odds of an individual allocating green-labeled income towards indulgence being in the PDUS stage rather than in the PDNI stage is 0.019 times lower than the odds of an individual who have no clear preference regarding allocation of green-labeled income. The odds of an individual who agrees to the default option being in the PDUS stage rather than in the PDNI stage is 0.279 times lower than the odds of an individual who doesn't agree with the default option. The odds of an individual who saves less despite the print media visibility incentive being in the PDUS stage rather than the PDNI stage is 0.115 times lower than the odds of an individual who saves more due to the print media visibility incentive.

Pre-Action (PRA) over Pre-Decision No Interest (PDNI)

The odds of an individual who has moderately high monthly disposable cash being in the PRA stage rather than the PDNI stage is 0.012 times lower than the odds of an individual who has high monthly disposable cash. The odds of an individual who prefers to save out of the travel expenses after the diversification of mental accounts being in the PRA stage rather than the PDNI stage is 0.141 times lower than the odds of an individual who has no clear preference about the allocation of travel expenses after the diversification of mental accounts. The odds of an individual who allocates green-labeled income to necessity items being in the PRA stage rather than in the PDNI stage is 0.165 times lower than the odds of individuals who have no clear preference for the allocation of green-labeled income. The odds of individual who allocated green-labeled income towards indulgence being in the PRA stage rather than the PDNI stage is 0.047 times lower than the odds of individuals who have no clear preference for allocation of green-labeled income. General information is found to have a negligible impact on the odds of an individual belonging to the PRA stage of behavior rather than the PDNI stage.

Action (A) over Pre-Decision No Interest (PDNI)

Like in the Pre-Action (PRA) stage, in the Action (A) stage of behavior, general information was found to have a negligible impact on the stage of behavior. The odds of an individual (who makes less allowance savings even after the print media visibility incentive) being in the A stage rather than the PDNI stage is 0.039 times lower than the odds of any individual who makes the highest savings. The odds of an individual (who prefers to allocate the allowance savings towards indulgence) being in the A stage rather than the PDNI stage is 31.124 times higher than the odds of an individual who has no clear preference about the allocation of allowance savings. The odds of an individual (who prefers to save allowance savings for the future) being in the A stage rather than the PDNI stage is 27.293 times higher than the odds of an individual who has no clear preference about the allocation of allowance savings.

Post-Action (POA) over Pre-Decision No Interest (PDNI)

The odds of an individual (who chooses to save the windfall earnings for the future) being in the POA stage rather than the PDNI stage is 0.001 times lower than the odds of an individual who has no clear preference for the allocation of windfall earnings. General information has a very negligible influence on one's POA stage of behavior. The odds of an individual (who save less out of an allowance saving even after print media visibility incentives) being in the POA stage rather than in the PDNI stage is 0.002 times lower than the odds of an individual with no clear preference for allocation of allowance savings.

No clear stage of behavior over Pre-Decision No Interest (PDNI)

The odds of males having no clear stage of behavior rather than being in the PDNI stage is 0.051 times lower than the odds of females. General information has a very negligible effect on stage of behavior. The odds of an individual (who saves less out of allowance savings after print media visibility incentive) is 0.041 times lower than the odds of an individual who saves most out of an allocation allowance. The odds of an individual (who saves moderately out of an allowance savings after print media visibility incentive) to have no clear stage of behavior rather than being in PDNI is 0.013 times lower than the odds of an individual who saves most out of an allocation allowance. The odds of an individual (who allocates allowance savings towards necessity items) having no clear stage of behavior rather than being in the PDNI stage is 47.66 times higher than the odds of an individual who has mixed preferences for allocation of allowance savings. The odds of an individual (who allocates allowance savings towards indulgence) having no clear stage of behavior rather than being in the PDNI stage is 71.21 times higher than the odds of an individual who has mixed preferences for allocation of allowance savings. The odds of an individual (who prefers to save out of the allocation allowance) having no clear stage of behavior rather than being in the PDNI stage is 49.05 times higher than the odds of a individual who has mixed preferences for allocation of allowance savings.

7.4.3 Participant group C (intervention group)

Stated Choice = *f* (Gender, Place, Monthly Disposable Cash, Fungibility, Diversified Mental Account-Reference Point Classmate Anchor, Windfall Earning, Green Labelled Earning, Default, Mobility Habit, General Information, PMV Allowance Savings, Allocation of Allowance Savings)

Table 7.14: Case Processing Summary

Variables	**Categories**	**Marginal Percentage**
Behavior Stage	1 Pre-Decision No Interest (PDNI)	24.5%
	2 Pre-Decision Unsure (PDUS)	26.6%
	3 Pre-Action (PRA)	22.9%
	4 Action (A)	12.2%
	5 Post-Action (POA)	3.7%
	6 No clear stage of behavior	10.1%
Gender	0 (Male)	29.8%%
	1 (Female)	70.2%
Place	0 (Metropolitan)	26.1%
	1 (Non-metropolitan)	73.9%
Monthly Disposable Cash	1 (<= 5000)	80.3%
	2 (5001- 10,000)	16.0%
	3 (10,001- 15,000)	3.2%
	4 (> 15,000)	0.5%
Fungibility	1 (No)	61.2%
	2 (Yes- E&S)	26.6%
	3 (Yes- Necessity)	12.2%
Diversified MA ARF	1 (Public transport)	22.3%
	2 (Personal vehicle)	29.3%
	3 (Vacay /Luxury/ Cool gadgets)	13.3%
	4 (Saving for future)	19.1%
	5 (Mixed response)	16.0%
Windfall Earning	1 (Necessity)	27.1%
	2 (Vacay/ Luxury/ Own vehicle)	10.1%
	3 (E-vehicles/ Cool gadgets)	2.7%
	4 (Saving for future)	35.6%
	5 (Mixed response)	24.5%
Green Labelled Earning	1 (Necessity)	55.3%
	2 (Vacay/ Luxury/ New vehicle)	17.0%
	3 (E-vehicle/ Energy saving gadget)	10.1%
	4 (Cool gadgets)	3.2%
	5 (Mixed response)	14.4%
Default	0 (Yes)	66.0%

	1 (No)	34.0%
Mobility Habit	1 (Walk/ City bus)	45.2%
	2 (Pvt cab/ Own vehicle)	26.1%
	3 (E-vehicle)	27.1%
	4 (Mixed response)	1.6%
Mobility Habit Carbon Footprint Info	1 (Walk & public transport)	44.7%
	2 (Personal vehicle)	35.6%
	3 (E-vehicle)	19.1%
	4 (Mixed response)	0.5%
SMV Allowance savings	1 (<= 1000)	47.9%
	2 (1001 – 2000)	43.1%
	3 (> 2000)	9.0%
Allocation of Allowance Savings	1 (Necessity)	43.1%
	2 (Vacay/ Luxury/ New vehicle)	14.9%
	3 (E-vehicle)	3.2%
	4 (Future savings)	30.9%
	5 (Mixed response)	8.0%

The dependent variable, stage of behavior has 6 categories: 1 represents pre-decision no interest (PDNI), 2 represents pre-decision unsure (PDUS), 3 represents pre-action (PRA), 4 represents action (A), 5 represents post-action (POA), and 6 represents no clear stage of behavior. While 24.5% participants in the intervention group-B belong to pre-decision no interest (PDNI), 26.6% of participants belong to pre-decision unsure (PDUS), 22.9% belong to the pre-action (PRA) group, 12.2% of participants belong to the action (A) group, 3.7% belong to post-action (POA), and 10.1% does not display clear belongingness to any behavior stage. The first independent variable group includes basic participant information like gender, place, and monthly disposable cash. The second independent variable group includes behavioral interventions namely: mental accounting, reference point- distant affinity (an average person from the city), default option, carbon footprint information, and social recognition- social media visibility.

Table 7.15: Model Fitting Information

	Model Fitting Criteria	Likelihood Ratio Test

Model	AIC	BIC	-2 Log Likelihood	Chi-Square	df	Sig
Intercept Only	627.251	643.433	617.251			
Final	746.998	1281.011	416.998	200.253	160	0.017

The log-likelihood is an estimate of how much unexplained variation is there in the data. Therefore, the difference or the change in log-likelihood emphasizes the improvement in the final model over the intercept only model. Here, the likelihood ratio chi-square of 200.253 with a p-value of 0.017 indicates that the model used in the study as a whole fits significantly better than the intercept only model.

Table 7.16: Pseudo R-Square

Cox and Snell	0.655
Nagelkerke	0.681
McFadden	0.324

The pseudo R-square is roughly analogous to the R-squared value in OLS regression models, which indicates the proportion of variance explained by the multinomial logistic regression model. We see that Nagelkerke pseudo R-squared value of 0.681 indicates 68.1% association between stated choice of sustainable mobility and the other independent variables used in the model.

Table 7.17: Likelihood Ratio Test

Variable	AIC of Reduced Model	BIC of Reduced Model	-2 Log Likelihood of Reduced Model	Chi-Square	df	Sig.
Intercept	746.998	1281.011	416.998	0.000	0	.
Gender	740.588	1258.419	420.588	3.590	5	0.610
Place	740.286	1258.117	420.286	3.288	5	0.656
Monthly Disposable Cash	725.929	1211.395	425.929	8.931	15	0.881
Fungibility MA	732.304	1233.953	422.304	5.306	10	0.870
Diversified MA ARF	729.996	1199.280	439.996	22.998	20	0.289
Windfall Earning	736.796	1206.080	446.796	29.798	20	0.073
Green Labelled Earning	725.298	1194.582	435.298	18.300	20	0.568

Default	739.928	1257.759	419.928	2.930	5	0.711
Mobility Habit	729.549	1215.016	429.549	12.551	15	0.637
Mobility Habit CF Info	731.669	1217.135	431.669	14.671	15	0.475
SMV Allocation Savings	731.941	1233.590	421.941	4.944	10	0.895
Allocation of Allowance Savings	723.770	1193.054	433.770	16.772	20	0.895

As it can be seen from the likelihood ratio test table, windfall earning, is found to significantly improve the final model over the intercept only model.

Table 7.18: Significant parameter estimates

Ref Grp: Pre-Decision No Interest (PDNI)	B	Sig	Exp(B)
Behavior Stage: Pre-Decision Unsure (PDUS)			
Diversified MA ARF 1 (Public transport)	2.035	0.042	7.649
Diversified MA ARF 5 (Mixed response)	.	.	.
Behavior Stage: No clear stage			
Windfall Earning 4 (Future savings)	-1.985	0.079	0.137
Windfall Earning 5 (Mixed response)	.	.	.
Mobility Habit CF Info 2 (Personal vehicle)	-3.101	0.022	0.045
Mobility Habit CF Info 5 (Mixed response)	.	.	.

As can be seen in the table 7.18, the nudges used for intervention group C do not have much impact on people's behavior. The odds of an individual (who prefers to allocate much of the travel expenses into public transport after the diversification of mental accounts, with an average person from the city as a reference point) being in the PDUS stage rather than the PDNI stage is 7.649 times higher than the odds of an individual who has no clear preference for the allocation of travel expenses after the diversification of mental accounts, with an average person from the city as a reference point. The odds of an individual (who prefers to save windfall earnings for the future) having no clear stage of behavior rather than being in the PDNI stage is 0.137 times lower than the odds of an individual who has no clear preference for allocation of windfall earnings. The odds of an individual (who prefers to use personal vehicle after being provided carbon footprint information) having no clear stage of behavior rather than being in the PDNI stage is 0.045 time slower than the odds of an individual who has mixed mobility preferences.

7.4.4 Results Participant Group D (Intervention Group)

Stated Choice = *f* (Gender, Place, Monthly Disposable Cash, Fungibility, Diversified Mental Account, Windfall Earning, Green Labelled Earning, Mobility Habit, Allowance Savings, Allocation of Allowance Savings)

Table 7.19: Case Processing Summary

Variables	**Categories**	**Marginal Percentage**
Behavior Stage	1 Pre-Decision No Interest (PDNI)	27.7%
	2 Pre-Decision Unsure (PDUS)	19.0%
	3 Pre-Action (PRA)	20.7%
	4 Action (A)	12.0%
	5 Post-Action (POA)	5.4%
	6 No clear stage of behavior	15.2%
Gender	0 (Male)	31.0%
	1 (Female)	69.0%
Place	0 (Metropolitan)	27.7%
	1 (Non-metropolitan)	72.3%
Monthly Disposable Cash	1 (<= 5000)	75.0%
	2 (5001- 10,000)	16.8%
	3 (10,001- 15,000)	5.4%
	4 (> 15,000)	2.7%
Fungibility	1 (No)	59.8%
	2 (Yes- E&S)	28.8%
	3 (Yes- Necessity)	11.4%
Diversified MA MRF	1 (Public transport)	19.6%
	2 (Personal vehicle)	14.1%
	3 (Vacay /Luxury/ Cool gadgets)	26.1%
	4 (Saving for future)	29.3%
	5 (Mixed response)	10.9%

Windfall Earning	1 (Necessity)	32.1%
	2 (Vacay/ Luxury/ Own vehicle)	11.4%
	3 (E-vehicles/ Cool gadgets)	
	4 (Saving for future)	34.2%
	5 (Mixed response)	22.3%
Green Labelled Earning	1 (Necessity)	51.6%
	2 (Vacay/ Luxury/ New vehicle)	16.8%
	3 (E-vehicle/ Energy saving gadget)	10.3%
	4 (Cool gadgets)	1.6%
	5 (Mixed response)	19.6%
Framing	0 (B)	12.5%
	1 (A)	87.5%
Mobility Habit	1 (Walk/ City bus)	55.4%
	2 (Pvt cab/ Own vehicle)	21.7%
	3 (E-vehicle)	20.7%
	4 (Mixed response)	2.2%
Mobility Habit Visual Info	1 (Walk & public transport)	50.0%
	2 (Personal vehicle)	23.9%
	3 (E-vehicle)	24.5%
	4 (Mixed response)	1.6%
Higher Allowance savings	1 (<= 2000)	45.1%
	2 (2001 – 4000)	40.8%
	3 (> 4000)	14.1%
Allocation of Allowance Savings	1 (Necessity)	37.0%
	2 (Vacay/ Luxury/ New vehicle)	19.0%
	3 (E-vehicle)	3.8%
	4 (Future savings)	27.2%
	5 (Mixed response)	13.0%

The dependent variable, stage of behavior has 6 categories: 1 represents pre-decision no interest (PDNI), 2 represents pre-decision unsure (PDUS), 3 represents pre-action (PRA), 4 represents action (A), 5 represents post-action (POA), and 6 represents no clear stage of behavior. While 27.7% participants in the intervention group-B belong to pre-decision no interest (PDNI), 19.0% of participants belong to pre-decision unsure (PDUS), 20.7% belong to the pre-action (PRA) group, 12.0% of participants belong to the action (A) group, 5.4% belong to post-action

(POA), and 15.2% does not display clear belongingness to any behavior stage. The first independent variable group includes basic participant information like gender, place, and monthly disposable cash. The second independent variable group includes behavioral interventions namely: mental accounting, reference point- moderate affinity (a person from the neighborhood), framing, information based on visual information, and higher monetary allowances.

Table 7.20: Model Fitting Information

	Model Fitting Criteria			Likelihood Ratio Test		
Model	AIC	BIC	-2 Log Likelihood	Chi-Square	df	Sig
Intercept Only	632.672	648.747	622.672			
Final	740.051	1254.440	420.051	202.621	155	0.006

The log-likelihood is an estimate of how much unexplained variation is there in the data. Therefore, the difference or the change in log-likelihood emphasizes the improvement in the final model over the intercept only model. Here, the likelihood ratio chi-square of 202.621 with a p-value of 0.006 indicates that the model used in the study as a whole fits significantly better than the intercept only model.

Table 7.21: Pseudo R-Square

Cox and Snell	0.668
Nagelkerke	0.691
McFadden	0.325

The pseudo R-square is roughly analogous to the R-squared value in OLS regression models, which indicates the proportion of variance explained by the multinomial logistic regression model. We see that Nagelkerke pseudo R-squared value of 0.691 indicates 69.1% association between stated choice of sustainable mobility and the other independent variables used in the model.

Table 7.22: Likelihood Ratio Test

Variable	**AIC of Reduced Model**	**BIC of Reduced Model**	**-2 Log Likelihood of Reduced Model**	**Chi-Square**	**df**	**Sig.**

Intercept	740.051	1254.440	420.051	0.000	0	.
Gender	735.966	1234.281	425.966	5.915	5	0.315
Place	734.731	1233.046	424.731	4.681	5	0.456
Monthly Disposable Cash	730.986	1197.151	440.986	20.935	15	0.139
Fungibility	734.474	1216.714	434.474	14.423	10	0.155
Diversified MA MRF	739.112	1189.203	459.112	39.062	20	0.007
Windfall Earning	727.423	1189.203	459.112	39.062	20	0.007
Green Labelled Income	736.929	1187.020	456.929	36.878	20	0.012
Framing	735.662	1233.977	425.662	5.611	5	0.346
Mobility Habit	741.197	1207.363	451.197	31.147	15	0.008
Mobility Habit Visual Information	734.391	1200.557	444.391	24.341	15	0.060
Higher Allowance Savings	745.600	1227.840	445.600	25.549	10	0.004
Allocation Allowance Savings	727.840	1177.931	447.840	27.789	20	0.114

From the likelihood ratio test we see that diversified mental account with a person from the neighborhood as a reference, windfall earnings, gender, green labelled income, mobility habit, visual information, and higher allowance saving significantly improved the fitted model over the intercept only model.

Table 7.23: Significant parameter estimates

Ref Grp: Pre-Decision No Interest (PDNI)	**B**	**Sig**	**Exp(B)**
Behavior Stage: Pre-Decision Unsure (PDUS)			
Windfall Earnings 2 (Vacay/ Luxury/ Own vehicle)	2.039	0.054	7.679
Windfall Earnings 5 (Mixed response)	.	.	.
Higher allowance savings 1 (<= 2000)	-1.734	0.075	0.177
Higher allowance savings 3 (> 4000)	.	.	.
Behavior Stage: Pre-Action (PRA)			
Monthly Disposable Cash 1 (<= 5000)	3.777	0.033	43.695

Monthly Disposable Cash 4 (> 15,000)	.	.	.
Diversified MA MRF 4 (Saving for future)	-1.956	0.077	0.141
Diversified MA MRF 5 (Mixed response)			
Green Label Earnings 2 (Vacay/ Luxury/ New vehicle)	1.661	0.099	5.267
Green Label Earnings 5 (Mixed response)	.	.	.
Behavior Stage: Action (A)			
Gender 0 (Male)	1.586	0.057	4.884
Gender 1 (Female)	.	.	.
Fungibility 2 (Yes- Entertainment & Shopping)	4.088	0.061	59.595
Fungibility 3 (Yes- Necessity)	.	.	.
Diversified MA MRF 1 (Public transport)	3.550	0.042	34.818
Diversified MA MRF 5 (Mixed response)	.	.	.
Behavior Stage: Post-Action (POA)			
Diversified MA MRF 1 (Public transport)	-7.438	0.026	0.001
Diversified MA MRF 2 (Personal vehicle)	-8.169	0.022	0.000
Diversified MA MRF 3 (Vacay /Luxury/ Cool gadgets)	-7.305	0.059	0.001
Diversified MA MRF 4 (Saving for future)	-5.044	0.075	0.006
Diversified MA MRF 5 (Mixed response)	.	.	.
Mobility Habit Visual Info 2 (Personal vehicle)	-3.731	0.055	0.024
Mobility Habit Visual Info 4 (Mixed response)	.	.	.
Behavior Stage: No clear stage			
Diversified MA MRF 2 (Personal vehicle)	-2.718	0.044	0.066
Diversified MA MRF 5 (Mixed response)	.	.	.

Pre-Decision Unsure (PDUS) over Pre-Decision No Interest (PDNI)

The odds of an individual (who prefers to allocate windfall earnings towards indulgence) being in the PDUS stage rather than in the PDNI stage is 7.679 times higher than the odds of an individual who has mixed preferences regarding allocation of windfall earnings. The odds of an individual (who save less out of a higher monetary allowance) to be in the PDUS stage rather than the PDNI stage is 0.177 times lower than the odds of an individual who save a high amount from the higher monetary allowance.

Pre-Action (PRA) over Pre-Decision No Interest (PDNI)

The odds of an individual with low monthly disposable cash to be in the PDUS stage rather than in the PDNI stage is 43.69 times higher than the odds of an individual who has a very high monthly disposable cash. The odds of an individual (who prefers to save much of the travel expenses after the diversification of mental accounts with a person from the neighborhood as a reference point) to be in the PDUS stage rather than the PDNI stage is 0.141 times lower the odds of an individual who have a mixed preference about the allocation of travel expenses after the diversification of mental accounts. The odds of an individual (who prefers to allocate green-labeled earnings towards indulgence) being in the PDUS stage rather than in the PDNI stage is 5.267 times higher than the odds of an individual who has mixed preferences regarding the allocation of green-labeled earnings.

Action (A) stage over the Pre-Decision No Interest (PDNI)

The odds of males being in the A stage rather than the PDNI stage is 4.884 times higher than the odds of females. The odds of a person (breaking the fungibility principle for indulgence) being in the action stage rather than the PDNI stage is 59.59 times higher than the odds of a person who breaks the fungibility principle for necessity. The odds of an individual (who prefers to allocate much of the travel fund towards public transport after the diversification of mental accounts and a person from the neighborhood as a reference point) being in the POA stage rather than the PDNI stage is 0.001 times lower than the odds of an individual with no clear preference for allocation of travel expenses after diversification of mental accounts. A person who wishes to allocate much of travel expenses towards indulgence after diversification of mental accounts also has a similar impact on the stage of behavior. An individual who prefers to allocate much of travel expenses towards personal vehicles has a significant but negligible impact on the POA stage of behavior. An individual who prefers to save much of the travel expenses after the diversification of mental accounts to be in the POA stage rather than the PDNI stage is 0.006 times lower than the odds of an individual who has mixed preferences about the allocation of travel expenses after the diversification of mental accounts. The odds of an individual (who prefers to use personal vehicles after being exposed to visual information) being in the POA stage rather than the PDNI stage is 0.024 times lower than the odds of an individual who has mixed mobility habits.

No clear stage of behavior over the Pre-Decision No Interest (PDNI)

The odds of an individual (who prefers to allocate much of the travel expenses towards personal vehicles after diversification of mental accounts, and with a person from the neighborhood as a reference point) having no clear stage of behavior rather than being in the PDNI stage is 0.066 times lower than the odds of an individual who has no clear preference about the allocation of travel expenses after the diversification of mental accounts.

7.5 Discussion

This study finds that people indicate their affinity to different stages of behavior which are not necessarily a linear transition across the stages. On detailed examination of an individual's intention in the different stages in relation to their pro-environmental intention, it was found that people do not have much interest in EVs in the pre-decision stage of behavior. Subjective norm is found to exert the strongest influence on intentions followed by attitude. PBC has a minor role, partially mediated by attitude and subjective norms. For individuals who are in an unsure state regarding adoption of EVs, they are not found to be completely disinterested in the same. For individuals in this group, the effect of perceived behavioral control gains strength. Attitude and subjective norms continue to have the same influence. Environmental concerns emerge, mediated by subjective norms and awareness of environmental consequences begins to impact intentions negatively affected by response cost. In the pre-action stage, influence of attitude reduces while that of perceived behavioral control becomes stronger. Indirect pathways develop, with subjective norms mediating attitude and ascription of responsibility towards intention to adopt EVs.

The second research question examines the efficacy of nudges in different stages of behavior. People in different stages of behavior are found to display different collective behavior/ tendencies. Indulgence, saving habits, and non-compliance with 'fungibility within accounts' is found to play a crucial role. In the control group, people adhering to the fungibility principle for consumption of necessity items are more likely to transition to the unsure stage from the disinterested stage. While people who tend to save current expenses for future consumption of luxury/indulgent commodities are found to belong in the action stage. People displaying a cautious saving tendency, s.a., allocation of windfall earnings for future consumption hinder the progression to advanced stages of pro-environmental decision making. Individuals displaying a preference for public transportation after the diversification of mental accounts, are more likely to move to the pre-action stage. People with indulgence saving tendencies are also found to possess a strong affinity of belongingness in the post-action stage. Financial nudges are found to have little effect on one's affinity towards the advanced stages of pro-environmental decision making.

Chapter 8. Summary of Findings, Conclusion and Policy Recommendations

This chapter summarizes the findings and concludes the thesis. Subsequently, various policy recommendations have also been made based on the findings of the thesis. These policy recommendations can be of use to policy makers in the climate change and transportation sector, electric vehicle manufacturers and promoters like government, non-profit agencies, etc. We outlined the major findings of the study for each objective of the thesis. Therefore, we first, summarize the determinants of the intention to adopt EVs, followed by variations in intention pathways for the different demographic groups. This is followed by a summary of the efficacy of nudges in stated choice for sustainable mobility. Finally, we summarize how the findings vary in different stages of behavior formation process. This chapter then concludes the thesis by situating the findings in the context of the study. The thesis concludes by suggesting possible recommendations for policymakers.

8.1 Summary of Findings

- An analysis of the gain, norm, and fear & protection motivation indicates that subjective norms are the strongest determinant of intention for a middle-income individual in Assam. Two other direct determinants of intention are ascription of responsibility and perceived behavioral control. Herd behavior and personal norm being directly and fully mediated by subjective norm also becomes an indirect determinant of intention to adopt an EV.

- Assam is a collectivist society rather than an individualistic society. Hence, external validation of the society is very crucial as it unconsciously drives behavior. This is more so, when it comes to the middle-class group residing in towns or small cities. Though an individual would straightly deny as requiring society's input for his decisions, or imitating others' decisions, these parameters feed in unconsciously in an individual's decision-making process. This might be because of the social competition, or because of an individual's race to enhance his standing in the ladder of social status.

- Another inference from the results is that if an individual can be made to feel responsible or important agent in the change process, that might trigger their intention to adopt an EV as well. Often people feel they are too small an entity to cause any harm or bring any positive change in the society. People often fail to consider the macro view where everyone thinks similarly. No anxiety related to EV infrastructure in India in the future is found from the analysis. People are open to adapting the new technology, provided the governments' plan of laying down EV related facilities are realized according to the roadmap already laid out.

- An interesting observation is the inverse relationship with environmental concern and people's intention to adopt an EV. This might be because greater the environmental concern, more they are worried about the use of an EV given the present status of electricity generation in India. Since electricity is mostly generated from coal at the present time, hence use of an EV can bring about a positive environmental change only after the share of renewables is increased in the electricity generation mix, for which the government has set a target of 50% power from renewable sources by 2030.

- Males tend to prioritize social validation from their social circles, which shapes their positive attitudes toward EVs, whereas females focus more on ease of use and personal attitudes, which are less swayed by social opinions. While males are heavily influenced by how their peers view EV adoption, females balance subjective norms with personal moral beliefs, showing a stronger commitment to environmental concerns.

- Awareness campaigns about the environmental impact of traditional vehicles effectively motivate both genders, particularly benefiting females who are more attuned to ecological issues.

- Fear and protection motivations also reveal gender disparities. Males are significantly affected by perceived personal vulnerability to the harmful effects of conventional vehicles, while females respond more to general awareness of negative consequences. Coping appraisal indicates that females feel more empowered to use EVs and believe more strongly in their effectiveness at reducing emissions, showcasing an impactful gender dynamic in the transition to sustainable mobility.

- Younger and middle-aged individuals exhibit similar attitudes toward electric vehicle (EV) adoption, shaped by subjective norms and personal attitudes. Positive attitudes significantly enhance adoption likelihood, with younger individuals showing a stronger influence from their assessment of maneuvering EVs. This positive assessment has a notable impact on their adoption intentions, mediated by social impressions, while the middle-aged group does not experience a direct effect.

- Younger individuals are driven by environmental concerns, personal norms, and subjective norms, whereas middle-aged individuals primarily respond to subjective norms. Awareness of vehicular emissions alone does not significantly affect adoption intentions; however, when coupled with positive social impressions, it effectively mediates the intention to adopt EVs.

- Ascription of responsibility lacks a direct effect on adoption intentions but is triggered by strong social impressions, resulting in mediated intentions for both age groups. Younger individuals feel personal responsibility linked to their environmental concern and personal norms. Fear and protection motivations reveal that younger individuals respond more to their maneuvering assessments and environmental concerns, while middle-aged individuals are influenced by perceived vulnerability and response efficacy, highlighting the importance of tailored messaging for different age groups in promoting EV adoption.

- Attitudes towards EVs have a greater impact in non-metropolitan areas than in metropolitan ones. In metropolitan settings, positive social impressions enhance attitudes but with a lesser effect, while perceived behavioral control significantly influences intentions more in metropolitan areas than in non-metropolitan areas. both metropolitan and non-metropolitan groups demonstrate similar influences of subjective norms.

- Normative motivations reveal that environmental concern is more impactful in metropolitan areas, whereas in non-metropolitan areas, personal responsibility and social approval play a larger mediating role. Ascription of responsibility does not directly influence EV adoption intentions; however, in non-metropolitan areas, social impressions fully mediate AR. In metropolitan areas, AR is mediated by personal and subjective norms.

- Perceived vulnerability primarily triggers threat appraisal in metropolitan areas, while in non-metropolitan areas, both awareness of consequences and perceived vulnerability affect intention formation. Coping appraisal is influenced by response efficacy in metropolitan regions and by both response efficacy and perceived behavioral control in non-metropolitan areas.
- Women are more likely than men to purchase EV hatchbacks, and metropolitan residents show a higher propensity for adopting both EV hatchbacks and SUVs compared to non-metropolitan residents.
- Individuals without established mobility habits are more inclined to buy EVs, while those with set travel routines are less likely.
- Individuals who allocate income from green sources (e.g., renewable energy) to daily necessities or savings are more inclined to buy EVs, whereas those who invest in consumer goods with green earnings are less likely to do so.
- Exposure to general information about climate change issues increases the likelihood of sustainable commuting behavior and EV hatchback adoption. People who preferred to continue using personal cars after being exposed about climate change were also more likely to buy EVs.
- People with a tendency to save present travel funds for future use are found to be less likely to adopt EV SUV.
- People with prior EV use experience and those moderately influenced by media campaigns are more likely to adopt EV SUVs, suggesting prior experience and media exposure as significant adoption factors.
- Individuals who violate ‘fungibility within accounts’ principle of mental accounting for luxury/indulgence expenses are less likely to adopt EV hatchbacks, indicating that

financial flexibility does not strongly influence energy-saving behaviors like EV adoption. People who violate ‘fungibility within accounts’ for frivolous consumption like shopping and entertainments for necessary expenses are more likely to adopt EV SUVs.

- Compliance with ‘labeling mental accounts’ in the context of green income for specific purposes, such as buying energy-efficient products with sustainability labeled income positively affected EV hatchback purchases. Windfall incomes encouraged EV hatchback purchases.
- Financial nudge in terms of higher monetary allowance had minimal effect on stated choice for sustainable mobility.
- Attitude has a high influence in the earlier stages of behavior, while the effect of perceived behavioral control strengthens in the later stages of behavior. Subjective norms are found to consistently influence intention in all stages of behavior.
- People violating ‘fungibility within accounts’ principle for consumption of necessity items are more likely to transition to the unsure stage from the disinterested stage. While people who tend to save current expenses for future consumption of luxury/indulgent commodities are found to belong in the action stage. People displaying a cautious saving tendency, s.a., allocation of windfall earnings for future consumption hinder the progression to advanced stages of pro-environmental decision making.
- Individuals displaying a preference for public transportation after the diversification of mental accounts, are more likely to move to the pre-action stage.
- People with indulgence saving tendencies are also found to possess a strong affinity of belongingness in the post-action stage. Financial nudges are found to have little effect on one’s affinity towards the advanced stages of pro-environmental decision making.
- In the Action stage, individuals who allocate allowance savings toward indulgence are 31.124 times more likely to progress, while those who save for the future are 27.293 times more likely to act. This highlights that future-oriented and indulgence-focused financial behaviors can encourage EV adoption.

- At the Post-Action (POA) stage, conservative savings behaviors hinder further EV engagement. For example, individuals who save windfall earnings for the future are 0.001 times less likely to remain engaged with EVs, demonstrating that cautious financial behavior may prevent further commitment.

8.2 Conclusion

Several nations in the global south are transitioning into fast growing economies or have begun industrializing its economies. Transportation is not only a crucial engine of growth in such nations, but also an aspirational commodity for the newly emerging middle-class, whose incomes and populations are also fast increasing. India is a case in point. A huge proportion of these new middle-income group resides in the emerging cities and large towns across the country, where public transport network is almost non-existent; or atleast its growth is unable to keep up the rate of population growth. This leaves personal vehicle as the most preferred daily mobility option, with its demands ever rising. To convert this demand for personal vehicle, (mostly petrol/diesel vehicle at present) into demand for EVs, both state and central governments in India had launched EV promotion schemes and other subsidies and rebates; yet some states like Assam has still failed to catch up with the adoption of EVs.

This thesis undertakes a behavioral lens to identify lacunae/ potential areas from individual behavior standpoint, which can be utilized to promote EVs without having to provide subsidies which are also expensive and therefore difficult to sustain for the government. As hypothesized, the role of subjective norms is found to be the most powerful determinant of intention which consistently influences intention in all demographic groups as well. All other constructs of gain, norm and fear & protection motivation have different effect in demographic groups examined in this study. For instance, women's pro-environmental intentions for adoption of EV can be triggered by activating their personal norms, environmental concern, and perceived efficacy of the act of EV use. They are also more likely to adopt EVs if they develop a confidence with the use of the same. Men on the other hand are primarily driven by societal impressions and perceived personal vulnerability due to non-adoption of EV. Similarly, environmental concern and personal norms can steer women towards EV adoption, however, a middle aged individual is found to be highly swayed by other's opinion about EV adoption. On examination of nudges in people's stated choice for EVs, general information, print media visibility, and mental accounting principle- labeling mental account. Finally, this thesis examines the nuances of the different stages of pro-environmental behavior and highlights that behavioral does not progress linearly across the different stages. While favorable attitude towards EVs and need for climate action can trigger one to progress from disinterest to interest, i.e., in the initial stages of behavior; perceived behavioral control starts to have a higher influence on decisions in the later stages of behavior. Subjective norms again emerge as having a strong impact on decision in all stages of behavior transition. Such behavioral aspects need to be accounted for in designing EV promotion policies.

8.3 Policy Recommendations

So far, the technical findings of the study have been discussed. The question then arises, given these different pathways of intention formation for the adoption of an EV, how do policymakers make use of it? This sub-section lists out some possible suggestions that policy makers can use to promote the adoption of EVs.

- Position EVs as Status Symbols: Promote EVs as symbols of prestige and environmental responsibility. Marketing campaigns should highlight the high social standing and environmental leadership associated with owning an EV. Local governments can support this by publicly recognizing EV buyers at community levels (wards or municipalities) with awards or certificates of environmental contribution.

- Subsidies Targeted to Social Networks: Instead of random subsidies, offer financial incentives targeted at social circles. For example, if a person buys an EV, their close friends and relatives should receive targeted subsidies, creating a ripple effect. This strategy leverages the competitive and socially connected nature of individuals, encouraging more people to feel capable of purchasing EVs.

- Promote EVs as Acts of Social Responsibility: Position EV adoption as an essential step in fulfilling social and environmental responsibility. Campaigns should emphasize the noble act of reducing one's carbon footprint by choosing an EV, framing it as part of a decent and responsible lifestyle.

- Personalized Environmental Impact Messaging: Use targeted, personalized messaging to communicate the negative effects of traditional vehicle emissions on individual health. Rather than focusing on abstract global issues like climate change, messages should emphasize personal risks, such as the harm that toxic emissions pose to one's lungs and health.

- Counter Optimism Bias: Address optimism bias by highlighting the immediate personal health risks associated with vehicle emissions. For example, policy campaigns could include testimonials or case studies of individuals suffering from air pollution-related health problems to make the issue more relatable and urgent.

- Local Infrastructure Development: Governments must ensure that the infrastructure supporting EVs, such as charging stations, is readily available. Local-level infrastructure investments will increase response efficacy, making EV adoption more feasible and showing individuals that their actions can make a difference in reducing greenhouse gas emissions.

- Incorporate Fear-Based Messaging with Solutions: Pair fear-based messages (such as the personal harm caused by emissions) with actionable solutions like switching to EVs. For instance, messaging could focus on how current vehicle emissions contribute to poor air quality, causing future health threats, but adopting an EV can mitigate those risks. This connects perceived vulnerability to response efficacy, encouraging behavior change.

- Promote EV Adoption Among Women and Metropolitan Residents

Gender-Sensitive Campaigns: Since women show a higher likelihood of purchasing EV hatchbacks, develop gender-targeted marketing campaigns that emphasize the environmental benefits, cost savings, and practicality of EVs. Highlight features that appeal to women, such as family-friendliness and safety.

Urban Focus: Metropolitan areas show higher EV adoption rates, so policies should focus on improving EV infrastructure, such as charging stations and parking incentives, in cities. Collaborate with urban planners to prioritize EV-friendly infrastructure development in densely populated areas.

- Capitalize on Environmental Awareness

Tailored Information on Climate Change: Expand awareness campaigns on climate change that

specifically promote sustainable transportation options like EVs. Campaigns should target individuals who already adopt eco-friendly commuting methods, like walking or public transport, as they are more likely to adopt EVs when presented with environmental information.
Media Campaigns: Use print and digital media to target people with moderate awareness of climate change and sustainability. Media incentives, such as advertisements and editorials highlighting the benefits of EVs, can nudge people toward purchasing EV SUVs.

- Leverage Mental Accounting and Green Income Labeling

Green Income Labeling: Encourage individuals to label income from sustainable sources (e.g., renewable energy or sustainable investments) for purchasing energy-efficient products like EVs. Policymakers can promote financial literacy programs that emphasize the allocation of green income towards eco-friendly choices, such as purchasing EVs.
Fungibility in Financial Decision-Making: Promote the idea of financial fungibility, particularly in how people allocate money across different financial categories. Incentives or information campaigns can encourage people to transfer funds from luxury or non-essential categories (e.g., entertainment, shopping) to sustainable transportation options like EV purchases.

- Nudge People with Flexible Mobility Habits

Target Individuals with Flexible Habits: Individuals without fixed mobility habits are more open to adopting EVs. Policies should focus on providing flexible commuting solutions, like shared EV programs, that appeal to those without established travel patterns.
Promote Habit-Breaking Strategies: For those with strong, well-established commuting habits, incentivize small shifts in behavior, such as trying out an EV for a limited time through short-term rental programs or subsidies for car-sharing services, to break the inertia of traditional vehicle usage.

- Use Financial Incentives Creatively

Targeted Subsidies: Offer subsidies or tax credits based on specific financial behaviors. For example, individuals who allocate funds from entertainment or luxury expenses towards transportation should receive additional incentives to purchase EVs. Tailored subsidies, based on mental accounting tendencies, will have more impact than general incentives.
Windfall Income Allocation: Encourage individuals to save and allocate unexpected windfall income (e.g., bonuses, inheritances) for sustainable investments like EVs. Policies that provide

matching funds or bonuses when windfall income is used for EV purchases can help drive adoption.

- Enhance Mobility Options with Non-Monetary Incentives

Beyond Financial Incentives: The study indicates that financial incentives alone are not enough to drive widespread EV adoption. Therefore, non-monetary incentives like exclusive EV parking, access to carpool lanes, or community recognition for eco-friendly choices can motivate behavior change, especially for SUV buyers.

- Encourage Behavioral Interventions Based on Media Exposure

Moderate Media Campaigns: Since moderate media exposure correlates with higher likelihoods of EV adoption, governments should invest in sustained, rather than overwhelming, media campaigns that educate the public on the environmental and financial benefits of EVs. This gradual exposure helps reinforce sustainable habits over time.

- Sustainability-Oriented Financial Products

Green Investment Products: Encourage the creation of financial products that allow individuals to invest in sustainability-related funds, with potential incentives for EV buyers. For example, tax breaks for investments in green bonds or funds could be tied to EV purchase programs, thus linking green income to green consumption.

- Flexible and Sustainable Mobility Habits

Support for Sustainable Mobility Habits: Develop policies that encourage sustainable mobility habits, such as promoting public transportation and walking, which already correlate with a higher likelihood of adopting EV hatchbacks. This could include offering combined discounts for EV and public transport users.

By addressing the psychological, demographic, and financial factors highlighted in the study, these policy recommendations aim to create a multifaceted approach to accelerating EV adoption, making electric vehicles a more attractive, viable, and sustainable option for a broader range of consumers.

8.3.1 EV policies in Assam and recommendations for revision

The Government of India has announced several schemes to promote EVs in India. These schemes are announced at the Central level as well as State level. For instance, in Andhra Pradesh (a southern state in India), the Govt. has announced the reimbursement of registration fees and the road tax on the sale of EVs until 2024. In Delhi, the capital of the country, the state government has announced a purchase incentive upto a maximum of INR 1,50,000 to the 1st 1000 e-car buyers. Similarly, Meghalaya, a state in the north-eastern part of India has announced purchase subsidies upto a maximum of INR 1,50,000 for the 1st 3500 e-2 wheelers, and a maximum of INR 15,00000 to the 1st 30 purchasers of strong hybrid 4-wheelers in the state.

There are several loopholes in the government schemes and incentives that are discussed above. For instance, reimbursement policies serve no purpose in giving people the feeling of financial benefit, which is the very purpose of the government behind these schemes. People generally value a present financial gain worth more than a cashback to be received at an undefined future date. Also, the hassle of official paperwork required to claim reimbursement is more like a psychological demotivation to even try for such a reimbursement. Thirdly, the sum of registration fee and road tax is much lower than the upfront price of an electric car/bike. Hence a buyer would not care much about spending a few additional thousands when he/she is already spending lakhs on the vehicle. According to behavioral theories, people try to save more on purchases worth smaller amounts but tend to attempt to bargain less on expensive purchases.

Regarding the incentive policies on the purchase price for the 1st few buyers, this policy is also subject to a lot of behavioral bias. It is often not possible to keep track of how many people have already bought the vehicle under the incentive, and if he/she wishes to buy one, whether they would qualify to be in those ‘few buyers’ bracket.

Firstly, in buying a durable good like a personal vehicle, often people take some time to consider the different options available and the one that suits their needs; rather than race to be in the bracket of the 1st few buyers and qualify for the incentive, but later realize that the car doesn’t suit his/her needs. People want to buy the time rather than the subsidy.

Secondly, the timeline set for the purchase subsidy for the first few buyers is not a realistic timeline. Presently, the EV charging infrastructure has just begun to be installed or planned for, that too in the cities, leave alone the several thousands of big towns in India, where a huge chunk of the middle-income people lives. Hence, the timeline already eliminates the possibility to incentivize the middle-class people from the towns, and many cities where it is doubtful that in another 2-3 years, there will be a flawless presence of all EV-related infrastructure.

These are just a few of the purchase incentive schemes from just a few states. There are several other incentives designed to target EV makers and buyers at different stages of the EV purchase & use process, and several schemes for different states. Most of these are designed without considering the ground reality, the feasibility, and most importantly, without asking the question of whether the incentives are actually incentivizing people.

This study finds that financial nudges need not be the only motivator for people to buy an EV. Infact, 'cost' is not even found to be a direct determinant of intention in Assam, nor it is an important mediator. This is a surprising finding for a cost-sensitive market like India. It is intriguing to analyze deeply the mechanisms of intention formation in an individual's mind, and especially to learn how other soft factors like norms, fear, etc., overpower considerations like cost. Hence designing incentives require a systematic and exclusive way to trigger different motivators like gain motivator, norm motivator, and fear & protection motivator.

The EV promotion policies in Assam that are designed based on the above discussed flaws need an urgent revision. With an optimistic view of scaling up of EV infrastructure in Assam and other states, adoption needs to be encouraged. In reformulating the EV promotion policies, special focus needs to be paid on using behavioral drivers of pro-environmental intention rather than designing policies based primarily on subsidies and tax rebates.

8.4 Limitations and Directions for Further Research

This thesis investigated a contemporary issue of climate change from an individual behavioral perspective. Several novelties have been attempted to be introduced in this thesis. Nevertheless, there are a few limitations in this thesis, which can be addressed in future studies.

The target sample in this thesis is middle-income individuals, between the ages of 18 – 60 years. However, in the stated preference survey, the sample consisted of only students between the ages of 18-25 years. This is partly because of difficulty of access to sample in the higher age groups. Another important reason which limited the experiment only with students is that the vignette experimental storyline could not be designed considering the contextual characteristics of both these groups. Designing separate vignette storylines for students and office staff members would have introduced considerable heterogeneity in the survey. Another limitation stems from the logistical arrangement of the data collection rounds. As objective 1B was decided to be additionally introduced to increase the insights from the study at a later stage, therefore, additional survey consisting of the intention questionnaire (used in 1st phase of survey) had to be introduced in the 2nd phase of data collection as well along with the stated preference survey.

This study opens several directions for further study. The determinants of intention to develop the EV ecosystem can also be explored from the supply chain perspective. After data on EV purchases is available, it will be interesting to examine the intention action gap in sustainable mobility behavior like adoption of EVs. Emerging topics like use of co-creation processes in fostering sustainable mobility eco-system is another direction that this thesis can be extended to in the future.

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Appendix A

Questionnaire Phase 1

This survey is a part of my Ph.D. thesis. Please read the questions carefully. There are no correct or wrong responses. We are only interested in your personal opinion. The responses will remain completely anonymous and will be used for academic purpose only. Thank you for your participation in the survey.

Gender: M……. F………

Age: 18-25 …… 25-35…… 35-45 …… 45-60 ……

Education Level:

School level …… Higher Secondary……. Graduation …… Post-Graduation & Above ……

Annual Household Income:

< 2,50,000 …… 2,50,001-500000 ……. 50,0001-7,50,000 …… 7,50,001- 10,00000…..

10,00001-12,50,000 ……. 12,50,001-15,00,000 ….. > 1500000 …..

Name of Hometown: ………………….. **State** ………………………..

Motor Vehicles You Drive/Ride: Cars …. Bike/Scooter …. Both ….. Neither ….

No. of Vehicles in Household: None …… One …… Two or more ……

Average Daily Distance Travelled:

<10 km ….. 10-20 km ….. 20-50 km ….. 50-100 km ….. >100 km …..

Please tick (√) the box that apply to you against each statement

		Strongly Agree	Agree	More or Less Agree	Undecided	More or Less Disagree	Disagree	Strongly Disagree
AC1	The use of conventional fuel vehicles leads to increase in emissions into the environment							
AC2	Increasing emissions contribute to the climate change crisis							

AC3	Increased use of petrol/diesel vehicles is contributing to the lower air quality of my surroundings							
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							
AT1	My adoption of electric vehicle (EV) in the future will result in stopping further damage to the environment							
AT2	Being able to stop further damage to the air quality and climate at large is good							
AT3	I think adopting EV to reduce vehicular emission is a smart measure							
AT4	It feels satisfying for me to adopt EV and reducing vehicular emissions on my part							

EVC 1	I am extremely worried about the state of drastically changing climate and what it means for my future							
EVC 2	Increased carbon intensive consumption leads to extreme climatic events							
PN1	I have the obligation to reduce my emissions from using petrol/diesel vehicles							
PN2	Adopting EV and reducing 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							
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							
HB1	The use of social media platforms will help me to gain							

	visibility regarding my adoption of EV							
HB2	My adoption of EV will help me get appreciation in my social circles							
HB3	Members in my social circle have already adopted EV. It might be better for me to adopt one too							
HB4	It might feel out of trend not to buy an EV when it is available in the market							
CO1	The price of EV will determine my intention to buy EV							
CO2	The price of EV will determine if I am capable to buy an EV or not							
CO3	Incentives like subsidies, low-interest loans, lower toll tax, and parking facilities will facilitate me to purchase EV							
PBC 1	It will not take me too much time to figure out the technicalities of using an EV							
PBC 2	If I am willing, I have the confidence to drive an EV							
PBC 3	Whether or not to drive an EV is completely upto me							
PBC 4	It will not take me long to find charging stations near me to charge my EV							

PR1	Extreme weather events will increase to a large extent due to increase in emissions							
PR2	EVs might be difficult to adopt due to infrastructural issues							
PR3	EVs might be difficult to adopt due to service-related issues							
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							
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							
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								
INT 1	I would like to adopt EV in the future								
INT 2	I plan to make an effort to learn more about using an EV and its benefits								
INT 3	I intend to buy an electric bike/car at some point in time								

Under what conditions will you want to adopt EV in the future?

………

Under what conditions will you not want to adopt EV in the future?

………

What is the correct spelling of 'CLIMATE' when spelled backward?

Circle the correct option:

ETAMLIC ETMAILC ETAMILC TEAMILC EMTAILC

Appendix B.

Questionnaire Phase 2

Please tick (√) the box to express how much you agree with the given statements

		Strongly Agree	Agree	More orLess Agree	Undecided	More or Less Disagree	Disagree	Strongly Disagree
AC1	The use of conventional fuel vehicles leadsto 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 iscontributing to the lower air quality of my surroundings							
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							
AT1	My adoption of electric vehicle (EV) in the future will result in stopping further damage to the environment							

AT2	Being able to stop further damage to the air quality and climate at large is good							
AT3	I think adopting EV to reduce vehicular emission is a smart measure							
AT4	It feels satisfying for me to adopt EV and reducing vehicular emissions on my part							
EVC 1	I am extremely worried about the state of drastically changing climate and what it means for my future							
EVC 2	Increased carbon intensive consumption leads to extreme climatic events							
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							
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								
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								
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								
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									
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									
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									
INT1	I would like to adopt EV in the future									
INT2	I plan to make an effort to learn more about using an EV and its benefits									
INT3	I intend to buy an electric bike/car at some point in time									

What is the correct spelling of 'CLIMATE' when spelled backward?

Circle the correct option:

ETAMLIC ETMAILC ETAMILC TEAMILC EMTAILC

Appendix C

Questionnaire: Stated Choice Survey Group A (No Intervention Group)

This is a fun game in the broader domain of people's preferences. We will take you on a 7-month journey of managing your pocket money, and being a more responsible version of yourself.

Please read the game rules carefully and indicate your choice.

There is no correct or wrong answer. It is completely a matter of your choice.

Your responses will remain completely anonymous.

|

1

Just for an introduction…

Circle the one that applies to you

1) I am a

2) The place where I live looks like this

2

1st Month- January 2023

It's New Year!!

Time for some resolution… ☺

From now, I will manage my pocket money in a better & more responsible way!

You arranged some magical '*Saving Jars*'. These 'saving jars' will help you to manage your pocket money better! All you have to do is name the jars according to different expense categories, like 'food jar', 'travel jar', 'internet & mobile jar', 'books & study materials jar', and so on…

From the saving jars, you take out money only from that jar when you have to buy something from that group.

Example, if you want to buy new cloths, you can take out money from 'shopping jar'

If you want to travel to Shillong for weekend! You take out money only from 'vacation jar'! And so on…

But ultimately it is your money, your wish! ☺ ☺

Fill in the blanks-

My total monthly pocket money/stipend is Rs. ……………….

3

Activity:

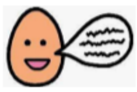
You have the following saving jars

Food, Travel, Education, Housing, Entertainment/Shopping

From your total pocket money, indicate how much money you want to put in each jar every month.

Savings Jars	Amount to be Saved in Jars
Food Jar	
Travel Jar	
Education Jar	
Housing Jar	
Shopping/Entertainment	

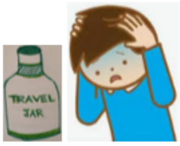
I want to say something which is not provided in the above options



…………………………………………………………

Now the month end is approaching and you are in a bit of a tight situation. You are running out of money in your 'travel jar'.

4



Would you like to transfer some money from any other jar to the 'travel jar' to avoid the shortage?

- ○ Yes, I want to transfer money to overcome the shortage
- ○ No, I will manage somehow

If yes, then from which saving jar would you want to transfer some money to the 'travel jar'? ....

Would you like to add *'the reason for your above choice'* here?

2nd Month- February 2023

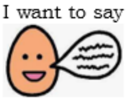
Now suppose you decided to further categorize your travel jar into the following: public transport travel jar, ola/uber travel jar, fuel expense jar, vacation travel jar, monthly saving to buy a personal vehicle in the future.

Activity

How much percentage of money would you allocate in each of these sub-jars now from the initially allocated money in the travel jar?

Travel Sub-Jars	Amount to be saved in sub-jars (%)
City Bus	
Fuel Expense	
Ola/Uber/Rapido	
Vacation	
Buy personal vehicle in the future	

I want to say something not provided in the above options



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3rd Month- March 2023

It's the beginning of the month. You got a very sweet surprise! ☺ ☺ You won the lottery amount of 1 lakh rupees, that you applied for in December last year!!

In which saving jar will you allocate this money?

- ○ Allocate this money to the monthly 'food jar'
- ○ Allocate this money to the monthly 'education jar'
- ○ Allocate this money to the 'housing jar'
- ○ Go on a vacation
- ○ Buying a new car/scooter
- ○ Buying an electric car/scooter
- ○ Indulge in some luxury which otherwise is difficult to afford with pocket money (expensive restaurants/expensive goods)
- ○ Buy some cool electronic gadgets
- ○ Save for the future/invest in mutual funds, etc

Where would you like to use this saving in future? ....

QUESTION CONTINUE IN THE NEXT PAGE....

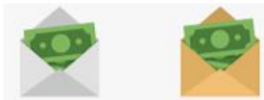
Please add *'the reason for your above choice'* here?

4th Month- April 2023

☞ Suppose you get a 'green cheque' of Rs 1 lakh from the state government to buy a 2-wheeler because of your good performance in the previous exam.

☞ Since it is a green cheque, it is suggested (but not mandatory) to buy an *electric 2-wheeler*

☞ You may also use this amount to buy other things (no one will ask where you have spent the money)



So you will

- ○ Allocate this money to the monthly 'food jar'

MORE OPTIONS IN NEXT PAGE ...

- ○ Save for your education
- ○ Save for buying a house
- ○ Go on a vacation
- ○ Buying a new car/scooter
- ○ Buying an electric car/scooter
- ○ Indulge in some luxury which otherwise is difficult to afford with pocket money (expensive restaurants/expensive goods)
- ○ Buy some cool electronic gadgets
- ○ Buy some energy-saving gadgets

Would you like to add *'the reason for your above choice'* here?

Activity

Circle the one which is not a vegetable out of the following:

Cauliflower, Chicken, Capsicum, Brinjal, Brocolli

5th Month- May 2023

Now that probably you have got the new vehicle, how would you prefer to go to your college/university from your home?

Circle your choice

Let me tell you why I choose the above option

....

6th Month- June 2023

This month, on the occasion of World Environment Day (5th June), the state government announced an attractive scheme. The students in the city are fed up with the rising prices, especially the price of fuel.

To provide some relief, the government will provide a ***pocket money card (Junio card)*** of Rs.2500 per month linked with google pay account, to all students to spend on personal vehicle fuel expenses only. When you buy petrol/diesel, then automatically the bill gets updated in this card record, since it is linked with google pay.

The top 50 students who can make the maximum savings in the Junio card by buying less fuel gets tagged as '***Sustainable User***'.

To recognize their efforts, their card amount gets increased by Rs.500 next month (that is, it becomes Rs. 3000). The top 50 '***Sustainable Users***' of this month again get an increment of Rs. 500 next month (that is, their Junio card gets loaded with Rs. 3500)...this continues for 6 months.

Finally, the first 50 savers of Rs. 10,000, get that amount as a cash prize!! This cash prize can be spent any way you like!

Activity

You can not take out the Junio card savings before you become the first 50 savers of Rs.10,000 on the card. Or if you think you can never make it to the top 50, you may spend all the money on fuel only.

You also have no idea of how much others plan to save. Based on your assumptions about others' decisions, you have to plan your Junio card savings.

Fill up the blanks:

I plan to save Rs........... out of Rs. 2500 in the first month on the Junio card.

What will you do?

If you are able to be the first 50 savers of Rs. 10,000, in which jar would you allocate this money? '✓' your choice.

- ○ Allocate this money to the monthly Food jar,
- ○ Allocate this money to the monthly Education jar
- ○ Allocate this money to the Housing jar
- ○ Go on a Vacation
- ○ Buying a new car/scooter
- ○ Buying an electric car/scooter
- ○ Indulge in luxury which otherwise is difficult to afford with pocket money (expensive restaurants/expensive goods)
- ○ Buy some cool electronic gadgets
- ○ Save for the future/mutual funds, etc

Where would you like to use this saving in the future? ....

Add *'the reason for your above choice'* here in the box?

7th Month- July

Now that over the last 6 months, you are giving some thought to managing your expenses more responsibly, and saving wherever possible, your parents are very happy with you and they have finally decided to buy a new car for your family as a reward.

Activity

Suppose you go to a Tata car showroom. You see the following cars: Tata Tiago, Tata Nexon. Both the petrol and electric versions are available.

Though the upfront price of the electric version may be higher, however, over the years the monthly maintenance cost of the electric version is lower as compared to the petrol car.

Also, the cost of petrol is increasing every day, while for electric vehicles, there is hope for lower electricity costs as renewable sources of electricity may increase in the future.

Assume that the EV charging facilities are present in the designated parking areas in your city, and also at regular intervals in your state highway.

What will you do?

Which one would you pick for your family? (Circle your choice)

Tata Tiago

Tata Tiago EV

Tata Nexon

Tata Nexon EV

Add *'the reason for your above choice'* here in the box?

Finally, let's wrap up this game! One last task

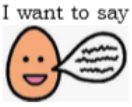
Below are some statements. ***Please mark (in %) against any three of these statements*** *based on how much you relate to them.*

EXAMPLE: The statement that I relate to most is A, followed by C, and then D. So I give approximately 40% against A, 35% against C and 25% against D.

The percentage values can be any % value according to you, based on how much you relate to the statement

	Statements	% of how much you relate to
A	I am happy with the car/2-wheeler owned by my family and do not see any reason to replace it with electric car/electric 2-wheeler	
B	At the moment I am unsure if we should buy an electric car/electric 2-wheeler	
C	I want that my family should own an electric car/electric 2-wheeler but I am not sure which model/type/brand	
D	I know that we will buy an electric car/electric 2-wheeler in our family, but we have not ordered yet	
E	We have bought/placed an order for electric car/electric 2-wheeler in our family	

I want to say something not provided in the above options



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Stated Choice Survey: Type B (Intervention Group)

This is a fun game in the broader domain of people's preferences. We will take you on a 7-month journey of managing your pocket money, and being a more responsible version of yourself.

Please read the game rules carefully and indicate your choice.

There is no correct or wrong answer. It is completely a matter of your choice.

Your responses will remain completely anonymous.

1

Just for an introduction…

Circle the one that applies to you

1) I am a

2) The place where I live looks like this

2

1st Month- January 2023

It's New Year!!

Time for some resolution… ☺

From now, I will manage my pocket money in a better & more responsible way!

You arranged some magical '*Saving Jars*'. These 'saving jars' will help you to manage your pocket money better! All you have to do is name the jars according to different expense categories, like 'food jar', 'travel jar', 'internet & mobile jar', 'books & study materials jar', and so on…

From the saving jars, you take out money only from that jar when you have to buy something from that group.

Example, if you want to buy new cloths, you can take out money from 'shopping jar'

If you want to travel to Shillong for weekend! You take out money only from 'vacation jar'! And so on…

But ultimately it is your money, your wish! ☺☺

Fill in the blanks-

My total monthly pocket money/stipend is Rs. ……………….

3

Activity:

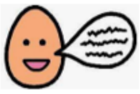
You have the following saving jars

Food, Travel, Education, Housing, Entertainment/Shopping

From your total pocket money, indicate how much money you want to put in each jar every month.

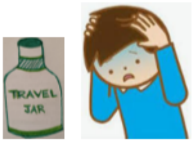
Savings Jars	Amount to be Saved in Jars (Rs)
Food Jar	
Travel Jar	
Education Jar	
Housing Jar	
Shopping/Entertainment	

I want to say something which is not provided in the above options

 ………………………………………………………………

Now the month end is approaching and you are in a bit of a tight situation. You are running out of money in your 'travel jar'.

4



Would you like to transfer some money from any other jar to the 'travel jar' to avoid the shortage?

- ○ Yes, I want to transfer money to overcome the shortage
- ○ No, I will manage somehow

If yes, then from which saving jar would you want to transfer some money to the 'travel jar'? ....

Please add *'the reason for your above choice'* in the box below.

2nd Month- February 2023

Now suppose you decided to further categorize your travel jar into the following: public transport travel jar, ola/uber travel jar, fuel expense jar, vacation travel jar, monthly saving to buy a personal vehicle in the future.

Activity

How much percentage of money would you allocate in each of these sub-jars now from the initially allocated money in the travel jar?

One of your classmate allocated the following:

Public transport travel jar: 20%
Ola/Uber/Rapido travel jar: 10%
Vacation travel jar: 30%
Fuel expense jar: 20%
Monthly saving to buy personal vehicle: 20%

Indicate your allocation into these sub-jars

Travel Sub-Jars	Amount to be saved in sub-jars (%)
City Bus	
Fuel Expense	
Ola/Uber/Rapido	
Vacation	
Buy personal vehicle in the future	

QUESTION CONTINUES IN NEXT PAGE ....

I want to say something not provided in the above options

....

3rd Month- March 2023

It's the beginning of the month. You got a very sweet surprise! ☺ ☺ You won the lottery amount of 1 lakh rupees, that you applied for in December last year!!

In which saving jar will you allocate this money that you won from lottery?

- ○ Allocate this money to the monthly 'food jar',
- ○ Allocate this money to the monthly 'education jar'
- ○ Allocate this money to the 'housing jar'
- ○ Go on a vacation
- ○ Buy a new car/scooter
- ○ Buy an electric car/scooter
- ○ Indulge in some luxury which otherwise is difficult to affors with pocket money (expensive restauants/expensive goods)
- ○ Buy some cool electronic gadgets
- ○ Save for the future/invest in mutual fund, etc.

QUESTION CONTINUES IN NEXT PAGE…

Where would you like to use this saving in future? ....

Please add *'the reason for your above choice'* in the box below.

4th Month- April 2023

☞ Suppose you get a 'green cheque' of Rs 1 lakh from the state government to buy a 2-wheeler because of your good performance in the previous exam.

☞ Since it is a green cheque, it is suggested (but not mandatory) to buy an electric 2-wheeler

☞ You may also use this amount to buy other things (no one will ask where you have spent the money)

So you will

- Allocate this money to the monthly 'food jar'
- Save for your education
- Save for buying a house
- Go on a vacation
- Buy a new car/scooter
- Buy electric car/scooter
- Indulge in some luxury which otherwise is difficult to afford with pocket money (expensive restaurants/expensive goods)
- Buy some cool electronic gadgets
- Buy some energy saving gadgets

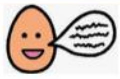
Please add *'the reason for your above choice'* in the box below..

Activity

Suppose the Government automatically provides an electric bike/scooty to all students unless you specifically want to opt out.

- *I agree with government's prize.*
- *I want to opt out. I need some thing else with this money. Specify ....*

Let me tell you why I chose the above option

 ....

Activity

Circle the one which is not a vegetable out of the following:

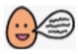
Cauliflower, Chicken, Capsicum, Brinjal, Brocolli

5th Month- May

Now that probably you have got the new vehicle, how would you prefer to go to your college/university from your home?

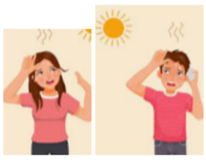
Circle your choice

Let me tell you why I chose the above option

 ....

Activity

It's mid-may now, and getting extremely hot & humid!



The temperature and pollution is increasing tremendously in your city. The temperature has increased by around 5-6 degrees as compared how the temperature in May used to be about 5 years back. It is being said reducing the use of vehicles or atleast using cleaner vehicles like electric vehicles can help reduce emissions. This will bring down both the number of hot days as well as the temperature sufficiently. Reducing the carbon emsiions can also strop the ill effects of climate change like glacier melts in the polar regions, decreased agricultural productivity, erratic monsoons, and extreme climatic events.

What will you do?

It's your friend's birthday party! The venue is a lovely café in the city which is at a distance of around 2-3 kilometers from where you stay.

Choose how you want to reach the venue! Circle your choice:

OPTIONS ARE IN NEXT PAGE....

Let me tell you why I chose the above option

 ....

6th Month- June 2023

This month, on the occasion of the World Environment Day (5th June), the state government announced an attractive scheme. The students in the city are fed up with the rising prices, especially the price of fuel.

To provide some relief, the government will provide a ***pocket money card (Junio card)*** of Rs.2500 per month linked with google pay account, to all students to spend on personal vehicle fuel expenses only. When you buy petrol/diesel, then automatically the bill gets updated in this card record, since it is linked with google pay.

The first 50 students who can make the maximum savings in the Junio card by buying less fuel gets tagged as ***'Sustainable User'***.

To recognize their efforts, their card amount gets increased by Rs.500 next month (that is, it becomes Rs. 3000). The first 50 ***'Sustainable Users'*** of this month again get an increment of Rs. 500 next month (that is, their Junio card gets loaded with Rs. 3500)…this continues for 6 months.

Finally, the first 50 savers of Rs. 10,000, get that amount as a cash prize!! This cash prize can be spent any way you like!

In addition, the first 50 savers of Rs. 10,000 also become the final ***'SUSTAINABLE CHAMPIONS' OF THE STATE***!!

They get featured in newspapers and city hoardings for their sustainability effort!

Activity

☞ You can not take out the Junio card savings before you become the first 50 savers of Rs.10,000 on the card. Or if you think you can never make it to the first 50 savers, you may spend all the money on fuel only.

☞ You have no idea of how much others plan to save. Based on your assumptions about others decisions, you have to plan your Junio card savings.

Fill up the blanks:

I plan to save Rs………… out of Rs. 2500 in the first month in the Junio card.

What will you do?

If you are able to be the first 50 savers of Rs. 10,000, in which jar would you allocate this money? '✓' your choice.

- O Allocate this money to the monthly Food jar,
- O Allocate this money to the monthly Education jar
- O Allocate this money to the Housing jar
- O Go on a Vacation
- O Buy a new car/scooter
- O Buy an electric car/scooter
- O Indulge in some luxury which otherwise is difficult to afford with pocket money (expensive restaurants/expensive goods)
- O Buy some cool electronic gadgets
- O Save for the future/invest in mutual funds, etc.

Where would you like to use this saving in the future?
………………………………

Please add *'the reason for your above choice'* in the box below:

7th Month- July

Now that over the last 6 months you are giving some thought to manage your expenses more responsibly, so your parents are very happy with you and they have finally decided to buy a new car for your family as a reward.

Activity

Suppose you go to a Tata car showroom. You see the following cars: Tata Tiago, Tata Nexon. Both the petrol and electric versions are available.

☞ Though the upfront price of the electric version may be higher, however, over the years the monthly maintenance cost of the electric version is lower as compared to the petrol car.

☞ Also, the cost of petrol is increasing every day, while for electric vehicles, there is hope for lower electricity costs as renewable sources of electricity may increase in the future.

☞ Assume that the EV charging facilities are present in the designated parking areas in your city, and also at regular intervals in your state highway

Choosing an EV will make you an example for advocating the cause of mitigating climate change. Your family gets the "Responsible Family" tag from the district authority on buying an electric car. One of your neighbors already got the tag!

What will you do?

Which one would you pick for your family? (Circle your choice)

Tata Tiago

Tata Tiago EV

Tata Nexon

Tata Nexon EV

Add *'the reason for your above choice'* here in the box?

Finally, let's wrap up this game! One last task

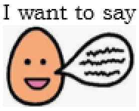
Below are some statements. ***Please mark (in %) against any three of these statements*** *based on how much you relate to them.*

EXAMPLE: The statement that I relate to most is A, followed by C, and then D. So I give approximately 40% against A, 35% against C and 25% against D.

The percentage values can be any % value according to you based on how much you relate to the statement

	Statements	**% of how much you relate to**
A	I am happy with the car/2-wheeler owned by my family and do not see any reason to replace it with electric car/electric 2-wheeler	
B	At the moment I am unsure if we should buy an electric car/electric 2-wheeler	
C	I want that my family should own an electric car/electric 2-wheeler but I am not sure which model/type/brand	
D	I know that we will buy an electric car/electric 2-wheeler in our family, but we have not ordered yet	
E	We have bought/placed an order for electric car/electric 2-wheeler in our family	

I want to say something not provided in the above options



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Stated Choice Survey: Type C (Intervention Group)

This is a fun game in the broader domain of people's preferences. We will take you on a 7-month journey of managing your pocket money, and being a more responsible version of yourself.

Please read the game rules carefully and indicate your choice.

There is no correct or wrong answer. It is completely a matter of your choice.

Your responses will remain completely anonymous.

Just for an introduction…

Circle the one that applies to you

1) I am a

2) The place where I live looks like this

1st Month- January 2023

It's New Year!!

Time for some resolution… ☺

From now, I will manage my pocket money in a better & more responsible way!

You arranged some magical '*Saving Jars*'. These 'saving jars' will help you to manage your pocket money better! All you have to do is name the jars according to different expense categories, like 'food jar', 'travel jar', 'internet & mobile jar', 'books & study materials jar', and so on…

From the saving jars, you take out money only from that jar when you have to buy something from that group.

Example, if you want to buy new cloths, you can take out money from 'shopping jar'

If you want to travel to Shillong for weekend! You take out money only from 'vacation jar'! And so on…

But ultimately it is your money, your wish! 😊 😊

Fill in the blanks-

My total monthly pocket money/stipend is Rs. ………………

Activity:

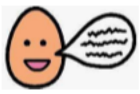
You have the following saving jars

Food, Travel, Education, Housing, Entertainment/Shopping

From your total pocket money, indicate how much money you want to put in each jar every month.

Savings Jars	Amount to be Saved in Jars
Food Jar	
Travel Jar	
Education Jar	
Housing Jar	
Shopping/Entertainment	

I want to say something which is not provided in the above options



……………………………………………………………

Now the month end is approaching and you are in a bit of a tight situation. You are running out of money in your 'travel jar'.

Would you like to transfer some money from any other jar to the 'travel jar' to avoid the shortage?

- ○ Yes, I want to transfer money to overcome the shortage
- ○ No, I will manage somehow

If yes, then from which saving jar would you want to transfer some money to the 'travel jar'? ....

Please add *'the reason for your above choice'* in the box below.

2nd Month- February 2023

Now suppose you decided to further categorize your travel jar into the following: public transport travel jar, ola/uber travel jar, fuel expense jar, vacation travel jar, monthly saving to buy a personal vehicle in the future.

Activity

How much percentage of money would you allocate in each of these sub-jars now from the initially allocated money in the travel jar?

*An **average person from Guwahati** is seen to allocate the initial travel fund as follows:*

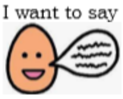
Public transport travel jar: 10%
Ola/Uber/Rapido travel jar: 30%
Vacation travel jar: 30%
Fuel expense jar: 25%
Monthly saving to buy personal vehicle: 5%

Indicate your allocation into these sub-jars

Travel Sub-Jars	Amount to be saved in sub-jars (%)
City Bus	
Fuel Expense	
Ola/Uber/Rapido	
Vacation	
Buy personal vehicle in the future	

QUESTION CONTINUES IN NEXT PAGE ....

I want to say something not provided in the above options



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3rd Month- March 2023

It's the beginning of the month. You got a very sweet surprise! ☺ ☺ You won the lottery amount of 1 lakh rupees, that you applied for in December last year!!

In which saving jar will you allocate this money?

- ○ Allocate this money to the monthly 'food jar'
- ○ Allocate this money to the monthly 'education jar'
- ○ Allocate this money to the 'housing jar'
- ○ Go on a vacation
- ○ Buy a new car/scooter
- ○ Buy electric car/scooter
- ○ Indulge in some luxury which otherwise is difficult to afford with pocket money (expensive restaurants/expensive goods)
- ○ Buy some cool electronic gadgets
- ○ Save for the future/ invest in mutual fund, etc.

QUESTION CONTINUES IN NEXT PAGE

Where would you like to use this saving in future?
....

Please add *'the reason for your above choice'* in the box below.

4th Month- April 2023

☞ Suppose you get a 'green cheque' of Rs 1 lakh from the state government to buy a 2-wheeler because of your good performance in the previous exam.

☞ Since it is a green cheque, it is suggested (but not mandatory) to buy an *electric 2-wheeler.*

☞ You may also use this amount to buy other things (no one will ask where you have spent the money)

So you will

- ○ Allocate this money to the monthly 'food jar'
- ○ Save for your education
- ○ Save for buying a house
- ○ Go on a vacation
- ○ Buy a new car/scooter
- ○ Buy an electric car/scooter
- ○ Indulge in some luxury which otherwise is difficult to afford with pocket money (expensive restaurants/expensive goods)
- ○ Buy some cool electronic gadgets
- ○ Buy some energy-saving gadgets

Please add *'the reason for your above choice'* in the box below.

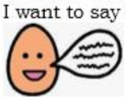
Activity

Suppose, the Government automatically provides the option to buy energy-saving gadgets as an alternative with the Rs.1 lakh green cheque and save the remaining amount. However please indicate if you want to opt out and prefer to buy something else.

- ○ *I agree with the government's prize*
- ○ *I want to opt-out. I need something else with this money. Specify* ....

QUESTION CONTINUE IN THE NEXT PAGE...

I want to say something not provided in the above options



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Activity

Circle the one which is not a vegetable out of the following:

Cauliflower, Chicken, Capsicum, Brinjal, Brocolli

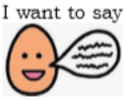
5th Month- May

Now that probably you have got the new vehicle, how would you prefer to go to your college/university from your home?

Circle your choice

QUESTION CONTINUE IN THE NEXT PAGE...

I want to say something not provided in the above options



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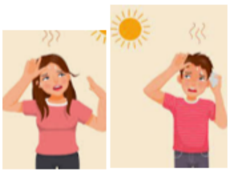
Activity

It's mid-may now, and getting extremely hot & humid!



While commuting from your room to college/university, using personal vehicles, you are contributing to making your city hotter.

FYI, here is how much carbon dioxide you are adding every day!

Mode of Travel	Avg. CO_2 emissions (gram/km)	
Walking/Cycling	0	
City Bus	25.76	
2-wheeler	57.5	
4-wheeler	122.6	
Electric 2-wheeler	31.4	
Electric 4-wheeler		

What will you do?

It's your friend's birthday party! The venue is a lovely café in the city which is at a distance of around 2-3 kilometers from where you stay.

Choose how you want to reach the venue! Circle your choice:

QUESTION CONTINUE IN THE NEXT PAGE...

Let me tell you why I choose the above option

....

6th Month- June 2023

This month, on the occasion of World Environment Day (5th June), the state government announced an attractive scheme. The students in the city are fed up with the rising prices, especially the price of fuel.

To provide some relief, the government will provide a ***pocket money card (Junio card)*** of Rs.2500 per month linked with google pay account, to all students to spend on personal vehicle fuel expenses only. When you buy petrol/diesel, then automatically the bill gets updated in this card record, since it is linked with google pay.

The first 50 students who can make the maximum savings in the Junio card by buying less fuel gets tagged as '***Sustainable User***'.

To recognize their efforts, their card amount gets increased by Rs.500 next month (that is, it becomes Rs. 3000). The first 50 '***Sustainable Users***' of this month again get an increment of Rs. 500 next month (that is, their Junio card gets loaded with Rs. 3500)...this continues for 6 months.

Finally, the first 50 savers of Rs. 10,000, get that amount as a cash prize!! This cash prize can be spent any way you like!

In addition, the first 50 savers of Rs. 10,000 also become the final ***'SUSTAINABLE CHAMPIONS' OF THE STATE***!!!

They get to be the government's official sustainability promoters on social media. They get to make Insta reels for sustainability in collaboration with the government and other celebrities of the state. Hence Government pays for higher visibility of these Champion's Instagram accounts!!

Activity

You can not take out the Junio card savings before you become the first 50 savers of Rs.10,000 on the card. Or if you think you can never make it to the first 50 savers, you may spend all the Junio card money on fuel only.

You have no idea of how much others plan to save. Based on your assumptions about others' decisions, you have to plan your Junio card savings.

Fill up the blanks:

I plan to save Rs............ out of Rs. 2500 in the first month on the Junio card.

What will you do?

If you are able to be the first 50 savers of Rs. 10,000, in which jar would you allocate this money? '✓' your choice.

- ○ Allocate this money to the monthly Food jar,
- ○ Allocate this money to the monthly Education jar
- ○ Allocate this money to the Housing jar
- ○ Go on a Vacation
- ○ Buy a new car/scooter
- ○ Buy an electric car/scooter
- ○ Indulge in some luxury which otherwise is difficult to afford with pocket money (expensive restaurants/expensive goods)
- ○ Buy some cool electronic gadgets
- ○ Save for the future/invest in mutual funds, etc.

Where would you like to use this saving in the future?
....

Please add '*the reason for your above choice*' in the box below:

7th Month- July

Now that over the last 6 months, you are giving some thought to managing your expenses more responsibly, your parents are very happy with you and they have finally decided to buy a new car for your family as a reward.

Activity

Suppose you go to a Tata car showroom. You see the following cars: Tata Tiago, Tata Nexon. Both the petrol and electric versions are available.

Though the upfront price of the electric version may be higher, however, over the years the monthly maintenance cost of the electric version is lower as compared to the petrol car.

Also, the cost of petrol is increasing every day, while for electric vehicles, there is hope for lower electricity costs as renewable sources of electricity may increase in the future.

Assume that the EV charging facilities are present in the designated parking areas in your city, and also at regular intervals in your state highway.

Choosing an EV will earn your family a "Responsible Family" badge from the district authority on buying an electric car. This badge provides benefits like no toll tax, no pollution control certificate requirements, and no parking fees.

What will you do?

Which one would you pick for your family? (Circle your choice)

Tata Tiago

Tata Tiago EV

Tata Nexon

Tata Nexon EV

Add *'the reason for your above choice'* here in the box?

Finally, let's wrap up this game! One last task

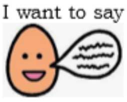
Below are some statements. ***Please mark (in %) against any three of these statements*** *based on how much you relate to them.*

EXAMPLE: The statement that I relate to most is A, followed by C, and then D. So I give approximately 40% against A, 35% against C and 25% against D.

The percentage values can be any % value according to you based on how much you relate to the statement

	Statements	**% of how much you relate to**
A	I am happy with the car/2-wheeler owned by my family and do not see any reason to replace it with electric car/electric 2-wheeler	
B	At the moment I am unsure if we should buy an electric car/electric 2-wheeler	
C	I want that my family should own an electric car/electric 2-wheeler but I am not sure which model/type/brand	
D	I know that we will buy an electric car/electric 2-wheeler in our family, but we have not ordered yet	
E	We have bought/placed an order for electric car/electric 2-wheeler in our family	

I want to say something not provided in the above options



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Stated Choice Survey: Type D (Intervention Group)

This is a fun game in the broader domain of people's preferences. We will take you on a 7-month journey of managing your pocket money, and being a more responsible version of yourself.

Please read the game rules carefully and indicate your choice.

There is no correct or wrong answer. It is completely a matter of your choice.

Your responses will remain completely anonymous.

Just for an introduction…

Circle the one that applies to you

1) I am a

2) The place where I live looks like this

1st Month- January 2023

It's New Year!!

Time for some resolution… ☺

From now, I will manage my pocket money in a better & more responsible way!

You arranged some magical '*Saving Jars*'. These 'saving jars' will help you to manage your pocket money better! All you have to do is name the jars according to different expense categories, like 'food jar', 'travel jar', 'internet & mobile jar', 'books & study materials jar', and so on…

From the saving jars, you take out money only from that jar when you have to buy something from that group.

Example, if you want to buy new cloths, you can take out money from the 'shopping jar'

If you want to travel to Shillong for the weekend! You take out money only from the 'vacation jar'! And so on…

But ultimately it is your money, your wish! ☺ ☺

Fill in the blanks-

My total monthly pocket money/stipend is Rs. ………………

Activity:

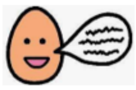
You have the following saving jars

Food, Travel, Education, Housing, Entertainment/Shopping

From your total pocket money, indicate how much money you want to put in each jar every month.

Savings Jars	Amount to be Saved in Jars
Food Jar	
Travel Jar	
Education Jar	
Housing Jar	
Shopping/Entertainment	

I want to say something which is not provided in the above options



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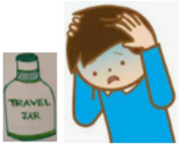
Now the month end is approaching and you are in a bit of a tight situation. You are running out of money in your 'travel jar'.



Would you like to transfer some money from any other jar to the 'travel jar' to avoid the shortage?

- ○ Yes, I want to transfer money to overcome the shortage
- ○ No, I will manage somehow

If yes, then from which saving jar would you want to transfer some money to the 'travel jar'? ....

Please add *'the reason for your above choice'* in the box below.

2nd Month- February 2023

Now suppose you decided to further categorize your travel jar into the following: public transport travel jar, ola/uber travel jar, fuel expense jar, vacation travel jar, monthly saving to buy a personal vehicle in the future.

Activity

How much percentage of money would you allocate in each of these sub-jars now from the initially allocated money in the travel jar?

Your neighbor uncle is seen to allocate in the following way:

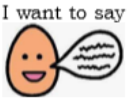
Public transport travel jar: 5%
Ola/Uber/Rapido travel jar: 5%
Vacation travel jar: 30%
Fuel expense jar: 40%
Monthly saving to buy personal vehicle: 20%

Indicate your allocation into these sub-jars

Travel Sub-Jars	Amount to be saved in sub-jars (%)
City Bus	
Fuel Expense	
Ola/Uber/Rapido	
Vacation	
Buy a personal vehicle in the future	

QUESTION CONTINUES IN NEXT PAGE...

I want to say something not provided in the above options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3rd Month- March 2023

It's the beginning of the month. You got a very sweet surprise! ☺ ☺ You won the lottery amount of 1 lakh rupees, that you applied for in December last year!!

In which saving jar will you allocate this money?

- ○ Allocate this money to the monthly 'food jar'
- ○ Allocate this money to the monthly 'education jar'
- ○ Allocate this money to the 'housing jar'
- ○ Go on a Vacation
- ○ Buy a new car/scooter
- ○ Buy electric car/scooter
- ○ Indulge in some luxury which otherwise is difficult to afford with pocket money (expensive restauants/expensive goods)
- ○ Buy some cool electronic gadgets
- ○ Save for the future/invest in mutual funds, etc

QUESTION CONTINUES IN NEXT PAGE....

Where would you like to use this saving in the future? ....

Please add *'the reason for your above choice'* in the box below.

4th Month- April 2023

☞ Suppose you get a 'green cheque' of Rs 1 lakh from the state government to buy a 2-wheeler because of your good performance in the previous exam.

☞ Since it is a green cheque, it is suggested (but not mandatory) to buy an *electric 2-wheeler*

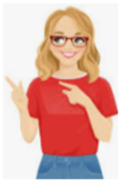
☞ You may also use this amount to buy other things (no one will ask where you have spent the money)

So you will

- ○ Allocate this money to the monthly 'food jar'
- ○ Save for your education
- ○ Save for buying a house
- ○ Go on a vacation
- ○ Buy a new car/scooter
- ○ Buy an electric car/scooter
- ○ Indulge in some luxury which otherwise is difficult to afford with pocket money (expensive restaurants/expensive goods)
- ○ Buy some cool electronic gadgets
- ○ Buy some energy-saving gadgets

Please add *'the reason for your above choice'* in the box below.





Activity

A few days back you also come across an SOS cry given out by an island nation to all other countries of the world.

It is a 800 sq.km small island nation in the Pacific with a population of 2000 people. Their country is in danger of sinking sometime soon in the future unless the people of the world help them out by reducing their carbon emissions and bringing down the global temperature.

What will you do?

Choose which action you want to take.

○ **Action-A**

If you take action A, there is: 

66.67% chance of reducing the global temperature by 2° celsius and thus save 267 sq. km of the island area

○ **Action-B**

If you take action B, there is:

33.33% chance of not mitigating carbon emissions to the required extent and 2/3rd of the island area will sink

○ *Any comments?* ....

Activity

Circle the one which is not a vegetable out of the following:

Cauliflower, Chicken, Capsicum, Brinjal, Brocolli

5th Month- May

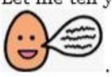
Now that probably you have got the new vehicle, how would you prefer to go to your college/university from your home?

Circle your choice





Let me tell you why I choose the above  option

 ....

Activity

It's mid-may now, and getting extremely hot & humid!

The temperature and pollution are increasing tremendously in your city.

In some parts of the country, this is the condition due to increasing temperature and rising number of hot days!

 This can soon be the condition in your city too! **You are equally at risk!**

 It is being said reducing the use of vehicles or at least using cleaner vehicles like electric vehicles can help reduce emissions. This will bring down both the number of hot days as well as the temperature sufficiently.

What will you do?

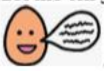
It's your friend's birthday party! The venue is a lovely café in the city which is at a distance of around 2-3 kilometers from where you stay.

Choose how you want to reach the venue! Circle your choice:

Let me tell you why I choose the above option



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6th Month- June 2023

This month, on the occasion of World Environment Day (5th June), the state government announced an attractive scheme. The students in the city are fed up with the rising prices, especially the price of fuel.

To provide some relief, the government will provide a ***pocket money card (Junio card)*** of Rs.5000 per month linked with google pay account, to all students to spend on personal vehicle fuel expenses only. When you buy petrol/diesel, then automatically the bill gets updated in this card record, since it is linked with google pay.

The first 50 students who can make the maximum savings in the Junio card by buying less fuel gets tagged as '***Sustainable User***'.

To recognize their efforts, their card amount gets increased by Rs.500 next month (that is, it becomes Rs. 5500). The first 50 '***Sustainable Users***' of this month again get an increment of Rs. 500 next month (that is, their Junio card gets loaded with Rs. 6000)...this continues for 6 months.

Finally, the first 50 savers of Rs. 20,000, get that amount as a cash prize!! This cash prize can be spent any way you like!

Activity

You can not take out the Junio card savings before you become the first 50 early savers of Rs.20,000 on the Junio card. Or if you think you can never make it to the first 50 savers, you may spend all the card amount on fuel only.

You have no idea of how much others plan to save. Based on your assumptions about others' decisions, you have to plan your Junio card savings.

Fill up the blanks:

I plan to save Rs........... out of Rs. 5000 in the first month on the Junio card.

What will you do?

If you are able to be the first 50 savers of Rs. 20,000, in which jar would you allocate this money? '✓' your choice.

- O Allocate this money to the monthly Food jar,
- O Allocate this money to the monthly Education jar
- O Allocate this money to the Housing jar
- O Go on a Vacation
- O Buying a new car/scooter
- O Buying an electric car/scooter
- O Indulge in some luxury which otherwise is difficult to afford with pocket money (expensive restaurants/expensive goods)
- O Buy some cool electronic gadgets
- O Save for the future /invest in mutual funds, etc

Where would you like to use this saving in the future?
....

Add *'the reason for your above choice'* here in the box?

7th Month- July

Now that over the last 6 months you are giving some thought to manage your expenses more responsibly, so your parents are very happy with you and they have finally decided to buy a new car for your family as a reward.

QUESTION CONTINUE IN NEXT PAGE…

Activity

Suppose you go to a Tata car showroom. You see the following cars: Tata Tiago, Tata Nexon. Both the petrol and electric versions are available.

Though the upfront price of the electric version may be higher, however, over the years the monthly maintenance cost of the electric version is lower as compared to the petrol car.

Also, the cost of petrol is increasing every day, while for electric vehicles, there is hope for lower electricity costs as renewable sources of electricity may increase in the future.

Assume that the EV charging facilities are present in the designated parking areas in your city, and also at regular intervals in your state highway.

Choosing an EV earns some monetary benefits like no toll tax, no pollution control certificate, and no parking fees.

What will you do?

Which one would you pick for your family? (Circle your choice)

Hyundai i20

Tata Tiago EV

Tata Nexon

Tata Nexon EV

Add *'the reason for your above choice'* here in the box?

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Finally, let's wrap up this game! One last task

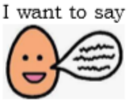
Below are some statements. ***Please mark (in %) against any three of these statements*** *based on how much you relate to them.*

EXAMPLE: The statement that I relate to most is A, followed by C, and then D. So I give approximately 40% against A, 35% against C and 25% against D.

The percentage values can be any % value according to you based on how much you relate to the statement

	Statements	**% of how much you relate to**
A	I am happy with the car/2-wheeler owned by my family and do not see any reason to replace it with electric car/electric 2-wheeler	
B	At the moment I am unsure if we should buy an electric car/electric 2-wheeler	
C	I want that my family should own an electric car/electric 2-wheeler but I am not sure which model/type/brand	
D	I know that we will buy an electric car/electric 2-wheeler in our family, but we have not ordered yet	
E	We have bought/placed an order for electric car/electric 2-wheeler in our family	

I want to say something not provided in the above options



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Appendix D. Robustness checks for multinomial logit regression analysis

The purpose of robustness checks in multinomial logit regression is to verify the reliability and stability of results. It involves examining whether the results hold under different assumptions, methods, or data subsets. We use the multicollinearity assessment and model re-specification to conduct robustness checks for multinomial logit regression model.

Re-specification of the Model:
We ran the multinomial logit regression by excluding different independent variables that could be collinear or weakly related in different rounds. Since the results did not change significantly after re-specification of the model, therefore the model can be said to be robust.

Table D1. Model Fitting Criteria Table

Model	Likelihood Ratio Test (Chi-Sq.)	Sig.
Group A (No Intervention Group)		
Original	76.744	0.002
Windfall Earning Eliminated	75.603	0.001
Green Labeled Earning Eliminated	76.318	0.001
Stage of Behavior + Behavior Transition Eliminated	70.589	0.001
Group B (Intervention Group)		
Original	78.186	0.009
Windfall Earning Eliminated	68.629	0.027
Green Labeled Earning Eliminated	73.996	0.009
Stage of Behavior + Behavior Transition Eliminated	64.392	0.030
Group C (Intervention Group)		
Original	72.511	0.025
Windfall Earning Eliminated	72.014	0.014
Green Labeled Earning Eliminated	70.999	0.017
Stage of Behavior + Behavior Transition Eliminated	65.964	0.022
Group D (Intervention Group)		
Original	60.540	0.169
Windfall Earning	55.266	0.219
Green Labeled Earning	56.188	0.195
Stage of Behavior + Behavior Transition Eliminated	48.968	0.317

Table D2. Likelihood Ratio Test

Model	**Significant Variables**
No Intervention Group	
Original	Place (0.040), Diversified MA (0.007)
Windfall Earning Eliminated	Place (0.041), Diversified MA (0.007), Allocation of Allowance Saving (0.075)
Green Labeled Earning Eliminated	Place (0.042), Diversified MA (0.007), Allocation of Allowance Saving (0.071)
Stage of Behavior + Behavior Transition Eliminated	Place (0.081), Diversified MA (0.004), Allocation of Allowance Saving (0.081)
Group B	
Original	Monthly Disposable Cash (0.039), Diversified MACRF (0.025), Windfall Earning (0.023), Behavior Stage (0.017), INT2 (0.028)
Windfall Earning Eliminated	Monthly Disposable Cash (0.093), Diversified MACRF (0.053), Behavior Stage (0.023),

	INT2 (0.041)
Green Labeled Earning Eliminated	Monthly Disposable Cash (0.049), Diversified MACRF (0.020), Windfall Earning (0.020), Behavior Stage (0.015), INT2 (0.025)
Stage of Behavior + Behavior Transition Eliminated	Monthly Disposable Cash (0.039), Diversified MACRF (0.021), Windfall Earning (0.035), INT2 (0.063)
Group C	
Original	Gender (0.055), CF Info MC (0.028)
Windfall Earning Eliminated	Gender (0.055), CF Info MC (0.020)
Green Labeled Earning Eliminated	Gender (0.052), CF Info MC (0.030)
Stage of Behavior + Behavior Transition Eliminated	Gender (0.091), CF Info MC (0.016), INT3 (0.091)
Group D	
Original	Behavior Stage (0.051)
Windfall Earning	Behavior Stage (0.059)
Green Labeled Earning	Behavior Stage (0.047)
Stage of Behavior + Behavior Transition Eliminated	

Multicollinearity Assessments:
The presence of high correlation between independent variables, i.e., multicollinearity can lead unstable coefficient estimates. We use variance inflation factor (VIF) to detect multicollinearity. A high VIF value (VIF > 5) indicates the presence of multicollinearity.

Table D3: VIF values Group A (Control Group)

Dependent Var →	Gender	Place	Windfall Earning	Mobility Habit	INT1	INT2	INT3	Behavior Stage	Behavior Transition
Gender		1.136	1.142	1.111	1.131	1.129	1.140	1.140	1.140
Place	1.088		1.095	1.043	1.086	1.094	1.078	1.087	1.090
Monthly Disposable Cash	1.106	1.114	1.102	1.115	1.117	1.117	1.109	1.117	1.116
Fungibility	1.129	1.114	1.128	1.103	1.129	1.125	1.129	1.101	1.127
Diversified MA	1.079	1.096	1.096	1.083	1.096	1.095	1.095	1.079	1.090
Windfall Earning	1.069	1.070		1.070	1.064	1.065	1.069	1.066	1.063
Green Labelled Earning	1.123	1.122	1.122	1.090	1.121	1.123	1.123	1.119	1.111
Mobility Habit	1.161	1.137	1.194		1.185	1.194	1.181	1.192	1.180
Allowance Saving	1.130	1.133	1.131	1.129	1.066	1.111	1.079	1.105	1.123
Allocation of Allowance Saving	1.178	1.193	1.161	1.187	1.188	1.147	1.191	1.186	1.190
Behavior Stage	1.173	1.168	1.172	1.174	1.159	1.171	1.173		1.168
Behavior Transition	1.069	1.067	1.065	1.059	1.060	1.071	1.071	1.064	
INT1	3.246	3.252	3.265	3.256		2.633	1.889	3.233	3.245
INT2	1.830	1.851	1.846	1.853	1.487		1.851	1.845	1.853
INT3	2.556	2.521	2.562	2.535	1.476	2.560		2.557	2.560

Table D4: VIF values Group B (Intervention Group)

Dependent Var →	Gender	Place	Windfall Earning	Mobility Habit	INT1	INT2	INT3	Behavior Stage	Behavior Transition
Gender		1.142	1.137	1.144	1.149	1.102	1.151	1.134	1.150
Place	1.130		1.108	1.127	1.130	1.139	1.134	1.137	1.130
Monthly Disposable Cash	1.149	1.140	1.141	1.116	1.133	1.127	1.148	1.128	1.140
Fungibility	1.132	1.096	1.128	1.123	1.123	1.134	1.135	1.130	1.107
Diversified MA CRF	1.186	1.185	1.143	1.141	1.163	1.187	1.176	1.187	1.166
Windfall Earning	1.163	1.145		1.174	1.177	1.175	1.175	1.175	1.174
Green Labelled Earning	1.048	1.049	1.042	1.049	1.049	1.045	1.049	1.049	1.043
Default	1.123	1.123	1.115	1.093	1.123	1.121	1.123	1.115	1.105
Mobility Habit	1.393	1.386	1.398		1.396	1.399	1.368	1.356	1.397
General Info MC	1.253	1.228	1.253	1.120	1.232	1.222	1.251	1.232	1.246
PMV Allowance Saving	1.097	1.114	1.113	1.116	1.114	1.115	1.116	1.108	1.111
Allocation of Allowance Saving	1.189	1.185	1.163	1.179	1.199	1.188	1.199	1.193	1.195
Behavior Stage	1.227	1.244	1.243	1.206	1.224	1.245	1.238		1.178
Behavior Transition	1.174	1.166	1.172	1.172	1.173	1.164	1.174	1.111	
INT1	2.409	2.395	2.412	2.404		2.126	1.684	2.371	2.410
INT2	1.688	1.762	1.760	1.760	1.553		1.694	1.762	1.747
INT3	2.151	2.142	2.148	2.101	1.502	2.067		2.138	2.151

Table D5: VIF values Group C (Intervention Group)

Dependent Var →	Gender	Place	Windfall Earning	Mobility Habit	INT1	INT2	INT3	Behavior Stage	Behavior Transition
Gender		1.220	1.214	1.213	1.216	1.144	1.219	1.220	1.203
Place	1.241		1.242	1.238	1.205	1.238	1.213	1.239	1.237
Monthly Disposable Cash	1.060	1.058	1.062	1.066	1.067	1.068	1.068	1.068	1.063
Fungibility	1.097	1.082	1.092	1.095	1.097	1.097	1.092	1.084	1.097
Diversified MA ARF	1.127	1.123	1.121	1.118	1.127	1.126	1.127	1.122	1.118
Windfall Earning	1.114	1.120		1.117	1.116	1.120	1.112	1.113	1.118
Green Labelled Earning	1.101	1.100	1.107	1.101	1.107	1.107	1.104	1.085	1.090
Default	1.278	1.141	1.280	1.262	1.279	1.274	1.279	1.269	1.276
Mobility Habit	1.268	1.273	1.273		1.275	1.272	1.269	1.181	1.247
CF Info MC	1.269	1.265	1.268	1.204	1.264	1.271	1.262	1.248	1.269
SMV Allowance Saving	1.098	1.091	1.096	1.100	1.101	1.093	1.103	1.086	1.099
Allocation of Allowance Saving	1.147	1.169	1.131	1.176	1.167	1.186	1.174	1.185	1.186
Behavior Stage	1.390	1.387	1.381	1.286	1.389	1.382	1.340		1.272
Behavior Transition	1.173	1.185	1.187	1.163	1.188	1.190	1.167	1.089	

INT1	2.607	2.540	2.607	2.616		2.246	1.546	2.616	2.613
INT2	1.536	1.634	1.639	1.634	1.406		1.633	1.629	1.639
INT3	2.313	2.264	2.300	2.303	1.368	2.308		2.233	2.271

Table D6: VIF values Group D (Intervention Group)

Dependent Var →	Gender	Place	Windfall Earning	Mobility Habit	INT1	INT2	INT3	Behavior Stage	Behavior Transition
Gender		1.100	1.091	1.097	1.102	1.100	1.099	1.099	1.100
Place	1.111		1.110	1.102	1.101	1.105	1.111	1.105	1.113
Monthly Disposable Cash	1.061	1.072	1.072	1.054	1.070	1.071	1.070	1.071	1.072
Fungibility	1.089	1.088	1.064	1.083	1.086	1.084	1.089	1.089	1.089
Diversified MA MRF	1.123	1.094	1.119	1.119	1.123	1.120	1.108	1.087	1.120
Windfall Earning	1.128	1.137		1.139	1.139	1.137	1.137	1.125	1.140
Green Labelled Earning	1.135	1.136	1.103	1.134	1.135	1.136	1.135	1.129	1.114
Framing	1.100	1.113	1.105	1.107	1.112	1.111	1.105	1.102	1.103
Mobility Habit	1.184	1.178	1.188		1.183	1.189	1.188	1.162	1.187
Visual Info MC	1.087	1.075	1.086	1.059	1.087	1.086	1.084	1.085	1.082
Higher Allowance Saving	1.122	1.109	1.133	1.098	1.133	1.134	1.135	1.127	1.135
Allocation of Allowance Saving	1.139	1.145	1.120	1.110	1.146	1.143	1.146	1.145	1.146
Behavior Stage	1.141	1.136	1.129	1.118	1.144	1.143	1.130		1.129
Behavior Transition	1.070	1.071	1.071	1.070	1.067	1.068	1.069	1.057	
INT1	2.285	2.261	2.284	2.273		2.022	1.635	2.286	2.276
INT2	1.758	1.747	1.755	1.760	1.557		1.634	1.760	1.755
INT3	2.233	2.234	2.232	2.237	1.600	2.077		2.211	2.232

List of Conference/ Fellowship & Articles/Report (Published & Submitted)

Conference

- Oral Paper Presentation at SDGS 2024 Conference, Knowledge for Sustainable Development: Dialogues Across Disciplines to Implement Sustainable Development Goals, Jan 18- 20, 2024, University of Hyderabad

Fellowship

- Young Scientist Summer Program (YSSP) at the International Institute for Applied Systems Analysis (IIASA), Laxenburg, Austria, June –August 2022

List of Articles/Report (Published & Submitted)

- Deka C, Dutta M.K, Yazdanpanah M, Komendantova N, 2024, When ,fear factors motivate people to adopt electric vehicles in India: An empirical investigation of the protection motivation theory, *Cleaner and Responsible Consumption*, Vol 13, 100191, DOI: https://doi.org/10.1016/j.clrc.2024.100191

- Deka C, Dutta M.K, Yazdanpanah M, Komendantova N, 2023, Can Gain Motivation Induce Indians to Adopt Electric Vehicles? Application of an Extended Theory of Planned Behavior to Map EV Adoption Intention, *Energy Policy*, Vol 182, DOI: https://doi.org/10.1016/j.enpol.2023.113724

- Deka C, 2022, *Adoption of Electric Vehicles by the Middle-Income Group in India: A Comparison of Gain, Norm, Fear & Protection Motivators and Other Factors.* IIASA YSSP Report. Laxenburg, Austria: IIASA, URL: https://pure.iiasa.ac.at/18323

- Deka C, Dutta M.K, Yazdanpanah M, Komendantova N, 2024, Driving Green or Driving Towards Doomsday? Unveiling Fear & Norm Dynamics in Electric Vehicle Adoption Among India's Middle-Class, *Environment, Development and Sustainability*, Springer Journals (*submitted, in review*)

- Deka C, Dutta M.K, 2025, 'Ladies First or Gents First'? An Analysis of the Gender Differences in Electric Vehicle Adoption Intention Pathways Among Indian Men and Women, *Applied Energy*, (*submitted to journal*)