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Young Scientists Summer Program

Adoption of Electric Vehicles by the Middle-Income Group in India: A Comparison of Gain, Norm, Fear & Protection Motivators and Other Factors

Author: Chayasmita Deka
Email: cdeka@iitg.ac.in

Approved by:

Mentor(s): Nadejda Komendantova, Masoud Yazdanpanah
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This report represents the work completed by the author during the IIASA Young Scientists Summer Program (YSSP) with approval from the YSSP mentor.

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Mentor signature:

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Abstract

The increasing frequency of extreme climatic events has necessitated climate change adaptation and mitigation efforts like never before. An understanding of the drivers of energy use behavior is hence deemed essential to change people's behavior. With the enhancement of lifestyles among the middle-income group in India, the number of personal vehicles on the road has also increased to a great extent. Unless the carbon emissions from this increased road congestion are minimized, India cannot expect to move closer to its target of net-zero emissions by 2070, as envisaged by the Government of India. Of the range of energy use behaviors, this project focuses on mobility behaviors, and especially the factors influencing the acceptance of electric vehicles (EVs) among the middle-income population in the towns and cities in India in the near future. Based on the Theory of Planned Behavior (TPB), the Norm Activation Model (NAM), and the Protection Motivation Theory (PMT), we analyze gain, norm, and fear & protection motivation as drivers of the intention to adopt EV. The effect of herd behavior and cost on formation of intention is also introduced as an extension to the original TPB theory. This study presents an indepth analysis of the direct and indirect pathways of intention formation in an individual's mind while he/she is considering purchasing an EV. Using structural equation modelling and mediation analysis, subjective norm was found to be the strongest motivator of intention to adopt EV. Overall, norms, threat and coping appraisal were found to be more important than gain motivators in prompting middle-class people in India to adopt EV. This study outlines a number of policy recommendations to the government to better design EV promotion policies and highlights how current policies can go wrong in pushing EVs among the Indian masses.

About the author

Chayasmita Deka is a third-year Ph.D. student at the Department of Humanities and Social Sciences (HSS) at the Indian Institute of Technology (IIT), Guwahati, India. She has a Bachelor's in Economics, from the University of Delhi, India, and a Master's in Applied Economics from Christ University, Bangalore, India. She worked as a Research Assistant in the Economics & Social Sciences Unit at the Indian Institute of Management (IIM), Bangalore, India. Her research interests are mitigating climate change through behavioral adaptation, experimental and behavioral economics, and management of scarce natural resources. (Contact: cdeka@iitg.ac.in)

Nadejda Komendantova is a senior research scholar in the Advancing Systems Analysis (ASA) Program and a leader of the Cooperation and Transformative Governance group. Her research interests include participatory, multi-risk, compromise, negotiation, and cooperation-oriented governance for complex policy challenges such as energy security, climate change mitigation and adaptation, technological innovations, health policy, and digitalization. The focus of her research is on governance and decision-making processes under uncertainty, complexity, ambiguity, and volatility, while incorporating systems thinking into strategic policy planning and addressing social dilemmas and wicked policy issues. Komendantova implemented several projects for the European Commission and for several national and international ministries and organizations. She is the author of over 180 publications in peer-reviewed journals. (Contact: komendan@iiasa.ac.at)

Masoud Yazdanpanah joined IIASA in 2010, first as a Guest Research Scholar in the Risk and Resilience (RISK) Program. In 2020, he worked jointly with RISK and the Advancing Systems Analysis (ASA) Program, and since 2021 he is a Guest Research Scholar in the Cooperation and Transformative Governance (CAT) Research Group within the ASA Program. He also holds a position as a Lecturer in Ramin University in Iran, where his main research topics are related to risk management, climate change mitigation and adaptation based on the understanding of views and risk perceptions of different stakeholders, participatory governance, natural resource management, and conservation, with particular focus on water and energy. (Contact: masoudyazdan@gmail.com)

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1. Introduction

"The world is reaching the tipping point beyond which climate change may become irreversible. If this happens, we risk denying present and future generations the right to a healthy and sustainable planet- the whole of humanity stands to lose" (Davis, 2015).

These were the words of Kofi Annan, the Former Secretary-General of the United Nations, as he calls out to the international community to act upon the looming climate crisis during the 2015 UN Climate Change Conference in Paris.

The climate change perils that we are facing today are the outcomes of anthropogenic changes to our environment. 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 (Climate Change: Evidences & Causes report, 2020). 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 (Climate Change: Impacts, Vulnerabilities, and Adaptation in Developing Countries report[1]).

Along with the concern for rising GHG concentrations, there has been a parallel concern about the depletion of fossil fuel reserves. According to Shafiee and Topal, (2009), after 2042, coal will be the only fossil fuel left on Earth, and the reserves of coal can fulfill the world's needs only till 2112. From the geological perspective, it is inevitable now that the production of fossil fuel will reach its peak at one point in time, and then start declining. After the near exhaustion of the fossil fuel reserves, favorable conditions will emerge in the market for transitioning towards alternative sources of energy (Brecha, 2008). Few studies have pointed out the importance of considering fossil fuel depletion in its climatic projections (Laherrere, 2001). 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). In the 1950s and 1960s, the prime oil fields were already discovered (Hall and Day, 2009), and it is not likely that there will be discoveries of newer oilfields in the coming few years. Also discovering new reserves necessitates new and advanced technologies. Apart from that, the energy return on energy invested (EROEI) is falling continuously for the extraction of fossil fuels. If investments are made in new technologies for more extraction, the EROEI will decline further. It will also increase the CO_2 concentrations and GHG concentrations further (Chiari and Zecca, 2011). Hence, the

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[1] The publication year of UNFCCC's 'The Climate Change: Impacts, Vulnerabilities, and Adaptation in Developing Countries' report is not mentioned. For more details, visit URL: https://unfccc.int/resource/docs/publications/impacts.pdf

Intergovernmental Panel on Climate Change (IPCC report 2007) calls for urgent adaptation and mitigation efforts.

The transport sector is one of the highest carbon-emitting sectors globally, accounting for 25% of global CO_2 emissions, and it is projected to double by 2035 (McCollum et al., 2018). With the increase in extreme climatic events, the need to mitigate greenhouse gas emissions has become all the more crucial. Sustainable transport systems or the use of electric vehicles have been accepted as one of the most promising solutions towards decarbonizing the transportation sector (Bruckmann, 2022; Munshi et al., 2022; Huang & Qian, 2021; Singh et al., 2020; Yang et al., 2019; De Rubens et al., 2018; Gnann et al., 2018). This shall also enhance a nation's oil security by reducing dependency (Huang & Qian, 2021) and curb local air pollution (Yang et al., 2019, Coffman et al., 2017; Wang et al., 2015; Fan et al., 2015; 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 Political Position of India's Climate Mitigation Plans: Past & Present

The political position of India's climate change mitigation efforts dates back to the year 1972, when the then Prime Minister of India, Indira Gandhi announced at the United Nations Conference on the Human Environment, in Stockholm that environmental protection comes in the way of India's socio-economic development goals, and hinted to the developed nations of the North for taking responsibility for the historical emissions. India's ideological stance was further elaborated through the publication of the report titled 'Global Warming in an Unequal World' by the Centre for Science & Environment (Agarwal & Narain, 1991). This ideological stance was supported by the political intellectuals of the time, and also the belief supported by the fact that the GHG emissions during 1850-2012 were way below the emissions from countries like the USA, EU, and China (Rocha et al., 2015). Jakobsen (1999; cited in Mohan, 2017) mentions that Indian negotiators successfully influenced the introduction of the principles of equity in climate change negotiations through the introduction of the concept of 'Common but Differentiated Responsibilities' (CBDR) and 'Respective Capabilities' (RC) in Article 3 of UNFCCC Convention 1992 (UNFCCC, 1992). India's political position of prioritizing economic growth over climate protection action for many years earned India the tag of being a difficult partner in the context of negotiations for climate change (Vihma, 2011).

With India's transition from an underdeveloped economy to an emerging economy, a notable shift was seen in its position on climate change action. At the COP 13 summit held at Bali in 2007, for the 1st time, India accepted the voluntary role of developing nations in climate mitigation action (Michaelowa & Michaelowa, 2012), despite tremendous domestic criticisms (Vihma, 2011; Thaker & Leiserowitz, 2014). This period also saw the emergence of Climate mitigation policies in India with the release of the National Action Plan on Climate Change (NAPCC), in 2008. However, this plan too was critiqued due to its' disconnect with the stakeholders at the fringes of society. The interesting irony was that while India pushed forth the principle of equity in global climate mitigation efforts, its' own domestic policy failed to protect the interest of the poorer section, but rather favored the privileged elite (Thakkar, 2009). If that was not enough, India positively surprised the world by pushing for legally binding climate commitments for all countries at COP 16 in Cancun, in 2010 (Lahiri, 2010; cited in Mohan, 2017). Immediately in 2011 at the COP 17 summit in Durban, the new political leadership again shifted back to its traditional stance of climate action conservatism (Michaelowa & Michaelowa, 2012; Thaker & Leiserowitz, 2014). The inconsistent swings in the political position on climate change hint towards the possibility that climate change mitigation forums have been nothing other than another platform for diplomacy. Was climate mitigation the only agenda? Probably not.

Nevertheless, the Durban summit marked a transition in climate action pathways from a bottom-up perspective, within which all countries would make climate mitigation pledges under a peer review system. The Nationally Determined Commitments (NDCs) were first adopted by countries in 2014 at COP 20, in Lima. The year 2013 also saw the launch of the National Electric Mobility Mission Plan 2020 (NEMMP 2020). This was followed by India's pledge to install upto 40% of total energy capacity by clean energy sources and bring down the economy's carbon intensity to 33-35% by 2030. In the recently concluded COP26 in Glasgow, India announced its net-zero target by 2070 (Vaidyanathan, 2021), while other developed nations set their targets for 2050. Considering India's unique position as a historical non-emitter of GHG emissions, but one of the higher emitters at present, India has come a long way from being the 'growth first stonewallers' to 'progressive realists' and finally 'progressive internationalists' by modifying its political position in initiating & leading climate action, despite domestic resistances.

At present its 2070 net zero targets is not way behind those of the historical emitters. Though the present optimism is encouraging; it cannot be forgotten that there exists a big gap between commitments and their realization. The leaderships change with time, and so are their ideologies, and strategic interests for diplomacy. To bring real change, the onus is on every individual. 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.

2. Background: Human Behavior, Government Policies & Climate Change Mitigation

Climate change is not new. It has taken place over the past many years. However, recently anthropogenic factors have aggravated the issue immensely, and climate extremes have begun to surface up. 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).

In this study, an attempt has been made to see how nudging human behavior towards clean mobility choices can help governments realize their commitments. According to IEA, to reach the 2050 target set by most of the developed countries, 60% of vehicles need to be electric by 2030, at a global level (IEA, 2021a). With India's EV30@30 Campaign, the government aims by 2030, to diffuse 30% of road vehicle sales as electric vehicles in each of the vehicle segments (Munshi et al., 2022). This ambitious goal along with India's efforts to increase its share of renewables in the energy mix as announced at the COP26 conference will help India to decarbonize its transportation sector. Efforts are also underway to strengthen the supporting charging infrastructure for faster acceptance of EVs. The FAME (Faster Adoption and Manufacturing of Electric Vehicles) scheme launched by the government is an initiative in this direction. Nevertheless, considering India's development needs, by 2050, it can only expect to cut down its emissions from the 2020 level. To reach net zero by 2050, 80% of 2-wheelers and 30% of 4-wheelers in India will have to be electric (Dhar et al., 2017). This timeframe also seems unfruitful considering the fact that coal is the main source of electricity production in India presently.

In view of the layout of Indian cities, in 2019, 39% of Indians were found to commute 0-5 km daily, and 31% were found to travel 5-10 km on a daily basis (Statista, 2021). In terms of fuel consumption, light-duty vehicles (LDV) of which India is the 5th largest market, were reported to consume around 5.7 liters of gasoline equivalent per 100 kilometers (Lge/100 km) in 2019. The large and small SUVs, sales of which have picked up in India, were reported to consume on average, 3.7% and 2.6% of more fuel since 2017 (IEA, 2021b). The associated carbon emissions are even more alarming. The tailpipe emissions from an average passenger vehicle are about 404 grams of CO_2 per mile (USEPA, 2018), which amounts to 1.3 kgs of CO_2 emissions by 39% of urban commuters, and 2.5 kgs of CO_2 emissions by 31% of urban commuters. The use of electric vehicles directly reduces these carbon emissions into our environment. At the national level, we can achieve a total reduction of roughly 2.4 billion kgs of CO_2 emissions per day, according to 2019 statistics. The latest 2021 statistics by the Organization Internationale des Constructeurs d'Automobiles (OICA) reports that India overtook Germany to be the 4th largest vehicle market in the world (Financial Express, 2022). With the rising incomes of the middle-income group in India and the demographic composition with a significant young population, the figures are expected to increase further. Hence a shift towards electric vehicle deserves a high priority for India. This increasing demand for personal mobility needs to be converted to demand for electric vehicles.

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 pattern (de Silva et al., 2022, Stankuniene et al., 2020). This calls for a decarbonization effort, keeping in mind the behavioral perspective.

2.1 Pro-Environmental Behavior: Theoretical Foundations

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). Another perspective describes pro-environmental behavior as a special type of pro-social behavior, performance of which is backed by the intention of initiating the welfare of an organization, group, or individual entity (Ramus & Killmer, 2007). Caprara & Steca (2007) asserts that pro-social behavior like helping other, sharing, caring, etc., materializes in the presence of a pro-social agency. For people to engage in such behaviors, they must be able to relate to the actions and emotions associated with such pro-social engagement.

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.

2.1.1 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).
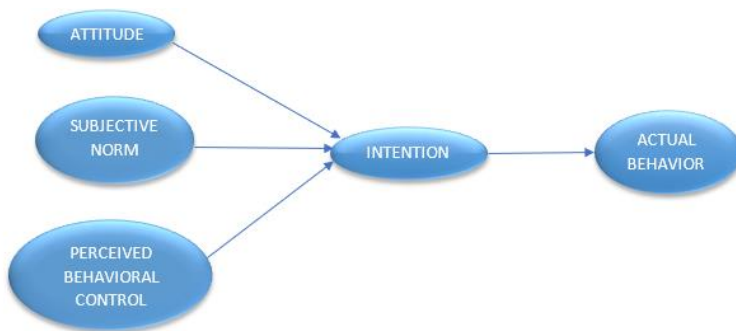
Figure 1: The Original TPB Model

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) find that a person's attitude and perceived behavioral control have a significant and large influence on the willingness to purchase EV. Studies have examined different components of attitude like awareness, use of EV, the experience of riding EV, social need, pro-environmental action, social message, fuel consumption, and carbon emission and finds that these factors have a huge influence on adoption of EV (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 EV as necessary for the 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 EV. Nevertheless, subjective norm is always proposed as an important construct in most of the theories like Theory of Planned Behaviour, Technology Acceptance Model, Diffusion of Innovation Theory. Studies support

the significant impact of family, friends, relatives, and society on the intention to adopt EV (Liao et al., 2017; Sang and Bekhet 2015b; Jeon et al., 2012).

In addition to examining the role of attitude towards EV, subjective norms around adoption of EV, and one's perceived behavioral control on the use of EV, 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.

2.1.2 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).
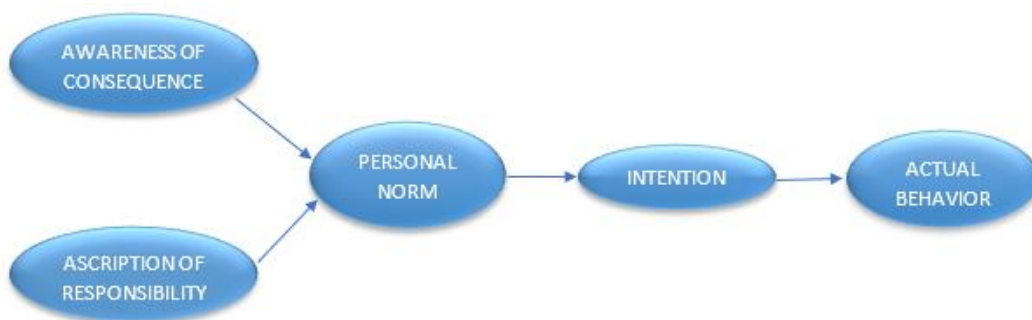

Figure 2: The Norm Activation Model

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 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 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.

2.1.3 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).
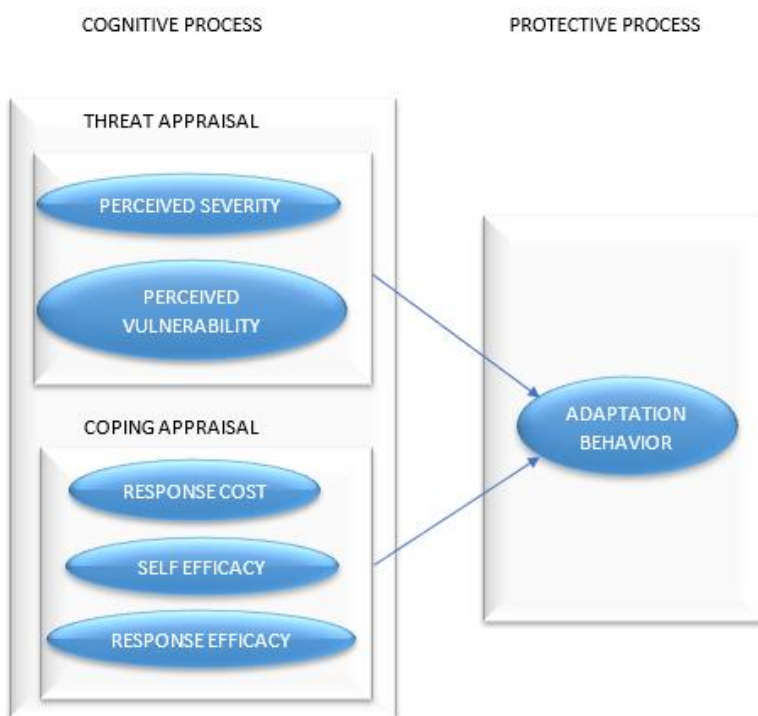
Figure 3: The Protection Motivation Theory (PMT)
Source: Pakmehr et al., 2020

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.

2.2 Background: India's '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 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 cities, 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, 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 5) even after a series of large-scale investments from the government of India. As shown in fig 5, 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.
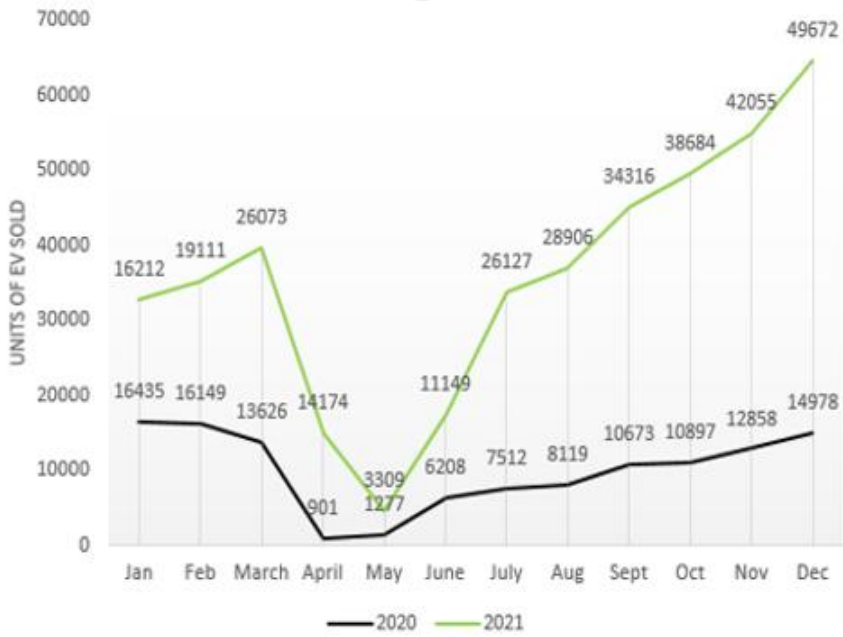
Fig 4: Trend of monthly sales of EV units
Source: JMK Research
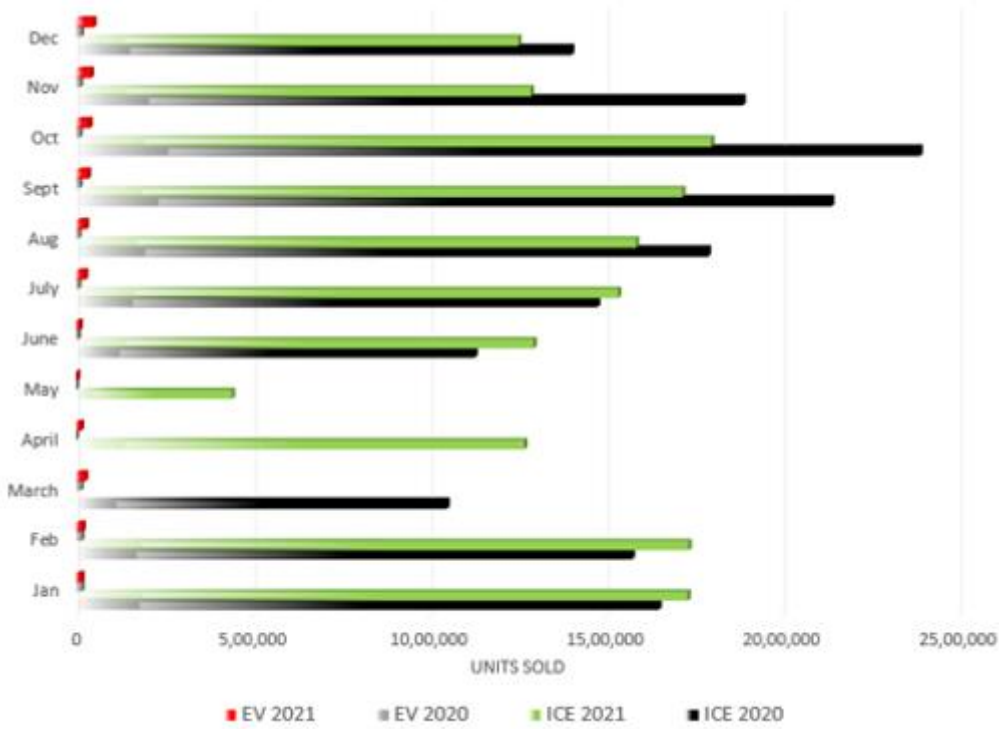
Fig 5: A Comparison: Monthly sales of EV Vs ICE vehicles (2020-2021)
Source: Society of Indian Automobile Manufacturers (SIAM)

2.3 The Conceptual Framework of the Study
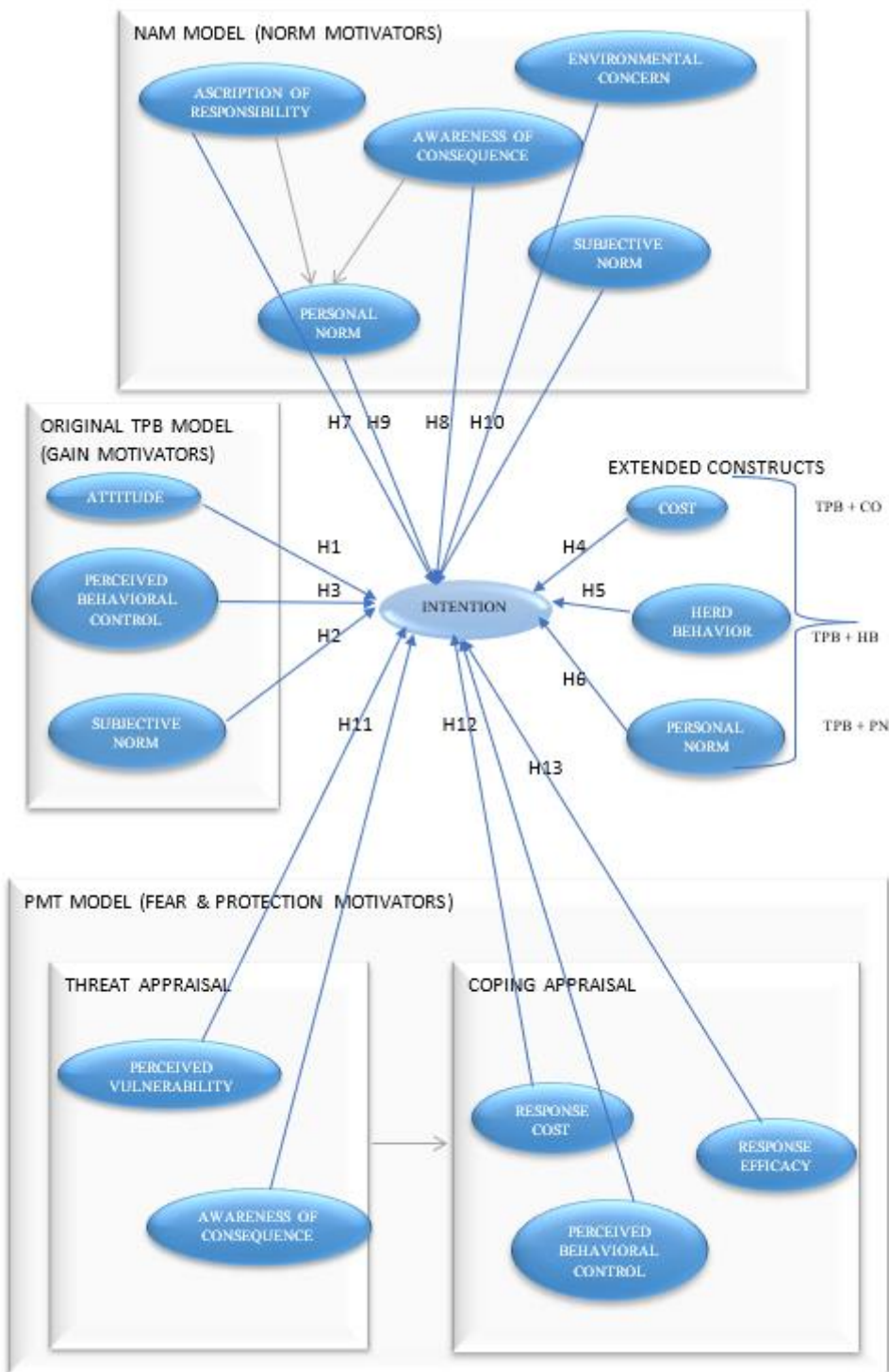
Fig 6: The Conceptual Framework of the Study

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 6. 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 represents the hypothesis.

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 separated compartments.

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.

3. The Study Design: Objectives, Research Questions, & Hypothesized Models

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 general 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?

In an attempt to find answers to such questions, this study sets the following objectives:

3.1 Objectives of the Study

- To examine the determinants of intention to adopt EV among the middle-class people in India
- To compare gain motivation, norm motivation, and fear & protection motivation in the formation of intention
- To analyze the indirect pathways of intention formation

3.2 Research Questions

- How does gain motivation influence intention?
- How does norm motivation influence intention?
- How do fear and protection motivation influence intention?
- Does gain motivation have a stronger influence on intention as compared to norm motivation and fear & protection motivation in the context of India's EV market?
- What are the indirect step-wise processes of intention formation towards EV adoption?

4. Methodology

4.1 Method

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

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. Such variables are either continuous or categorical, but latent variables are always continuous, atleast for the studies dealt with by the SEM method. There are other methods for dealing with categorical latent variables. 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).

4.1.1 Steps in SEM

Table 1: Steps involved in Structural Equation Modeling
Source: (Kline, 2016)
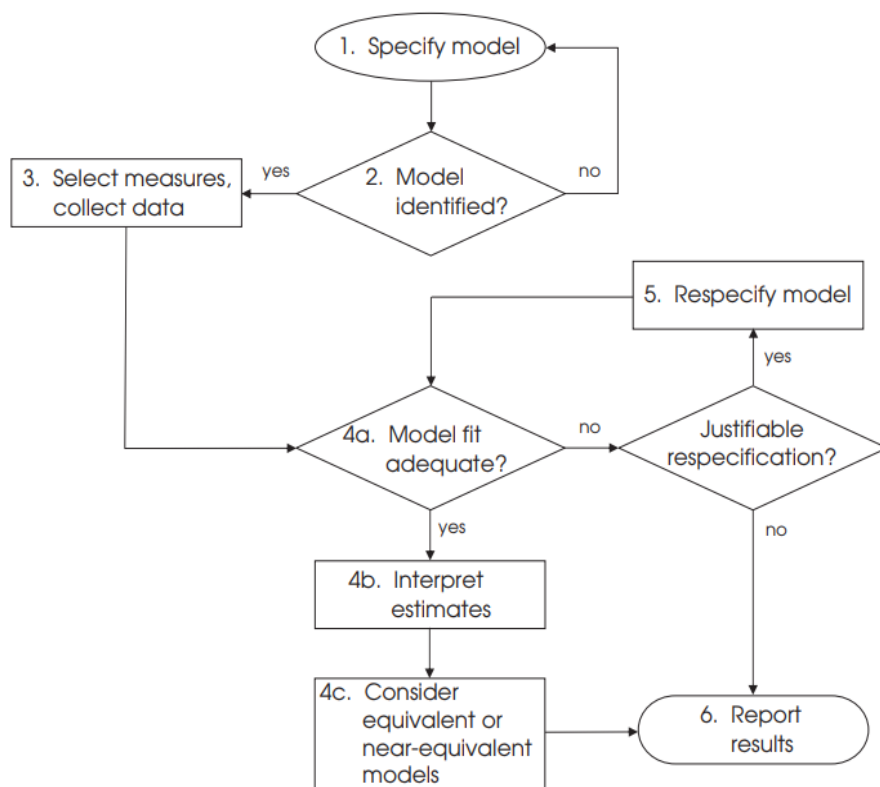
SEM involves the following steps:

(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 in order 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 have to 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 particular 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.

4.1.2 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 7.

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'.
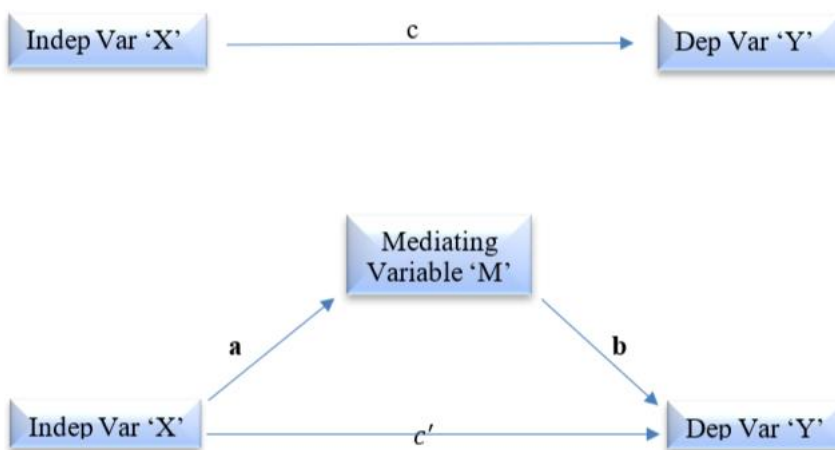
Figure 7: A Mediation model depicting the different effects

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 takes into account the variability in 'Y'. The influence of 'X' on 'Y' reduces to a great extent 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.

Table 2: Steps involved in mediation analysis
Source: Zhao et al., (2010)
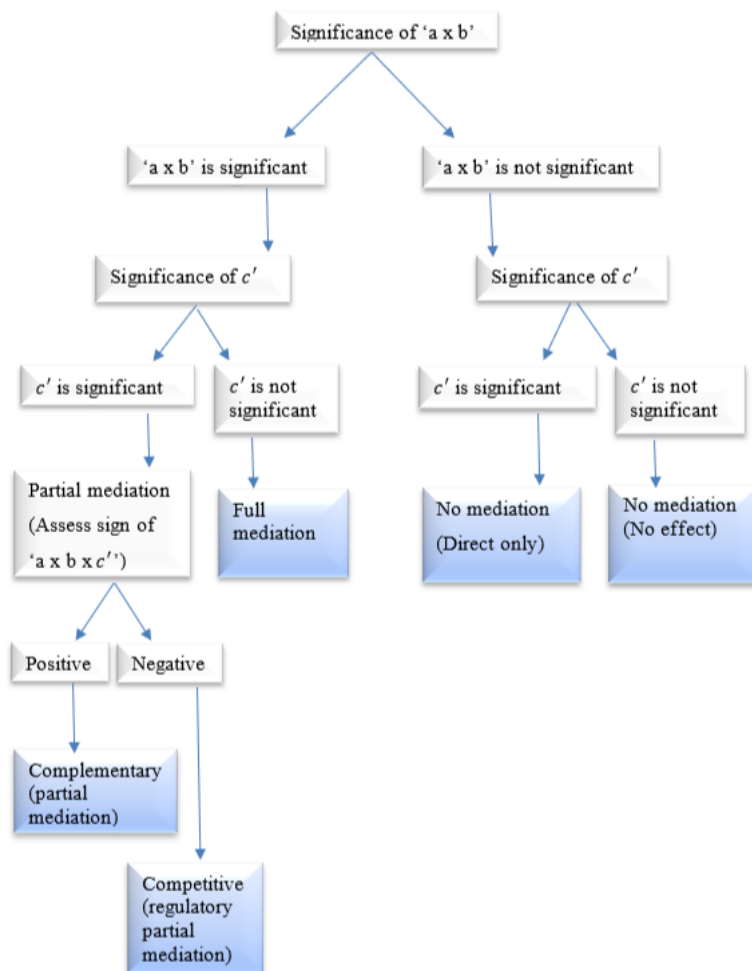
4.2 Data & Variables

This study is centered on the process of intention formation to adopt EVs among the middle-class people in 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 study sample comprised of middle-income people 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 study.

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 intention to adopt EV is the dependent variable. Since gain motivation, norm motivation, and protection motivation is 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 table 3). A sample of the questionnaire is attached in the appendix A.

Table 3: The Variables Considered in the Study
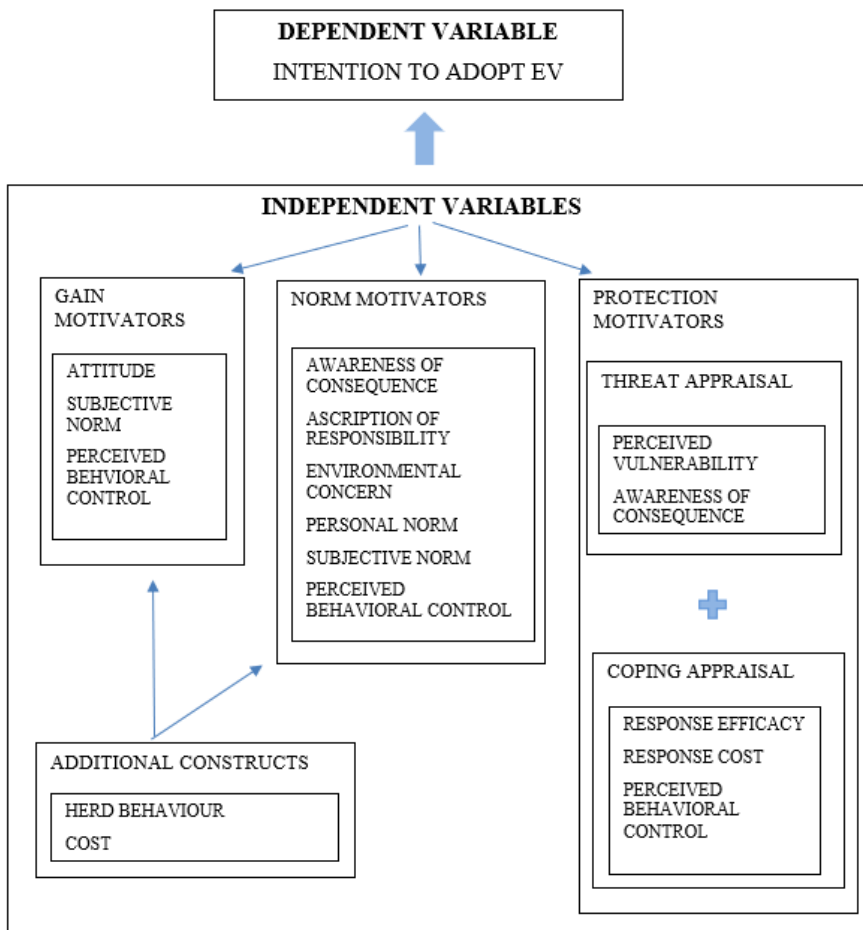
All the independent variables listed in the table above and the dependent variables are latent constructs, as these cannot be defined or measured objectively. The indicators for the latent constructs are borrowed from literature (see table 4). The indicators for two additional latent constructs namely 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: 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. The meaning of these constructs is listed in table 5:

Table 5: 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)

The above table 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 on the basis of 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. Data was collected by a combination of online and field survey. A similar sampling frame was used in prior literature (Jiang et al., 2020; Han et al., 2017). Online questionnaires were sent out through emails and WhatsApp groups using a convenience sampling frame. Offline questionnaires were distributed to office-goers and students in randomly picked offices and colleges. 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 in order to have 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 completely 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 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).

5. Results & 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 (2nd part of SEM) and mediation analysis.

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

5.1 Sample Description

Table 7: Summary of demographic characteristics of the sample in second wave (n = 330)

Demographic Characteristic	Category	Count	Percentage
Gender	Female	164	49.7%
	Male	163	49.4%
Age	18-25	87	26.4%
	26-35	131	39.7%
	36-45	46	13.9%
	46-60	64	19.4%
Education Level	School Level	9	2.7%
	Higher Secondary	24	7.3%
	Graduate	102	30.9%
	Post-Grad & above	193	58.5%
Annual Household Income (INR)	<2,50,000	84	25.4%
	2,50,001-500000	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 7 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. The majority 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.

5.2 Results of CFA Analysis

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. This study examines a total of 13 measurement models. These are tabulated in the appendix B.
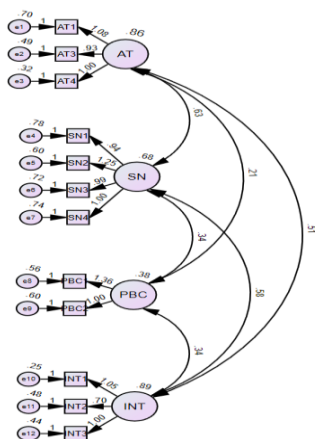

Figure 8: An example of a measurement model: the TPB model

Figure 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 a sufficient amount of variance from the latent construct (Kilic et al., 2020). 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 in order to identify the CFA model. A CFA model is identified when for a given set of data, and for a specified research problem, a sufficient number of 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 8: 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 8, 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 9: 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 9 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 taken into account by the calculated population covariance. It is similar to R2 (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).

5.3 Results of the Structural Models (2nd part of SEM) + Mediation Analysis

In accordance with the hypothesis proposed in the conceptual framework (fig 6), 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:

5.3.1A The TPB model & its extensions
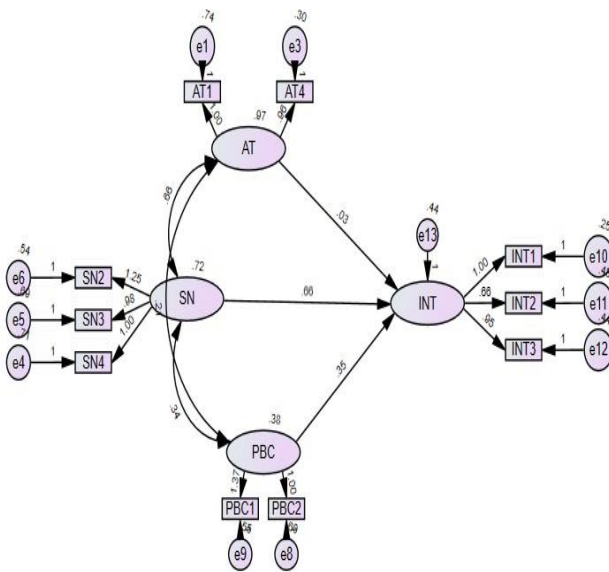
Figure 9A: The structural model original TPB

Table 10: 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]			
H4: Higher cost of EV → Lower intention	0.124	0.267	Rejected
H5: Positive herd behaviour → 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 10. 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

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[2] Original TPB model has been extended with three different latent constructs: cost (TPB + CO), herd behaviour (TPB + HB), and personal norm (TPB + PN).

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.

5.3.1B Mediated Pathways: TPB model & its extensions

From the results of the structural models, we find that all the three extended constructs: cost, herd behaviour, and personal norm have no direct influence in the formation of intention to adopt 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).
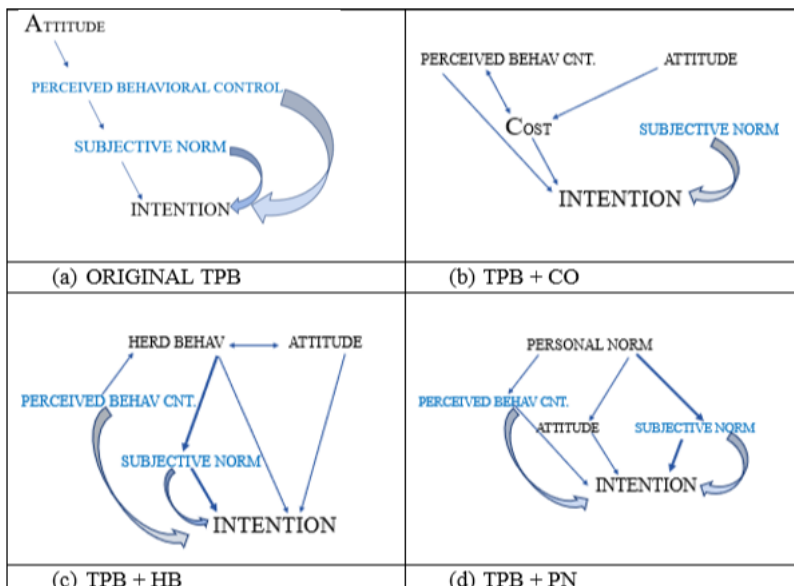
Figure 9B: Mediated Pathways of Intention Formation in the TPB model

The above figure 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 9B(a)), 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 9B(b)), 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 11. The earlier structural model analysis indicated no direct impact of herd behavior on intention, but as seen in the TPB + HB model (fig 9B(c)), herd behaviour is fully mediated by subjective norm with an effect size 0.3977. Herd behaviour 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 9B(d)). Personal norm is also partially mediated by attitude with an effect size 0.1831.

Table 11: 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

5.3.2.A The NAM model

Figure 10A: The NAM Structural Model
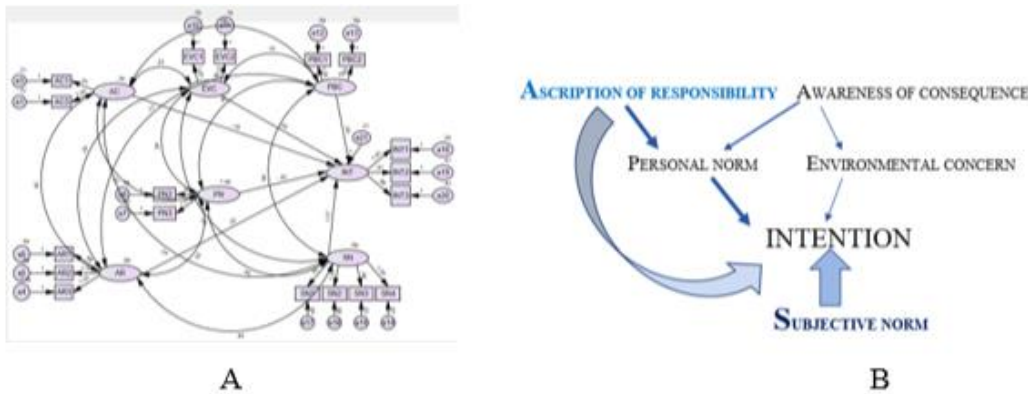
Figure 10B: Mediated Pathways of Intention Formation in the NAM Model

Table 12: 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 12, 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.

5.3.2.B Mediated Pathways: NAM model

Fig 10B 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 10B, 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 13 summarizes the significant mediated intention formation pathways.

Table 13: 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

5.3.3.A The PMT model
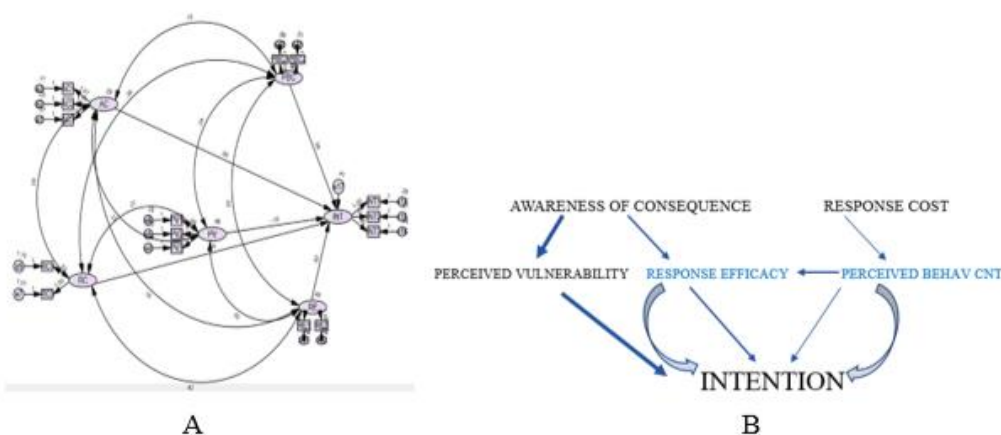
Figure 11A: The PMT Structural Model
Figure 11B: Mediated Pathways of Intention Formation in the PMT model

Table 14 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 the 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.

5.3.3.B 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 15: 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

## 5.3.4.A 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 16.

Table 16: 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
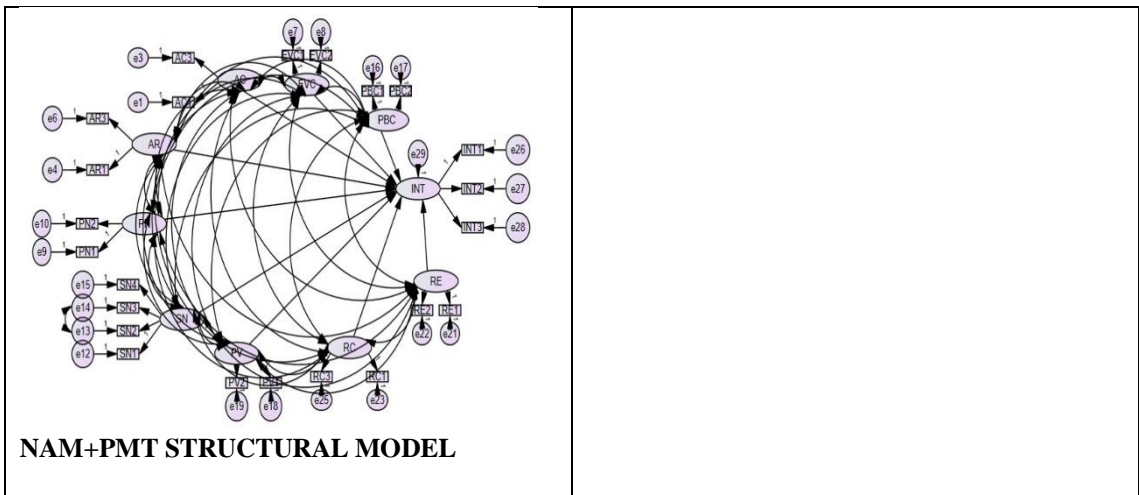
NAM+PMT STRUCTURAL MODEL
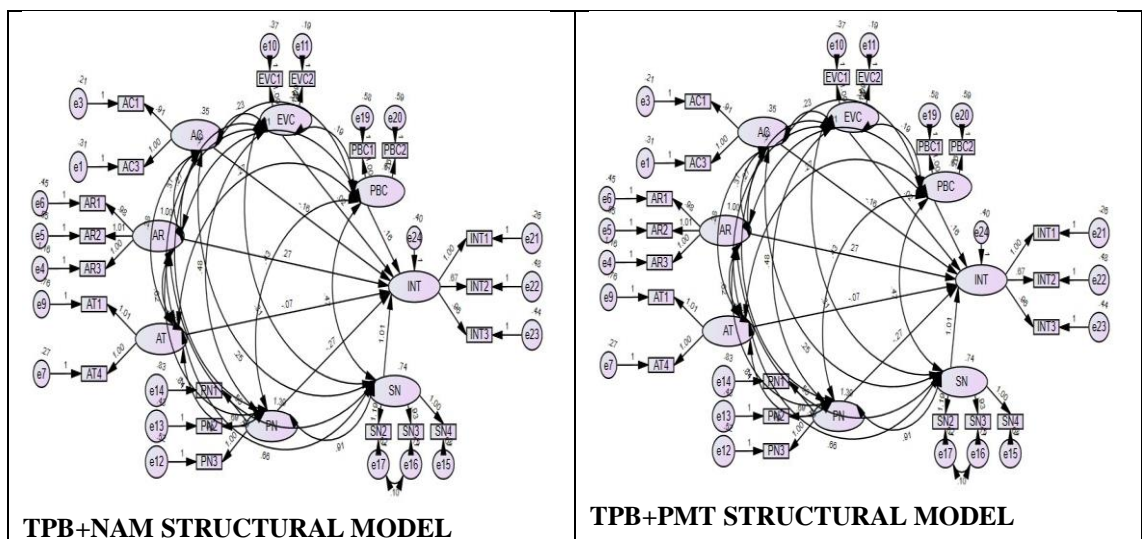
Figure 12A: Combined Structural Models

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%).

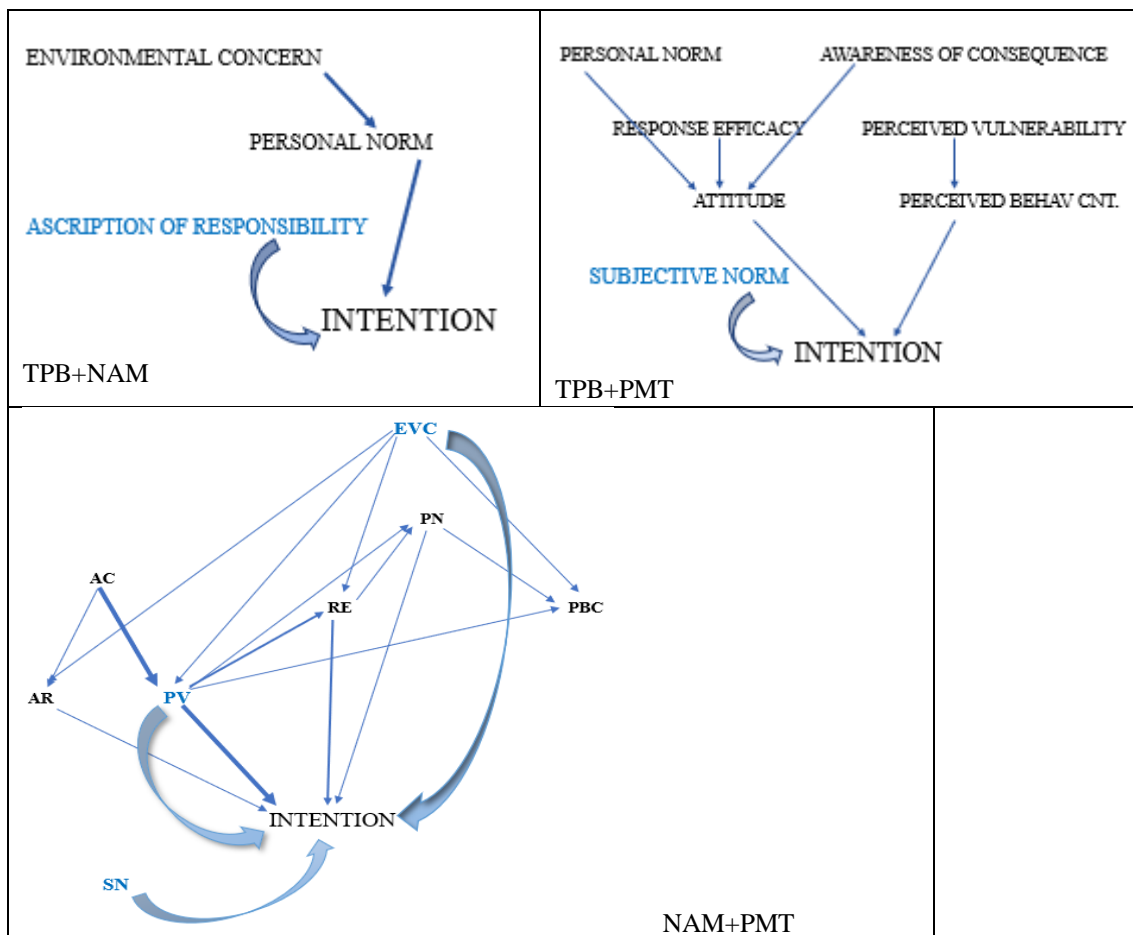## 5.3.4.B Mediated Pathways of Intention Formation: Combined Models

Figure 12B: Mediated Pathways of Intention Formation

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

Table 17: 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

6. Discussions

From the CFA analysis this study establishes that all the latent constructs have met the criteria of reliability and validity. Infact the newly developed constructs of herd behavior and cost have also been established. All of 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 India, for a middle-income individual. Two other direct determinants of intention in India 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.

Based on the mechanism of intention formation towards adoption of an EV, this study suggests an adaptation of the original TPB model and suggests a new structural model as shown below in figure 13.
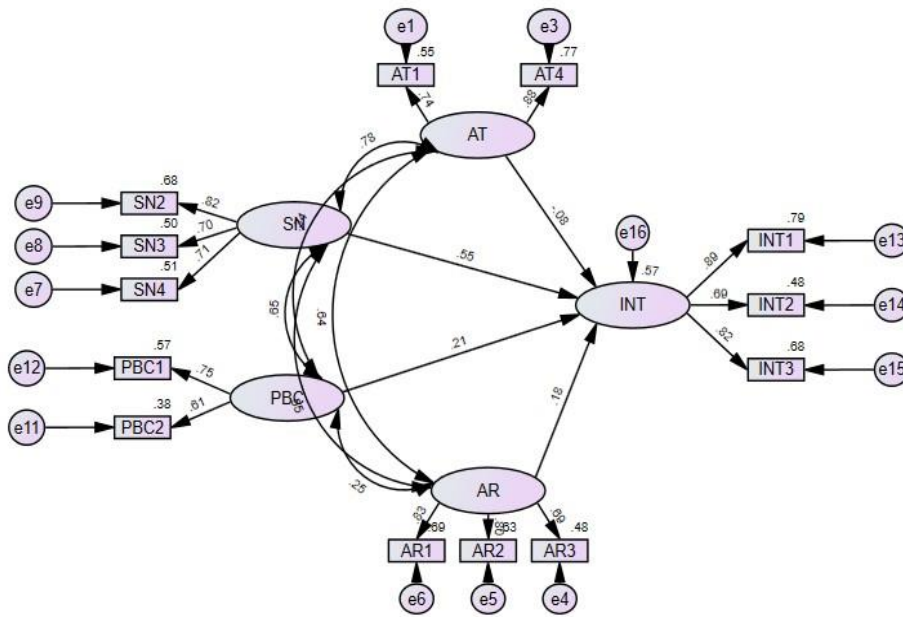
Figure 13: New Structural Model for Intention to Adopt an EV in India

In the newly suggested structural model in the context of India's EV adoption, three out of four constructs are direct determinants of intention. Subjective norm has a direct impact on intention with an effect size of 0.547 (significant at 1%), perceived behavioral control has a direct impact of size 0.214 (significant at 5%), and ascription of responsibility has a direct effect of size 0.179 (significant at 1%) on intention to adopt an EV. Regarding attitude, it is mediated by perceived behavioral control with an effect size 0.0969 and perceived behavioral control in turn is mediated by subjective norm with an effect size of 0.2688. Hence it can be stated that intention formation for adoption of an EV in India is given by INT = f (SN, PBC, AR). It will be interesting to examine if this new structural model holds good in other contexts or other countries as well.

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? In the section that follows, recommendations for behaviorally informed policies are discussed.

7. Policy Recommendations & Conclusion

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 amount but tends 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 a 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 also 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 taking into account the consideration of 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 India, 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.

7.1 Policy Recommendations to Activate Gain Motivation

Subjective norms and perceived behavioral control are the direct determinants of intention and hence policies should aim to trigger these two aspects to activate gain motivation. Once these two aspects are activated, then policies to trigger people's positive attitude towards EV adoption may be targeted.

Now the question that arises is how can policies trigger subjective norms? This can be done by trying to enhance an individual's perception of other people's impressions of him/her buying an EV. For instance, an EV can be positioned as status symbol' among the range of cars in the market. An individual's act of buying an EV needs to be given due recognition at the local level, such as at the level of a ward or a municipality, where the possibility of people knowing one another in the city increases.

People are in general competitive by nature. Especially when other members in their social circle successfully adapt to a task, they find it hard to even think they will not be able to do it. This behavioral characteristic of an individual can be used to trigger perceived behavioral control. For instance, instead of providing subsidies at random, subsidies should be targeted to friends and relatives of the buyers of an EV. This will reinforce the perceived behavioral control of the second phase buyers in the social network. The subsidies can be continued with a slight reduction then to the third phase buyers. Creation of such a chain will facilitate the working of the intention formation mechanism where subjective norm mediates perceived behavioral control, and perceived behavioral control in turn mediates attitude, and subjective norm is the strongest determinant of intention to buy an EV. Providing subsidies at random reduces the chances of development of such a social motivation chain in pushing out EVs rather than petrol/diesel vehicles onto the roads.

7.2 Policy Recommendations to Activate Norm Motivation

Among the norm motivators, again subjective norm and ascription of responsibility are the strongest and direct determinants of intention to adopt an EV. Personal norm acts as an important mediator in the formation of intention.

To trigger people's subjective norm and personal norms, EVs need to be positioned also as an act of responsibility, a noble act towards the society, and an act of decent living.

To trigger people's ascription of responsibility, they need to be made to feel responsible of causing some harm to the environment and how they can act to prevent it. If awareness campaigns about climate change will not help. An individual needs to know his/her contribution to it. This can be done by providing an account of people's

personal carbon footprints in their daily travel, and how those could have been reduced through sustainable personal mobility options like an EV. These personal carbon footprint information needs to be displayed not only to the person himself/herself, but to trigger social competition and subjective norms, such a neighborhood/social circle ranking need to be displayed so that everyone can keep a track of their and others footprints as well. The process doesn't end here. Those who ranks the highest in terms of least carbon footprints needs to be provided special privileges and rewards in the society. This again needs to be done at a local level of a ward or municipality to be effective. Another benefit of pre-specified ascription of responsibility is that it can act as a natural guard against its violation as people have an inherent fear of giving a negative impression on others of their not being able to fulfil their responsibilities.

The effects of subjective norms wane off as the boundary of the social circle increases. Hence, targeting these incentives at a local level is important. Also, at a local level, an individual can be made to feel an integral part of the society and that his/her action matters. Individuals need to be made to realize that they are an important agent that can make awesome differences for their future. A feeling of 'importance' and a 'feeling of my action matters' is important to activate ascription of responsibility.

Subjective norms can also be triggered by providing awards, symbolic recognition like a 'green badge' to the sustainable household, etc.

7.3 Policy Recommendations to Activate Protection Motivation

Perceived vulnerability, response efficacy, and perceived behavioral control are the strongest fear and protection motivators in the intention formation for adoption of an EV.

Fear can be used to motivate people to take corrective actions. While triggering fear, this again needs to be done at the level of an individual rather than at the level of the society to enhance its effectiveness. For instance, when providing messages about how an individuals' personal vehicle emission can cause future threat to himself/herself by causing them to breathe in toxic air & how it is harming their body can help invoke fear which can then trigger him/her to take actions for sustainable mobility. But if the message is spread in a way that says 'personal vehicle emissions increase the GHG emissions that is speeding up the process of climate change', then in this 2nd statement people's fear do not get triggered as it seems like possible threat looms at the global level. People are by nature self-centered and as long as personal harm is not underway, corrective measures are difficult to enforce.

People are also seen to display a lot of optimism bias. At the face of any messages communicating dangers to the climate, they feel that personally they will be fine. This kind of optimism bias also necessitates invoking fear at a personal level. Many a times people also feel that climate change is a distant possibility and any catastrophic consequences is atleast not destined to happen during their lifetime. This is another way of displaying optimism bias. Another reason besides being self-centered nature of people might be that they feel they are too small an entity to cause any harm or do any good.

Also, to trigger response efficacy, government must design policies and provide infrastructural facilities that make adoption of EV feasible, and achieving reduction of GHG emissions on their part a doable action, atleast

at the local level. The feasibility and do-ability aspect will encourage many people to get involved in the adoption of sustainable personal mobility options like an electric vehicle.

8. Directions for Further Expansion of this Study

As the climate change process has begun to place before us new challenges to be addressed and new questions to be answered, this field of research has many directions. This study attempts to provide a crucial and in-depth insight into the process of intention formation in the decision to adopt an EV for an individual belonging to the middle-class group in India. It presents before us the rules for intention formation, and surprisingly it is heavily dependent on norms and fear, rather than popular considerations like costs and subsidies based on which the governments in various states, and at the center is enthusiastically framing EV adoption incentive schemes. Since there are several loopholes in the present government policies, it will be interesting to examine the sensitivity of people's intentions for EV adoption or any other pro-environmental action with the changes in government policies, as an extension of the present study.

Secondly, the newly proposed structural model in fig 13, poses several questions that are left to be answered: can this new model answer pro-environmental behavioral intentions in other similar socio-demographic, and socio-political contexts? If it holds good in explaining pro-environmental behavior in general, can it be developed as a theory? Herd behavior and personal norms were full mediators in the presence of subjective norms. It will be interesting to incorporate these two mediators in the proposed new structural model as well. This is because, these small nudges provide a lot of low-cost options to policy makers, especially in the developing nations to influence people's pro-environmental behavior, rather than relying on heavy subsidies and external financing to achieve climate change mitigation goals.

Again, influencing behavior is not as easy as doing so by providing some subsidies and incentives. Behavior change is a phase-wise transition process that begins with pre-contemplation, contemplation, preparation, action, and ends with maintenance. Often, intention does not translate to behavior, or as it is commonly said intention-behavior gap is seen to exist. We would like to extend this study by analyzing intention-behavior gap, where the objective will be to minimize the intention-behavior gap and prevent behavioral rebound effects.

This study can be extended in many different directions, as well as methodologically. Infact, it can be agreed that the era of behavioral sciences and behavioral economics has just begun. New political orders are getting formed very often. Priorities and social trends are changing, and so are the inconsistencies in the decision-making process. It is always easy to make paternalistic policies at the governmental level and try to strictly enforce at the level of the common man. This then raises the question of fairness and people's welfare. Also, how long can such paternalistic policies be sustained? Similarly, climate mitigation behavior in people needs to be developed organically in order to make it a habit and sustain it in the long-term. For this, an in-depth behavioral understanding of the change-making agents is the key to the future. This is what this study was about and it commits to achieve, going ahead in the future.
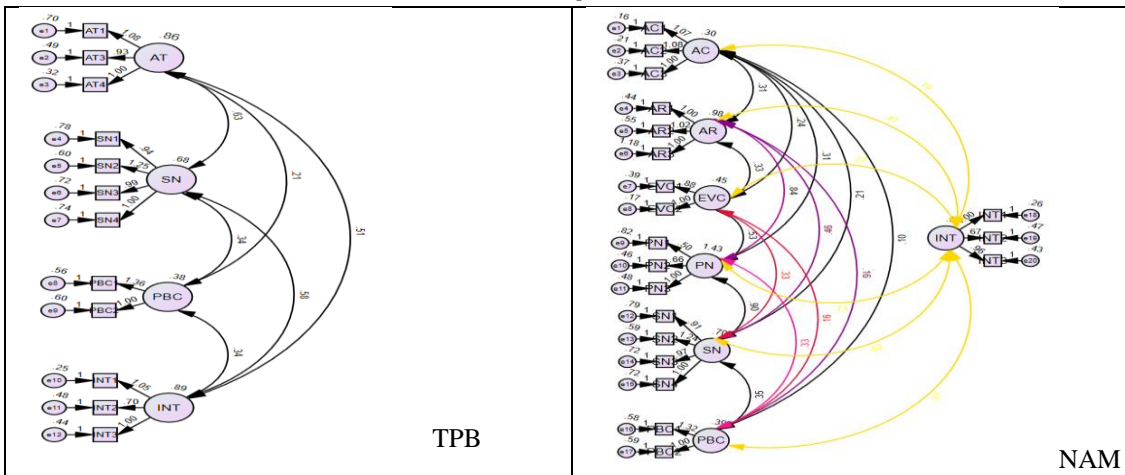
Appendix A

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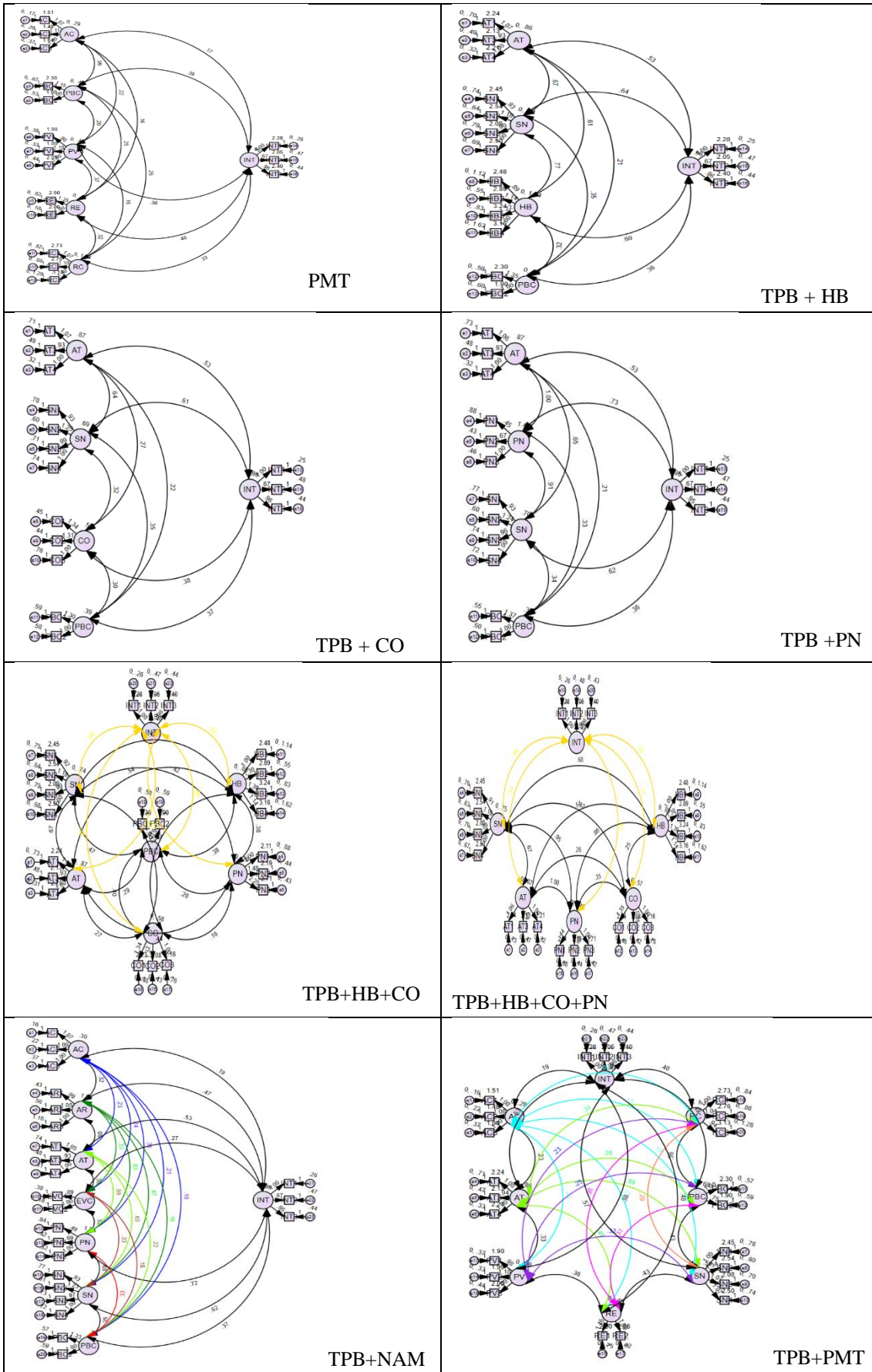
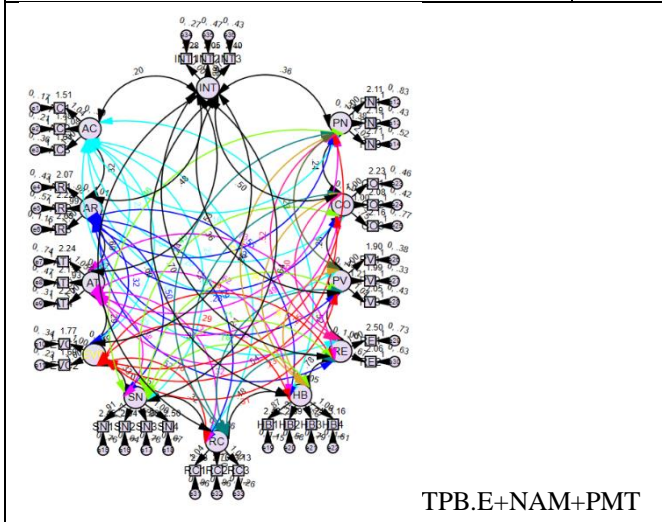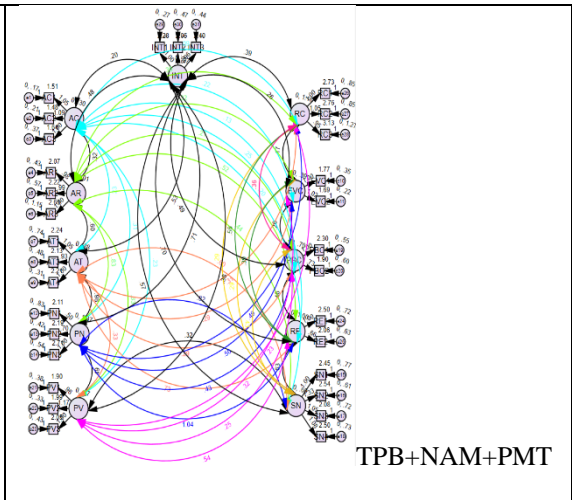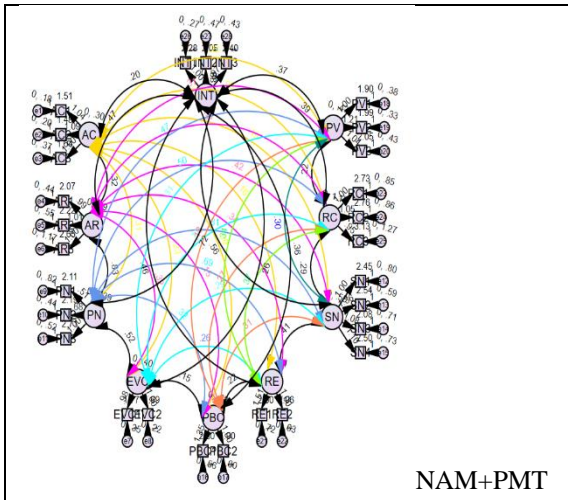Please tick (√) the box that apply to you against each statement

		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 CO_2 emissions into the environment							
AC2	Increasing CO_2 emissions contribute to the climate change crisis							
AC3	Increased use of petrol/diesel vehicles is contributing to the lower air quality of my surroundings							
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							

Appendix B
The measurement models used in the study

TPB

NAM

PMT

TPB + HB

TPB + CO

TPB +PN

TPB+HB+CO

TPB+HB+CO+PN

TPB+NAM

TPB+PMT

NAM+PMT

TPB+NAM+PMT

TPB.E+NAM+PMT

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