

**FACTOR AFFECTING THE ADOPTION OF ELECTRIC VEHICLE:
A MODERATING ROLE OF CHARGING INFRASTRUCTURE
BASED ON AN EXTENDED UNIFIED THEORY OF
ACCEPTANCE AND USE
OF TECHNOLOGY**



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Thesis Title Factor affecting the adoption of electric vehicle: A moderating effect of charging infrastructure based on an extended unified theory of acceptance and use of technology (UTAUT2)

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ABSTRACT

Electric vehicles (EVs) have the potential to reduce significantly the amount of gasoline consumed and carbon emissions produced during transportation. The transition from conventional autos to EVs must be implemented in Thailand and Pakistan. Therefore, this study investigated the determinants that drive customers to embrace EVs in Thailand and Pakistan to show a comparative analysis. The survey comprised 520 respondents, including 220 from Thailand and 300 from Pakistan. The data were gathered via an offline survey questionnaire using purposive sampling. This study applied confirmatory factor analysis (CFA) and structural equation modeling (SEM) techniques to provide a comprehensive informational framework about the variables of UTAUT2. UTAUT2 is optimal for examining the adoption of new technology in consumer settings, as it encompasses both practical considerations and psychological components. This study extended the UTAUT2 to provide a thorough knowledge of the determinants affecting EV adoption,

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emphasizing technological, behavioral, environmental, and policy-related issues. This research offers a distinctive comparative examination of Thailand and Pakistan, two developing markets where electric vehicle adoption is on the rise, despite UTAUT2's primary application in single-country situations. This study investigates how these countries influence consumer behavior under varied cultural and economic contexts. This comparative method facilitates a comprehensive knowledge of the various factors influencing EV adoption, providing essential insights for policy formulation and marketing strategies that can advance sustainable transportation solutions adapted to regional contexts. The findings ultimately enhance EV adoption by addressing technological and behavioral variables within a cross-cultural framework. The results show that in Thailand, factors such as environmental concern, hedonic motivation, trust, behavior intentions, social influence, and effort expectancy are significant factors. However, price value, facilitating condition, habit, and satisfaction with incentive policies were insignificant factors. In Pakistan, environmental concerns include price value, hedonic motivation, trust, behavior intentions, and habits. However, conditions, social influence, effort expectancy, and satisfaction with incentive policies are facilitated. Overall, the model results for Thailand and Pakistan differ; however, some factors were similar in path-to-path analysis after the model was different. The study also provides practical implications for policymakers and companies for mass adoption in Thailand and Pakistan. By effectively incorporating these criteria, sustainable and competitive policies will enhance consumers' likelihood of using EVs. In addition to the need to use EVs in institutional settings, the state government must formulate a comprehensive plan for transitioning its current vehicle fleet and public transportation to EVs.

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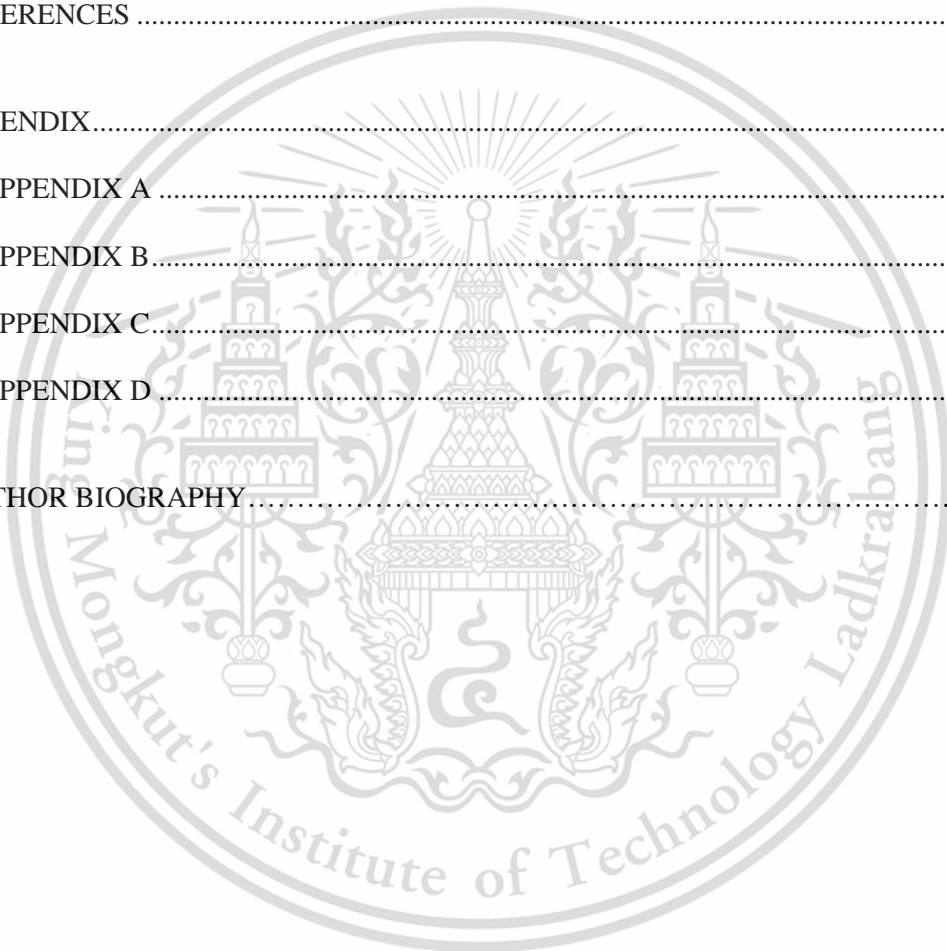
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The logo of Mongkut's Institute of Technology Ladkrabang is a circular emblem. It features a central five-tiered stupa with a sunburst above it. The stupa is flanked by two traditional Thai lamps (Ladkrabang) on stands. The entire emblem is surrounded by a decorative border. The text 'Mongkut's Institute of Technology Ladkrabang' is written in a circular path around the emblem.

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CHAPTER 1

INTRODUCTION

1.1 Background of the study

On average, most individuals, precisely nine out of ten, inhale polluted outdoor air that surpasses the limit set by the World Health Organisation (World Health Organisation, 2016). As per the United Nations (2014), over half of the global population already resides in urban regions, and this proportion is projected to increase to 70% by 2050. The swift expansion of urban activities has exacerbated air pollution in densely populated regions, heightening considerable health and environmental issues. (Cavallaro et al., 2024; Cheng et al., 2016). Transportation pollutants, primarily from fossil fuel vehicles, contaminate urban air. These emissions release nitrogen oxides and particulate matter, contaminating the air and adversely affecting health. Enhancing urban air quality necessitates reducing harmful pollutants by promoting cleaner, more efficient transportation methods (Singh et al., 2023). The presence of densely built high-rise buildings and limited open spaces can worsen air quality problems by restricting natural air circulation (Ahmed et al., 2021). Mitigating air pollution necessitates enhancing the efficiency and equilibrium of vehicular energy usage. This guarantees optimal energy utilization, decreases emissions, and facilitates the integration of cleaner, renewable energy sources, thus fostering a healthier environment (Cavallaro et al., 2024). To achieve widespread adoption, vehicle energy sources must be available (Kongklaew et al., 2021; Savari et al., 2022).

Goswami and Sadhu (2021) emphasize the economic and time-efficient benefits of electric vehicles (EVs), as well as their favorable environmental impacts (Karolemeas et al., 2021). EVs differ from ICE vehicles due to the lack of several complex systems in traditional engines. Internal combustion engine vehicles require coolant to prevent engine overheating, regular oil changes for lubrication, and a starting battery to ignite the engine. Moreover, they have exhaust systems that

necessitate maintenance to control emissions. Electric vehicles include simpler drivetrains defined by a reduced number of moving parts and the elimination of some components, hence significantly decreasing maintenance costs and improving long-term reliability (Albatayneh, 2024; Vražić et al., 2014). In urban regions, a potential scenario entails transitioning from conventional vehicle fleets to environmentally sustainable options, such as electric or hybrid automobiles. This change may substantially diminish urban air pollution, lower greenhouse gas emissions, and foster a healthier environment. Furthermore, it would promote sustainable urban growth and establish a benchmark for future environmentally friendly transport efforts (Efthymiou et al., 2017; Woo et al., 2024). The transition to clean energy and decarbonization depends on the widespread adoption of electric vehicles (EVs) and electric mobility (Morton et al., 2017; Zhou et al., 2020). Individuals with a solid environmental consciousness are less inclined to own vehicles that rely on fossil fuels (Joshi et al., 2022). The concern about the environmental impact it causes may motivate individuals to choose electric automobiles instead of conventional ones (Bockarjova & Steg, 2014). Furthermore, electric vehicles exhibit minimal adverse ecological consequences due to their recharging ability and independence from finite fossil fuels (de Oliveira et al., 2022). Therefore, it is imperative to develop adoption-related strategies and policies that can enhance the process's robustness, effectiveness, and long-term viability (Karolemeas et al., 2021). Nevertheless, the broad adoption of electric vehicles is expected to result in economic and technological challenges and benefits (Ajanovic & Haas, 2016; Burra et al., 2024). Some of the major obstacles are the development of charging infrastructure, improvement of the electrical distribution grid, addressing practicality issues, and dealing with legal and privacy concerns related to coordinated "smart" charging systems (Trinko et al., 2022).

Tamilmani, Rana, Wamba, and Dwivedi (2021) and Dwivedi, Rana, Jeyaraj, Clement, and Williams (2019) conducted a comprehensive analysis of UTAUT by employing meta-analysis and structural equation modeling techniques on 162 prior studies. Their findings indicate that variables like attitude were not considered mediators due to their potential for directly influencing behavioral

intentions. Hence, it would be intriguing to incorporate novel mediators, such as trust, into the UTAUT2 framework. Chaouali, Yahia, and Souiden (2016) have discovered compelling data demonstrating trust's significant impact on intention within the UTAUT2 paradigm. Gu, Wei, and Xu (2016) assert that trust plays a fundamental role in the decision-making process of adopters when it comes to utilizing new technologies, particularly in the context of energy-efficient products like electric vehicles (Gorton et al., 2021). Trust is widely recognized as crucial in uncertain situations and risks (Yuen et al., 2020; Zhou, 2011).

The UTAUT2 theory has a significantly higher predictive capacity than UTAUT. It can explain around 74 percent of the variation in consumers' behavioral intention and 52 percent in consumers' technology usage of the focus technology (Venkatesh et al., 2016). UTAUT2 is particularly suitable for studying consumer acceptance of technology, especially in electric vehicles (Curtale et al., 2022). Arribas-Ibar, Nylund, and Brem (2021) argue that adopting electric vehicles requires government interventions due to market, system, and institutional problems hindering this important technological transition. The empirical investigation of policy effects on electric vehicle (EV) adoption remains a notable research gap (Hu et al., 2020).

Zhang, Bai, and Shang (2018) investigated the advantages of adopting electric vehicles and the motivation to participate in incentive programs using data from 264 respondents. They also suggested investigating the influence of policies on behavioral intentions towards electric vehicles. They suggested that policies might mitigate the adverse effects of incentive policies being phased out by the recognized environmental benefits of electric vehicles and enhance charging infrastructure to minimize perceived risks. Furthermore, Trinko et al. (2022) examine the economic viability of high charging power in locations with heavy traffic and propose that the infrastructure of charging stations is undetermined. Therefore, it would be intriguing to investigate the moderating influence of charging infrastructure.

Thananusak et al., 2020; Nguyen et al. (2024) underscore that charging infrastructure is essential for the extensive deployment of electric vehicles (EVs). Robust and accessible charging

networks enhance consumer confidence by mitigating apprehensions regarding range anxiety and the convenience of recharging. This guarantee motivates additional individuals to contemplate and invest in electric vehicles, thus facilitating increased adoption and the transition to sustainable transportation. Murugan and Marisamynathan (2024) examined policies related to adopting charging facilities. They proposed investigating the impact of charging infrastructure in developing nations, as the willingness of users to adopt EVs differs across countries owing to factors such as the availability of charging infrastructure, incentives, consumer behavior, and user awareness. Similarly, Burra et al. (2024) examined the impact of charging infrastructure on EV ownership. They proposed further investigation into this topic due to their inadequacy of sample size and study type. Prior studies have examined facilities (Hu et al., 2020; Zhang et al., 2018), although the specific aspect of charging station facilities remains unexplored. This study has examined charging infrastructure as a moderating variable. Electric vehicles are a recent entrant in the transportation business, and numerous research have been undertaken in wealthy nations. Nonetheless, research in developing nations like Thailand and Pakistan remains insufficient. Previous research has concentrated on infrastructure and incentives in industrialized nations, including China, the United States, and Europe (Zhang et al., 2018; Trinko et al., 2022; Curtale et al., 2022).

Thanatrakolsri and Sirithian (2024) emphasized that Thailand confronts substantial issues concerning air pollution and greenhouse gas (GHG) emissions from road transportation. Notwithstanding actions aimed at reducing emissions, such as the promotion of electric vehicles (EVs) and public transportation, Thailand is anticipated to experience a 6.58% rise in the number of vehicles on the road by 2030, resulting in elevated emissions. The adoption of electric cars (EVs) and the reduction of vehicle kilometers traveled (VKT) might substantially decrease greenhouse gas emissions and pollutants, aiding the nation in fulfilling its commitments under the Paris Agreement. Similarly, In Pakistan, air pollution from internal combustion engines, particularly from obsolete

automobiles, intensifies environmental and health issues. Bajwa and Sheikh (2023) observed that metropolitan regions in Pakistan are significantly impacted by emissions from two- and three-wheeled vehicles, which discharge detrimental particulate matter and hazardous compounds. Both nations encounter significant environmental issues, although they also undertake measures to shift to electric mobility.

Thailand has witnessed significant expansion in its electric car market, with electric vehicle registrations surging by 380% from 2022 to 2023, indicating a swift adoption of EVs. The Thai government aims for 30% of the national fleet to consist of electric vehicles by 2030, bolstered by substantial infrastructure advancements, notably the proliferation of charging stations. Conversely, Pakistan's electric car market remains nascent, with approximately 15,000 electric vehicles currently in operation as of 2024. The nation has established lofty objectives within its EV Policy 2020–2025, targeting the deployment of up to 100,000 electric vehicles in the forthcoming years, with aspirations for 90% of vehicle sales to be electric by 2040. Thailand possesses a sophisticated EV infrastructure and substantial governmental backing, but Pakistan faces obstacles such as inadequate infrastructure, insufficient consumer awareness, and the necessity for enhanced regulatory enforcement. This study provides valuable insights into the distinct barriers and opportunities for electric vehicle adoption in these two countries through a comparative analysis, with implications for policy-making and infrastructure development in other developing economies seeking to transition to sustainable transportation solutions. This paper analyses the adoption of electric vehicles (EVs) in Thailand and Pakistan, emphasizing the principal problems encountered by both nations. These nations face similar challenges, including the necessity for comprehensive charging infrastructure and

legislation suited to their unique environments. The results underscore the significance of incorporating solar energy and properly positioning fast-charging stations to facilitate the extensive adoption of electric vehicles. This research compares the experiences of Thailand and Pakistan, offering useful insights for other developing nations facing analogous infrastructure issues, so establishing a foundation for future policy formation and research in this domain.

To accomplish this goal, this study will examine the impact of several factors on usage behavior in Thailand and Pakistan. Secondly, the intermediary function of trust and the intention to utilize electric vehicles. Furthermore, the moderating function of charging infrastructure. Finally, this study will expand the UTAUT2 framework by examining environmental, behavioral, technological, and policy-related viewpoints. This study aims to assist practitioners in the field of electric vehicles with marketing techniques specific to widespread acceptance and government policy execution in Thailand and Pakistan.

1.2 Problem statement

Air pollution is a significant challenge in Thailand and Pakistan, and ICE is the most significant contributor to poor air quality. Therefore, a shift from ICT to EV is vital. However, people are still reluctant to adopt because of many factors, such as policies and infrastructure. Therefore, this study has provided implications and a clear picture for practitioners, government, and policymakers to encourage mass adoption.

In Thailand, air pollution is worsening owing to the country's reliance on fossil fuels; cars are one of the significant contributors to poor air quality. The Thai Ministry of Energy has decided to raise domestic electric vehicle production by 30% by 2030. According to Thailand's Energy Efficiency Plan 2015 (EEP2015), the transportation sector has the most significant potential to cut energy usage. Energy consumption in the transportation sector is expected to drop by 40% by 2036,

with 1.2 million private electric vehicles on the road, implying lower energy consumption. EVs can tremendously reduce fuel usage and CO₂ emissions in the transportation sector. In a recent study in Thailand, Kongklaew et al. (2021) concluded that the main problems with adoption are financial, performance, and infrastructure, which challenge governments, policymakers, stakeholders, and the private sector to overcome these barriers. The most concerning EV barrier is public infrastructure, which could imply that currently available infrastructure does not meet public satisfaction. Issues regarding adopting electric vehicles must be resolved to maintain air quality and conserve energy. As a result, this research is an initial endeavor to explore the factors affecting adopting electric vehicles in Thailand.

In the report of Ullah (2019), The transportation sector has been growing with double-digit growth in Pakistan. Almost all of the transportation sector is dependent on oil-based products, and the country spends almost USD 13 billion on oil imports every year. If our transport sector continues to grow at the same double-digit rate, the bill for oil import is expected to reach USD 30 billion by 2025. Pakistan has already been declared the seventh most vulnerable country due to the effects of climate change (Global et al., 2018). In Pakistan, EVs can readily utilize the power—supply glut in the next several years. According to our estimates, almost 500,000 EVs can be fully charged daily with a supply of just under 1000 MW after considering all the transmission and distribution losses. Due to the efficiency of battery-based energy storage, EVs can give the same mileage at one-third of the cost compared to their Flexible fuel vehicles (FFV) rivals. Almost 37 percent of electricity generation in Pakistan is from renewable sources. Adding this to the efficiency of EVs results in 70-80 percent less environmental emissions when compared to FFVs. This means that while the tailpipe emissions of EVs are zero, the overall impact of EVs is around 70-80 percent reduction in environmental emissions in the overall energy value chain. Environmental pollution is a severe concern for the earth's atmosphere, so a dire need has emerged to address the potential threat. The world has realized the significance of EVs in promoting sustainable global development. Whether developed, developing, or underdeveloped, many countries across the globe have set

targets to incorporate a fixed number of EVs into their transportation network over the next few years. In Pakistan, environmental pollution is not a threat. Instead, its adverse effects can be easily quantified. Therefore, Pakistan needs an even more ambitious plan to limit environmental degradation, and the introduction of EVs in Pakistan can potentially be a substantial component of this plan.

1.3 Research Gap

Current research on electric vehicle adoption inadequately encompasses all pertinent aspects affecting the adoption process. The influence of charging infrastructure on adoption is notably under-examined, especially in developing nations like Pakistan and Thailand. These studies frequently neglect to account for the varied consumer behaviors, technological factors, environmental influences, and policy-related perspectives that affect adoption in different regions. Consequently, additional research is required to broaden the analyzed factors, incorporate a more diverse array of stakeholders, and evaluate the moderating impacts of charging infrastructure on electric vehicle adoption across different geographical contexts, especially in emerging economies. This might be accomplished by employing more extensive models, such as the expanded UTAUT2.

This study by Boubker et al. (2024) analyses the factors affecting electric car (EC) uptake in Morocco, emphasizing important characteristics like relative advantage, perceived ease of usage, green perceived usefulness, environmental concern, and social impact. These characteristics positively influence people's opinions about ECs, augmenting their inclination to embrace them. Nevertheless, the study population was confined to automobile consumers, and broadening the research to encompass experts and professionals involved in the EV production process could enhance the model and yield a more profound comprehension of how EC attributes affect adoption. The study examined only six variables in assessing the determinants of EC adoption intention; future research could enhance this model by including additional factors such as EC characteristics, social status, trust, and individual traits to understand the adoption process better.

Curtale, Liao, and Rebalsk (2022) conducted a quantitative study on transitional behavioral intention to use autonomous electric cars in European countries by applying UTAUT2 and collected data from 2154 respondents from France, Italy, the Netherlands, and Spain. The multi-group analysis showed heterogeneous intentions across the countries. Further, it allowed future researchers to explore other factors of UTAUT2, such as price value and habits, to have a more solid understating of electric vehicles. Similarly, Khazaei and Tareq (2021) explored the adaptation of electric vehicles in Malaysia with 322 respondents. For the future, it is recommended to include performance expectancy, price value, and habit to understand better electric vehicles based on UTAUT2, as the current study could provide a precise implementation of UTAUT2. Therefore, it will be fruitful for future researchers to investigate electric vehicles based on extended UTAUT2 for a clear picture.

Tamilmani, Rana, Wamba, and Dwivedi (2021) and Dwivedi, Rana, Jeyaraj, Clement, and Williams (2019) argued that after rigorously examining UTAUT using meta-analysis and structural equation modeling techniques on 162 previous pieces of research, variables such as attitude were not included as mediators because they can have a direct effect on behavioral intentions. Therefore, it would be interesting to include new mediators, such as trust, in the mechanism of UTAUT2. Incorporating trust into the UTAUT2 model, Riffai, Grant, and Edgar (2012) and Chaouali, Yahia, and Souiden (2016) find strong evidence for the role of trust in affecting intention as well as use behavior (Yuen et al., 2020). According to Gu, Wei, and Xu (2016), trust is a basis for adopters' decisions to use new technologies, especially in energy-efficient products such as electric vehicles. Indeed, trust is considered a focal concept in uncertain and risky situations (Yuen et al., 2020; T. Zhou, 2011).

In the study of Arribas-Ibar, Nylund, and Brem (2021), it has been mentioned that EV adoption requires policy interventions, as the electric vehicle sector still lacks a whole perspective, structure, and ecosystem governance since the coordination of policies requires cooperation, not only from different public national and international authorities but also between the different

stakeholders and participants in the ecosystem. Therefore, there is still a significant research gap regarding empirical analysis of the effect of policies on EV adoption Hu, Wang, & Li, (2020). Similarly, Zhang, Bai, and Shang (2018) explored the benefits related to adaptation of electric vehicles and motivation toward incentive policies based on 264 respondent data, further recommended examining the impact of policies on behavioral intentions towards electric vehicles as policies can reduce the negative impacts of incentive policy phasing out by outstanding EV's environmental benefits and increasing charging facilities to reduce perceived risks. Additionally, Trinko et al. (2022) studied the economic feasibility of high charging power in high-traffic areas and suggested that the infrastructure of charging stations is still undefined; therefore, it will be interesting to explore the moderating role of charging infrastructure.

Yuen, Cai, Qi, and Wang (2020) explored factors influencing autonomous vehicle adoption based on the technology acceptance model and innovation diffusion theory and further suggested that studying actual behavior and using another model, such as the Unified Theory of Acceptance and Use of Technology², As UTAUT² is a more appropriate model for technology adoption in the consumer context. Wu et al. (2019) conducted a study on the role of environmental concerns and intention to use electric vehicles in China based on the TAM model, as the study considered young respondents and prospective users. They further recommended studying other factors related to technology adoption in the context of electric vehicles to understand behavior thoroughly. Based on the above studies, this study investigated factors affecting the adoption of electric vehicles, a moderating effect of charging infrastructure based on an extended unified theory of acceptance and use of technology (UTAUT²).

1.4 Contextual Gap

Burra et al. (2024) addressed a deficiency in understanding the determinants influencing EV ownership, particularly at a localized scale. This is crucial for optimising public charging infrastructure investments. They employed a methodology that integrates a discrete choice model

with a synthetic population generated by a Bayesian network. The research primarily focused on Maryland, United States, and examined the impact of public charging stations (level-2 chargers and DC fast chargers) on the quantity of electric vehicle users at the census tract level. Several significant factors influencing electric vehicle (EV) usage were identified, including the availability of rapid charging, the option to charge at the workplace, and the capacity to work remotely. The model applied to the fabricated population indicated that electric vehicle adoption will accelerate more rapidly in suburban areas than urban centres, with higher-income demographics being the most inclined to purchase an electric vehicle. This indicated that disparities in EV ownership are influenced by geographic location and income levels. Also, it is important to use the most recent data to show how quickly the market for electric cars and charging stations is changing. This method might be beneficial in other states or countries where the electric vehicle business is still new to find the most significant problems and best chances to get people to buy electric cars. This is an excellent way for policymakers in Thailand and Pakistan to learn about how charging infrastructure varies by area, how different factors affect adoption rates, and the demographics that affect how well electric vehicles are received. Putting money into infrastructure and giving benefits suited to these needs could speed up the switch to electric vehicles, ensure everyone has a fair chance, and help the EV market grow in both countries.

The research of Asadi et al. (2021) formulates a model that combines the Theory of Planned Behaviour (TPB) and the Norm Activation Model (NAM) to forecast customers' intention to embrace electric cars (EVs). The results demonstrate that variables such as attitude, perceived value, consumer efficacy, subjective norms, perceived behavioral control, and personal norms substantially affect intentions to adopt electric vehicles. The study has drawbacks, notably its dependence on behavioral intentions instead of actual adoption and its utilization of the Theory of Planned Behaviour (TPB) and the Norm Activation Model (NAM), indicating that future research would benefit from integrating alternative frameworks such as the Technology Acceptance Model. The findings, derived from research conducted in Malaysia, may lack generalizability to other

situations. Consequently, it would be pertinent to undertake research in Pakistan and Thailand, as these developing nations encounter distinct problems and opportunities regarding EV adoption. At the same time, most existing studies have concentrated on industrialized countries. These nations encounter varying socio-economic conditions, infrastructural obstacles, and consumer behaviors that may affect electric vehicle adoption. Executing analogous studies in these places would yield significant insights and assist in customizing policies and methods to enhance EV adoption in emerging nations, taking into account their distinct conditions and developmental phases.

Ponsree et al. (2020) investigated environmental knowledge and intents for electric vehicles in Khon Kaen, Thailand. Nonetheless, the survey mostly concentrated on feedback from adolescents, which may not accurately reflect the wider demographic of Thailand. This constraint indicates that subsequent studies should focus on gathering data from a broader range of demographic groups to enhance the credibility and generalizability of the findings. A broader representation of age demographics, income brackets, and geographic areas would yield a more thorough comprehension of the determinants affecting electric vehicle adoption in Thailand. Consequently, gathering data from metropolitan areas like Bangkok would be valuable, as they exhibit greater diversity in demographics, income levels, and consumer behaviors. Research in metropolitan areas would yield a more thorough understanding of the factors affecting electric car adoption among a broader and more representative demographic. This would enhance the applicability of the findings to the broader Thai public and influence specific policies and tactics for advancing EV adoption in the nation.

Research on the potential of electric vehicles in developing nations, particularly Thailand, proposed improving the electric vehicle sector through infrastructure development, consumer education, and government legislation (Rajper & Albrecht, 2020). Considering that Thailand and Pakistan encounter analogous developmental issues, it would be beneficial to correlate the findings of this study with those from Pakistan. Both nations encounter distinct obstacles to electric vehicle adoption, including inadequate charging infrastructure, user knowledge, and financial accessibility.

Investigating EV adoption in Thailand and Pakistan can yield significant comparative insights, facilitating customized recommendations to enhance EV uptake in emerging countries and advance sustainable transportation solutions.

Yaqoob et al. (2021) emphasize the recent endorsement of Pakistan's National Electric Vehicle Policy (NEVP), which seeks to attain a 30% objective for EVs in all passenger vehicles and heavy-duty trucks by 2030, with a long-term goal of achieving 90% EV adoption by 2040. This strategy represents a crucial advancement in transforming Pakistan's transport industry, as it aims to diminish the nation's carbon emissions and minimize its reliance on imported oil, which incurs an estimated annual cost of 13 billion USD. Adopting electric vehicles presents numerous benefits, such as improved energy efficiency and a cleaner, zero-emission substitute for traditional petrol and diesel vehicles. Moreover, transitioning to electric vehicles may diminish Pakistan's susceptibility to volatile oil prices and foreign supply chain disturbances. Nonetheless, the study highlights the difficulties in achieving these objectives. Notwithstanding the presence of policies designed to advance renewable energy and alternatives to mineral oil, their execution has been lethargic, as the Economic Coordination Committee (ECC) faces challenges in developing the requisite infrastructure and regulatory frameworks to facilitate electric vehicle adoption. To achieve its ambitions for electric vehicles, Pakistan must urgently enhance charging infrastructure, offer targeted incentives for customers and producers, and ensure effective governance and policy enforcement. Moreover, additional investigation into the impediments to electric vehicle adoption, including consumer attitudes, financial incentives, and infrastructural deficiencies, is essential for expediting the shift to electric mobility in Pakistan.

Ashraf Javid, Ali, Abdullah, Campisi, and Shah (2021) investigated the adoption of electric vehicles in Pakistan via the lens of the Norm Activation Model (NAM), emphasizing the impact of environmental concerns, personal norms, and social influence on consumers' intentions to embrace electric vehicles (EVs). The authors noted that the restricted sample size of their study might not adequately represent the population's diversity, indicating the necessity for further research

utilizing a more prominent and more representative sample. Furthermore, they advised that subsequent research should concentrate on the effects of regulations, as governmental measures and incentives are essential for fostering electric vehicle usage in Pakistan. Policymakers must prioritize infrastructure enhancement, financial incentives, and measures to address obstacles such as elevated costs and insufficient charging stations to expedite the transition to electric vehicles.

The study of Mouhy-Ud-Din et al. (2024) reveals a notable deficiency in comprehending the effects of electric vehicle (EV) charging choices in developing nations, particularly those with inadequate power infrastructure. It contrasts home and rapid charging, emphasising their unique economic and technical implications, while noting the insufficient study on the influence of these approaches on daily power use as electric vehicle adoption increases. The study underscores the importance of solar power in alleviating grid strain and highlights the necessity for additional research and policy formulation to guarantee a dependable electricity supply. The study, conducted in Pakistan, is pertinent to other emerging nations facing analogous power issues, emphasizing the necessity for customized policies to accommodate the increasing demand for EV charging. It concludes that efficient and cost-effective fast charging stations can be installed at venues such as places of worship, businesses, and shopping centers to alleviate the demand for home charging. The study advocates for the augmentation of the EV load profile by incorporating diverse vehicle models with varying battery capacities, investigating flexible charging requirements, and conducting additional analysis of different organizations and infrastructure configurations to enhance comprehension of EV charging necessities in developing nations.

This study has explored the adoption of electric vehicles (EVs) in Thailand and Pakistan, emphasizing significant hurdles. Both nations encounter analogous challenges, including the necessity for a comprehensive charging infrastructure and rules customized to local circumstances. The results underscore the significance of incorporating solar energy and correctly positioning fast-charging stations to facilitate sustainable electric vehicle uptake. This comparative analysis offers

significant insights for developing nations with analogous infrastructure difficulties and establishes a foundation for future research and policy formulation.

1.5 Why Thailand and Pakistan

Technologies that contribute to a carbon-neutral society by reducing carbon emissions have drawn wide attention from all over the world, as climate change and global warming are emerging as big threats. Against this background, the transportation sector, which consumes a great amount of primary energy, is undergoing a significantly important updating through electrification. It is reported that with the development of electric vehicles, greenhouse gas emissions can be reduced by 20% and by a further 40% if the electricity is produced by renewable energy. Many countries and organizations have proposed remarkable policies and initiatives, especially in Asia. Countries like Thailand and Pakistan are facing serious environmental issues, and road transportation is the top contributor, especially in major cities. The main reason behind taking these two countries is that both are in the initial stage of implementation of EV policies and have set goals for a decade.

Thanatrakolsri and Sirithian (2024) argued that Thailand faces difficulties due to air pollution and greenhouse gas (GHG) emissions, mainly from road cars. Notwithstanding initiatives designed to mitigate emissions, including promoting electric vehicles (EVs) and public transport, the number of vehicles on the road will rise by 6.58% by 2030, resulting in elevated emissions. By adopting electric vehicles (EVs) and decreasing vehicle kilometers traveled (VKT), Thailand can markedly diminish greenhouse gas (GHG) emissions and pollutants in the transportation sector by the nation's obligations under the Paris Agreement. Likewise, in Pakistan, pollution is due to internal combustion engines; as noted by Bajwa and Sheikh (2023), urban areas in Pakistan have considerable air pollution, chiefly resulting from emissions of two- and three-wheeled vehicles and poorly maintained automobiles, which emit harmful particulate matter and toxic chemicals. These vehicles, abundant with outdated engines, release high levels of pollutants, exacerbating environmental and health concerns nationally. Elevated sulfur levels in fuels and inadequate

exhaust systems intensify the issue. The Electric Vehicle Association of Thailand (EVAT) claims significant growth in the nation's electric vehicle sector, with new registrations of Battery Electric Vehicles (BEVs), including electric automobiles, increasing to 76,366 units in 2023 from 9,678 units the prior year. In 2023, electric vehicle registrations across various types were 100,219 units, reflecting a remarkable growth rate of 380% from 20,816 units in 2022. This significant rise highlights the rapid progress and optimistic outlook of electric mobility in Thailand. Predictions indicate that electric car sales may attain between 90,000 and 100,000 units in 2024. The Thai government aims to achieve a 30% electric vehicle representation in the national fleet by 2030. Enhancing various electric vehicle infrastructure, including charging stations, facilitates this initiative and encourages more consumer use of electric automobiles. The import of electric vehicles under the EV 3.5 program is projected to approximate 175,000 units from 2023 to 2024 (Bangkokpost, 2024).

As a developing South Asian nation, Pakistan is just beginning to adopt electric vehicles. The current quantity of electric vehicles on the road is approximately 15,000 and is anticipated to rise. Under its EV Policy 2020–2025, Pakistan has set objectives of up to 100,000 automobiles, 500,000 two- and three-wheelers, 1,000 trucks, and 1,000 electric buses within five years of the policy's implementation. The program stipulates that 90% of automobile sales, including two- and three-wheelers, buses, and trucks, are to be electric by 2040. According to the Ministry of Finance, Pakistan has around 27 million registered two-wheelers, 1 million three-wheelers, and 4.5 million four-wheelers (Outlook, 2024).

Each country encounters unique problems and opportunities in its electric vehicle adoption process. Thailand's swift increase in EV registrations and manufacturing is bolstered by a robust infrastructure and significant governmental initiatives to achieve future objectives. Conversely, Pakistan remains in the nascent phase, exhibiting low electric vehicle figures although possessing potential strategies and policies to encourage local manufacturing and market uptake. Through comparative analysis, your research can provide significant insights into how emerging nations in

South Asia might overcome challenges related to infrastructure, consumer awareness, and policy formulation to expedite electric vehicle adoption. This international comparison would offer a worldwide viewpoint on the obstacles and approaches to advancing sustainable mobility in developing economies.

1.6 Research question

1. What will be the impact of factors on EV adoption?
2. What will be the mediating effect of trust and behavioral intentions between factors and use behavior?
3. How does charging infrastructure moderate the relationship between factors and trust?
4. What is the difference between adoption in Thailand and Pakistan?

1.7 Research objectives

1. To examine the impact of factors on EV's adaptation.

The main research objective is to empirically investigate the impact of factors affecting EV user behavior. Factors include environmental concerns, price value, hedonic motivation, facilitating condition, effort expectancy, social influence, and satisfaction with incentive policies.

2. To examine the mediating role of trust and behavioral intentions.

This objective tests the mediating role of trust behavior intentions and user behavior. Factors include environmental concerns, price value, hedonic motivation, facilitating condition, effort expectancy, social influence, and satisfaction with incentive policies.

3. To explore the moderating role of charging infrastructure.

This objective tests moderation between environmental concerns, price value, hedonic motivation, facilitating conditions, and trust.

4. To compare the adoption levels of Thailand and Pakistan.

This objective aims to compare the differences and similarities between Thailand and Pakistan.

1.8 Significance of the study

The theoretical significance is going to be the contribution to UTAUT2 literature in terms of extending by adding more variables to the theory in the setting of electric vehicle adoption context as well as contribution in the literature of use consumer behavior and technology adoption. This study will add some exciting variables, such as environmental concerns, satisfaction with policies, and trust in the mechanism of UTAUT2. This study also has significance for the managers or practitioners of the automobile industry who are offering EVs; this study will identify the factors that can influence consumer behavior in adopting EVs, as consumer behavior is very important for increasing the number of electric vehicles. So, practitioners can consider these factors to make consumers trust their intentions and use electric vehicles. For more details about the significance, refer to the implication in Chapter 5.

1.9 Scope of the study

The population of the study is the auto sector of Thailand and Pakistan, and the respondents are electric vehicle users. This study used extended UTAUT2 to explore technological, behavioral, environmental, and policy-related perspectives.

The study will cover the following variables.

- Environmental concern
- Price value
- Hedonic motivation
- Effort expectancy
- Facilitating condition
- Habit

- Social influence
- Satisfaction with incentive policies
- Trust
- Behavioral intentions
- Use behavior
- Charging infrastructure

1.10 Definitions

- **Environmental Concern:** The environmentally concerned consumer is ‘the one who knows that the production, distribution, use, and disposal of products leads to external costs, and who evaluates such external costs negatively, trying to minimize them by his/her behavior.
- **Price Value:** Price is defined as the amount of money a business charges or the sum of the value customers pay for the benefits of having or using a product/service.
- **Hedonic motivation:** Hedonic motivation is defined as “the fun or pleasure of using a technology.
- **Facilitating condition:** The facilitating condition is mainly represented by the Information technology infrastructure and the organization, e.g., computers, speed of internet, communication integration/ cloud integration, etc.
- **Habit:** It is defined as the extent to which people tend to perform behavior automatically because of learning.
- **Effort expectancy:** The perception of an institution and how easily it can do the job by using the technology; the interaction with the system is easy to use, easy for me to become skillful by using it, and easy to operate the system.
- **Social Influence:** The definition of social influence is “the intensity of institution perception that what other gives importance after using the new technology.”

- **Satisfaction with Incentive Policies:** The degree to which people are satisfied with the incentive policies for electric taxis is the extent to which customers compare their perceived effects of incentive policies with their expected values.
- **Trust:** Trust enables the existing relationship to be enduring, moving beyond the consideration of a one-time transaction.
- **Behavioral intentions:** Behavioral intention is the measure, or intensity, of an individual's intention to perform a specific behavior.
- **Use Behavioral:** Buying behavior is generally associated with purchasing in a responsible, ethical, sustainable, and environmentally friendly way.



CHAPTER 2

LITERATURE REVIEW

2.1 Electric Vehicles

There has been much focus on the issue of environmental deterioration in recent years due to the unchecked and persistent release of harmful atmospheric pollutants from a wide range of human activities. The primary cause is industries' use of fossil fuels and the transportation sector (Asadi et al., 2020; Sabri et al., 2016). More greenhouse gases have been produced as the number of people who own cars has increased worldwide (Xu et al., 2019), creating significant challenges for environmental protection and energy independence (Chandra et al., 2010; Huang & Ge, 2019). About 60 million barrels of oil per day (nearly 70% of total oil production) is used to power the world's one million vehicles, reports the International Energy Agency (IEA); nearly 36 million barrels of daily oil consumption is associated with private vehicles, leading to 14 million tons of carbon dioxide emissions (Sang & Bekhet, 2015). Therefore, it may be considered a good idea to switch from traditional cars to ones powered by alternative energies (Tu & Yang, 2019).

Electric cars were invented before steam engines were invented. However, more than a century has passed with no advancement in the use of electric vehicles due to poor endurance, charging issues, and low safety. Around the same time, the petroleum industry underwent a revolution, and internal combustion engine technology advanced to the point where internal combustion engine cars became the norm (Hagman & Langbroek, 2019; Yang et al., 2018).

Due to a gasoline shortage brought on by the "oil crisis," automakers were obliged to explore alternate energy sources, and electric vehicles once again drew much attention. Toyota's "Prius" became the world's first mass-produced hybrid car when it was introduced in Japan in 1997. Nickel-metal hydride batteries and an internal combustion engine power it. This is a historic occasion, and its success reflects consumer concerns about growing gas prices and carbon

emissions (Hagman & Langbroek, 2019; Yang et al., 2018). Many automakers have announced plans for electric car manufacturing in the last ten years, including the Tesla, Chevrolet Volt, Nissan LEAF, Smart ED, Ford C-Max, and BMW i3. At the moment, there are four primary types of electric vehicles: hybrid electric vehicle (HEV), plug-in hybrid electric vehicle (PHEV), all-electric vehicle (commonly referred to as a BEV or AEV for short), and plug-in electric vehicle (PEV) (Hardman, 2019; Sellmair & Schelo, 2019). China and the United States are the world's top producers and consumers of electric vehicles, with about half of all sales occurring in this region (Hao et al., 2020).

2.2 Theories Used in the Adoption of Electric Vehicles

In the context of EVs, Egbue and Long (2012) studied barriers to the mass adoption of electric vehicles and used the theory of planned behavior. Similarly, Singh et al. (2020) also used TPB to study EVs. In the same context, Mohammed, Niesten, and Gagliardi (2020) developed a theoretical framework “FAST” for firm adoption of sustainable technologies (FAST) based on the following theories: a unified theory of acceptance and use of technology (UTAUT), Technology, Organization and Environment (TOE) model, and theory of organizational emotions towards adoption. Another study in the EVs domain showed the importance of policies in EV adoption using TAM (Wang et al., 2018). Peters and Dütschke (2014) examined the perception of consumers about EVs based on (DOI) diffusion of innovation theory. He and Zhan (2018) explored EV adoption using the NAM norm activation theory. He and Hu (2022) also explored the same domain of EVs based on affect-as-information theory. Curtale, Liao, and Rebalsk (2022) used UTAUT2 in the domain of electric cars. In prior studies, different theories have been applied to the context of electric vehicle adoption. So, this study will use UTAUT2 as UTAUT is the combination of eight different theories (Dwivedi et al., 2007; Dwivedi & Weerakkody, 2007b; Kapoor et al., 2014). UTAUT2 is more appropriate for technology adoption studies in the consumer context (Tamilmani et al., 2021).

2.3 Unified Theory of Acceptance and Use of Technology UTAUT2

Development of the Unified Theory of Acceptance and Use of Technology (UTAUT2) as a technology acceptance model (Venkatesh et al., 2003; Venkatesh et al., 2012). The primary goal of the UTAUT2 is to characterize the gap between the ideal and real uses of an information system from the user's perspective (Venkatesh et al., 2003a, 2012a). UTAUT2 is the combination of different theories, such as the Technology Acceptance Model (TAM), Diffusion of Innovation (DoI), Theory of Planned Behaviour (TPB), and Task Technology Fit (TTF). Most commonly, these theories were used to investigate questions about adoption and diffusion-related issues (Dwivedi et al., 2007; Dwivedi & Weerakkody, 2007b; Kapoor et al., 2014). Social Influence from Theory of Reasoned Action (TRA), Facilitating Conditions and Social Influence from the Theory of Planned Behaviour (TPB), Performance Expectancy and Effort Expectancy from Technology Acceptance Model (TAM), Performance Expectancy, Effort Expectancy and Social Influence from Technology Acceptance Model2 (TAM2), Performance Expectancy, Effort Expectancy, Social Influence and Facilitating Conditions from Innovation Diffusion Theory (IDT), Performance Expectancy from Social Cognitive Theory (SCT), Performance Expectancy from Motivational Model (MM), Performance Expectancy, Effort Expectancy, Social Influence and Facilitating Conditions from Model of PC Utilization (MPCU) and the Performance Expectancy, Social Influence and Facilitating Conditions from Combined TAM-TPB (C-TMA-TPB) (Amrouni et al., 2019). Given a thorough audit of eight predominant technology acceptance models, Venkatesh et al. (2003) established a unified theory of acceptance and use of technology (UTAUT) in the organizational framework emphasizing the utilitarian value (extrinsic motivation) of organizational users after the elimination of similar/redundant constructs. The emergence of consumer technologies prompted researchers to adapt the UTAUT model for a consumer setting, where they could place greater emphasis on consumers' hedonic value (intrinsic motivation). As a result, the

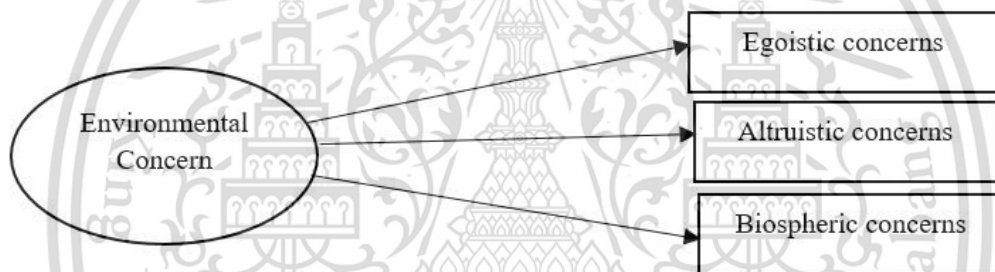
original UTAUT was expanded with the addition of three new constructs—hedonic motivation, price value, and habit—and this updated version is commonly referred to as UTAUT2.

UTAUT has many practical uses, but it was the replications and expansions that were crucial to understanding how widely people would embrace the technology and where its theoretical boundaries would go. Literature on IT acceptance and usage behavior has led to the development of an updated version of the theory (UTAUT2) (Dwivedi et al., 2019; Tamilmani et al., 2021). UTAUT2 is a more robust method for revealing the primary phenomenon of EV adoption since it takes into account more pertinent antecedents/predictors. Hedonic price, habit, and incentive were all identified as new constructs in UTAUT2, but voluntariness was removed as a moderator. Not taking some of the variables in the research of EV adoption is not an uncommon practice in the transportation context (Curtale et al., 2022b; Kapsler et al., 2021), as well as studies in e-shopping have not included variables that were not appropriate in the context (Rehman et al., 2022). Tamilmani et al. (2021) and Venkatesh et al. (2016) argued that UTAUT2 might have various extensions, such as adding new exogenous, endogenous, mediator, and outcome mechanisms. So, this study will extend the UTAUT2 by exploring new perspectives such as environmental, behavioral, and technological policy related to the electric vehicle adoption context.

2.4 Environmental Concern

Grunert and Juhl (1995) define an environmentally concerned consumer as ‘the one who knows that the production, distribution, use and disposal of products leads to external costs, and who evaluates such external costs negatively, trying to minimize them by his/ her behavior’ (p. 44). With the deterioration of environment, public awareness of environmental protection improves gradually (Wang, Shen, & Jin, 2017). Environmental concern (EC) is related to public awareness of environmental problems, which can be indicated by attitude, recognition and response towards environmental issues (Weigel & Weigel, 1978). Albayrak, Aksoy, and Caber (2013) and Stern and Dietz (1994) suggested three environmental concerns: egoistic concerns, altruistic concerns, and

biospheric concerns. Where the egoistic concern is related to individuals' self-benefits, altruistic covers people as a whole, and lastly, the biospheric concern is related not just to humans but also to other creatures such as animals. According to Karolemeas et al. (2021), the quality of the environment is declining day by day, and the transportation sector is one of the top contributors to greenhouse gas emissions. The transport sector is important, particularly related to the environment, as it is responsible for almost one-quarter of energy-related emissions Karolemeas et al. (2021). Conventional transport systems dominated by private cars generated many environmental consequences, such as scarcity of oil (Palma et al., 2011), deterioration of air quality, and greenhouse gas (GHG) emissions (Bouguerra & Layeb, 2019).



Sources: (Albayrak et al., 2013; Stern & Dietz, 1994a)

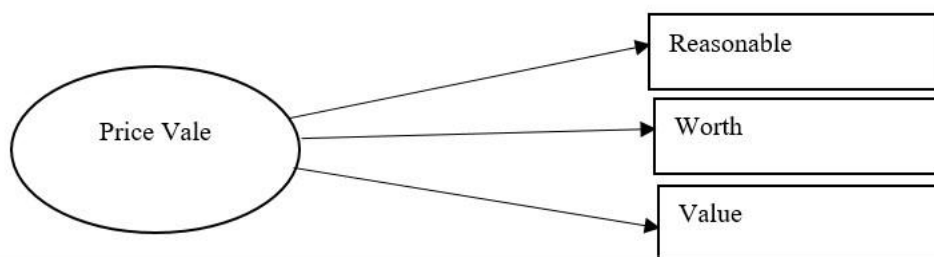
Figure 2.1 Environmental Concerns Model

Table 2.1 Environmental Concerns Details

Researchers	Latent Variable	Observed variable	Key points	Domain
Albayrak et al. (2013) and Stern & Dietz (1994)	Environmental Concern	Egoistic concerns Altruistic concerns Biospheric concerns	benefits me worse better quality benefit humans/ creatures	Green Purchase Behavior in Telecom
Stern and Dietz (1994)	Environmental Concern	Egoistic concerns Altruistic concerns Biospheric concerns	benefits me worse better quality Benefit humans/ creatures.	Behaviour related to Climate change

2.5 Price Value

Price is a critical element that assists in predicting customer behaviors before, during, and after using a product or service. Price is defined as the amount of money that a business charges or the sum of values that customers pay for the benefits of having or using a product/service (Hanif et al., 2010). In general, many factors can influence the results, which should be appropriately considered in the assessment. The first among these are economic elements, for example, the fuel price or the price of vehicles and batteries, which are strongly dependent on the economies of scale in production (Lévay, Drossinos, & Thiel, 2017; Siragusa et al., 2022). In the context of electric vehicle Bridi, Jabra, and Hosani (2022) suggested that price is an important factor and can cause issued, if it's not nominal therefore to attract new customers its vital to keep low price.



Sources: (Venkatesh et al., 2003a; M. Zhou et al., 2021a)

Figure 2.2 Price Value Model

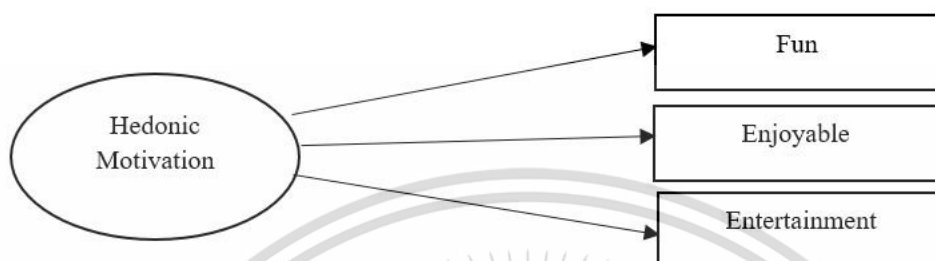
Table 2.2 Price Value Details

Researchers	Latent Variable	Observed variable	Key points	Domain
Zhou et al. (2021)	Price Vale	Reasonable Worth value	Reasonable Worth Value	Electric Vehicle
Venkatesh et al. (2003)	Price vale	Reasonable Worth value	Reasonable Worth value	Banking

2.6 Hedonic motivation

Hedonic motivation is defined as “the fun or pleasure derived from using a technology (Venkatesh et al., 2003). Motivation can be divided into extrinsic and intrinsic, where extrinsic refers to the utilitarian outcome and intrinsic refers to the self-fulfillment while engaged in the activity (Vallerand, 1997). Van der Heijden (2004) extended TAM and found that adding an element of enjoyment to an instrument leads to prolonged use. When considering the use of an IT artifact, individuals make rational and emotional decisions (Koo et al., 2015). In the context of sustainability, an important reason for consumer purchase of sustainable products is the hedonic

motivation, or whether sustainable consumption improves one's feelings (Rezvani et al., 2017, 2018). Anticipating feelings of pleasure and excitement from the purchase of an electric vehicle can increase the probability of an electric vehicle (Rezvani et al., 2018).



Sources: (Venkatesh et al., 2003a; Zhou et al., 2021a)

Figure 2.3 Hedonic Motivation Model

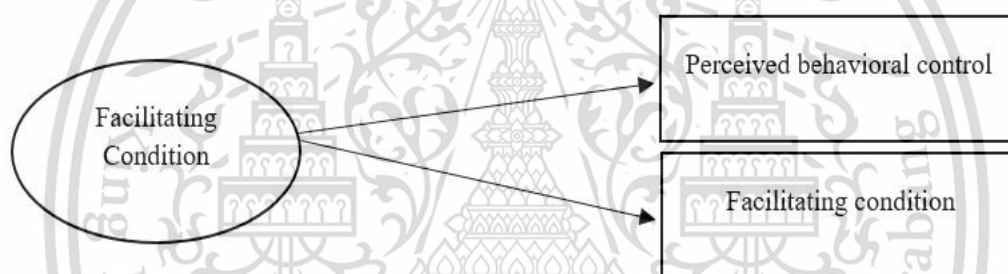
Table 2.3 Hedonic Motivation Details

Researchers	Latent Variable	Observed variable	Key points	Domain
Zhou et al. (2021)	Hedonic Motivation	Fun Enjoyable Entertainment	Fun Enjoyable Entertainment	Electric Vehicle
Venkatesh et al. (2003)	Hedonic Motivation	Fun Enjoyable Entertainment	Fun Enjoyable Entertainment	Banking

2.7 Facilitating condition

The facilitating condition is mainly represented by the Information technology infrastructure and the organization, e.g., computers, speed of internet, communication integration/

cloud integration, etc. (Wamba & Queiroz, 2019). The organizational infrastructure and the IT infrastructure in the banking sector support the adoption (Kim & Song, 2018). The facilitating condition is the resources necessary, compatibility, knowledge required, and assistance to operate the technology (Venkatesh et al., 2003). Venkatesh et al. (2003) suggested three underlying dimensions to measure facilitating conditions: perceived behavioral control, facilitating conditions, and compatibility. Perceived behavior control is described as a person's perception of ease or difficulty while performing an act. Facilitating conditions have been described as the degree to which a user believes that existing infrastructure can help to use technology. Compatibility means that users and technology can go along while using.



Sources: (Khazaei, 2019a; Venkatesh et al., 2003a)

Figure 2.4 Facilitating Condition Model

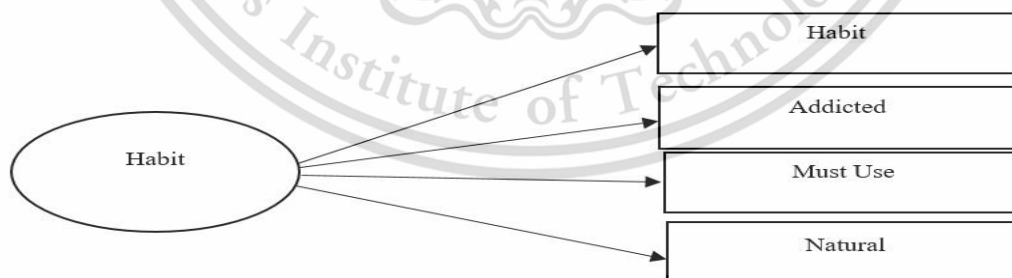
Table 2.4 Facilitating Condition Details

Researchers	Latent Variable	Observed variable	Key points	Domain
Khazaei (2019)	Facilitating Condition	Perceived behavioral Control Facilitating Condition	Resources Knowledge Compatible help from others	Electric Vehicle

Researchers	Latent Variable	Observed variable	Key points	Domain
Venkatesh et al. (2003)	Facilitating Condition	Perceived behavioral Control Facilitating Condition	Resources Knowledge Compatible help from others	Banking

2.8 Habit

Habit is defined as the extent to which people tend to perform behavior automatically because of learning (Venkatesh et al., 2012). Automatic behavior is formed by the accumulation of knowledge and skills over time, and it is different from experience. Habit is viewed as prior behavior and measured as the extent to which an individual believes logical time. Logical time (i.e., experience) can lead to different levels of habit, which depend on interaction and familiarity with the target technology. In the context of electric cars habits are the result of repeated pleasurable experiences in the same context (Moons & De Pelsmacker, 2015). In general, it can be expected that positive emotions related to the habitual product experience of car driving will reinforce the habit and inhibit people from adopting a new travel mode, such as the electric car (Klößner & Matthies, 2004; Moons & De Pelsmacker, 2015).



Sources: (Venkatesh et al., 2003a; M. Zhou et al., 2021a)

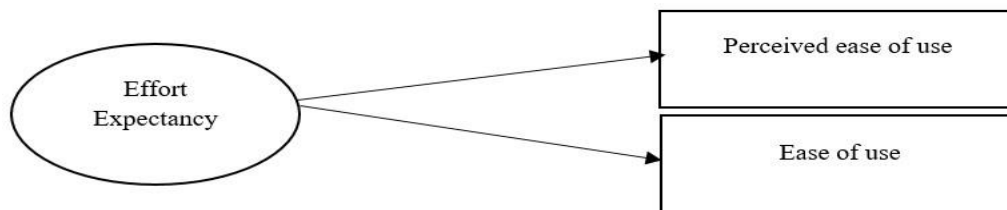
Figure 2.5 Habit Model

Table 2.5 Habit details

Researchers	Latent Variable	Observed variable		Domain
Zhou et al. (2021)	Habit	Habit	Habit	Electric Vehicle
		Addicted	Addicted	
		Must use	Must use	
		Natural	Natural	
Venkatesh et al. (2003)	Habit	Habit	Habit	Banking
		Addicted	Addicted	
		Must use	Must use	
		Natural	Natural	

2.9 Effort expectancy

The effort expectancy can be defined as “the perception of an institution that how easily can make the job by using the technology, The interaction with the system, easy to use, easy for me to become skillful by using the system, easy to operate the system” (Venkatesh et al., 2003). Venkatesh et al. (2003) suggested three dimensions to measure effort expectancy: perceived ease of use, complexity, and ease of use. Davis (1989) suggested that perceived ease of use is the degree to which a person believes that using a particular system would be free of effort”. In the context of electric cars effort expectancy plays an important role (Manutworakit & Choocharukul, 2022). Further, focusing on employees of a telecommunication company in Paris, Fleury et al. (2017) showed that effort expectancy is one of the most important drivers of corporate car-sharing and that the perceived environmental friendliness of the service, despite a limited magnitude, plays a significant role.



Sources: (Curtale et al., 2022a; Venkatesh et al., 2003a; M. Zhou et al., 2021a)

Figure 2.6 Effort Expectancy Model

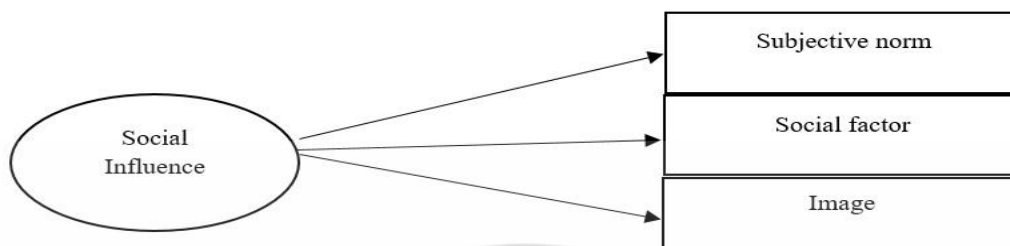
Table 2.6 Effort Expectancy Details

Researchers	Latent Variable	Observed variable	Key points	Domain
Curtale et al. (2021)	Effort Expectancy	Perceived ease of use Ease of use	Simple Skillful easy to use learning	Electric Vehicle
Zhou et al. (2021)	Effort Expectancy	Perceived ease of use Ease of use	Simple Skillful easy to use learning	Electric Vehicle
Venkatesh et al. (2003)	Effort Expectancy	Perceived ease of use Ease of use	Simple Skillful easy to use learning	Banking

2.10 Social Influence

The definition of social influence is “the intensity of institution perception that what other gives importance after using the new technology” (Venkatesh et al., 2003). The social influence is what other stakeholders (who are important to me and who can influence my behaviors) perceive me after using the technology (Baishya & Samalia, 2020a). Venkatesh et al. (2003) studied social influence with three underlying dimensions: subjective norms, social factors, and image. Social norm means that the community will like my behavior and make them do what I do. Social influence means that society will be influenced by my decision related to electric vehicles, and image is related to the status symbol. In the domain of electric cars, Manutworakit and

Choocharukul (2022) exhibited that social influence is a vital factor in terms of choosing electric cars.



Sources: (Khazaei, 2019c; Venkatesh et al., 2003a)

Figure 2.7 Social Influence Model

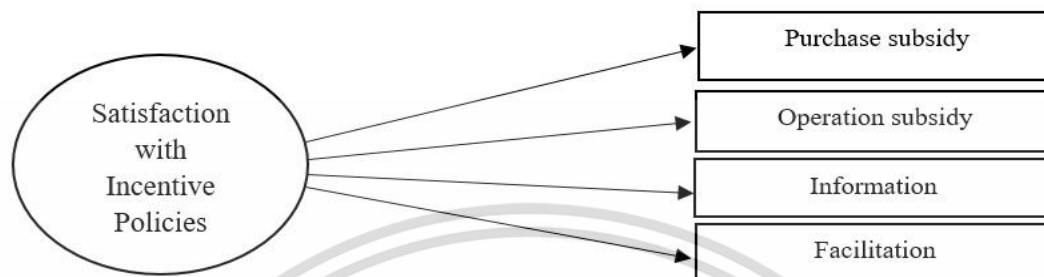
Table 2.7 Social Influence Details

Researchers	Latent Variable	Observed variable	Key points	Domain
Khazaei (2019)	Social influence	Subjective norm Social factor Image	Influence my behavior Important to me Society status symbol	Electric Vehicle
Venkatesh et al. (2003)	Social influence	Subjective norm Social factor Image	Influence my behavior Important to me Society status symbol	Banking

2.11 Satisfaction with Incentive Policies

Satisfaction with Incentive Policies is defined as the degree to which people are satisfied with the incentive policies for electric taxis, that is, the extent to which customers compare their perceived effects of incentive policies with their expected values. Governments around the world have introduced incentives to stimulate consumers to adopt electric vehicles, including financial

incentives, information provision policies, and facilitation policies (Han et al., 2017; Wang et al., 2018).



Sources: (Wang et al., 2018; Zhou et al., 2021)

Figure 2.8 Satisfaction with Incentive Policies Model

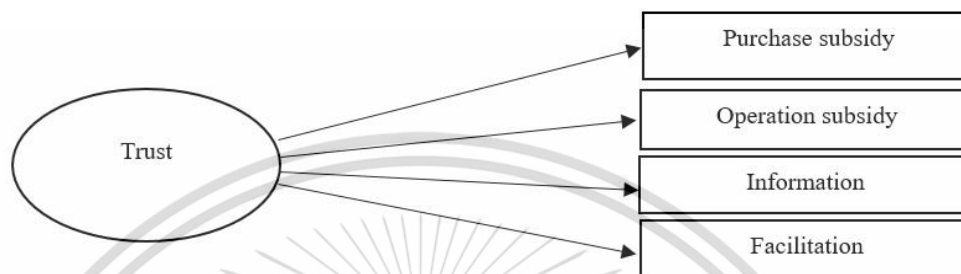
Table 2.8 Satisfaction with Incentive Policies Details

Researchers	Latent Variable	Observed variable	Key points	Domain
Zhou et al. (2021)	Satisfaction with incentive policies	Purchase subsidy Operation subsidy Information Facilitation	Purchase subsidy Operation subsidy Information Facilitation	Electric Vehicle
Wang et al. (2018)	Satisfaction with incentive policies	Sufficient Subsidy policy tax policies	Purchase subsidy Operation subsidy Information	Electric Vehicle

2.12 Trust

Trust enables the existing relationship to be enduring, moving beyond the consideration of one-time transactions (Sargeant & Lee, 2004). Moorman et al. (1992) asserted that when an

individual trusts an exchange partner, he/she willingly relies on the partner with whom he/she has confidence. In this regard, Morgan and Hunt (1994) described trust as customers' perception of confidence in the reliability and integrity of the provider.



Sources: (Choi & Hyun, 2017; Venkatesh et al., 2003a)

Figure 2.9 Trust Model

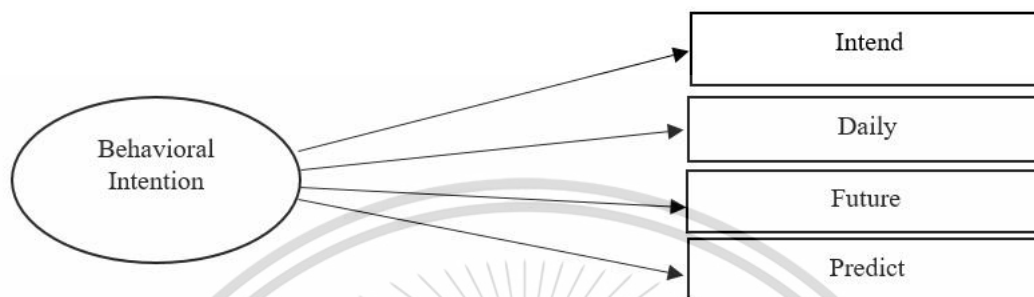
Table 2.9 Trust Details

Researchers	Latent Variable	Observed variable	Key points	Domain
Choi and Hyun, 2017 and Ng et al. (2018)	Trust	Honest	Honest	Electric Vehicle
		Reliability	Reliability	
		Responsible	Responsible	
		Dependable	Dependable	
Venkatesh et al. (2003)	Trust	Honest	Honest	Banking
		Reliability	Reliability	
		Responsible	Responsible	
		Dependable	Dependable	

2.13 Behavioral intentions

Behavioral intention (BI) is the measure, or intensity, of an individual's intention to perform a specific behavior (Fishbein & Ajzen, 1975). Consumers' intentions toward electric

vehicle purchase are a mixture of demographic, situational, contextual, and psychological factors (Gunawan et al., 2022). According to Kim, Rasouli, and Timmermans (2014), psychological factors and demographic profiles positively impact EV purchase intention.



Sources: (Alalwan et al., 2016; Venkatesh et al., 2003)

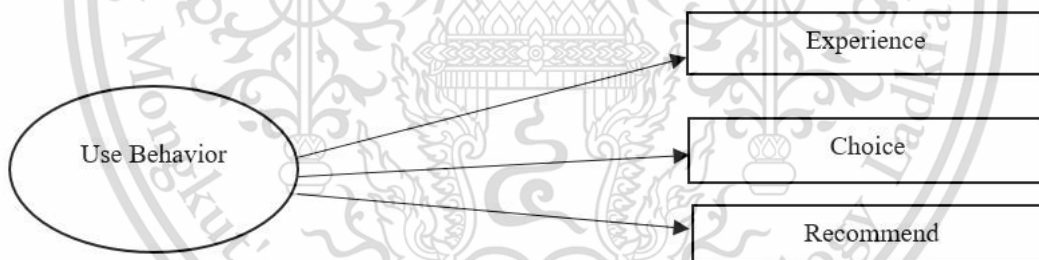
Figure 2.10 Behavioral Intentions Model

Table 2.10 Behavioral Intentions Details

Researchers	Latent Variable	Observed variable	Key points	Domain
Alalwan et al. (2016)	Behavioral Intentions	Intend	Intend	Electric Vehicle
		Daily	Daily	
		Future	Future	
		Predict	Predict	
Venkatesh et al. (2003)	Behavioral Intentions	Honest	Honest	Banking
		Reliability	Reliability	
		Responsible	Responsible	
		Dependable	Dependable	

2.14 Use Behavior

Buying behavior is generally associated with purchasing in a responsible, ethical, sustainable, and environmentally friendly way. According to Paço et al. (2013), use behavior includes buying energy-efficient products, avoiding over-packaged goods, exhibiting a preference for biodegradable and recycled articles, buying fair-trade and locally sourced products, contributing not only to equity and wellbeing in the community but also to the reduction of pollution and the preservation of the planet. According to Kumar and Ghodeswar (2015), such purchasing decisions also take the form of supporting green companies, adopting sustainable consumption practices, and being likely to spend more on green products. In fact, the literature contains several different ways of measuring environmentally friendly purchasing behavior. Some researchers have focused more on the functional aspects of these products, while others have adopted a more holistic approach to buying behavior.



Sources: (Alalwan et al., 2016; Venkatesh et al., 2003)

Figure 2.11 Use Behavior Model

Table 2.11 Use Behavior

Researchers	Latent Variable	Observed variable	Key points	Domain
Alalwan et al. (2016)	Use Behavior	Experience	Experience	Electric Vehicle
		Choice	Choice	
		Recommend	Recommend	
Venkatesh et al. (2003)	Behavioral Intentions	Experience	Experience	Banking
		Choice	Choice	
		Recommend	Recommend	

2.15 Charging Infrastructure

The transportation sector is undergoing a rapid transition to electric power, which eliminates tailpipe emissions and enables zero emissions from recharging with future clean electric grids (Trinko et al., 2022). As the number of electric vehicles (EVs) is significantly increasing, impacts on power grid performance and efficiency, such as overloading, reduced efficiency, power quality issues and disturbances, and voltage regulation, particularly at the distribution level, may significantly increase in the near future (Amry et al., 2022; Khalid et al., 2021).



Sources: (Haustein & Hunecke, 2007; Joshi et al., 2022b)

Figure 2.12 Charging Infrastructure Model

Table 2.12 Charging Infrastructure Details

Researchers	Latent Variable	Observed variable	Key points	Domain
Joshi et al. (2022)	Charging infrastructure	Uninterrupted Worried Unpractical	Uninterrupted Worried Unpractical	Electric Vehicle
(Haustein and Hunecke (2007) and Haustein and Jensen (2018))	Charging infrastructure	Uninterrupted Worried Unpractical	Uninterrupted Worried Unpractical	Transportation

2.16 Hypothesis

H1a: Environmental concern has a positive impact on trust.

H1b: Environmental concern has a positive impact on use behavior.

H2: Price value has a positive impact on trust.

H3: Hedonic motivation has a positive impact on Trust.

H4: Facilitating condition has a positive impact on Trust.

H5: Trust has a positive impact on behavioral Intentions

H6: Behavioral Intentions has a positive impact on use behavior.

H7: Habits has a positive impact on behavioral Intentions.

H8: Effort expectancy has a positive impact on behavioral Intentions.

H9: Social influence has a positive impact on behavioral Intentions.

H10a: Satisfaction with incentive policies has a positive impact on behavioral Intentions.

H10b: Satisfaction with incentive policies has a positive impact on use Behavior.

H11: Trust and behavior Intentions sequentially mediated the relationship between environmental concerns and use behavior.

H12: Trust and behavior Intentions sequentially mediated the relationship between price and use behavior.

H13: Trust and behavior Intentions sequentially mediated the relationship between hedonic motivation and use behavior.

H14: Trust and behavior Intentions sequentially mediated the relationship between facilitating conditions and use behavior.

H15: Behavioral intention mediates the relationship between habit and use behavior.

H16: Behavioral intention mediates the relationship between effort expectancy and use behavior.

H17: Behavioral intention mediates the relationship between social influence and use behavior.

H18: Behavioral intention mediates the relationship between satisfaction with policies and use behavior.

H19a-e: Charging infrastructure moderates the relationship between environmental concerns/price value/hedonic motivation/facilitating condition and trust.

2.17 Environmental Concerns and Trust

Global warming has heightened consumers' environmental awareness, leading them to prioritize the purchase of green brands (Chang & Chen, 2014). Corporate entities are highly motivated to enhance their production processes' environmental sustainability to present their products as ecologically friendly to consumers (Laufer, 2003). Given the significance of environmental friendliness to many consumers, they will doubt the product's environmental dependability and efficacy and scrutinize its credibility (Chen & Chang 2012). A study of Han et al. (2024) in Japan, South Korea, Singapore, and Taiwan, Environmental awareness mitigates perceived risk associated with adopting electric vehicles (EVs) by emphasizing their sustainability advantages. Emphasizing the environmental advantages of EVs can increase customer trust and relieve worries, making adoption more attractive. Trust, in the context of environmental sustainability, refers to the willingness to depend on a product, service, or brand based on the belief

or expectation that it is credible, benevolent, and capable of meeting environmental standards (Chen, 2013). Chen et al. (2015) argue that incorporating environmental factors into a product or service promotes consumer trust and confidence, fostering their perception of it as environmentally sustainable. Furthermore, individuals who believe in anthropogenic climate change are more inclined to endorse increased levies on fossil fuels in nations with a significant degree of confidence in the institutions of political governance (Fairbrother et al., 2019). A study by Tjernström and Tietenberg (2008) revealed that countries with greater trust in government exhibit reduced greenhouse gas emissions.



Figure 2.13 Environmental Concern and Trust

2.18 Environmental Concerns and Use Behavior

Environmental concern is the primary factor that determines the sustainable use of the environment (Kilbourne & Pickett, 2008). Some studies have suggested that consumers' purchasing decisions may be influenced by health, environmental, and ethical factors, as supported by research conducted by Wang et al. (2020) and Yazar and Burucuoğlu (2019). However, other studies have found no correlation between these factors and consumers' decisions (Jin et al., 2020; Michaelidou & Hassan, 2008). This research conducted in India underscores the substantial influence of a pro-environmental strategy on consumer behavior, especially with the adoption of electric two-wheelers (E2Ws). Environmental awareness stimulates enthusiasm, encouraging consumers to perceive E2Ws as a viable, sustainable transportation alternative. Nonetheless, the pro-environmental approach has shown an inconsequential positive effect on real purchasing behavior, indicating that although environmental

concerns stimulate interest and intention, they do not significantly convert into actual buying decisions (Shetty & Rizwana, 2024). The study undertaken by Paço et al. (2013) focused on environmental values, attitudes, and behavior and constructing a model suitable for consumers in various nations. An analysis of perception was conducted by collecting 1175 samples. The findings indicated that consumers with a greater level of environmental concern are more likely to engage in eco-friendly buying. Furthermore, the correlation between a consumer's purchasing behavior and their health, environmental, and ethical considerations seems to differ based on the specific shopping behavior, the product category, and the degree of country development (Xu et al., 2020). Consumers with a heightened awareness of environmental issues are more likely to acquire electric vehicles (EVs) and actively participate in efforts to protect the environment (Wu et al., 2019). Previous studies have shown that those who prioritize environmental issues are more likely to use electric vehicles (Maniatis, 2016).



Figure 2.14 Environmental Concern and Use Behavior

2.19 Price Value and Trust

Each product or service can be categorized into two pricing components: short-term and long-term valuation. While short-term price cuts positively influence sales, long-term price reductions do not affect customers' inclination to return (Kim, 2019). Martin, Ponder, and Lueg (2009), devoted customers may perceive that the company has violated the implicit trust developed in the relationship if they believe that the retailer is engaging in unfair practices. Put differently, trust might be conceptualized as necessitating fairness as a prerequisite. Previous research has defined pricing fairness as a factor that influences trust in the context of customer behavior (Sirdeshmukh

et al., 2002). Wang and Khan (2024) examined sustainable consumer aspirations to embrace Over-the-Air (OTA) updates for Electric Vehicles (EVs), emphasizing trust and satisfaction as important factors for relationship quality. Notably, the price of electric vehicles does not influence trust or relationship quality, indicating that consumers' readiness to invest in over-the-air upgrades is primarily motivated by their confidence in the technology and the satisfaction they obtain from the product, rather than the vehicle's price. In their study, Brenner and Meyll (2020) highlighted the significant issue of implicit price policy for investors who may require the assistance of human financial advisors. Seng, Wu, and Liu (2013) proposed that the affordability of internal combustion engines for consumers is less promising and is more influenced by fluctuations in petrol prices than by tax credits for electric vehicles. They further suggested that reducing taxes would make electric vehicles more affordable. An effective pricing policy demonstrates the trustee's competence and encourages investors to have more confidence in the trustee (Pappas, 2017). The study by Jeaheng et al. (2020) examined halal services for Muslim travelers within the tourist industry. The researchers found that Muslim travelers are prepared to pay for these services throughout their travels, and halal product prices have a notable and beneficial impact on trust. Furthermore, (Demir et al., 2021) showed a positive relationship between the perceived value of prices and the level of trust in the field of halal products and services in South Korea.

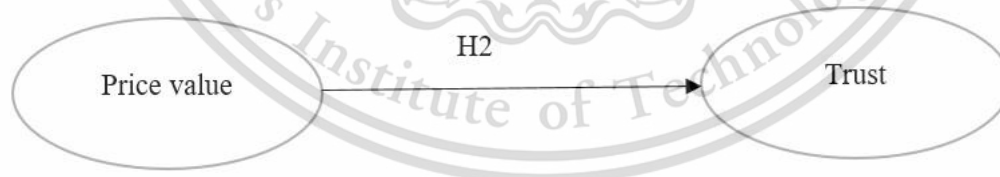


Figure 2.15 Price Value and Trust

2.20 Hedonic Motivation and Trust

Hedonic motivation, defined as the enjoyment or pleasure derived from utilizing technology, is a crucial determinant in technology adoption and usage (Venkatesh et al., 2012).

Research has shown that in the context of customers, intrinsic utilities such as fun, playfulness, and enjoyment play a crucial role in influencing customers' perception and intention to embrace new technologies (Van der Heijden, 2004). Customers in the electric vehicle sector have higher levels of satisfaction when driving electric vehicles (EVs) as compared to the performance of cars powered by internal combustion engines (Zhou et al., 2021). Furthermore, Akhlaq and Ahmed (2013) provided empirical evidence that intrinsic motivation has a significant role in enhancing consumer trust in the context of technology adoption, as seen by the customers. In their study, Alalwan et al. (2015) investigated the function of technologies related to online banking in the Middle East. They proposed that individuals' confidence in technology increases when hedonic factors drive them. When consumers discover that buying products and services through their mobile phones grants them access to various items and services, they develop a substantial level of trust and acceptance towards the online purchasing process (Gefen et al., 2003). A study conducted by Baabdullah (2018) revealed a significant correlation between hedonic motivation and trust among users employing technology in the setting of social network games. In the context of telemedicine adoption, Wu, Gu, Gu, and You (2021) demonstrated a noteworthy and positive correlation between motivation and trust.

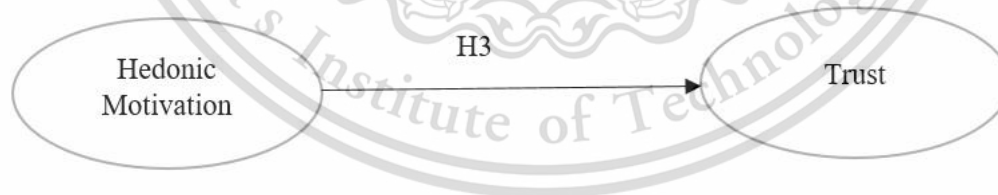


Figure 2.16 Hedonic Motivation and Trust

2.21 Facilitating Condition and Trust

Information technology infrastructure and organizational factors such as computers, internet speed, and communication integration/cloud integration are the primary facilitating

conditions (Queiroz & Wamba, 2019). Within the context of electric vehicles (EVs), it can be understood as the accessibility of batteries, educational resources or maintenance, and post-purchase services. The inclusion of internal features such as seat adjustment, a user manual for convenient technology navigation, and bluetooth communication with smartphones are crucial factors in fostering confidence among drivers of electric vehicles (Gorenflo et al., 2019a; Jain et al., 2022a). Lu, Yu, and Liu (2005) investigated the correlation between facilitating conditions and trust and the significance of enabling conditions in establishing corporate trust. Their findings revealed a robust association between facilitating conditions and trust. According to Vairetti et al. (2019), the transportation sector benefits from facilitating conditions that promote the adoption of Inter-Organizational Information Systems. Similarly, Zhang et al. (2022) demonstrated that the provision of information about performance and characteristics greatly enhances trust in electric vehicles.

A study conducted by Lu, Yu, and Liu (2005) examined the impact of facilitating conditions, such as technical training, online support, and a protective legal and regulatory framework, on the level of trust towards wireless Internet services via mobile technology (WIMT) among 357 MBA students. Wakefield, Stocks, and Wilder (2004) contended that the presence of guarantees, training, or other safety net measures cultivates a level of trust between two parties. The study conducted by Ratnasingham (2004) examined a comparable correlation within the context of an electronic marketplace. The findings revealed that the presence of marketplace facilities enhances consumer confidence in particular technologies. In a similar vein, Gu et al. (2016) discovered that conducive conditions enhance the first trust in the arena of wearable commerce.

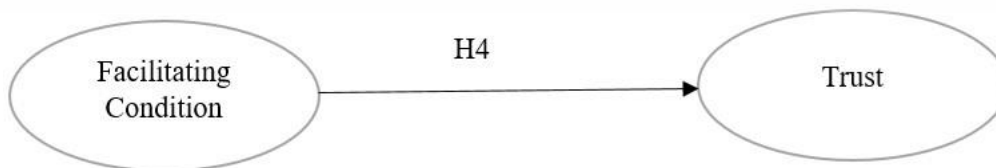


Figure 2.17 Facilitating Condition and Trust

2.22 Trust and Behavior Intentions

Trust is the extent to which consumers' assessments of the reliability and safety of the electric vehicle they purchase are credible (Wang et al., 2018). Trust is a conceptual framework that can influence the widespread adoption of technology (Liébana-Cabanillas et al., 2017). The study of Wang and Khan (2024) examined the adoption of Electric Vehicles (EVs) and concludes that trust significantly influences consumers' willingness to buy EVs. Trust demonstrates a significant correlation with the intention to adopt electric vehicles, suggesting that customers' faith in the technology's reliability and sustainability is essential in influencing their decision-making process. Ajao, Sadeeq, and Sodiq (2024) argued that trust influences behavioral intentions about adopting electric vehicles (EVs), especially in developing markets like Nigeria. Consumers in these places must possess confidence in the reliability and usefulness of electric vehicles to overcome concerns and cultivate favorable intents for adoption. This trust is particularly crucial in places like Nigeria, where apprehensions regarding performance, long-term usability, and the availability of maintenance services may impede adoption. The correlation between trust and behavioral intentions indicates that bolstering trust via open communication, assurances of reliability, and robust after-sales assistance might profoundly affect consumer choices about adopting electric vehicles (EVs). Policymakers and manufacturers in Nigeria must prioritize establishing confidence by addressing these issues and assuring the provision of support services, hence facilitating increased adoption rates of electric vehicles nationwide. Concerning electric vehicles, trust pertains to the perception of their environmental benefits, reliability, safety, cost-effectiveness, and performance. Given that electric vehicles are energy-efficient technologies, a significant number of individuals lack knowledge about their performance, characteristics, and operational procedures compared to conventional petrol vehicles. Due to their lack of awareness of the importance of EVs in reducing carbon emissions, consumers are likely to have doubts about their performance and safety attributes (Simsekoglua & Nayum, 2019; White & Sintov, 2017). Hence, consumers are

more inclined to assess greater risks linked to electric vehicles, such as financial risk, charging risk, physical danger, and psychological risk, and adopt a cautious approach (Li et al., 2017). Additionally, consumers hold biases against electric vehicles and lack trust in them because of information asymmetry and preconceived notions (Raimin & Leary, 2014). Nevertheless, when consumers have confidence in the advantages of electric vehicles in Hong Kong, they are more inclined to have favorable intentions to purchase electric cars in the future (Ng et al., 2018). In the banking domain, (2016) conducted a study to examine the correlation between trust and behavioral intentions in the adoption of Internet banking. Their findings indicated a statistically significant association between trust and behavioral intentions.

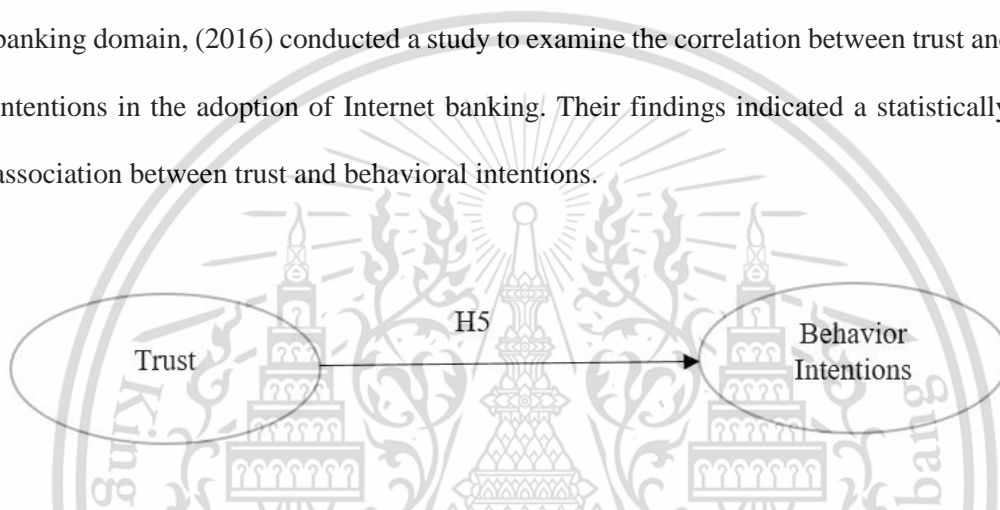


Figure 2.18 Trust and Behavior Intentions

2.23 Behavioral Intentions and Use Behavior

The concept of behavioral intention, as defined by King and He (2006), refers to the level of rational decision-making by an organization to either carry out or not carry out a task in the future. Intentional activities positively influence technology use behaviors (Warshaw, 1980). Yousafzai et al. (2007) found that among 145 investigations, just 11 (7.5 percent) included actual usage, whereas the remaining studies either documented self-detailed usage or expressed aspirations. In the context of electric car adoption, Zhou et al. (2021) Examined the market acceptance of electric vehicles in China. A study conducted on 725 participants revealed a robust and statistically significant association between individuals' aspirations to embrace electric vehicles (EVs) and their actual usage. Furthermore, the study revealed that the desire to adopt electric

automobiles could accurately forecast the actual adoption behavior, accounting for around 89% of the variability in adoption intention and 50% in actual usage behavior. Furthermore, according to Brown, Pope, and Voges (2003), consumers who have a positive intention are more inclined to use electric vehicles compared to those who lack such intent. A study conducted by (2020) in the banking sector in Pakistan showed that consumers who have an intention to use e-banking are more inclined to actually use it. Venkatesh et al. (2003) proposed that in an organizational setting, a positive behavioral intention results in the adoption of technology within the organization, while negative intentions give rise to a situation where the institution chooses not to employ the technology.



Figure 2.19 Behavior Intentions and Use Behavior

2.24 Habits and Behavior Intentions

Habit refers to the extent to which individuals engage in behavior automatically after acquiring knowledge (Venkatesh et al., 2012). Habit is defined as an individual's belief in logical time, which is quantified based on their prior conduct. The degree of habit might vary depending on the level of involvement and familiarity with the target technology. Continued usage of new technology for a logical period builds a habit, fostering a positive intention to use it (Tamilmani et al., 2019). Within the realm of electric vehicle adoption, Zhou et al. (2021) contended that drivers need to modify their current work routines, encompassing driving abilities, fueling/charging practices, battery replacement, and mileage estimation. Furthermore, Zhou et al. (2021) proposed that habits exhibit a strong and positive correlation with intentions to engage in relevant behaviors. In their study Likewise, Vassileva and Campillo (2017) demonstrated that drivers with prior

experience operating an electric car are more inclined to acquire and utilize them. The study conducted by Lam, To, and Lee (2023) demonstrated that habit positively impacts the intention to employ smart building management systems. In their study on visitor behavior in the hotel industry, Wang et al. (2023) found that the personality attributes and habits of guests play a crucial role in determining their energy-saving behavior. They also proposed a noteworthy correlation between habit and intention.

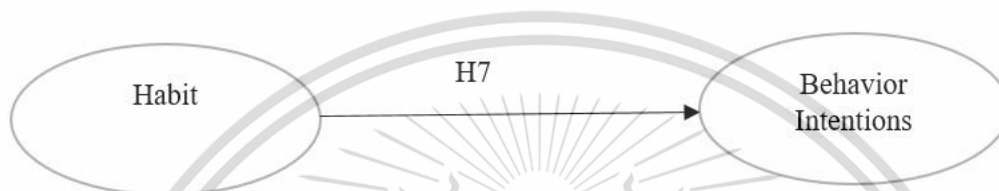


Figure 2.20 Habit and Behavior Intentions

2.25 Effort Expectancy and Behavior Intentions

Effort expectancy can be defined as "the perception of a consumer that how easily can make the action by using the technology, the interaction with the system, easy to use, easy for me to become skillful by using the system, easy to operate the system (Venkatesh et al., 2012). Curtale et al. (2022) explored psychological aspects related to autonomous electric cars sharing service (AECS) in European countries i.e. France, Italy, Spain, and Netherlands using UTAUT2 and suggested that facilitating condition (easiness and usefulness) of electric car sharing service (ECS) lead to behavior intentions towards ECS and facilitating condition leads to intention to use AESC through ESC behavioral intentions. Similarly, Zhou et al. (2021) conducted a study on electric car adoption by taxi drivers in China and exhibited that facilitating conditions have a significant relationship with intention towards electric cars. In the context of a restaurant mobile app, facilitating conditions related to the app is a strong predictor of behavioral intention (Palau-Saumell et al., 2019). However, in India, effort expectancy was determined to have no substantial impact on adopting electric two-wheelers (E2Ws). This may be ascribed to a need for more knowledge

and comprehension of EV technology, resulting in a feeling of complexity related to E2Ws. Simplifying the user experience can improve the entire ownership experience. To enhance adoption, stakeholders must concentrate on performance aspects such as speed, range, and acceleration, as well as user-friendly software, cutting-edge technology, convenient charging solutions, and adaptability in their marketing strategies.

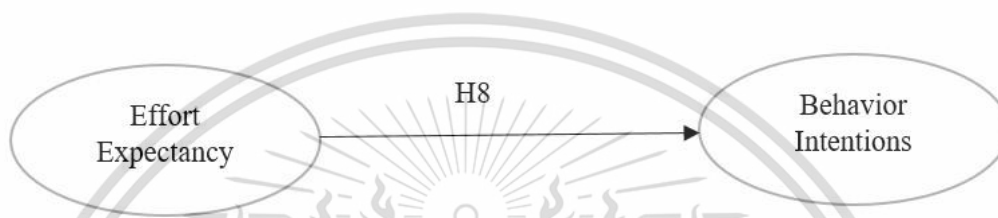


Figure 2.21 Effort Expectancy and Behavior Intentions

2.26 Social Influence and Behavioral Intentions

Social influence is the measure of the extent to which stakeholders affect the use of technology (Cabrera-Sánchez & Villarejo-Ramos, 2020). Certain studies indicate that social influence can be exerted by friends, family, and coworkers (Baishya & Samalia, 2020), whereas Queiroz and Wamba (2019) research emphasises the significance of social impact in the adoption of new technologies.. The social effect of technology is a crucial factor that generates positive behavioural intentions towards its use by incorporating social aspects into the new technology (Sung et al., 2015). Abbasi et al. (2021) examined consumer reasoning for adopting electric vehicles in Malaysia using the Unified Theory of Acceptance and Use of Technology (UTAUT). They found a favorable positive relationship between social influence and behavioral intentions. Through their investigation of electric car-sharing services in European countries. Likewise, Curtale et al. (2022) discovered a notable correlation between social impact and behavioral intentions. A study by Khazaei (2019) investigated the adoption of electric vehicles and revealed a significant correlation between social influence and behavioral intentions. However, Zhou et al.

(2021) did not find any relationship between social influence and the intention to use electric automobiles in China and further demonstrated that the adoption of EVs is impacted by the perspectives of stakeholders, encompassing society, family, friends, and colleagues. Electric vehicles and EVs represent the most recent technological breakthrough in road transport. Ownership of an electric vehicle is regarded as a representation of one's identity and social status. Social influence within the domain of mobile gaming plays a positive role in shaping behavioral intentions. Social influence within the domain of mobile gaming plays a positive role in shaping behavioral intentions. Given the ease with which players can participate in group play and exchange their ranks and high scores on social networking sites, individuals can obtain data pertaining to the scores and rankings of these players. This knowledge might influence their view of the games (Baabdullah, 2018a). Shetty and Rizwana (2024) conducted a study in India that indicates that social influence has little effect on adopting electric two-wheelers (E2Ws). Although social norms and peer pressure may impact consumer behavior, the results indicate that social influence does not substantially alter the intention or purchase of E2Ws in this setting. In Nigeria, social influence profoundly affects the intention to embrace electric cars (EVs). In a developing market such as Nigeria, where communal and social networks significantly influence decision-making, individuals are more inclined to adopt electric vehicles if they observe endorsement from peers, family, or community leaders. The communal perspective of electric vehicles significantly impacts individual choices to adopt new technology (Ajao, Sadeeq, & Sodiq, 2024).

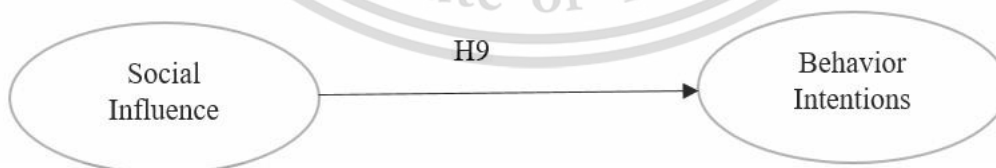


Figure 2.22 Social Influence and Behavior Intentions

2.27 Satisfaction with Incentive Policies, Behavioral Intentions, and Use Behavior

The level of customer satisfaction with electric car incentive plans is influenced by the degree of alignment between the actual results and their expectations (Zhou et al., 2021). The high cost of electric vehicles (EVs) in comparison to conventional petrol vehicles is a significant obstacle that restricts people from buying EVs (Lin & Wu, 2018). For most consumers, the purchase price is a significant factor that influences their decision to embrace a product or service (Wang et al., 2017). More than half of respondents in a recent survey conducted in the United States identified purchasing prices as a significant obstacle (Carley et al., 2013). Governments worldwide have adopted financial incentives, communication standards, and facilitation measures to promote the use of electric vehicles (Han et al., 2017). Shakeel (2022) studied in Pakistan investigates the influence of monetary and non-monetary incentives on customer intentions to acquire Electric Vehicles (EVs) via the lens of the Theory of Planned Behavior (TPB) model. The results indicate that whereas monetary incentives, such as tax exemptions and reduced fees, enhance purchasing intentions, non-monetary incentives, including awareness initiatives and infrastructure improvements, exert a more substantial effect. The analysis underscores the significance of both policy types in facilitating electric vehicle adoption and accentuates the potential of electric vehicles to diminish greenhouse gas emissions, mitigate environmental challenges, and foster economic expansion within the electric vehicle industry. It also recommends that the Pakistani government prioritize policies that foster corporate expansion and offer economic incentives to automakers to expedite the shift to electric mobility. The study conducted on 324 Chinese adults revealed a strong correlation between three incentive policies and the inclination to use electric vehicles. Among these policies, convenience policies were identified as the most crucial in promoting electric autos (Wang et al., 2017). Electric buses (Mohamed et al., 2018), electric trucks (Stokes & Breetz, 2018), and electric

taxis are all being driven by incentives (Bauer et al., 2018). Among clients who are extrinsically motivated, Coad et al. (2009) found that financial incentive schemes are more persuasive than those who are intrinsically motivated. Hoen and Koetse (2014) found that incentive mechanisms do influence consumers' intentions to use electric vehicles (EVs) in the Netherlands. However, these policies are not very effective in alleviating concerns about the reliability of EVs.

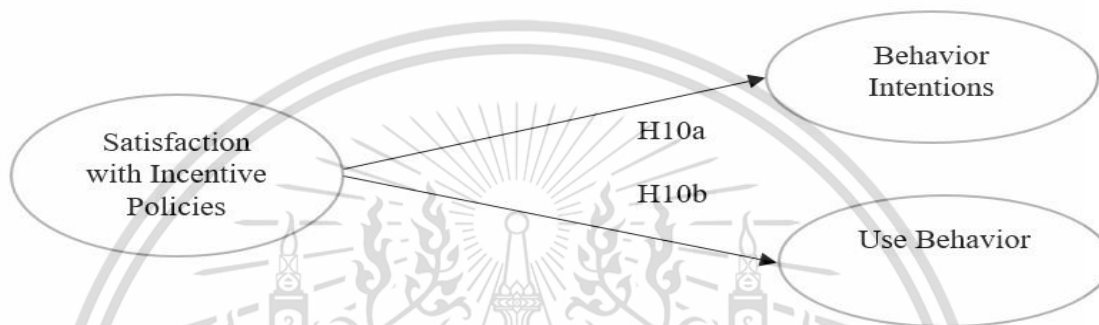


Figure 2.23 Satisfaction with Incentive Policies, Behavior Intentions, and Use Behavior

2.28 Sequential Mediation of Trust and Behavior Intention

Environmental concerns have been shown in numerous studies to increase trust in electric automobiles (Chen & Chang, 2012). Fernandes and Calamote (2016) discovered that an unjust price structure undermines consumers' faith in businesses. However, Konuk (2018) found a significant association between price value and trust. Hedonic motivation also boosts people's confidence in using specific information technologies. Individuals who are highly driven by hedonic factors develop trust in the use of technology (Alalwan et al., 2015). Baabdullah (2018) also showed a significant relationship between hedonic motivation and trust. Lu et al. (2005) facilitating conditions, wireless trust, and adoption Intention were investigated, and it was discovered that there is a substantial relationship between facilitating conditions and trust, as well as the fact that facilitating conditions are a key component in developing business trust.

Adding to it, many scholars' empirical studies indicate that trust has a significant effect on behavioral intention in electronic commerce (Pavlou, 2003; Van der Heijden, Verhagen, & Creemers, 2003). In addition, when it comes to transactions, trust is the most important factor in determining behavior intentions (Wang et al., 2015). In every technology, trust plays a critical part, as it is the user's expectation of the system (Wang et al., 2015). A recent study by Zhou et al. (2021) in the context of electric vehicle adoption tested a relationship between behavioral intentions and use behavior and showed a significant relationship.

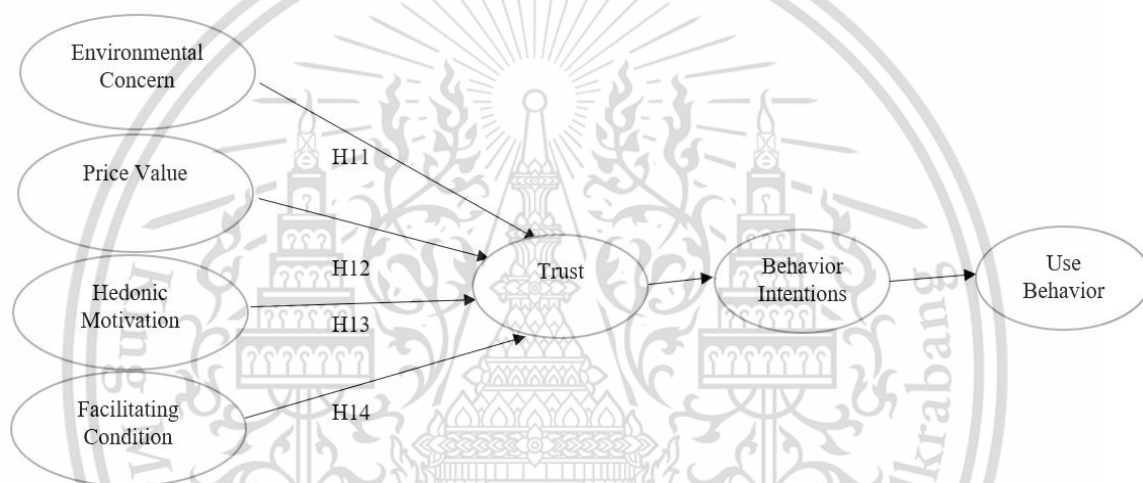


Figure 2.24 Sequential Mediation of Trust and Behavioral Intention

2.29 The Mediating Role of Behavioral Intentions

Previous studies in the settings of EV adoption habits have shown that it has a positive effect on intentions (Zhou et al., 2021). A recent study in the domain of electric car sharing has confirmed an indirect relationship between effort expectancy and behavior intentions (Curtale et al., 2022). Zhou et al. (2021) explored the same relationship in the context of electric vehicles and found a positive relationship between these factors. In the domain of EVs, Curtale et al. (2022) studied electric car-sharing services in European countries and tested a positive relationship between social influence and behavioral intentions.

Zhou et al. (2021) argued in the context of electric vehicle adoption that behavioural intentions and use behaviour has a significant relationship. Ahmad et al. (2020) explored a similar relationship in the context of e-banking and exhibited a positive relationship between intention and actual use e-banking technology. Another study, with admiration political elections (Ajzen, 1991a) has set up a critical positive connection between lodge voting intentions and genuine voting behaviors. The Theory of Reasoned Action Fishbein et al. (1980) contended that behavior can be estimated by the BI to play out a real conduct. As indicated by Brown et al. (2003) client with intentions to buy positive item will uncover more prominent genuine purchasing sums than those clients who establish that they have no BI.

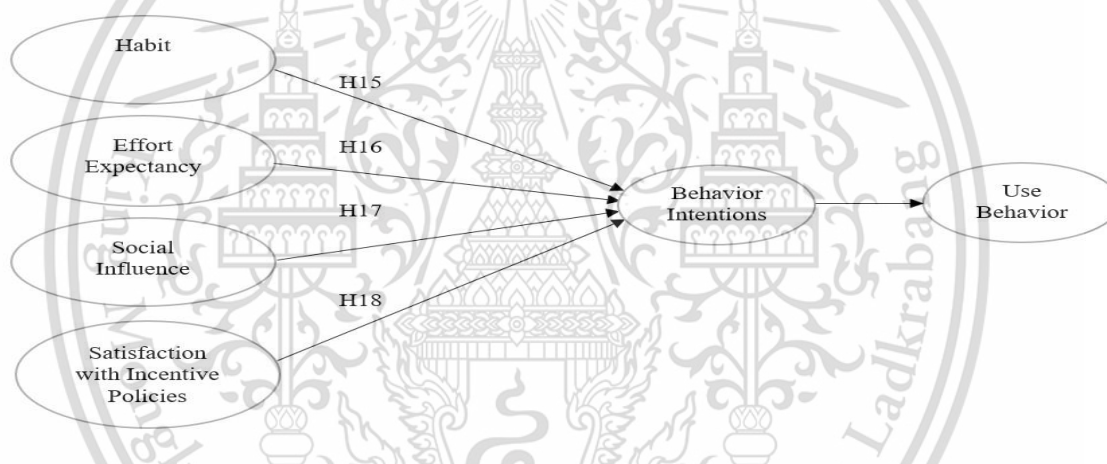


Figure 2.25 Mediation of Behavioral Intention

2.30 Moderating role of Charging Infrastructure

The transportation industry is currently seeing a swift shift towards electric power, resulting in the elimination of tailpipe emissions and facilitating zero emissions during recharging under future clean electric networks (Trinko et al., 2022). With the substantial growth in EVs, the effects on power grid performance and efficiency, including overloading, decreased efficiency, power quality problems and disruptions, and voltage regulation, especially at the distribution level, are expected to escalate further in the next years (Amry et al., 2022; Khalid et al., 2021).

Furthermore, Wolbertus et al. (2018) undertook a research analysis on variables associated with EV charging infrastructure and proposed that the charging infrastructure can influence consumer attitudes toward electric vehicles. A range of tactics can be employed to encourage the acceptance and expansion of electric vehicles (EVs), including providing monetary incentives for purchases and developing readily available charging infrastructure in metropolitan regions (Lin & Greene, 2011). However, range anxiety, the concern that the vehicle may lack sufficient battery power to reach its intended destination, has been recognized as a major barrier to the widespread use of battery electric vehicles (BEV). The presence of range anxiety not only reduces the probability of individuals acquiring Battery Electric Vehicles (BEVs), but it also limits their communal benefits. According to (Dong et al., 2014), those who are early adopters of electric vehicles may only be able to use them for short trips, resulting in a lower annual mileage compared to those who do not have concerns about limited driving range. Joshi, Malhotra, and Singh 2022 and Li et al. (2017) contended that the high cost and lack of accessible crucial support systems such as charging batteries lead to a decline in consumer trust towards electric vehicles (EVs). According to Silvia and Krause (2016), the use of advanced batteries and the development of infrastructure in the country can effectively overcome these challenges. Despite the availability of charging stations at home or the workplace, the absence of such facilities creates a psychological obstacle (Morrissey et al., 2016).

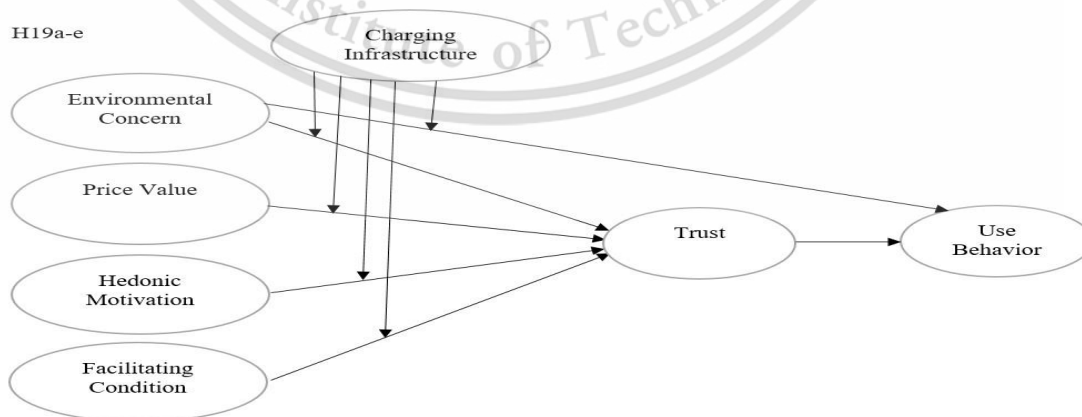


Figure 2.26 Moderation of Charging Infrastructure

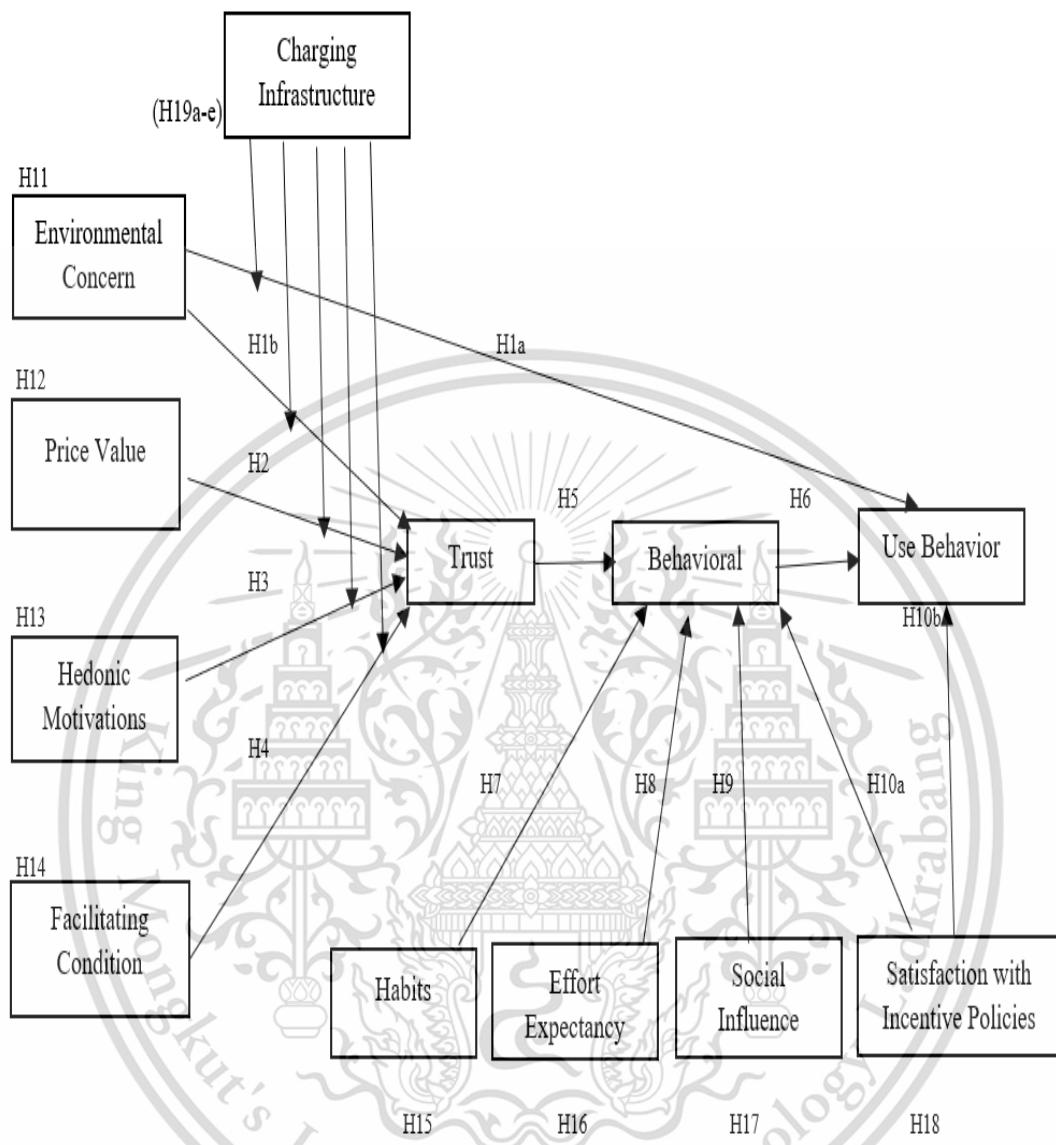


Figure 2.27 Theoretical Model

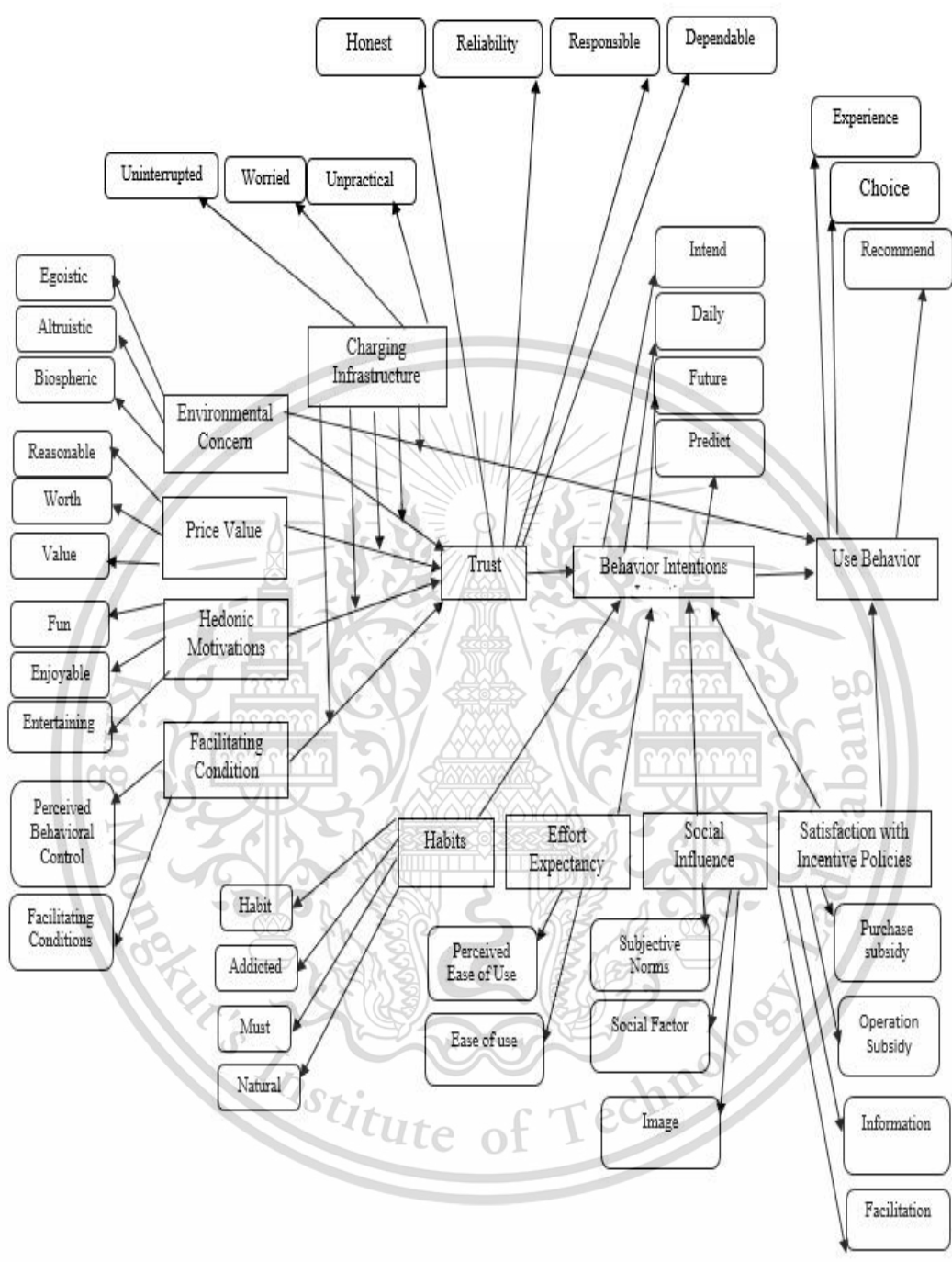


Figure 2.28 Theoretical Model with Observed Variable

CHAPTER 3

METHODOLOGY

The methodology of this study is discussed in this section, which includes the design of this study, population, and sampling. The design of the research gives structure for collecting data and analysis and also shows the type of research. This section also embraces the research approach, sampling techniques of variables, the procedure of collecting data, and the techniques to explore the link between the variables. This study is quantitative in nature, and the researcher will use a survey questionnaire to collect data to study problems in the automobile industry.

3.1 Research Design

On the basis of the research problem, the study can be quantitative, qualitative, or mixed; all methodologies are not the same, as it depends upon the nature of the data. On one hand, the dependency of qualitative research on the data comprises perceptions, sentences, words, images, and photographs. On the other hand, the reliance on quantitative research is contingent on information that contains numbers (Cooper et al., 2006). Finally, the mixed method contains quantitative and qualitative methodologies (Creswell et al., 2003). In this study, a quantitative method will be used.

As Cooper and Guinan (2006) explored, the most suitable technique is a quantitative method if the end goal is to investigate the association between the factors for which the researcher applies speculations, models, and theories and keeps these in mind. For testing theory, the quantitative method is most suitable, and for finding the relationship between variables, the quantitative design is best (Creswell, 2013). So, the approach that was utilized is the survey method. It comprises a questionnaire procedure as the key to the data collection techniques for statistical analysis. The cross-sectional techniques were used; the data was collected in one-time frame. The respondents of this study were consumers of the automobile industry (Electric Vehicle).

In this research, the philosophy is positivism. Blau (1964) explains, "Positivist approaches to the social sciences assume things can be studied as hard facts and the relationship between these facts can be established as scientific laws." Positivism is probably the most significant attempt to generate knowledge about the social world. It is based upon the values of reason, validity, and truth, focusing merely on facts gathered by direct observation or experience and measured empirically using quantitative methods. Positivists trust that exploration should be completed in a scientific nature. It is observational research that takes a strict arrangement of rules and ought to be completed by properly prepared researchers. This examination is generally in light of a deductive approach, moving from hypothesis to perception. As a rule, positivists need their discoveries to be material to the entire populace. The investigation of perceptions is quantifiable rather than subjective. It is deemed necessary for the positivists to carry out research in a scientific manner. This requires trained scientists to find empirical results by following a strict set of guidelines. For this purpose, the deductive approach is used to move from theory to observation, and the results are applicable to the population.

3.2 Population

Sekaran and Bougie (2009) stated that "population relates to the overall group of people and organization which might be of interest to the researcher". The population for this research is Unknown. The target population includes consumers in the automotive sector in Thailand and Pakistan. The study aims to explore the determinants affecting their usage decisions, which is crucial for understanding adoption trends and potential obstacles in both markets.

3.3 Sampling Technique

This study used a non-probability, purposive sampling technique to focus on users with particular characteristics compatible with the research purpose (Qureshi et al., 2022). As non-

probability, each sample has no chance of being a respondent from the targeted population. In this study, probability sampling might not be possible as the population is unknown.

3.3.1 Procedures for Recruitment and Participation

After the approval from the KMITL Business School Review Board (IRB), a survey was shared with the electric vehicle users to coordinate the timing of the administration of the survey. The respondents for this study were electric vehicle users, and each respondent received a consent letter. The users were approached at charging stations and EV promotional events to collect data from appropriate samples.

3.4 Sample size

Picking a precise sample is continually considered an essential portion of the completion of any study. Moreover, the size of the sample could be determined either through expected opinions or by dependable guidelines (Teddlie & Yu, 2007). Choosing a correct sample is critical on the grounds that, for all intents and purposes, it is not conceivable to assemble data from each segment of the population because of extraordinary cost, time restriction, and lack of investigation coworkers to collect data. That is why Cooper, Schindler, and Sun (2006) and Zikmund-Fisher et al. (2010) argued that data should be collected from the targeted individuals, not from each unit of the population.

In addition, choosing an appropriate sample from a focused population is essential for steady and dependable research results. Lowry and Gaskin (2014) determined that a sample size exceeding 200 is advisable for conducting structural equation modeling (SEM). Therefore, for accuracy, 300 questionnaires were distributed among electric car users in Thailand and 350 among Pakistani EV users, of which 220 from Thai users and 300 from Pakistani users were appropriate for data analysis. The differences in sample size are supported by the study of Hausteine et al. (2021), which explored the adoption of EVs in Denmark and Sweden.

The disparity in sample sizes between Thailand (300 respondents) and Pakistan (350 respondents) can be ascribed to multiple factors, including the disparate market penetration of electric vehicles (EVs) in each nation, the differing sizes of the target populations, and logistical impediments encountered during data collection. For instance, Pakistan's electric vehicle market may be in a nascent phase of adoption, requiring a more extensive sample to encompass a more comprehensive array of consumer viewpoints. Moreover, practical limitations such as geographic dispersion in Thailand and constrained resources may have impeded data collection, resulting in a reduced sample size. Notwithstanding these disparities, the sample sizes are sufficient for a comparative study since they represent the distinct characteristics and circumstances of electric vehicle adoption in both nations.

3.5 Design of Questionnaire

The questionnaire survey was comprised of two principal parts. The Likert scale will be used to examine in what way the respondents strongly agree to a specific statement (Uma and Roger, 2003). The purpose of this 5-point Likert scale is to assess the respondents with extra choice and well choices or the variability in their attitudes and feelings, as well as to capture (Hinkin, 1995).

Five-point Likert scale, offers the respondents with considerably more basic alternatives from where they can choose without much of a stretch go for their grouping. The planned surveys questionnaire was used for this study. The questionnaire was distributed among the targeted respondents at charging stations and EV promotional, Burns and Bush (2003) approved this way of collecting data. More than that, the unit of analysis was individuals or electric vehicle user. The aim of the study is to understand Factors affecting the adoption electric cars. The individual level of investigation was considered on the grounds.

3.6 Measurement

Environmental concern was measured with 4 items and adapted from the study (Cruz & Manata, 2020), Price value was measured with 3 items, habit was measured with 4 items, satisfaction with policies was measured with 4 items, and use behavior was measured with 3 items (Zhou et al., 2021). Effort expectancy is measured with 4 items (Curtale et al., 2021). The hedonic motivation was measured with 3 items and social influence and facilitation was measured with 4 items (Khazaei, 2019; Venkatesh et al., 2012). Charging infrastructure was measured with 3 items (Joshi et al., 2022) and. Trust was measured with 5 items (Choi & Hyun, 2017; Ng et al., 2018), behavioral intentions were measured with 4 items (Venkatesh et al., 2012 and Alalwan, Dwivedi, Rana, et al., 2016). **Table 3.13.** compares the original and modified measurement items used in the study. For the final version of the questionnaire, refer to Appendix A.

Table 3.13 Scale and Questions

Latent Variables	Observed Variables	Scale	Modified Scale	Sources
Effort Expectancy (Venkatesh et al., 2003a)	Perceived Ease of Use	My interaction with the system would be clear and understandable.	I assume a simple and understandable interaction while using the EVs.	(Curtale et al., 2021)
		It would be easy for me to become skillful at using the system.	I assume it would be easy to be skillful at using the EVs.	
		I would find the system easy to use.	I assume I would find the EVs easy to use.	
	Ease of Use	Learning to operate the system is easy for me.	I assume learning to operate the EV's is easy for me.	
Social Influence (Venkatesh et al., 2003a)	Subjective Norms	People who influence my behavior think that I should use the system.	People who influence my behavior think that I should use the EV's.	(Khazaei, 2019; Venkatesh et al., 2012)
		People who are important to me think that I should use the system.	People who are important to me think that I should use the EV's.	

Latent Variables	Observed Variables	Scale	Modified Scale	Sources
	Social factor	In general, the organization has supported the use of the, system.	In general, the society has supported the use of the, EV's.	al., 2012c)
	Image	Having the system is a status symbol in my organization.	Having the EV's is a status symbol in my Circle.	
Facilitating Conditions (Venkatesh et al., 2003a)	Perceived behavioral Control	I have the resources necessary to use the system. I have the knowledge necessary to use the system. The system is not compatible with other systems I use.	The resources necessary to use electric cars are existed. I have the knowledge necessary to use electric cars. The electric vehicle is compatible with other technologies I use.	(Khazaei, 2019; Venkatesh et al., 2012c)
	Facilitating Conditions	A specific person)or group (is available for assistance with system difficulties	I can get help from others when I have difficulties using electric car.	
Hedonic Motivations (Venkatesh et al., 2012c)	Fun Enjoyable Entertainment	Using mobile Internet is fun Using mobile Internet is enjoyable. Using mobile Internet is very entertaining.	Using EV's is fun. Using EV's is enjoyable. Using EV's is very entertaining.	(Zhou et al., 2021b)
Price Value (Venkatesh et al., 2012c)	Reasonable Worth value	Mobile Internet is reasonably. Mobile Internet is a good value for the money. At the current price, mobile Internet provides	The price for an electric Vehicles is reasonable. Using an electric vehicle is worth the money. At the current price, EV's provides a good value.	(Zhou et al., 2021b)
Habit (Venkatesh et al., 2012c)	Habit	The use of mobile Internet has become a habit for me. I am addicted to using mobile Internet.	The use of an electric vehicle has become a hab it for me. I am addicted to using an electric Vehicle.	(Zhou et al., 2021b)

Latent Variables	Observed Variables	Scale	Modified Scale	Sources
	Addicted	I must use mobile Internet.	I must use an electric Vehicle as the habit.	
	Must use	Using mobile Internet has become natural to me.	Using an electric taxi has become natural to me.	
	Natural			
Environmental Concerns (Albayrak et al., 2013; Stern & Dietz, 1994)	Egoistic Concerns	Protecting the environment will threaten the jobs of people like me.	Protecting the environment while using EV's will benefits me.	(Cruz & Manata, 2020)
	Altruistic Concerns	The effects of pollution on public health are worse than we realize. Environmental protection will help people have a better quality of life	The pollutions caused by Fossil Fuels Vehicles are worse than we imagine. Environmental protection while using EV's will help people have a better quality of life.	
	Biospheric Concerns	Over the next several decades, thousands of species of plants and animals will become extinct	The EV's will not just benefit humans but also the other creatures.	
Trust (Butler, 1991; Deutsch, 1960; Smith & Barclay, 1997)	Honest	This brand is honest.	Electric vehicles claims are honest.	(Choi & Hyun, 2017; Ng et al., 2018)
	Reliable	This brand is reliable.	I trust Electric vehicles reliability.	
	Responsible	This brand is responsible.	Electric vehicles are responsible in terms of the environment.	
	Dependable	This brand is dependable.	I trust that Electric vehicles are dependable.	
	Good Intentions	This brand is act with good intentions.	Electric vehicles act with good intentions in terms of the environment.	

Latent Variables	Observed Variables	Scale	Modified Scale	Sources
Satisfaction with policies (Choi & Hyun, 2017; Mohamed et al., 2018; Wang et al., 2018; Westbrook & Oliver, 1981)	Purchase subsidy	I think the subsidy policy for purchasing EVs is sufficient.	I am satisfied with the purchase subsidy policies of electric Vehicles.	(Zhou et al., 2021b)
	Operation subsidy	I know well about the subsidy policy for purchasing EVs.	I am satisfied with the operation subsidy policies of electric vehicles.	
	Information	Subsidy policy and preferential tax policies are important for me to purchase EVs.	I am satisfied with the information provision policies of electric vehicles.	
	Facilitation	I am satisfied with the facilitation policies of electric vehicles.	I am satisfied with the facilitation policies of electric vehicles.	
Behavioral Intentions (Ajzen, 2002; Davis, Bagozzi, & Warshaw, 1989; Venkatesh et al., 2003a)	Intend	I intend to use Mobile banking in the future.	I intend to use electric vehicles in the future.	(Venkatesh et al., 2012c) (Alalwan et al., 2016)
	Daily	I will always try to use Mobile banking in my daily life.	I will always try to use electric vehicles in my daily life.	
	Future	I plan to use Mobile banking in future.	I plan to use electric vehicles in future.	
	Predict	I predict I would use Mobile banking in the future.	I predict I would use electric vehicles in the future.	
Use Behavior (Venkatesh et al., 2012c)	Experience	It is a pleasant experience to use an electric taxi.	It is a pleasant experience to use electric Vehicles.	(Zhou et al., 2021b)
	Choice	Electric taxis are my first choice When I need to replace a new one.	Electric Vehicles are my first choice When I need to replace a new one.	
	Recommend	I will recommend to my friends to use electric taxis, if it is available.	I will recommend to my friends to use electric Vehicles, if it is available.	

Latent Variables	Observed Variables	Scale	Modified Scale	Sources
Charging Infrastructure (Haustein & Hunecke, 2007; Haustein & Jensen, 2018) (Joshi et al., 2022)	Uninterrupted	I like public transportation because there are a lot of interesting things to see.	1) A lot of charging stations are required for uninterrupted journey.	(Joshi et al., 2022)
	Worried	For me using public transportation is relaxing.	While driving an Electric vehicle, I will always be worried about running out of charge.	
	Unpractical	The public transportation is practical and convenient for daily use.	The need for charging makes Electric vehicles very impractical and inconvenient for daily use.	

3.7 Quality of the instrument

Five technologists and experts in the field of electric vehicle adoption have examined the quality of the questionnaire in this research. The instruments for item objectivity congruence (IOC) were determined for each question and attribute.

Formula to calculate the value (tuner & Carlson, 2003).

$IOC = \sum r/N$, For instance, $1+1+0 = 2/3$, So $IOC = .67$. Where the experts total is three and the score is two.

3.7.1 Validity

Step one: The questionnaire was sent to the experts for any suggestions for improvement.

Step two: The questionnaire was corrected and adjusted in accordance with comments and recommendations made by experts.

Step three: After receiving expert feedback and recommendations, the Index of Item-Objective Congruence (IOC) was used to find the content validity. In this process, the questionnaire

was checked by three experts, including Pakistani and Thai experts in the field of technology adoption and electric vehicle adoption.

The Item-Objective Congruence (IOC) was used to evaluate the questionnaire items based on the score range from -1 to +1.

Congruent = + 1 Questionable = 0 Incongruent = -1

The items that had scores lower than 0.5 were revised.

On the other hand, the items that had scores higher than or equal to 0.5 were reserved.

3.7.2 Reliability

The reliability of the questionnaire was determined to ensure that the responses collected through the instrument were reliable and consistent. The questionnaire's reliability was evaluated using a sample of 40 respondents from Pakistan and 40 respondents from Thailand. This method offers a thorough and equitable assessment of the instrument in two different cultural contexts. Bujang et al. (2024) indicate that a minimum of 30 participants is necessary for a reliable study, and utilizing 40 respondents from each country surpasses this need, hence augmenting the robustness and reliability of the findings. The reliability value was calculated by using Cronbach's alpha to ensure whether there was internal consistency within the items. George and Mallery (2010) illustrated the value of Coefficient Cronbach's Alpha as the following: ≥ 0.9 = Excellent, ≥ 0.8 = Good, ≥ 0.7 = Acceptable, ≥ 0.6 = Questionable, ≥ 0.5 = Poor, and ≤ 0.5 = Unacceptable. Therefore, in order for the research questionnaire to be reliable, its value of Coefficient Cronbach's Alpha must be at least 0.7.

3.8 Time Horizon

There are two types of time horizon cross sectional study and the longitudinal study. The longitudinal research is when the data are collected from two different farms of time, while the cross-sectional time horizon does not have any restriction of time; the data can be collected through

different techniques at one time. In this study, the cross-sectional horizon was used to collect the data from the sample.

3.9 Techniques for Data Analysis

This study used different data analysis techniques to draw conclusions from the collected data to test the developed hypothesis and answers to the research questions. These techniques include descriptive statistics, correlation, regression, exploratory factor analysis, confirmatory factor analysis CFA, composite reliability CR, and average variance extracted AVE and path model (SEM). The values of composite reliability CR should be greater than .70, and the average variance extracted AVE should be greater than 0.50 (Sarstedt, Ringle, enseler, & Hair, 2014). The value of X^2/df should be within the acceptable range, between 1-5 (Wheaton et al., 1977). According to Doll, Xia, and Torkzadeh (1994) and Homburg and Baumgartner (1995), if the values of GFI and AGFI are greater than .8 is acceptable. All of the parameters NFI, CFI, TLI, and IFI should be close to 1, and the RMSEA should be greater than .08 (Lowry & Gaskin, 2014). These tests were applied by using 20.0 SPSS and AMOS.

3.10 Normality and Validity

To ensure normality, all factors must have skewness and kurtosis values within the allowable range, as defined by Groeneveld and Meeden (1984) and Kline (2005), which is between +2 and -2 for skewness and +3 and -3 for kurtosis. For ensuring reliability, Abraham and Barker (2015) stated that Cronbach α of all the variables greater than .7 is a good fit. The composite reliability values of all constructs should greater than 0.70, and the average extracted variance is greater than 0.50 (Lowry & Gaskin, 2014). All items load on their respective components, ensuring convergent validity, as noted by (Anderson & Gerbing, 1988), and discriminant validity shows the degree to which one concept differs from another. All the diagonal values should be more than the correlation values, the AVE values must be greater than the MSV (maximum shared variance), and

all the MSV values should be less than 1; this ensures that the discriminant validity of the data is not at risk (Fornell & Larcker, 1981).

3.11 Unit of Analysis

An important step is to decide how the data will be analyzed by the researcher and to define what will be the unit of analysis for the study (Trochim, 2006). The unit of analysis is the “who” or the “what” that a researcher is analyzing for the study. The individual is the most common unit of analysis, and if the researcher is interested in studying two-person interactions, then it is known as dyads; it may be a group, department, organization, city, country, etc. The unit of analysis for the present study was a user of electric vehicles.

3.12 Multi-group SEM

After applying SEM, multi-group analyses were conducted to compare Thailand and Pakistan. Multiple-group structural equation models test separate structural models in two or more groups (Jöreskog, 1971; Sorböm, 1974). This study utilized multiple-group structural equation models to assess the variations in factors impacting the adoption of electric vehicles in Thailand and Pakistan. Two groups were compared: Group 1 (Thailand) with a sample size of 220 and Group 2 (Pakistan) with a sample size of 300. These models may include path models, evaluation of indirect effects, confirmatory factor models, or comprehensive structural equation models. Multi-group models often maintain a consistent structure across all groups and can offer distinct evaluations of parameters specific to each group, such as loadings, pathways, and correlations. Chi-square and fit indices can be calculated for each group individually and for the overall fit indices of the combined, multigroup model. The study utilized Structural Equation Modeling (SEM) to discover significant and insignificant paths for each group. The insignificant variables for both nations were removed to create the unconstrained model. The parameters were designated to presume that they were equivalent for both groups in order to create the constrained model. The

discrepancy between Chi-square and degree of freedom was computed for the Thailand and Pakistan groups to assess their invariance. The analysis aims to determine if a scale or test exhibits consistent measuring qualities across different groups, known as invariance testing. If a test maintains consistent measurement features across different groups, it is deemed "invariant."



CHAPTER 4

ANALYSIS AND FINDINGS

This chapter shows the results of the study “Factor affecting the adoption of electric vehicle (EV): A moderating effect of charging infrastructure based on an extended unified theory of acceptance and use of technology (UTAUT2) in Thailand and Pakistan. This chapter incorporated demographic, descriptive statistics, confirmatory factors analysis, discriminant validity, SEM, and multi group SEM analysis. This was carried out in two countries the sample. The sample size collected from Thailand was 220, and from Pakistan, 300.

4.1 Thailand Analysis and Finding

4.1.1 Demographics Analysis

The table displays in-depth demographic data collected from a group of 220 participants. Out of 220 respondents, 106 (48.2%) are male and 114 (51.8%) are female, showing a fairly even distribution between genders. The majority of respondents are in the 30-39 age category (40.0%), followed by those aged 50 and above (30.5%), the 40-49 age category (25.9%) and the smallest group is in the 18-29 age range (3.6%). The majority of respondents have either a bachelor's degree (35.0%) or a master's degree (38.2%) followed by doctorate (13.6%) and under bachelors are (13.2%). The majority of drivers have 6–10 years of experience (41.8%), with the next largest group being those with 0–5 years (31.4%) and above 10 years respondent had (26.8%). Regarding electric vehicle (EV) experience, the majority of respondents (75.0%) have had exposure to EVs for 2-4 years, up to 1 year were (17.7%) of the sample and above 5 years were (7.3%). This detailed summary provides valuable information about the varied demographics and experiences of the individuals surveyed.

Table 4.14 Demographics

		Frequency	Percent
Gender	Male	106	48.2
	Female	114	51.8
	Total	220	100
Age	18-29	8	3.06
	30-39	88	40.0
	40-49	57	25.9
	50 and above	67	30.5
	Total	220	100.0
Education	Under Bachelor	29	13.2
	Bachelor	77	35.0
	Masters	84	38.2
	Doctorate	30	13.6
	Total	220	100.0
Driving Exp	0-5	69	31.4
	6-10	92	41.8
	Above 10	59	26.8
	Total	220	100.0
EV Exp	Upto 1 year	39	17.7
	Above 2-4	165	75.0
	Above 5 years	16	7.3
	Total	220	100.0

4.1.2 Descriptive Statistics Thailand

Descriptive statistics shows the Mean values, Std. Deviation, Skewness, and Kurtosis.

Table 4.2 shows that N=220 shows the number of participants in this research study. According to (Kline, 2005), which depicts platykurtic, mesokurtic, and leptokurtic distributions, the skewness and kurtosis values of all the constructs fall within the permissible range (between +2 and -2 for skewness and between +3 and -3 for kurtosis). The skewness and kurtosis values of environmental concerns are Skewness is 0.93 and Kurtosis is 0.58, price value Skewness is -0.11 and Kurtosis is

-1.04, hedonic motivation value for Skewness is 0.47 and Kurtosis is -0.35, facilitating condition value for skewness is -0.37 and Kurtosis is -0.30, Trust skewness value is 0.58, and Kurtosis is 0.10, behavior intentions value for Skewness is 0.57, and Kurtosis is -0.11, use behavior value for Skewness is 0.52 and Kurtosis is -0.37, habit value for Skewness is -0.71 and Kurtosis is 0.42, effort expectancy value for Skewness is 0.66 and Kurtosis is 0.08, social influence value for Skewness is 0.38, and Kurtosis is -0.23, satisfaction with incentive policies value for Skewness is 0.45 and Kurtosis is -0.05, and charging infrastructure value for Skewness is 0.25, and Kurtosis is -0.2. This means there are no problems with the data due to non-normality.

Table 4.15 Descriptive Statistics

Constructs	N	Mean	SD	Skewness	Kurtosis
EC	220	2.21	1.00	0.93	0.58
PV	220	3.08	1.22	-0.11	-1.04
HM	220	2.14	0.87	0.47	-0.35
FC	220	3.36	1.78	-0.37	-0.30
TR	220	2.35	0.95	0.58	0.10
BI	220	2.15	0.88	0.57	-0.11
UB	220	2.44	0.99	0.52	-0.37
HBT	220	3.41	0.83	-0.71	0.42
EE	220	2.14	0.88	0.66	0.08
SI	220	2.53	0.91	0.38	-0.23
SP	220	2.30	0.86	0.45	-0.05
CI	220	2.34	0.72	0.25	-0.27

Note: Environmental Concern = EC; Price Value = PV; Hedonic Motivation = HM; Facilitating Condition = FC; Habit = HBT; Effort Expectancy = EE; Social Influence = SI; Satisfaction with Incentive Policies = SP; Trust; = TR; Behavioral Intentions = BI; Use Behavior = UB; Charging infrastructure = CI.

4.1.3 Structural Equation Modeling Thailand

CFA of Environmental Concern

The CFA model evaluated the validity of environmental concerns with three observed variables: egoistic, altruistic, and biospheric. The e1 represents egoistic, e2 and e3 represent altruistic, and e4 was deleted because of low loading, which was biospheric. The analysis results are shown below. The factor loading is $e1 = .80$, $e2 = .82$, and $e3 = .83$. The factor loading of the factors is significant at 0.05 level.

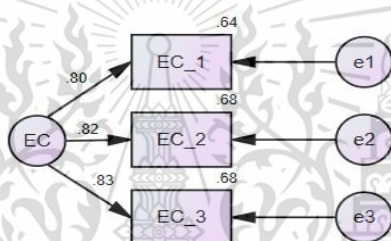


Figure 4.29 CFA of Environmental Concerns

CFA of Price Value

The CFA model evaluated the validity of price value with three observed variables: reasonable, worth, and value. The p1 represents reasonable, p2 represents worth, and p3 represents value. The analysis results are shown below. The factor loadings are $p1 = .88$, $p2 = .93$, and $p3 = .90$. The factor loading of the factors is significant at 0.05.

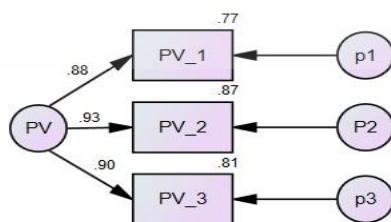


Figure 4.30 CFA of Price Value

CFA of Hedonic Motivation

The CFA model evaluated the validity of hedonic motivation with three observed variables: fun, enjoyable, and entertaining. The h1 represents fun, h2 represents enjoyment, and p3 represents entertainment. The analysis results are shown below. The factor loadings are $h1 = .72$, $h2 = .78$, and $h3 = .79$. The factor loading of the factors is significant at 0.05.

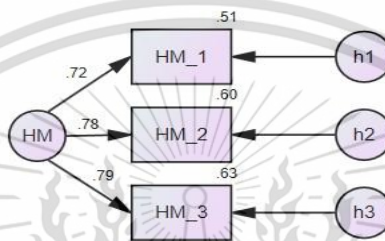


Figure 4.31 CFA of Hedonic Motivation

CFA of Facilitating Condition

The CFA model evaluated the validity of facilitating conditions with two observed variables: perceived behavioral control and facilitating condition. The analysis results are shown below. The factor loadings are $f1 = .51$, $f2 = .96$, and $f3 = .73$. The factor loading of the factors is significant at 0.05.

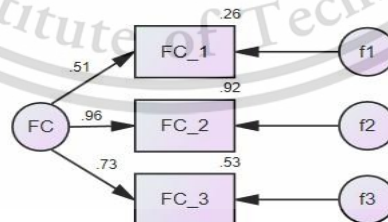


Figure 4.32 CFA of Facilitating Condition

CFA of Trust

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The CFA model evaluated the validity of trust with four items or observed variables: honest, reliability, responsible, and dependable. Honest is represented by t1, t2 represents reliability, t3 represents responsible, and t4 represents dependable. The analysis results are shown below. Dependable was removed due to low loading. The factor loadings are $t1 = .71$, $t2 = .87$, and $t3 = .80$. The factor loading of the factors is significant at 0.05.

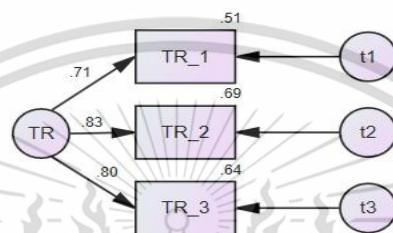


Figure 4.33 CFA of Trust

CFA of Behavior Intentions

The CFA model evaluated the validity of behavior intentions with three items or observed variables: intend, daily, and future. The b1 represents intend, b2 represents daily, and b3 represents future. The analysis results are shown below. The factor loadings are $b1 = .74$, $b2 = .80$, and $b3 = .87$. The factor loading of the factors is significant at 0.05.

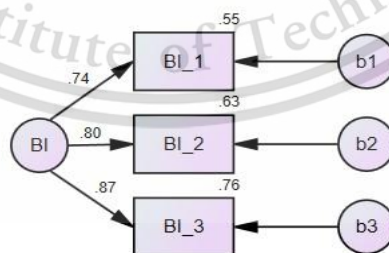


Figure 4.34 CFA of Behavior Intention

CFA of Use Behavior

The CFA model evaluated the validity of use behavior with three items or observed variables: experience, choice, and recommend. The u1 represents experience, u2 represents choice, and b3 represents recommend. The analysis results are shown below. The factor loadings are $u1 = .86$, $u2 = .74$, and $u3 = .73$. The factor loading of the factors is significant at 0.05.

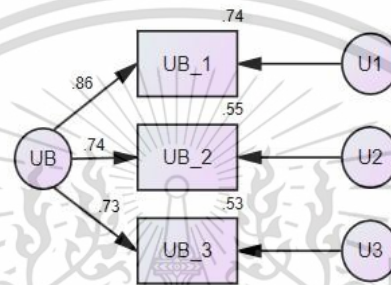


Figure 4.35 CFA of Use Behavior

CFA of Habit

The CFA model evaluated the validity of habit with four items or observed variables: habit, addicted, must, and natural. The h1 represents habit, h2 represents addiction, h3 represents must, and h4 represents natural. The analysis results are shown below. The factor loadings are $h1 = .57$, $h2 = .75$, $h3 = .99$, and $h4 = .99$. The factor loading of the factors is significant at 0.05.

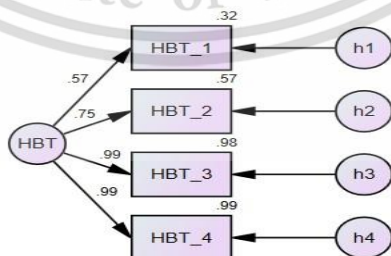


Figure 4.36 CFA of Habit

CFA of Effort Expectancy

The CFA model evaluated the validity of effort expectancy with two observed variables: perceived ease of use and ease of use. The analysis results are shown below. The factor loadings are $e1 = .76$, $e2 = .85$, and $e3 = .71$. The factor loading of the factors is significant at 0.05.

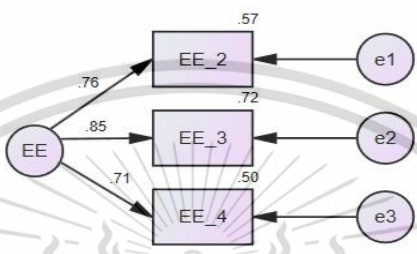


Figure 4.37 CFA of Effort Expectancy

CFA of Social Influence

The CFA model evaluated the validity of social influence with three observed variables: subjective norm, social factor, and image. The s1 and s2 represent subjective norms, the s3 social factor, and the s4 image. The analysis results are shown below. The factor loadings are $s1 = .74$, $s2 = .79$, $s3 = .84$, and $s4 = .82$. The factor loading of the factors is significant at 0.05.

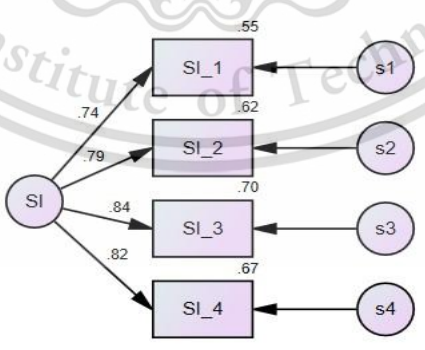


Figure 4.38 CFA of Social Influence

CFA of Satisfaction with Incentive Policies

The CFA model evaluated the validity of satisfaction with incentive policies with three items or observed variables: purchase subsidy, operation subsidy, information subsidy, and facilities subsidy. The s1 represents purchase subsidy, s2 represents operation subsidy, s3 represents information subsidy, and s4 represents facilities subsidy. The analysis results are shown below. The factor loadings are $s1 = .68$, $s2 = .73$, and $s3 = .81$. The factor loading of the factors is significant at 0.05.

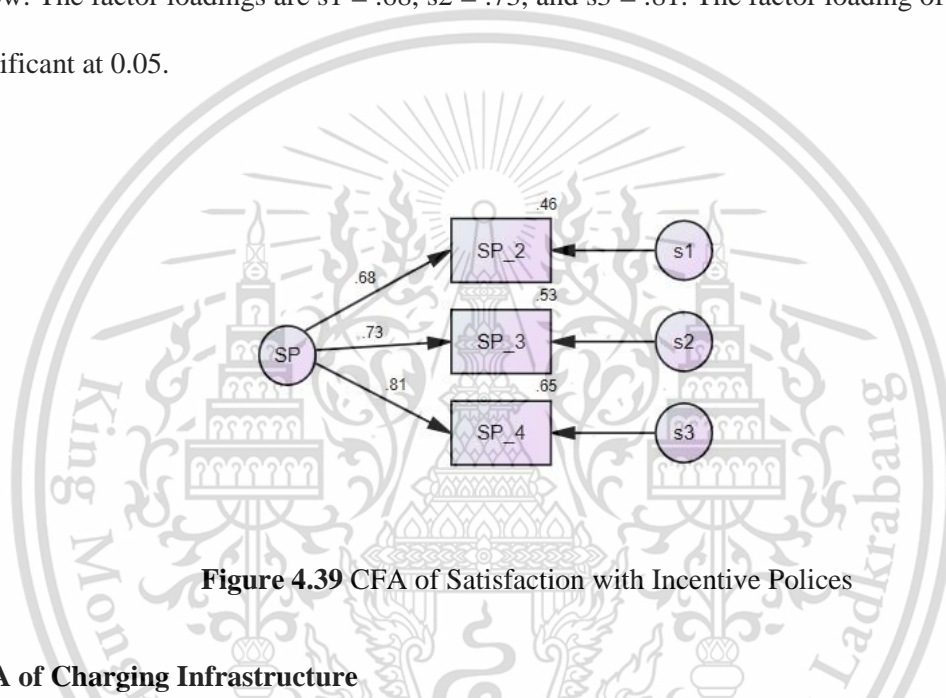


Figure 4.39 CFA of Satisfaction with Incentive Policies

CFA of Charging Infrastructure

The CFA model evaluated the validity of charging infrastructure with three items or observed variables: uninterrupted, worried, and unpractical. The C1 represents uninterrupted, c2 represents worried, c3 represents unpractical. The analysis results are shown below. The factor loadings are $c1 = .58$, $c2 = .82$, and $c3 = .56$. The factor loading of the factors is significant at 0.05.

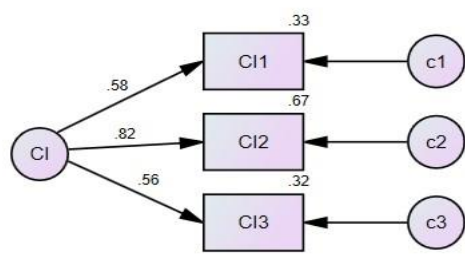


Figure 4.40 CFA of Charging Infrastructure

Table 4.16 Factor Loadings

Items	Factor Loadings	Cronbach's alpha
EC1	0.79	0.85
EC2	0.84	
EC3	0.82	
BI1	0.75	0.84
BI2	0.79	
BI3	0.87	
UB1	0.83	0.81
UB2	0.77	
UB3	0.73	
EE2	0.72	0.79
EE3	0.82	
EE4	0.80	
FC1	0.50	
FC2	0.98	0.75
FC3	0.71	
PV1	0.88	
PV2	0.93	0.92
PV3	0.90	
SP2	0.68	0.78
SP3	0.73	

Items	Factor Loadings	Cronbach's alpha
SP4	0.80	
HM1	0.71	
HM2	0.80	0.80
HM3	0.77	
SI1	0.75	
SI2	0.82	0.87
SI3	0.83	
SI4	0.79	
HBT1	0.57	
HBT2	0.75	0.88
HBT3	0.99	
HBT4	0.99	
TR1	0.72	
TR2	0.84	0.82
TR3	0.78	
CI1	0.79	0.67
CI2	0.76	
CI3	0.60	

Note: Environmental Concern = EC; Price Value = PV; Hedonic Motivation = HM; Facilitating Condition = FC; Habit = HBT; Effort Expectancy = EE; Social Influence = SI; Satisfaction with Incentive Policies = SP; Trust; = TR; Behavioral Intentions = BI; Use Behavior = UB; Charging infrastructure = CI

Confirmatory factor analysis (CFA) is widely regarded as the fundamental component of covariance structural equation modeling. A distinguishing characteristic between covariance-based

structural equation modeling (SEM) and variance-based SEM is the implementation of confirmatory factor analysis (CFA). Table 3 displays the loadings obtained from the confirmatory factor analysis and the values of Cronbach's alpha. The results in **Table 4.3** indicate that all of the values fall within the acceptable range. The loadings range from 0.32 (Poor), 0.45 (Fair), 0.55 (Good), 0.63 (Very Good), and 0.71 (Excellent), as determined by Comrey and Lee (1992). The reliability study indicates that all variables have a Cronbach's alpha above 0.6, which is considered satisfactory. Five Items, namely EC4, FC4, BI4, EE1, and SP1, were eliminated. Based on the results, a value of $X^2/df = 1.11$ is considered respectable, and values up to 5.0 are acceptable, according to Wheaton et al. (1977). The findings indicate that the GFI value is 0.87 and the AGFI value is 0.84, both of which fall within the acceptable range (Doll et al., 1994; Homburg & Baumgartner, 1995). CFI, TLI, IFI, NFI, RMSEA, and RMR values are 0.984, 0.982, 0.985, 0.871, 0.023, and 0.048 respectively. These values fall within the acceptable range as CFI, TLI, IFI, and NFI are all less than 1, while RMSEA is less than 0.08 and RMR is less than 0.05 (Lowry & Gaskin, 2014b; MacCallum et al., 1996). The results are presented in **Table 4.4**.

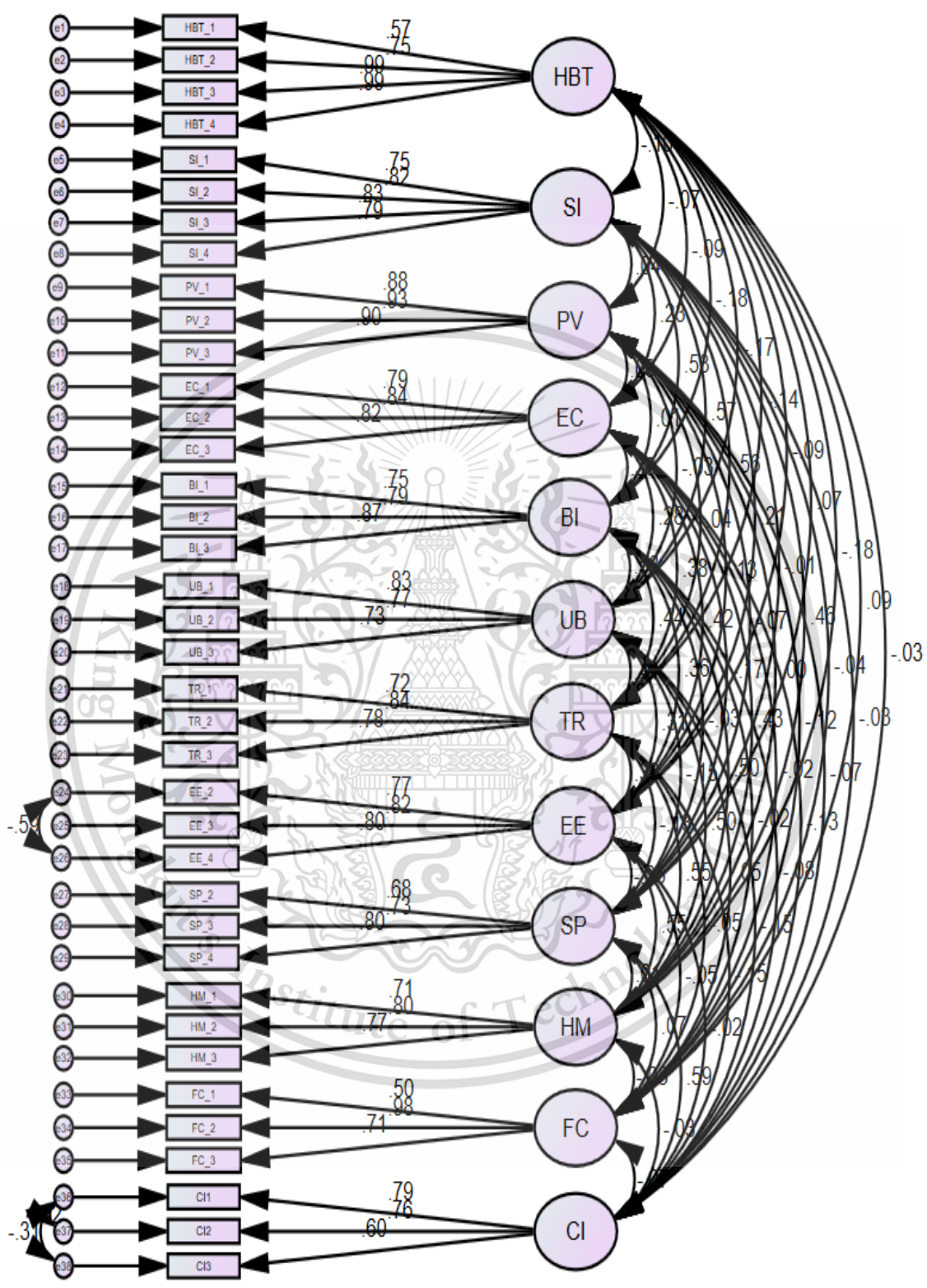


Figure 4.41 CFA Thailand

Table 4.17 Measurement Model Fit Indices

Indices	Criteria	Statistics Value
CMIN/DF	<5	1.1
GFI	>0.8	0.87
AGFI	>0.8	0.84
CFI	<1	0.984
TLI	<1	0.982
IFI	<1	0.985
NFI	<1	0.871
RMSEA	<0.08	0.05
Conclusion		Model Fit

Table 4.18 Discriminant validity

	CR	AVE	MSV	MaxR(H)	FC	HBT	SI	PV	EC	BI	UB	TR	EE	SP	HM	CI
FC	0.79	0.57	0.01	0.95	0.75											
HBT	0.90	0.71	0.03	0.99	0.09	0.84										
SI	0.87	0.63	0.32	0.87	-	-0.10	0.79									
PV	0.92	0.81	0.01	0.93	-	-0.07	0.03	0.90								
EC	0.85	0.66	0.18	0.85	-	-0.09	0.22	0.08	0.81							
BI	0.84	0.64	0.28	0.85	-	-0.17	0.53	0.01	-0.38	0.80						
UB	0.82	0.60	0.32	0.82	0.04	-0.16	0.57	-0.02	0.28	0.52	0.77					
TR	0.82	0.61	0.31	0.83	-	-0.13	0.56	0.04	0.38	0.43	0.41	0.78				
EE	0.84	0.63	0.29	0.84	-	-0.09	0.21	0.13	0.41	0.35	0.30	0.33	0.79			
SP	0.78	0.54	0.34	0.79	0.06	0.07	-	-0.06	-	-	-	-	-	0.73		
							0.01		0.17	0.02	0.15	0.13	0.04			

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	CR	AVE	MSV	MaxR(H)	FC	HBT	SI	PV	EC	BI	UB	TR	EE	SP	HM	CI
HM	0.80	0.58	0.29	0.81	-	-0.18	0.46	0.003	0.42	0.50	0.49	0.54	0.54	0.008	0.76	
					0.03											
CI	0.76	0.52	0.34	0.78	-	-0.03	-	-0.07	-	-	-	-	-	0.58	-	0.72
					0.07		0.02		0.12	0.08	0.14	0.15	0.01		0.02	

Note: Environmental Concern = EC; Price Value = PV; Hedonic Motivation = HM; Facilitating Condition = FC; Habit = HBT; Effort Expectancy = EE; Social Influence = SI; Satisfaction with Incentive Policies = SP; Trust; = TR; Behavioral Intentions = BI; Use Behavior = UB; Charging infrastructure = CI.

Table 4.5 displays the results of the analysis on composite reliability ($CR > .70$), convergent validity ($AVE > 0.50$), and discriminant validity. These measures were used to assess the reliability and validity of the constructs (Sarstedt, Ringle, enseler, & Hair, 2014). Given that each item is loading on its designated factor, convergent validity is guaranteed. On the other hand, Discriminant validity measures the extent to which one construct differs from others. Therefore, it is crucial to verify that the items are adequately chosen (Anderson & Gerbing, 1988). Furthermore, discriminant validity was confirmed as the diagonal values of all constructs exceeded the correlational values (Fornell & Larcker, 1981). The value of maximum reliability (MaxR(H)) is higher than that of composite reliability (CR), and the values of maximum shared variance (MSV) are lower than the particular average variance extracted (AVE) values. Hence, there are no issues with discriminant validity.

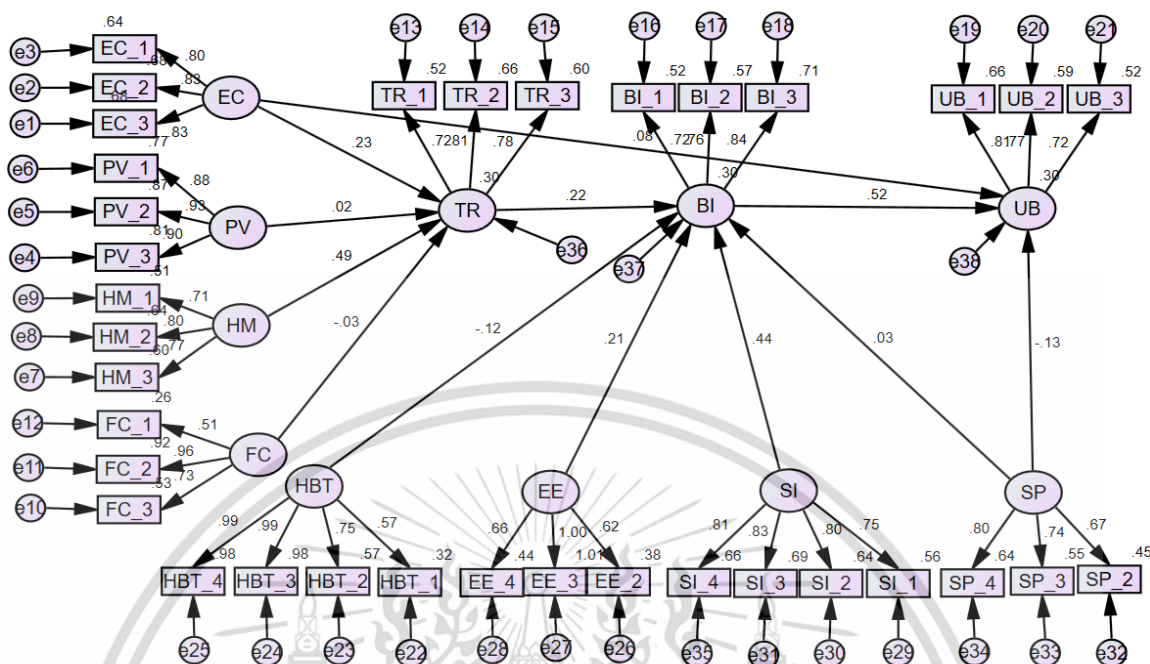


Figure 4.42 Path Model Thailand

Table 4.19 Direct Effect of Structural Model

Hypotheses	Path	Coeff.	SE	C.R	Sig	
H1a	EC→TR	0.187	0.06	3.116	0.002	Accepted
H1b	EC→UB	0.074	0.068	1.089	0.276	Rejected
H2	PV→TR	0.013	0.045	0.290	0.772	Rejected
H3	HM→TR	0.473	0.084	5.632	0.000***	Accepted
H4	FC→TR	-0.038	0.076	-0.491	0.623	Rejected
H5	TR→BI	0.197	0.067	2.944	.003	Accepted
H6	BI→UB	0.683	0.111	6.158	0.000***	Accepted
H7	HBT→BI	-0.169	0.092	-1.841	0.066	Rejected
H8	EE→BI	0.230	0.074	3.114	0.002	Accepted
H9	SI→BI	0.376	0.068	5.517	0.000***	Accepted

Hypotheses	Path	Coeff.	SE	C.R	Sig	
H10a	SP→BI	0.025	0.071	0.349	0.727	Rejected
H10b	SP→UB	-0.170	0.097	-1.753	0.080	Rejected

Note: Environmental Concern = EC; Price Value = PV; Hedonic Motivation = HM; Facilitating Condition = FC; Habit = HBT; Effort Expectancy = EE; Social Influence = SI; Satisfaction with Incentive Policies = SP; Trust; = TR; Behavioral Intentions = BI; Use Behavior = UB; Charging infrastructure = CI.

After establishing the construct validity and reliability, the structural model was analyzed to evaluate the hypotheses, as exhibited in **Table 4.6**. The hypotheses of this research were precisely tested on the structure model **Figure 4.2**. hypothesis 1a ($\beta = 0.187$, C.R = 3.116, $P < .05$), hypothesis 3 ($\beta = 0.473$, C.R = 5.623, $P < 0.05$), hypothesis 5 ($\beta = 0.197$, C.R = 2.944, $P < 0.05$), hypothesis 6 ($\beta = 0.683$, C.R = 6.158, $P < 0.05$), hypothesis 8 ($\beta = 0.230$, C.R = 3.114, $P < 0.05$) and hypothesis 9 ($\beta = 0.376$, C.R = 5.517, $P < 0.05$). These results indicate that the hypotheses have been accepted, as the critical ratio (C.R) and significance (Sig) values are both more than 2, and the p-value is less than 0.05 (Rehman et al., 2022b). However, the results for hypothesis 1b ($\beta = 0.074$, C.R = 1.089, $P > 0.05$), hypothesis 2 ($\beta = 0.013$, C.R = 0.290, $P > 0.05$), hypothesis 4 ($\beta = -0.038$, C.R = -0.491, $P > 0.05$), hypothesis 7 ($\beta = -0.169$, C.R = -1.841, $P > 0.05$), hypothesis 10a ($\beta = 0.025$, C.R = 0.349, $P > 0.05$), hypothesis, and 10b ($\beta = -0.170$, C.R = -1.753, $P > 0.05$). These results indicate that the hypotheses have been rejected due to the values of the (C.R) and (Sig) beyond the permissible range.

Table 4.7. illustrates the mediation of the hypotheses, i.e., hypothesis 11 ($\beta = 0.025$, LLCL = 0.004, ULCL = 0.073, $P < .05$), hypothesis 13 ($\beta = 0.064$, LLCL = 0.014, ULCL = 0.158, $P < .05$), hypothesis 16 ($\beta = 0.157$, LLCL = 0.070, ULCL = 0.270, $P < .05$), hypothesis 17 ($\beta = 0.257$, LLCL = 0.145, ULCL = 0.403, $P < .05$) are accepted as ($P < .05$; LLCL-ULCL $\neq 0$). However, hypothesis 12 ($\beta = 0.002$, LLCL = -0.007, ULCL = 0.014, $P > .05$), H14 ($\beta = -0.005$, LLCL = -0.038, ULCL = 0.008, $P > 0.05$), hypothesis 15 ($\beta = -0.115$, LLCL = -0.237, ULCL = -0.011, $P > 0.05$), H18 ($\beta = 0.017$, LLCL = -0.074, ULCL = 0.105, $P > 0.05$) shows no mediation. Table 6 also

shows about the moderation relationships, hypothesis 19a ($\beta = 0.051$, C.R = 0.248, $P > 0.05$), hypothesis 19b ($\beta = -0.002$, C.R = -0.039, $P > 0.05$), hypothesis 19c ($\beta = -0.006$, C.R = -0.122, $P > 0.05$), hypothesis 19d ($\beta = -0.117$, C.R = -1.824, $P > 0.05$), and hypothesis 19e ($\beta = -0.085$, C.R = -1.437, $P > 0.05$). The results show that there is no moderation.

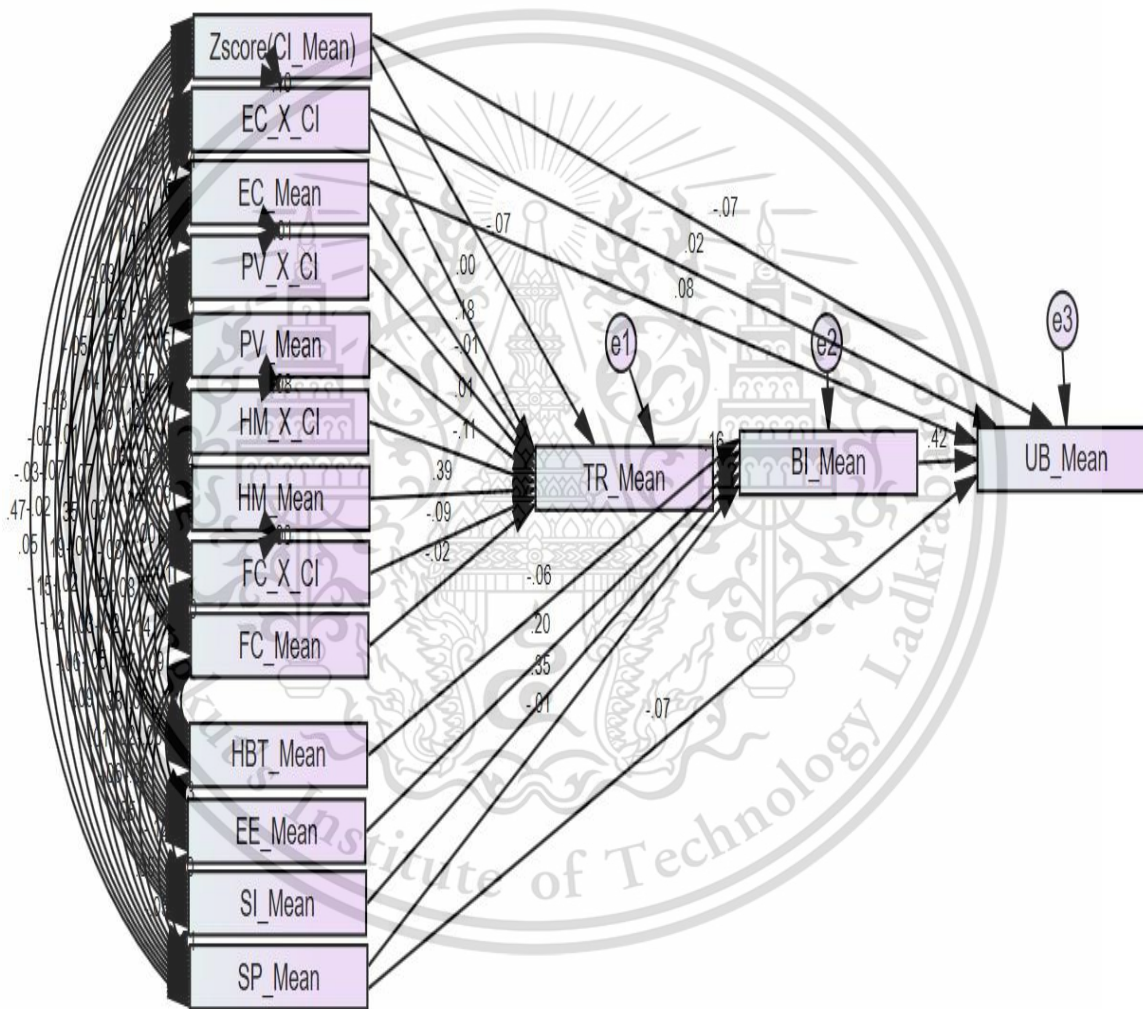


Figure 43 Moderating Model Thailand

Table 4.20 Indirect Effect of the Structural Model

Hypotheses	Path	Coeff.	LLCL	ULCL	Sig	Status
H11	EC→TR→BI→UB	0.025	0.004	0.073	0.039	Accepted
H12	PV→TR→BI→UB	0.002	-0.007	0.014	0.586	Rejected
H13	HM→TR→BI→UB	0.064	0.014	0.158	0.032	Accepted
H14	FC→TR→BI→UB	-0.005	-0.038	0.008	0.426	Rejected
H15	HBT→BI→UB	-0.115	-0.237	-0.011	0.068	Rejected
H16	EE→BI→UB	0.157	0.070	0.270	0.005	Accepted
H17	SI→BI→UB	0.257	0.145	0.403	0.001	Accepted
H18	SP→BI→UB	0.017	-0.074	0.105	0.774	Rejected
	Path	Coeff.	SE	C.R	Sig	
H19a	EC_X_CI→UB	0.015	0.061	0.248	0.804	Rejected
H19b	EC_X_CI→TR	0.002	0.059	0.039	0.969	Rejected
H19c	PV_X_CI→TR	-0.006	0.052	-0.122	0.903	Rejected
H19d	HM_X_CI→TR	-0.117	0.064	-1.824	0.068	Rejected
H19e	FC_X_CI→TR	-0.085	0.058	-1.437	0.141	Rejected

Note: Environmental Concern = EC; Price Value = PV; Hedonic Motivation = HM; Facilitating Condition = FC; Habit = HBT; Effort Expectancy = EE; Social Influence = SI; Satisfaction with Incentive Policies = SP; Trust; = TR; Behavioral Intentions = BI; Use Behavior = UB; Charging infrastructure = CI.

4.2 Pakistan Analysis and Finding

4.2.1 Demographics Analysis

Table 4.21 A total of 430 participants were approached for this study, and 300 completed questionnaires were received. As a result, 300 was chosen for the data analysis. Table 1 shows the demographics of the participants. Out of 300 participants, 234 (78%) were males and 66 (22%) were female users of EVs. 18 (6%) respondents were between the age of 18-29, 116 (38.7%) respondents were between the age of 30-39, 74 (24.7%) were between the age of 40-49, 92 (30.7%) respondents were 50 and above of the total respondents. The column of education shows that 137

(45.7%) were under bachelor level of education, 67 (22.3%) were bachelor's degree holders, 93 (31%) had master's degree, and respondents with doctorate level of education were 3 (1%) of the total respondents. Moreover, 88 (29.3%) of the respondents had 0-5 years of driving experience, 143 (47.7) had 6-10 years of driving experience, and 69 (23%) had above 10 years of driving experience. The respondents were also asked about their experience driving an electric vehicle. 32 (10.7%) of the respondents had up to 1 year of experience, 200 (66.7%) of the respondents had the experience of above 1-2 years, and 68 (22.7%) of the respondents had above 2 years of driving experience of an electric vehicle.

Table 4.21 Demographics of Pakistan

		Frequency	Percent
Gender	Male	234	78.0
	Female	66	22.0
	Total	300	100
Age	18-29	18	6.0
	30-39	116	38.7
	40-49	74	24.7
	50 and above	92	30.7
	Total	300	100.0
Education	Under Bachelor	137	45.7
	Bachelor	67	22.3
	Masters	93	31.0
	Doctorate	3	1.0
	Total	300	100.0
Driving Exp	0-5	88	29.3
	6-10	143	47.7
	Above 10	69	23.0
	Total	300	100.0
EV Exp	Less than 1 year	32	10.7
	From 1-2	200	66.7

	Frequency	Percent
Above 2 years	68	22.7
Total	300	100.0

4.2.2 Descriptive Analysis

Table 4.22 Descriptive Statistics Pakistan

Constructs	N	Mean	S.D	Skewnees	Kurtosis
EC	300	3.465	1.075	-0.127	-0.820
PV	300	3.835	0.733	-0.709	0.451
HM	300	3.608	0.882	-0.711	0.407
FC	300	3.501	1.099	-0.148	-0.992
TR	300	3.560	0.783	-0.835	1.210
BI	300	3.452	0.848	-0.349	-0.033
UB	300	3.621	0.875	-0.517	0.572
HBT	300	3.748	0.824	-0.731	0.344
EE	300	3.790	0.777	-0.440	-0.333
SI	300	3.784	0.827	-0.584	-0.467
SP	300	2.157	0.904	0.649	-0.012
CI	300	3.696	0.729	0.417	-0.976

Note: Environmental Concern = EC; Price Value = PV; Hedonic Motivation = HM; Facilitating Condition = FC; Habit = HBT; Effort Expectancy = EE; Social Influence = SI; Satisfaction with Incentive Policies = SP; Trust; = TR; Behavioral Intentions = BI; Use Behavior = UB; Charging infrastructure = CI.

Table 4.8 of descriptive statistics shows the Mean values, Std. Deviation, Skewness, and Kurtosis. In the above table, N=300 indicates the number of participants in this research study. According to (Kline, 2005), which depicts platykurtic, mesokurtic, and leptokurtic distributions,

the skewness and kurtosis values of all the constructs fall within the permissible range (between +2 and -2 for skewness and between +3 and -3 for kurtosis), Hence data is normally distributed.

4.2.3 Structural Equation Modeling Pakistan

CFA of Environmental Concern

The CFA model evaluated the validity of environmental concerns with three observed variables egoistic, and altruistic and biospheric. The e1 represents egoistic, e2 and e3 represent altruistic, and e4 was deleted because of low loading, which was biospheric. The analysis results are shown below. The factor loading is $e1 = .89$, $e2 = .94$, and $e4 = .97$. The factor loading of the factors is significant at 0.05 level.

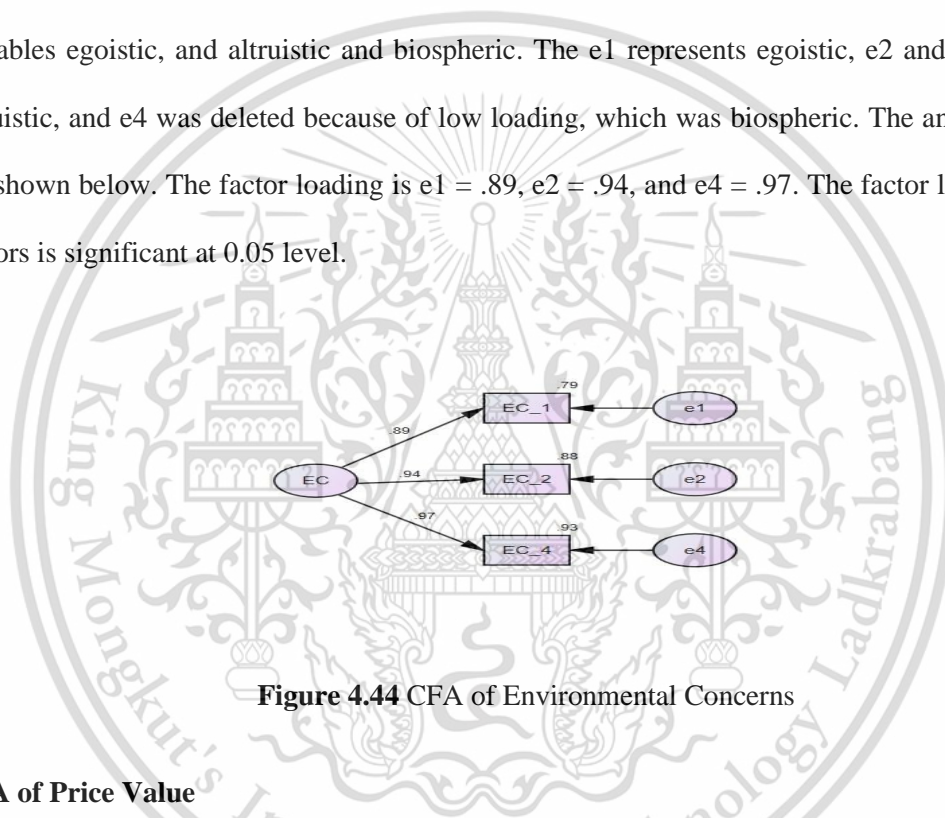


Figure 4.44 CFA of Environmental Concerns

CFA of Price Value

The CFA model evaluated the validity of price value with three observed variables: reasonable, worth, and value. The p1 represents reasonable, p2 represents worth, and p3 represents value. The analysis results are shown below. The factor loadings are $p1 = .83$, $p2 = .92$, and $p3 = .77$. The factor loading of the factors is significant at 0.05.

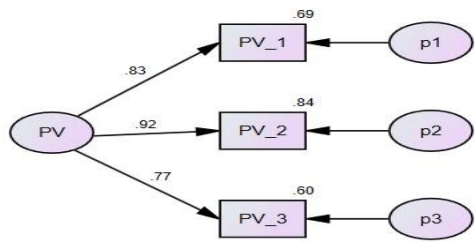


Figure 4.45 CFA of Price Value

CFA of Hedonic Motivation

The CFA model evaluated the validity of hedonic motivation with three observed variables: fun, enjoyable, and entertaining. The h1 represents fun, h2 represents enjoyable, and p3 represents entertaining. The analysis results are shown below. The factor loadings are h1 = .83, h2 = .86, and h3 = .71. The factor loading of the factors is significant at 0.05.

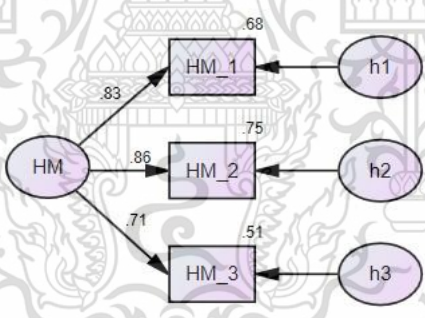


Figure 4.46 CFA of Hedonic Motivation

CFA of Facilitating Condition

The CFA model evaluated the validity of facilitating conditions with two observed variables: perceived behavioral control and facilitating condition. The analysis results are shown below. The factor loadings are f1 = .99, f2 = .92, and f4 = .97. The factor loading is significant at 0.05.

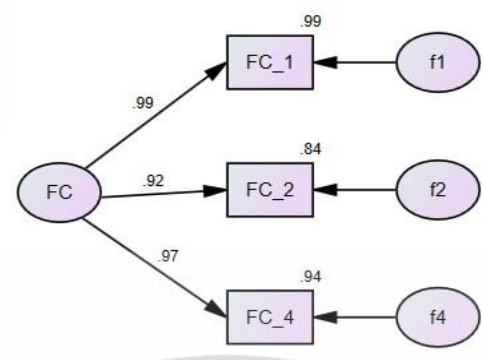


Figure 4.47 CFA of Facilitating Condition

CFA of Trust

The CFA model evaluated the validity of trust with four items or observed variables: honest, reliability, responsible, and dependable. Honest is represented by t1, t2 represents reliability, t3 represents responsible, and t4 represents dependable. The analysis results are shown below. Dependable was removed due to low loading. The factor loadings are t1 = .98, f2 = .72, and f3 = .96. The factor loading of the factors is significant at 0.05

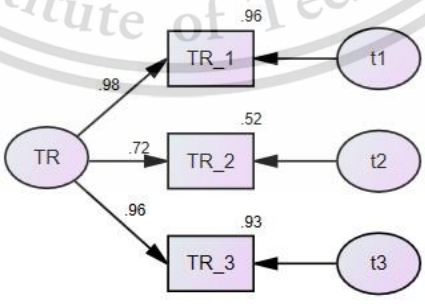


Figure 4.48 CFA of Trust

CFA of Behavior Intentions

The CFA model evaluated the validity of behavior intentions with four items or observed variables: intend, daily, future, and predict. The b1 represents intend, b2 represents daily, b3 represents future, and b4 represents predict. The analysis results are shown below. The factor loadings are $b1 = .90$, $b2 = .96$, $b3 = .88$, and $b4 = .76$. The factor loading of the factors is significant at 0.05.

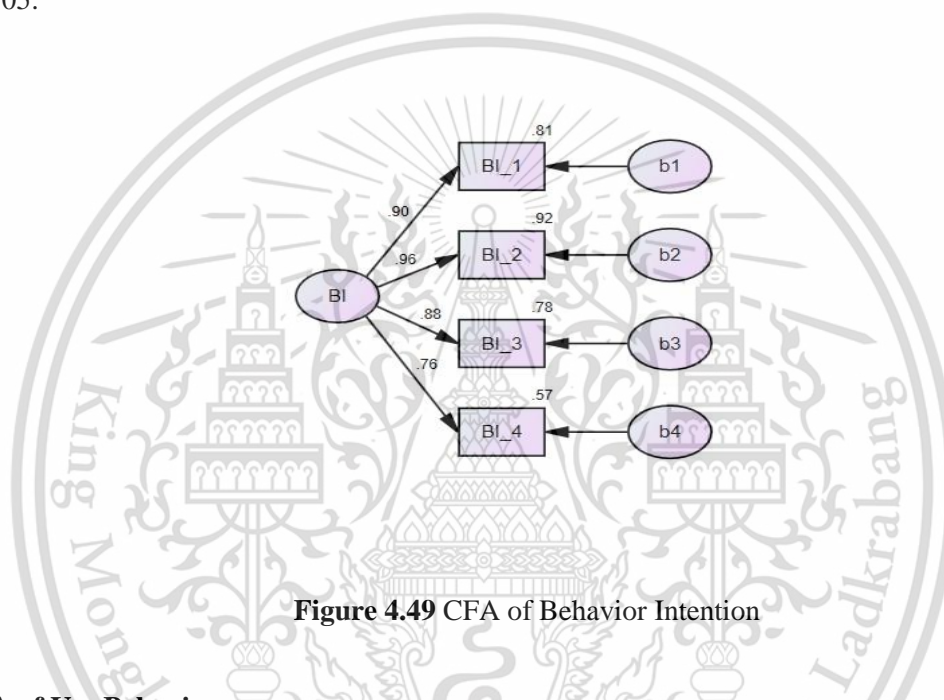


Figure 4.49 CFA of Behavior Intention

CFA of Use Behavior

The CFA model evaluated the validity of use behavior with three items or observed variables: experience, choice, and recommend. The u1 represents experience, u2 represents choice, and b3 represents recommend. The analysis results are shown below. The factor loadings are $u1 = .99$, $u2 = .98$, and $u3 = .96$. The factor loading of the factors is significant at 0.05.

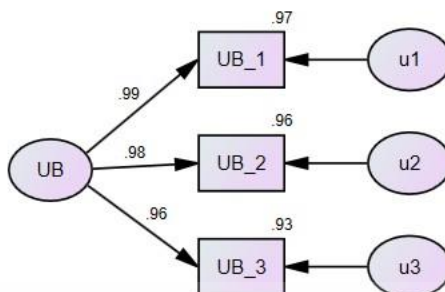


Figure 4.50 CFA of Use Behavior

CFA of Habit

The CFA model evaluated the validity of habit with four items or observed variables: habit, addicted, must, and natural. The h1 represents habit, h2 represents addiction, h3 represents must, and h4 represents natural. The analysis results are shown below. The factor loadings are $h1 = .57$, $h2 = .75$, $h3 = .99$, and $h4 = .99$. The factor loading of the factors is significant at 0.05.

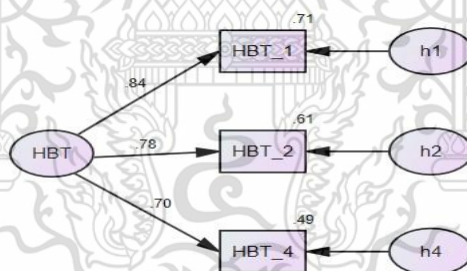


Figure 4.51 CFA of Habit

CFA of Effort Expectancy

The CFA model evaluated the validity of effort expectancy with two observed variables: perceived ease of use and ease of use. The analysis results are shown below. The factor loadings are $e1 = .70$, $e2 = .86$, $e3 = .86$, and $e4 = .87$. The factor loading of the factors is significant at 0.05.

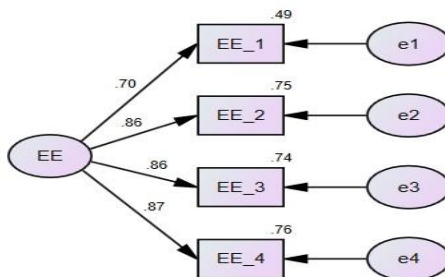


Figure 4.52 CFA of Effort Expectancy

CFA of Social Influence

The CFA model evaluated the validity of social influence with three observed variables: subjective norm, social factor, and image. The s1 and s2 represent subjective norms, the s3 social factor, and the s4 image. The analysis results are shown below. The factor loadings are $s2 = .62$, $s3 = .93$, and $s4 = .67$. The factor loading of the factors is significant at 0.05.

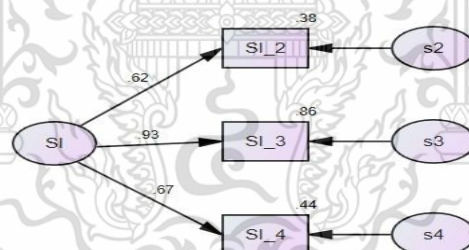


Figure 4.53 CFA of Social Influence

CFA of Satisfaction with Incentive Policies

The CFA model evaluated the validity of satisfaction with incentives policies with three items or observed variables: purchase subsidy, operation subsidy, information subsidy and facilities subsidy. The s1 represents purchase subsidy, s2 represents operation subsidy, s3 represents information subsidy and s4 represents facilities subsidy. The analysis results are shown below. The

factor loadings are $s1 = .86$, $s2 = .85$, and $s3 = .84$. The factor loading of the factors is significant at 0.05.

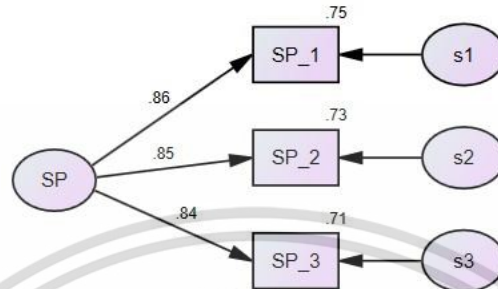


Figure 4.54 CFA of Satisfaction with Incentive Polices

CFA of Charging Infrastructure

The CFA model evaluated the validity of charging infrastructure with three items or observed variables: uninterrupted, worried, and unpractical. The C1 represents uninterrupted, c2 represents worried, c3 represents unpractical. The analysis results are shown below. The factor loadings are $c1 = .87$, $c2 = .91$, and $c3 = .75$. The factor loading of the factors is significant at 0.05.

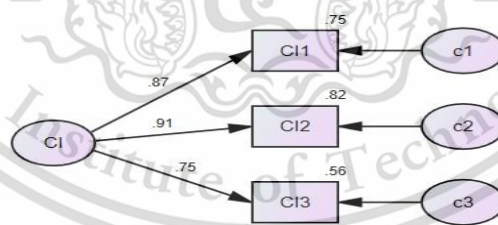


Figure 4.55 CFA of Charging Infrastructure

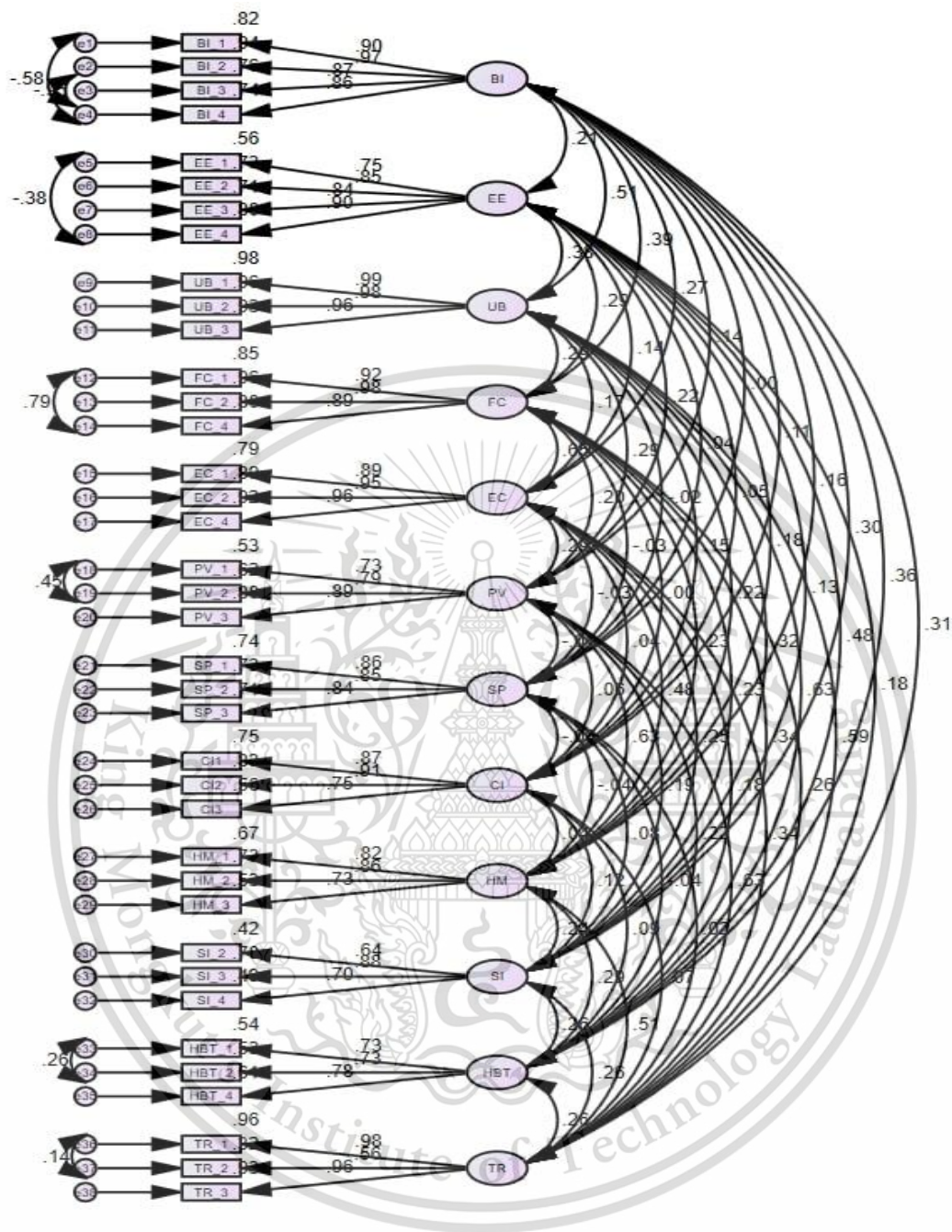


Figure 4.56 CFA Pakistan

Model fitness was verified using confirmatory factor analysis (CFA) by examining the loading of items on their respective factors. Five items were removed, EC3, FC3, HBT3, SI1 and SP4. According to the outcomes in **table 4.9**, $X^2/df = 1.978$ is a respectable value, and values up to 5.0 are acceptable (Wheaton et al., 1977). According to (Doll et al., 1994; Homburg &

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Baumgartner, 1995), the values of GFI and AGFI should be not less than 0.8, and the results show that the value of GFI = 0.844 and AGFI = 0.805, both of the values are in the suitable range. The value of CFI = 0.944, TLI = 0.933, IFI= 0.944, NFI = 0.894, RMSEA= 0.057, and RMR = 0.049 which is also in the acceptable range, as the values of CFI, TLI, IFI and NFI are less than 1 and RMSEA is less than 0.08 and RMR is less than 0.05 (Lowry & Gaskin, 2014b; MacCallum et al., 1996). **Table 4.10** and **figure 4.3** portrays the loadings of confirmatory factor analysis and cronbach's alpha. All of the vales are within the permitted range, according to the results. Loadings from 0.32 (Poor), 0.45 (Fair), 0.55 (Good), 0.63 (Very Good), or 0.71, as indicated by (Comrey & Lee, 1992), (Excellent) and reliability analysis shows that cronbach's alpha of all the varaibles are above .07, which is acceptable.

Table 4.23 Measurement Model Fit Indices Pakistan

Indices	Criteria	Statistics Value
CMIN/DF	<5	1.978
GFI	>0.8	0.844
AGFI	>0.8	0.805
CFI	<1	0.944
TLI	<1	0.933
IFI	<1	0.944
NFI	<1	0.894
RMSEA	<0.08	0.057
Conclusion		Model Fit

Table 4.24 Factor Loadings Pakistan

Items	Factor Loadings	Cronbach's alpha
EC1	0.89	0.951
EC2	0.95	
EC4	0.96	

Items	Factor Loadings	Cronbach's alpha
BI1	0.90	
BI2	0.97	0.930
BI3	0.87	
BI4	0.86	
UB1	0.99	
UB2	0.98	0.984
UB3	0.96	
EE1	0.70	
EE2	0.85	0.892
EE3	0.84	
EE4	0.90	
FC1	0.92	
FC2	0.98	0.969
FC3	0.89	
PV1	0.73	
PV2	0.79	0.887
PV3	0.89	
SP1	0.86	
SP2	0.85	0.888
SP3	0.84	
HM1	0.82	

Items	Factor Loadings	Cronbach's alpha
HM2	0.86	0.838
HM3	0.73	
SI1	0.64	
SI2	0.88	0.776
SI3	0.70	
HBT1	0.73	
HBT2	0.73	0.818
HBT3	0.78	
TR1	0.98	
TR2	0.56	0.865
TR3	0.96	
CI1	0.87	0.874
CI2	0.91	
CI3	0.75	

Note: Environmental Concern = EC; Price Value = PV; Hedonic Motivation = HM; Facilitating Condition = FC; Habit = HBT; Effort Expectancy = EE; Social Influence = SI; Satisfaction with Incentive Policies = SP; Trust; = TR; Behavioral Intentions = BI; Use Behavior = UB; Charging infrastructure = CI.

Table 4.25 Discriminant Validity Pakistan

	CR	AVE	MSV	MaxR	HBT	BI	EE	UB	FC	EC	PV	SP	CI	HM	SI	TR
(H)																
HBT	0.792	0.56	0.401	0.794	0.748											
BI	0.946	0.814	0.263	0.962	0.361	0.902										
EE	0.902	0.699	0.233	0.913	0.483	0.212	0.836									
UB	0.984	0.954	0.401	0.987	0.633	0.513	0.384	0.977								
FC	0.952	0.87	0.425	0.969	0.344	0.391	0.291	0.293	0.933							
EC	0.952	0.868	0.425	0.959	0.177	0.266	0.137	0.169	0.652	0.931						
PV	0.847	0.651	0.399	0.871	0.22	0.137	0.217	0.29	0.202	0.287	0.807					
SP	0.889	0.727	0.006	0.889	-0.038	0.004	0.041	0.015	0.032	-0.03	0.012	0.853				
CI	0.881	0.713	0.021	0.901	0.086	0.11	0.049	0.145	0.004	0.04	0.064	0.059	0.844			
HM	0.846	0.647	0.392	0.857	0.292	0.158	0.175	0.216	0.234	0.477	0.626	0.039	0.045	0.804		
SI	0.79	0.561	0.101	0.839	0.263	0.298	0.128	0.318	0.231	0.252	0.189	0.076	0.125	0.236	0.749	
TR	0.889	0.738	0.399	0.976	0.26	0.312	0.185	0.594	0.259	0.339	0.632	0.02	0.073	0.507	0.256	0.859

Note: Environmental Concern = EC; Price Value = PV; Hedonic Motivation = HM; Facilitating Condition = FC; Habit = HBT; Effort Expectancy = EE; Social Influence = SI; Satisfaction with Incentive Policies = SP; Trust = TR; Behavioral Intentions = BI; Use Behavior = UB; Charging infrastructure = CI.

Table 4.11 exhibits that the researcher has examined composite reliability (CR > .70), convergent validity (AVE > 0.50), and discriminant validity to evaluate the reliability and validity of the constructs (Sarstedt, Ringle, enseler, & Hair, 2014). Since all of the items are loading on their respective factors, convergent validity is ensured, and discriminant validity shows how much one construct differs from others. Ensuring the items are appropriately selected (Anderson & Gerbing, 1988). Additionally, discriminant validity was established since the diagonal values of all constructs were higher than the correlational values (Fornell & Larcker, 1981). Maximum

reliability [MaxR(H)] is greater than composite reliability (CR), and maximum shared variance (MSV) values are smaller than the specific AVE values. Therefore, discriminant validity problems can be discounted.

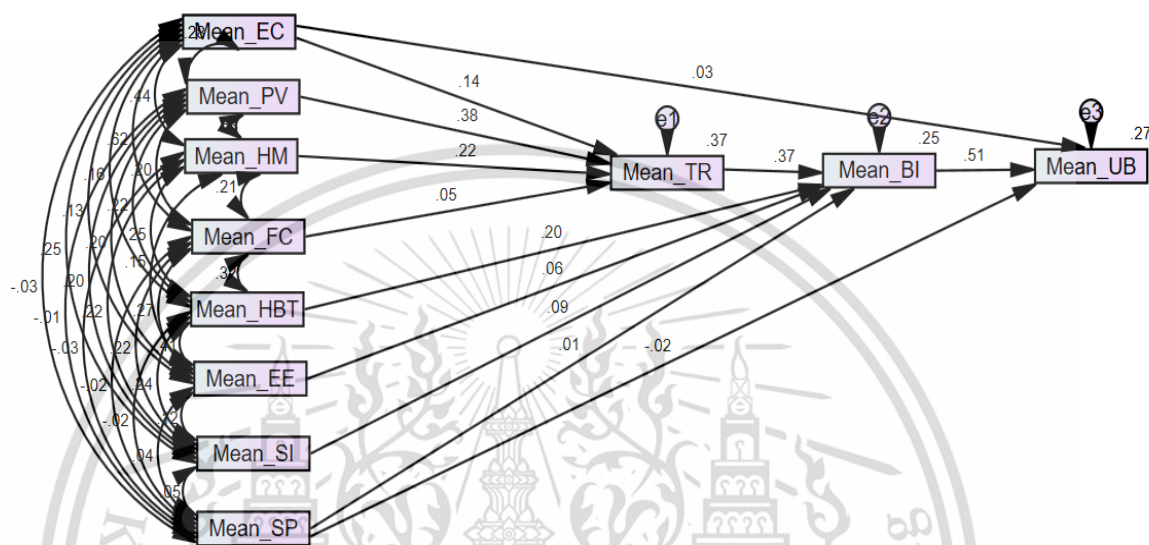


Figure 4.57 Path Model Pakistan

Table 4.266 Direct effect of structural Model

Hypotheses	Path	Coeff.	SE	CR	Sig	Status
H1a	EC→TR	0.103	0.046	2.214	0.027	Accepted
H1b	EC→UB	0.027	0.041	0.658	0.511	Rejected
H2	PV→TR	0.401	0.058	6.925	0.000***	Accepted
H3	HM→TR	0.193	0.052	3.731	0.000***	Accepted
H4	FC→TR	0.034	0.042	0.818	0.413	Rejected
H5	TR→BI	0.401	0.055	7.262	0.000***	Accepted
H6	BI→UB	0.526	0.052	10.032	0.000***	Accepted
H7	HBT→BI	0.203	0.058	3.525	0.000***	Accepted
H8	EE→BI	0.060	0.060	1.012	0.311	Rejected

Hypotheses	Path	Coeff.	SE	CR	Sig	Status
H9	SI→BI	0.091	0.053	1.712	0.087	Rejected
H10a	SP→BI	0.007	0.047	0.158	0.874	Rejected
H10b	SP→UB	-0.021	0.048	-0.438	0.661	Rejected

Note: Environmental Concern = EC; Price Value = PV; Hedonic Motivation = HM; Facilitating Condition = FC; Habit = HBT; Effort Expectancy = EE; Social Influence = SI; Satisfaction with Incentive Policies = SP; Trust; = TR; Behavioral Intentions = BI; Use Behavior = UB; Charging infrastructure = CI.

Structural model was examined to test the hypotheses, as represented in **Table 4.12**. The hypotheses of this research were precisely tested on the structure model. H1a ($\beta = 0.103$, C.R = 2.214, $P < .05$), H2 ($\beta = 0.401$, C.R = 6.925, $P < 0.05$), H3 ($\beta = 0.193$, C.R = 3.731, $P < 0.05$), H5 ($\beta = 0.401$, C.R = 7.262, $P < 0.05$), H6 ($\beta = 0.526$, C.R = 10.032, $P < 0.05$), and H7 ($\beta = .203$, C.R = 3.252, $P < 0.05$) these results demonstrates that hypotheses has been accepted as the (C.R and Sig) value is greater than 2 and p is less than 0.05 (Rehman et al., 2022b). On the other hand, H1b ($\beta = 0.27$, C.R = 0.658, $P > 0.05$), H4 ($\beta = 0.34$, C.R = .818, $P > 0.05$), H8 ($\beta = 0.060$, C.R = 1.012, $P > 0.05$), H9 ($\beta = .91$, C.R = 1.712, $P > 0.05$), H10a ($\beta = 0.007$, C.R = 0.158, $P > 0.05$), H10b ($\beta = -0.021$, C.R = -0.438, $P > 0.05$) these results shows that these hypotheses has been rejected as the values of (C.R and Sig) are not in the acceptable range.

Table 4.13 illustrates the mediation of the hypotheses, i.e., H11 ($\beta = 0.022$, LLCL = 0.007, ULCL = 0.048, $P < .05$), H12 ($\beta = 0.085$, LLCL = 0.046, ULCL = 0.137, $P < .05$), H13 ($\beta = 0.041$, LLCL = 0.019, ULCL = 0.072, $P < .05$), H15 ($\beta = 0.107$, LLCL = 0.059, ULCL = 0.167, $P < .05$), H11, H12, H13 indicating sequential mediation and H15 indicating simple mediation as ($P < .05$; LLCL-ULCL $\neq 0$). However, H14 ($\beta = 0.007$, LLCL = -0.004, ULCL = 0.024, $P > .05$), H16 ($\beta = 0.0362$, LLCL = -0.014, ULCL = 0.093, $P > 0.05$), H17 ($\beta = 0.048$, LLCL = -0.002, ULCL = 0.098, $P > 0.05$), H18 ($\beta = 0.004$, LLCL = -0.036, ULCL = 0.045, $P > 0.05$) shows no mediation. Table 6 also shows about the moderation relationships, H19 ($\beta = 0.021$, C.R = 0.378, $P > 0.05$), H20 ($\beta = -0.021$, C.R = -0.450, $P > 0.05$), H21 ($\beta = 0.035$, C.R = 0.723, $P > 0.05$), H22 ($\beta = -0.086$, C.R = -1.810, $P > 0.05$), H19, H20, H21, H22 shows that there is no moderation.

Table 4.277 Indirect Effect of Structural Model

Hypotheses	Path	Coeff.	LLCL	ULCL	Sig	
H11	EC→TR→BI→UB	0.022	0.007	0.048	0.007	Accepted
H12	PV→TR→BI→UB	0.085	0.046	0.137	0.001	Accepted
H13	HM→TR→BI→UB	0.041	0.019	0.072	0.001	Accepted
H14	FC→TR→BI→UB	0.007	-0.004	0.024	0.285	Rejected
H15	HBT→BI→UB	0.107	0.059	0.167	0.001	Accepted
H16	EE→BI→UB	0.032	-0.014	0.093	0.255	Rejected
H17	SI→BI→UB	0.048	0.002	0.098	0.085	Rejected
H18	SP→BI→UB	0.004	-0.036	0.045	0.885	Rejected
	Path	Coeff.	SE	C.R	Sig	
H19a	EC_X_CI→UB	-0.033	0.046	-0.734	0.463	Rejected
H19b	EC_X_CI→TR	0.021	0.056	0.378	0.705	Rejected
H19c	PV_X_CI→TR	-0.021	0.047	-0.450	0.653	Rejected
H19d	HM_X_CI→TR	0.035	0.049	0.723	0.470	Rejected
H19e	FC_X_CI→TR	-0.086	0.048	-1.810	0.070	Rejected

Note: Environmental Concern = EC; Price Value = PV; Hedonic Motivation = HM; Facilitating Condition = FC; Habit = HBT; Effort Expectancy = EE; Social Influence = SI; Satisfaction with Incentive Policies = SP; Trust; = TR; Behavioral Intentions = BI; Use Behavior = UB; Charging infrastructure = CI

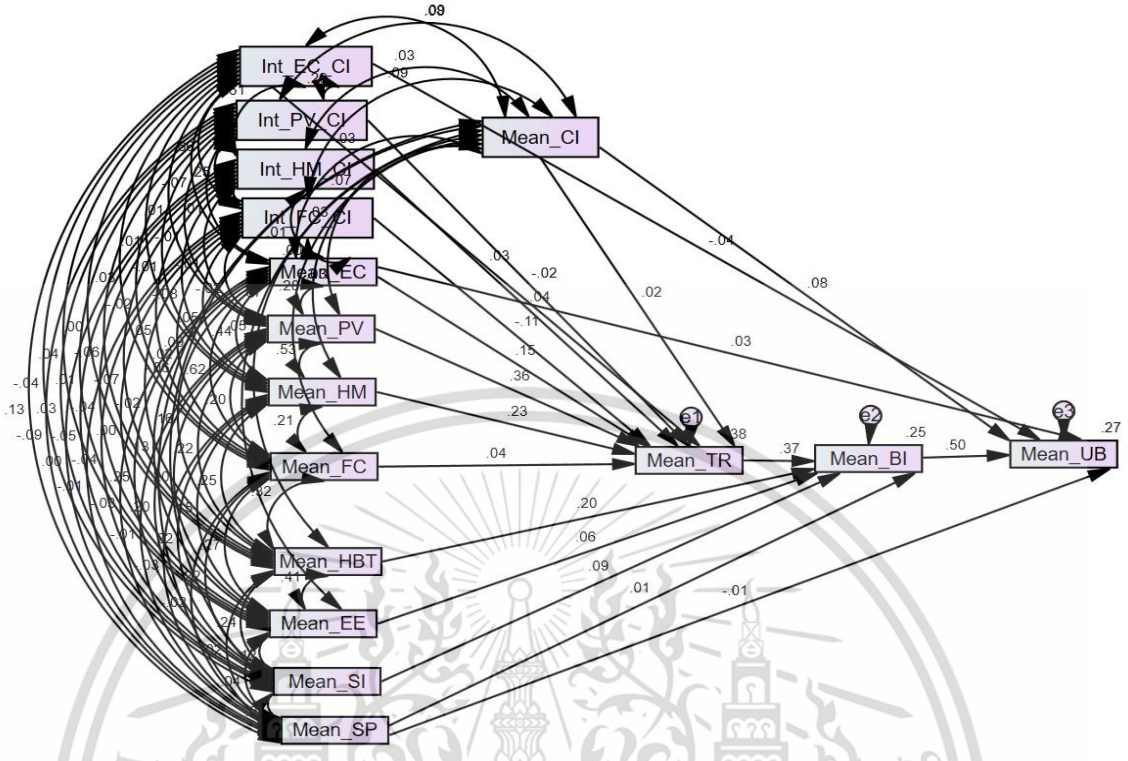


Figure 4.58 Moderating Model Pakistan

4.3 Comparing Thailand and Pakistan.

Multi-group SEM Analysis

Multi-group analysis was conducted to compare Thailand's and Pakistan's adoption of electric vehicles. The section conducted the multi group SEM analysis to compare the difference between two countries. The investigation uncovers both parallels and disparities in the structural equation modelling (SEM) pathways between Thailand and Pakistan. This suggests that while certain factors have a constant impact in all situations, others differ, emphasizing the significance of cultural and contextual aspects in SEM study (1 Thailand = 1 and 2= Pakistan). The initial study was assessing the entire model to determine whether there are any differences between the two groups (Thailand and Pakistan). In order to accomplish this, the Chi square discrepancies between

the unconstrained and constrained models were compared. The results of the default model are displayed below after executing the model.

Table 4.28 Indirect effect of structural Model

Hypotheses	Path	Thailand		Pakistan	
		Coeff.	Sig	Coeff.	Sig
H1a	EC→TR	0.170	0.006	0.101	0.030
H1b	EC→UB	0.029	0.580	0.027	0.501
H2	PV→TR	0.017	0.716	0.402	0.000***
H3	HM→TR	0.415	0.000***	0.191	0.000***
H4	FC→TR	-0.03	0.736	0.040	0.340
H5	TR→BI	0.115	0.021	0.406	0.000***
H6	BI→UB	0.805	0.000***	0.526	0.000***
H7	HBT→BI	-0.057	0.296	0.290	0.000***
H8	EE→BI	0.204	0.000***	0.042	0.486
H9	SI→BI	0.352	0.000***	0.090	0.108
H10a	SP→BI	0.017	0.805	0.004	0.935
H10b	SP→UB	-0.096	0.204	-0.035	0.502

Note: Environmental Concern = EC; Price Value = PV; Hedonic Motivation = HM; Facilitating Condition = FC; Habit = HBT; Effort Expectancy = EE; Social Influence = SI; Satisfaction with Incentive Policies = SP; Trust = TR; Behavioral Intentions = BI; Use Behavior = UB; Charging infrastructure = CI.

Table 4.29 Constrained and Unconstrained Models

	Chi-square	df	P-value	Invariant?
Overall model				
Unconstrained	251.53	30		
Fully constrained	328.565	42		
Number of groups		2		
Difference	77.035	12	0.000	No
Chi-square thresholds				
90% Confidence	254.24	31		
Difference	2.71	1	0.100	

	Chi-square	df	P-value	Invariant?
95% Confidence	255.37	31		
Difference	3.84	1	0.050	
99% Confidence	258.16	31		
Difference	6.63	1	0.010	

Table 14.15 indicates that the unconstrained model, which has fewer limits, exhibits a much superior fit compared to the fully constrained model, which has more restrictions. The chi-square difference (77.035, p-value = 0.000) and the degree of freedom is 12. Therefore, the models are not invariant across the tested groups (Thailand and Pakistan). The chi-square thresholds for various confidence levels offer insight into the behavior of the chi-square statistic at different levels of confidence. The p-value is 0.000 ($p < 0.1, 0.5, 0.1$) also confirms that the models are not invariant. Therefore, path-to-path analysis is presented in **Table 4.16**

Table 4.30 Path-by-Path Analysis

Hypotheses	Path	Invariant
H1a	EC→TR	Yes
H1b	EC→UB	Yes
H2	PV→TR	No
H3	HM→TR	No
H4	FC→TR	Yes
H5	TR→BI	No
H6	BI→UB	No
H7	HBT→BI	No
H8	EE→BI	No
H9	SI→BI	No
H10a	SP→BI	Yes
H10b	SP→UB	Yes

Table 4.331 Hypothesis Testing

Hypotheses	Path	Country	Beta	Status
H1a	Environmental concern has a positive impact on trust in Pakistan and Thailand.	Thailand	0.187	Accept
		Pakistan	0.103	Accept
H1b	Environmental concern has a positive impact on use behavior.	Thailand	0.074	Reject
		Pakistan	0.027	Reject
H2	Price value has a positive impact on trust.	Thailand	0.013	Reject
		Pakistan	0.401	Accept
H3	Hedonic motivation has a positive impact on Trust.	Thailand	0.473	Accept
		Pakistan	0.193	Accept
H4	Facilitating condition has a positive impact on Trust.	Thailand	-0.038	Reject
		Pakistan	0.034	Reject
H5	Trust has a positive impact on behavioral Intentions	Thailand	0.197	Accept
		Pakistan	0.401	Accept
H6	Behavioral Intentions has a positive impact on use behavior.	Thailand	0.683	Accept
		Pakistan	0.526	Accept
H7	Habits has a positive impact on behavioral Intentions.	Thailand	-0.169	Reject
		Pakistan	0.203	Accept
H8	Effort expectancy has a positive impact on behavioral Intentions.	Thailand	0.230	Accept
		Pakistan	0.060	Reject
H9	Social influence has a positive impact on behavioral Intentions.	Thailand	0.376	Accept
		Pakistan	0.091	Reject
H10a	Satisfaction with incentive policies has a positive impact on behavioral Intentions.	Thailand	0.025	Reject
		Pakistan	0.007	Reject
H10b	Satisfaction with incentive policies has a positive impact on use Behavior.	Thailand	-0.170	Reject
		Pakistan	-0.021	Reject
H11	Trust and behavior Intentions sequentially mediated the relationship between environmental concerns and use behavior.	Thailand	0.025	Accept
		Pakistan	0.022	Accept

Hypotheses	Path	Country	Beta	Status
H12	Trust and behavior Intentions sequentially mediated the relationship between price and use behavior	Thailand	0.002	Reject
		Pakistan	0.085	Accept
H13	Trust and behavior Intentions sequentially mediated the relationship between hedonic motivation and use behavior.	Thailand	0.064	Accept
		Pakistan	0.041	Accept
H14	Trust and behavior Intentions sequentially mediated the relationship between facilitating conditions and use behavior	Thailand	-0.005	Reject
		Pakistan	0.007	Reject
H15	Behavioral intention mediates the relationship between habit and use behavior.	Thailand	-0.115	Reject
		Pakistan	0.107	Accept
H16	Behavioral intention mediates the relationship between effort expectancy and use behavior	Thailand	0.157	Accept
		Pakistan	0.032	Reject
H17	Behavioral intention mediates the relationship between social influence and use behavior	Thailand	0.257	Accept
		Pakistan	0.048	Reject
H18	Behavioral intention mediates the relationship between satisfaction with policies and use behavior.	Thailand	0.017	Reject
		Pakistan	0.004	Reject
H19a	Charging infrastructure moderates the relationship between environmental concerns and trust.	Thailand	0.002	Reject
		Pakistan	0.021	Reject
H19b	Charging infrastructure moderates the relationship between environmental concerns and use behavior.	Thailand	0.015	Reject
		Pakistan	-0.033	Reject
H19c	Charging infrastructure moderates the relationship between price value and trust.	Thailand	-0.006	Reject
		Pakistan	-0.021	Reject
H19d	Charging infrastructure moderates the relationship between hedonic motivation and trust.	Thailand	-0.117	Reject
		Pakistan	0.035	Reject

Hypotheses	Path	Country	Beta	Status
H19e	Charging infrastructure moderates the relationship between facilitating conditions and trust.	Thailand	-0.085	Reject
		Pakistan	-0.086	Reject

H1a: Environmental concern has a positive impact on trust.

In the case of Thailand, environmental concern has a positive significant relationship with trust ($\beta = 0.187$, $p < 0.05$). Similarly, in Pakistan, environmental concern has a positive significant relationship with trust ($\beta = 0.103$, $p < 0.05$). It means environmental concern (egoistic, altruistic, biospheric) improves user trust on EVs.

H1b: Environmental concern has a positive impact on use behavior.

In the case of Thailand, environmental concern has an insignificant relationship with use behavior ($\beta = 0.074$, $p > 0.05$). Similarly, in Pakistan, environmental concern has an insignificant relationship with use behavior ($\beta = 0.027$, $p > 0.05$). It means that environmental concerns (egoistic, altruistic, biospheric) have no direct influence on use behavior.

H2: Price value has a positive impact on trust.

In the case of Thailand, price value has an insignificant relationship with trust ($\beta = 0.013$, $p > 0.05$). In Pakistan, price value has a positive significant relationship with trust ($\beta = 0.401$, $p < 0.05$). It means that price value (responsible, worth, value) failed to affect trust in Thailand. However, price value improves user trust in EVs in Pakistan.

H3: Hedonic motivation has a positive impact on Trust.

In the case of Thailand, hedonic motivation has a positive significant relationship with trust ($\beta = 0.473$, $p < 0.05$). Similarly, in Pakistan, hedonic motivation has a positive significant relationship with trust ($\beta = 0.193$, $p < 0.05$). It means that hedonic motivation (fun, enjoyable, and entertaining) positively enhances trust user trust in EVs in Thailand and Pakistan.

H4: Facilitating condition has a positive impact on Trust.

In the case of Thailand, the facilitating condition has an insignificant relationship with trust ($\beta = -0.038$, $p > 0.05$). Similarly, in Pakistan, the facilitating condition has an insignificant relationship with trust ($\beta = 0.034$, $p > 0.05$). It means that facilitating conditions (perceived behavioral control and facilities) failed to affect trust in Thailand and Pakistan.

H5: Trust has a positive impact on behavioral Intentions

In the case of Thailand, trust has a positive significant relationship with behavior intentions ($\beta = 0.197$, $p < 0.05$). Similarly, in Pakistan, trust has a positive significant relationship with behavior intentions ($\beta = 0.401$, $p < 0.05$). It means that trust (honest, responsible, reliability, and dependable) has a positive effect on behavior intentions in Thailand and Pakistan.

H6: Behavioral Intentions has a positive impact on use behavior.

In the case of Thailand, behavior intention has a positive significant relationship with use behavior ($\beta = 0.683$, $p < 0.05$). Similarly, in Pakistan, behavior intention has a positive significant relationship with use behavior ($\beta = 0.526$, $p < 0.05$). It means that behavior intention (intend, daily, future, and predict) positively affects use behavior in Thailand and Pakistan.

H7: Habits have a positive impact on behavioral Intentions.

In the case of Thailand, the habit has a positive insignificant relationship with behavior intention ($\beta = -0.169$, $p > 0.05$). However, in Pakistan, habit has a positive significant relationship with behavior intention ($\beta = 0.203$, $p < 0.05$). It means that habit (natural, addicted, and must) failed to affect behavior intention in Thailand but significantly affected behavior intentions in Pakistan.

H8: Effort expectancy has a positive impact on behavioral Intentions.

In the case of Thailand, effort expectancy has a positive significant relationship with behavior intention ($\beta = 0.230$, $p < 0.05$). However, in Pakistan, effort expectancy has an insignificant relationship with behavior intention ($\beta = 0.060$, $p > 0.05$). It means that Effort expectancy (perceived ease of and ease of use) failed to affect behavior intention in Pakistan but significantly affected behavior intentions in Thailand.

H9: Social influence has a positive impact on behavioral Intentions.

In the case of Thailand, social influence has a positive significant relationship with behavior intention ($\beta = 0.376$, $p < 0.05$). However, in Pakistan, social influence has an insignificant relationship with behavior intention ($\beta = 0.091$, $p > 0.05$). It means that social influence (subjective norm, social factor, and image) failed to affect behavior intention in Pakistan but significantly affected behavior intentions in Thailand.

H10a: Satisfaction with incentive policies has a positive impact on behavioral Intentions.

In the case of Thailand, Satisfaction with incentive policies has an insignificant relationship with behavior intention ($\beta = 0.025$, $p > 0.05$). Likewise, in Pakistan, Satisfaction with incentive policies has an insignificant relationship with behavior intention ($\beta = 0.007$, $p > 0.05$). This means that satisfaction with incentive policies (purchase subsidy, operation subsidy, information, facilitation) has failed to affect behavior intention in Thailand and Pakistan.

H10b: Satisfaction with incentive policies has a positive impact on use Behavior.

In the case of Thailand, Satisfaction with incentive policies has an insignificant relationship with use behavior ($\beta = -0.170$, $p > 0.05$). Likewise, in Pakistan, Satisfaction with incentive policies has an insignificant relationship with use behavior ($\beta = -0.021$, $p > 0.05$). This means that satisfaction with incentive policies (purchase subsidy, operation subsidy, information, facilitation) has failed to affect use behavior in Thailand and Pakistan.

H11: Trust and behavior Intentions sequentially mediated the relationship between environmental concerns and use behavior.

In the case of Thailand, trust and behavior intentions sequentially mediated the relationship between environmental concerns and use behavior ($\beta = 0.025$, $p > 0.05$). Likewise, in Pakistan ($\beta = 0.022$, $p > 0.05$).

H12: Trust and behavior Intentions sequentially mediated the relationship between price value and use behavior.

In the case of Thailand, trust and behavior intentions failed to sequentially mediate the relationship between price value and use behavior ($\beta = 0.002, p > 0.05$). However, trust and behavior intentions sequentially mediate the relationship in Pakistan ($\beta = 0.085, p < 0.05$).

H13: Trust and behavior Intentions sequentially mediated the relationship between hedonic motivation and use behavior.

In the case of Thailand, trust and behavior intentions sequentially mediated the relationship between hedonic motivation and use behavior ($\beta = 0.064, p < 0.05$). Likewise, in Pakistan ($\beta = 0.041, p < 0.05$).

H14: Trust and behavior Intentions sequentially mediated the relationship between facilitating conditions and use behavior.

In the case of Thailand, trust and behavior intentions failed to sequentially mediate the relationship between facilitating conditions and use behavior ($\beta = -0.005, p > 0.05$). Likewise, in Pakistan ($\beta = 0.007, p > 0.05$).

H15: Behavioral intention mediates the relationship between habit and use behavior.

In the case of Thailand, behavior intentions failed to mediate the relationship between habit and use behavior ($\beta = -0.115, p > 0.05$). However, in Pakistan, behavior intentions mediate the relationship ($\beta = 0.107, p < 0.05$).

H16: Behavioral intention mediates the relationship between effort expectancy and use behavior.

In the case of Thailand, behavior intentions mediate the relationship between effort expectancy and use behavior ($\beta = 0.157, p < 0.05$). However, in Pakistan, behavior intentions failed to mediate the relationship between effort expectancy and use behavior ($\beta = 0.032, p > 0.05$).

H17: Behavioral intention mediates the relationship between social influence and use behavior.

In the case of Thailand, behavior intentions mediate the relationship between social influence and use behavior ($\beta = 0.257, p < 0.05$). However, in Pakistan, behavior intentions failed to mediate the relationship between social influence and use behavior ($\beta = 0.048, p > 0.05$).

H18: Behavioral intention mediates the relationship between satisfaction with policies and use behavior.

In the case of Thailand, behavior intentions failed mediate the relationship between satisfaction with policies and use behavior ($\beta = 0.017, p > 0.05$). Likewise, in Pakistan, behavior intentions failed to mediate the relationship between satisfaction with policies and use behavior ($\beta = 0.004, p > 0.05$).

H19(a-e): Charging infrastructure moderates the relationship between environmental concerns/price value/hedonic motivation/facilitating condition and trust.

In the case of Thailand, charging infrastructure was shown as an insignificant moderator between environmental concerns and behavior ($\beta = 0.002, p > 0.05$), environmental concerns and trust ($\beta = 0.015, p > 0.05$), price value and trust ($\beta = -0.006, p > 0.05$), hedonic motivation and trust ($\beta = -0.117, p > 0.05$), facilitating condition and trust ($\beta = -0.085, p > 0.05$). Similar results were found in Pakistan, environmental concerns and behavior ($\beta = 0.021, p > 0.05$), environmental concerns and trust ($\beta = -0.033, p > 0.05$), price value and trust ($\beta = -0.021, p > 0.05$), hedonic motivation and trust ($\beta = 0.035, p > 0.05$), facilitating condition and trust ($\beta = -0.086, p > 0.05$).

CHAPTER 5

CONCLUSION, DISCUSSION AND IMPLICATION

This chapter focuses on comparing the findings of both countries, Thailand and Pakistan. The aim was to discover how environmental concern, price value, hedonic motivation, facilitating condition, habit, effort expectancy, social influence, and satisfaction with incentive policies influence use behavior towards EVs. The study also investigated the mediating role of trust and behavior intentions. Furthermore, the study tested charging infrastructure as a moderator. The data was collected from 220 Thai users and 300 Pakistani users. The data was collected through a survey questionnaire, and different tests were conducted, including descriptive statistics, reliability analysis, discriminant validity, CFA, and SEM. Based on the results, this chapter covers discussion, implication, conclusion, and avenue for future researchers.

5.1 Conclusion

Electric vehicle adoption is a contemporary area of interest to be examined and studied, especially considering the main challenges accompanying EV adoption. The transition from conventional autos to EVs must be implemented in Thailand and Pakistan. This study aimed to investigate the determinants that drive customers to embrace EVs in Thailand and Pakistan. The SEM technique seeks to provide a comprehensive informational framework about the variables of UTAUT2. The study suggests that environmental concern has a positive significant relationship with trust in Thailand and Pakistan. The study also suggested that environmental concern has an insignificant relationship with use behavior in both countries, while price value has an insignificant relationship with trust in Thailand. However, price value showed significant relationship with trust. In both countries, hedonic motivation has a positive significant relationship with trust. Facilitating condition has an insignificant relationship with trust in both contexts. The study also suggests that trust has a positive significant relationship with behavior intentions in both context. Similar results

were shown between behavior intentions and use behavior in Thailand and Pakistan. In Thailand, the habit has an insignificant relationship with the intention to behave. However, in Pakistan, habit has a positive significant relationship with behavior intention. Effort expectancy has a positive significant relationship with behavior intention. However, in Pakistan, effort expectancy failed to affect behavior intention. In Thailand, social influence has a positive significant relationship with behavior intention. However, in Pakistan, social influence has an insignificant relationship. The study also exhibits that Satisfaction with incentive policies has an insignificant relationship with behavior intention in both contexts. Similarly, Satisfaction with incentive policies has an insignificant relationship with use behavior in Thailand and Pakistan. The study also showed that trust and behavior intentions sequentially mediated the relationship between environmental concerns and use behavior in both countries. Trust and behavior intentions failed to mediate the relationship between price value and use behavior sequentially, but mediates the relationship in Pakistan. Between hedonic motivation and use behavior, it showed positive sequential mediation in both contexts. However, trust and behavior intentions failed to mediate between facilitating conditions and the use of behavior in both contexts. In Thailand, behavior intentions failed to mediate the relationship between habits and use behavior. However, in Pakistan, behavior intentions mediate the relationship. Behavior intentions mediate the relationship between effort expectancy and use behavior, however, in Pakistan, behavior intentions failed to mediate the relationship between effort expectancy and use behavior. In Thailand, behavior intentions mediate the relationship between social influence and use behavior. However, in Pakistan, behavior intentions failed to mediate. In both contexts behavior intentions failed mediate the relationship between satisfaction with policies and use behavior. Lastly the study showed the moderating effect of charging infrastructure. Charging infrastructure was shown as an insignificant moderator in both countries.

5.2 Discussion (Thailand and Pakistan)

This part provides empirical validation for the model used to analyze the adoption of EVs in Thailand. The market for EVs in Thailand has received limited attention since its introduction in 2015. To facilitate the widespread adoption of EVs, it is imperative to analyze thoroughly the key factors that influence EV adoption. This will enable the government and other relevant stakeholders to formulate effective strategies to promote the EV market's long-term growth.

Effect of Environmental concerns and use behavior

The results exhibit that environmental concerns' influence on use behavior is insignificant in Thailand ($\beta = 0.074$, $p > 0.05$). Similarly, in Pakistan, environmental concern has an insignificant relationship with use ($\beta = 0.027$, $p > 0.05$). Stern and Dietz (1994) also showed insignificant results between environmental concerns and use behavior. However, Richardson (2013) showed that environmental concerns could transform consumer usual behavior into pro-environmental behavior. By including environmental concerns in UTAUT2, the study augments its explanatory capacity, especially in sustainability-oriented scenarios, by addressing cultural variances and psychological elements. This adaptation enhances comprehension of the interaction between non-traditional elements and the fundamental pillars of UTAUT2, presenting a more extensive framework for forecasting usage behavior across many cultural and environmental situations. The results show that concerns about environmental protection and pollution caused by fossil fuel use do not significantly affect behavior towards EVs. The influence of environmental concerns on usage behavior was determined to be insignificant in both Pakistan and Thailand. This may suggest that individuals in these nations do not comprehensively grasp or prioritize environmental concerns when making consumption choices. Consumers may be motivated by prestige or social recognition rather than environmental consciousness while purchasing. This research by Buhmann and Criado (2023) emphasizes that consumers' inclination towards EVs is motivated by environmental considerations and a desire for status. Buyers motivated by reputation are more likely to select

electric vehicles when their prices exceed those of conventional automobiles, associating EV ownership with social status.

Effect of Environmental concerns and trust

The findings also show a positive effect of environmental concern on trust in Thailand ($\beta = 0.187, p < 0.05$) and ($\beta = 0.103, p < 0.05$) Pakistan, which aligns with the previous research conducted by Jian et al. (2020). According to Chen, Lin, and Weng (2015), including environmental aspects in a product increases consumer trust. Environmental concerns are related to public awareness, which depends on their response and attitude towards the environment, and Wang, Zhang, and Wong (2022) argued that environmental concerns can affect attitude negatively. The results show that concerns about the environment, the impact on people's lives, and pollution caused by fossil fuel vehicles influence user trust positively. The results indicate that environmental concern favorably affects trust in Thailand and, to a lesser degree, in Pakistan, underscoring trust's crucial function in augmenting the UTAUT2 framework, especially for emerging technologies such as electric vehicles (EVs). Trust facilitates the connection between environmental ideals and behavioral intentions by mitigating uncertainties and perceived dangers, which are prevalent obstacles to electric vehicle adoption. Incorporating trust within UTAUT2 enhances the framework's predictive capability by addressing the psychological and contextual variables critical for adopting high-risk, sustainability-focused technologies. Furthermore, the cross-cultural variation highlights the flexibility of UTAUT2 with the inclusion of trust, offering a more profound comprehension of how environmental and societal values affect technology adoption across many contexts. It means that in both Pakistan and Thailand, environmental concern positively influences trust. Nevertheless, the findings indicate that Thai users are more aware of environmental issues than Pakistani users. This may result from heightened environmental consciousness and governmental measures in Thailand, including legislation advocating sustainability. Consumers with heightened environmental awareness are more inclined to regard EVs as a credible and sustainable option, indicating that environmental considerations augment

EVs' perceived reliability and advantages across many cultural contexts. This highlights the significance of environmental awareness in fostering consumer trust in various marketplaces.

Effect of Price value on trust

The influence of price value on trust is insignificant ($\beta = 0.013$, $p > 0.05$), as previous research has also shown. According to Martin, Ponder, and Lueg (2009), loyal customers may feel that their implicit trust in the relationship is violated if they perceive that the product or brand is involved in unfair pricing. In Pakistan, price value has a positive significant relationship with trust ($\beta = 0.401$, $p < 0.05$). Franke et al. (2015) also showed a positive relationship between price value and trust. Incorporating trust into the UTAUT2 framework enhances the model's capacity to consider price perceptions and their influence on technology adoption. Trust elucidates how customers assess product value, especially when price considerations are paramount, hence enhancing UTAUT2's efficacy in forecasting adoption behavior in marketplaces where cost is a critical element, exemplified by electric cars (EVs). In Thailand, the absence of a substantial correlation between price value and trust may stem from the perception that the elevated costs of electric vehicles (EVs) are unjust, with buyers prioritising the pursuit of equitable prices in light of the more advanced EV industry relative to Pakistan. In the study of Techa-Erawan et al. (2024) exhibited that prices of EV in Thailand has negative effect of adoption of EV. In Pakistan, where the electric vehicle market is nascent, a favorable correlation exists between price value and consumer trust. Higher-income individuals are more inclined to acquire electric vehicles to display their status and embrace innovation, notwithstanding the elevated costs. The market's embryonic phase and the aspirational element render pricing value more closely associated with trust in Pakistan.

Effect of hedonic motivation on trust

The results show that hedonic motivation significantly affects trust in the context of EVs in both Thailand ($\beta = 0.473$, $p < 0.05$) and Pakistan ($\beta = 0.193$, $p < 0.05$). Previous studies of

Baabdullah (2018) and Zhou et al. (2021) align with the study's findings. The finding that hedonic motivation substantially influences trust in Thailand and Pakistan enriches the UTAUT2 paradigm by integrating emotional elements into the adoption process. Hedonic motivation, indicative of the pleasure and satisfaction obtained from product usage, impacts trust and influences adoption behavior. This enhancement fortifies UTAUT2 by acknowledging that emotional appeal is crucial in fostering customer confidence, especially for electric vehicles (EVs), where user experience can profoundly influence trust and technology acceptance. The results suggested that users become confident when using the EVs, which results in desired fun and enjoyment and accelerates users' performance. The notable correlation between hedonic motivation and trust in Thailand and Pakistan indicates that consumers cultivate increased confidence in electric vehicles when they see the experience as pleasurable and delightful. This favorable emotional bond with the car fosters confidence in its performance, leading users to perceive electric vehicles as both a pragmatic choice and an enjoyable one. In both nations, the pleasurable experience of using EVs enhances their adoption as consumers develop a correlation between enjoyment and trust in the technology, thereby solidifying their preference for EVs as an effective and enjoyable mode of transportation.

Effect of facilitating condition on trust

The facilitating condition has an insignificant relationship with trust in Thailand ($\beta = -0.038, p > 0.05$) and Pakistan ($\beta = 0.034, p > 0.05$). The earlier study by Chemingui (2013) found no significant association between facilitating conditions and trust, which aligns with the current findings. However, some studies have shown a positive relationship between facilitating conditions and trust (Gorenflo et al., 2019b; Jain et al., 2022b; Wang et al., 2020). The negligible correlation between facilitating conditions and trust in Thailand and Pakistan enhances the UTAUT2 framework by indicating that, in the realm of electric vehicle (EV) adoption, trust may be more affected by elements such as hedonic motivation or performance expectancy than by external resources or infrastructure. This finding enhances UTAUT2 by emphasizing that conducive conditions may not consistently be a crucial factor in trust, especially in developing technologies,

prompting a focus on psychological and experiential elements in the adoption process. The results indicate that favourable factors, such as access to essential resources, knowledge, and infrastructure, do not substantially enhance trust in electric cars (EVs) in Thailand and Pakistan. Despite the growing accessibility of information regarding electric vehicles and heightened awareness, the necessary infrastructure remains inadequate. In emerging electric vehicle markets, infrastructure may be regarded as a work in progress. Consequently, customers may lack complete confidence in the infrastructure's stability or durability, potentially undermining its influence on their decision-making.

Effect of trust on behavior intentions

The findings indicate that trust is a reliable indicator of behavioral intentions in Thailand ($\beta = 0.197$, $p < 0.05$) and Pakistan ($\beta = 0.401$, $p < 0.05$), aligning with previous studies (Zhang et al., 2022; Nget al., 2018). The finding that trust is a reliable predictor of behavioral intentions in as a reliable predictor of behavioral intentions in both Thailand and Pakistan enriches the UTAUT2 framework by underscoring trust as a vital element affecting customers' intentions to embrace electric cars (EVs). This reinforces UTAUT2 by demonstrating that trust directly influences adoption decisions alongside the conventional conceptions of performance expectancy and effort expectancy. The substantial correlation between trust and behavioral intentions indicates that trust in technology or brand is crucial for fostering adoption, especially for emerging technologies such as electric vehicles, where customers may hesitate or hesitate. Assuming that the use of a particular electric car does not violate the reliability, environment, and other related things of the participant, it would appeal to potential users of EVs. The more significant influence of trust on behavioral intentions in Pakistan relative to Thailand may stem from each nation's differing stages of electric vehicle development. In Thailand, electric vehicles are more advanced, and buyers are inclined to evaluate multiple aspects, including cost, infrastructure, and long-term advantages, potentially diminishing the influence of trust in their decision-making process. Conversely, Pakistan's electric vehicle market remains nascent. However, government initiatives to encourage EV adoption have

fostered customer optimism and confidence in the future prospects of electric vehicles. This hope and the anticipation of future enhancements may render trust more significant in influencing their behavioral intentions about EV adoption.

Effect of behavior intentions on use behavior

The impact of behavioral intentions on use behavior is positive in both Thailand ($\beta = 0.683$, $p < 0.05$) and Pakistan ($\beta = 0.526$, $p < 0.05$). The results are consistent with prior research findings (Zhou et al., 2021; Mansoor et al., 2023). The favorable effect of behavioral intentions on usage behavior in Thailand corroborates the fundamental assertion of the UTAUT2 paradigm, which contends that intentions to utilize a technology directly affect actual utilization. This discovery substantiates UTAUT2 by confirming the correlation between behavioral intentions and actual usage, especially with electric vehicle (EV) adoption, where the intention to adopt serves as a crucial predictor of actual usage behavior. The findings indicate that individuals with a strong behavior intention to utilize EVs in the future demonstrate a more pronounced influence on their actual usage behavior in Thailand and Pakistan. Nonetheless, the effect is marginally more significant in Thailand, potentially attributable to its more advanced electric vehicle market. Thailand's excellent infrastructure, policies, and overall awareness of electric vehicles may enhance customer intentions to accept them, and Pakistan's electric vehicle market remains nascent. Consequently, the more advanced market in Thailand probably leads to a more robust link between intention and behavior.

Effect of habit on behavior intentions

The results found no relationship between habit and behavioral intentions in Thailand ($\beta = -0.169$, $p > 0.05$), consistent with previous studies (Gunawan et al., 2022; Singh et al., 2023). However, In Pakistan ($\beta = 0.203$, $p < 0.05$), it shows positive significant results. The results are in line with Ramírez-Correa et al. (2019), who showed a significant relationship between habit and behavioral intentions in the gaming industry. The results indicate that habit does not significantly

correlate with behavioral intentions in Thailand. However, it exhibits a positive significant correlation in Pakistan, so enhancing the UTAUT2 paradigm by underscoring cultural disparities in the impact of habitual behavior on technology adoption. In Pakistan, habit influences behavioral intentions, indicating that consumers' prior experiences or established patterns may facilitate adoption in this environment. The absence of such a link in Thailand indicates that alternative factors, such as performance expectancy or hedonic motivation, may exert a more significant influence on behavioral intentions. This variance underscores the necessity for UTAUT2 to incorporate cultural and environmental elements in comprehending the influence of habit on technology adoption. The shift from internal ICE to EVs in Thailand is non-disruptive, as driving behaviors for both vehicle types are comparable, allowing users to readily acclimatize to operating EVs. The smooth transition is attributable to Thailand's advanced EV infrastructure and market, where consumers are already acquainted with the technology and encounter fewer obstacles, such as range anxiety or insufficient charging stations. Conversely, Pakistan's electric car sector remains nascent, with users predominantly dependent on conventional automobiles due to inadequate infrastructure, reinforcing entrenched habits. The move to electric vehicles in Pakistan is, hence, more challenging, with habitual behavior significantly influencing adoption intentions. The emerging electric vehicle market in Pakistan presents more significant obstacles for consumers, complicating their transition compared to Thailand's.

Effect of social influence on behavior intentions

The impact of social influence on behavioral intentions is positively correlated ($\beta = 0.376$, $p < 0.05$), which aligns with prior research (Baabdullah., 2018; Zhou et al., 2021); however, Pakistan ($\beta = 0.091$, $p > 0.05$) shows an insignificant relationship. Mansoor et al. (2023) also showed an insignificant result in the banking industry. Consequently, prospective EV users exhibit a keen interest in the perspectives of their acquaintances, relatives, coworkers, and the broader community and consider EVs as status symbols. This finding enhances the UTAUT2 paradigm by highlighting that social impact is a crucial determinant of behavioral intentions in specific

situations, such as Thailand, while not in others, like Pakistan. UTAUT2 often incorporates social influence as a crucial determinant of adoption behaviors; nevertheless, this finding indicates that its effect may fluctuate based on cultural and socioeconomic variables. The research enhances the UTAUT2 model by emphasizing contextual variables, indicating the necessity for adaptation to reflect regional variations in the impact of social influence on technology adoption, especially regarding emerging technologies such as electric vehicles (EVs). Social influence does not markedly impact the behavioral intentions to embrace EVs in Pakistan, perhaps due to the nation's emerging economy and cultural background. In Pakistan, the nascent EV market is predominantly influenced by pragmatic factors, including cost, infrastructure, and availability, rather than social pressure or peer influence. EVs are not yet prevalent in Pakistan, resulting in insufficient exposure and acceptance to enable social influence to impact consumer behavior significantly. Conversely, in more developed economies such as Thailand, where the electric vehicle market is expanding, and the infrastructure is well-established, social influence exerts a more significant impact on behavioral intentions. The growing popularity and visibility of EVs in Thailand enhance their social acceptance, making individuals more affected by peers, family, or societal trends in their purchasing decisions. Consequently, whereas social influence has a restricted impact in Pakistan, it profoundly affects customer behavior in Thailand's more developed electric vehicle market.

Effect of effort expectancy on behavior intentions

The impact of effort expectancy on behavioral intentions is statistically significant in Thailand ($\beta = 0.230$, $p < 0.05$), which aligns with previous studies (Curtale et al., 2021; Leicht et al., 2018). Similarly, in the context of autonomous vehicles, Leicht et al. (2018) showed a positive significant relationship between effort expectancy and behavioral intentions. However, in Pakistan ($\beta = 0.060$, $p > 0.05$), effort expectancy and behavioral intentions showed an insignificant relationship. The results are consistent with the study of (Ramírez-Correa et al., 2019). The finding that effort expectation strongly influences behavioral intentions in Thailand, although not in Pakistan, enhances the UTAUT2 paradigm by underscoring the critical role of effort expectancy—

the perceived ease of use—in facilitating technology adoption in certain contexts. In Thailand, the notable correlation corresponds with other studies, indicating that usability is a crucial determinant in influencing adoption intentions for emerging technologies such as electric cars (EVs). Nonetheless, the insignificance observed in Pakistan suggests that alternative factors, such as performance expectancy or social influence, may exert greater influence in this context. This variation indicates that UTAUT2 must be adaptable to accommodate regional disparities in the influence of effort expectancy on adoption, highlighting the necessity for a more contextually aware methodology in forecasting technology uptake across diverse markets. The influence of effort expectancy on behavioral intentions is statistically significant in Thailand, where customers regard EVs as accessible and user-friendly, enhancing their desire to embrace the technology. This is probably attributable to the more advanced EV infrastructure and more familiarity with the technology. In Pakistan, effort expectancy does not substantially influence behavioral intentions. This may be due to the nascent stage of the EV market in Pakistan, where consumers are less acquainted with the technology and may perceive the interface as more intricate or difficult to navigate. The insufficient exposure, support infrastructure, and user education in Pakistan may diminish the relevance of effort expectancy in influencing consumers' intents to adopt electric vehicles in this market.

Effect of satisfaction with incentive policies on behavior intentions and use behavior

The study showed no significant effect of satisfaction on incentive policies on behavioral intention ($\beta = 0.025$, $p > 0.05$) and use behavior ($\beta = -0.170$, $p > 0.05$) In Thailand. Similarly, In Pakistan, no relationship between satisfaction with incentive policies and behavior intentions ($\beta = 0.007$, $p > 0.05$) as well as with use behavior ($\beta = -0.021$, $p > 0.05$). These findings align with prior research conducted by Diamond (2009). However, Zhou et al. (2021) showed a positive and significant relationship. This finding contributes to UTAUT2 by demonstrating that satisfaction with incentive programs may not consistently serve as a significant predictor of behavioral intentions or usage behavior, especially with electric vehicle (EV) uptake in Thailand and Pakistan.

Although UTAUT2 typically incorporates external elements like conducive conditions, this research indicates that government incentives may be less impactful than other factors, such as performance expectancy or trust. It underscores that personal views and experiences may be pivotal in fostering adoption, advocating for a more individual-focused methodology in forecasting behavior within emerging technology marketplaces. This underscores the necessity for UTAUT2 to consider the differing importance of external incentives based on contextual and cultural variables rather than supposing a uniform effect of external policy. Furthermore, the findings demonstrate that contentment with incentive policies, such as operational subsidies, information provision subsidies, and facilitation policies, does not substantially influence behavioral intentions and usage behavior in Thailand and Pakistan. This indicates that users are discontent with the existing policies, primarily because the designated funds for the stated number of vehicles have been depleted. Consequently, governments must obtain authorization for supplementary incentive packages to sustain ongoing growth in the electric vehicle market. The absence of pleasure may diminish the effectiveness of these policies on consumer intents and behavior, underscoring the need for durable and adaptive incentives to promote electric vehicle adoption.

Sequential mediating effect of trust and behavior intentions

The study additionally examined the mediation of trust and behavioral intentions in Thailand. Furthermore, this analysis identifies trust and behavioral intention as crucial sequential mediators, regulating two paths significantly while rendering two paths insignificant. The significance of environmental concerns ($\beta = 0.025$, $p > 0.05$) and hedonic motivations ($\beta = 0.064$, $p < 0.05$) on user behavior is noteworthy. However, the relationships between price value ($\beta = 0.002$, $p > 0.05$) and facilitating conditions ($\beta = -0.005$, $p > 0.05$) with the use of behavior through trust and behavior intentions are not statistically significant. In Pakistan, there is a sequential mediation of trust and behavioral intentions between environmental concerns, price value, hedonic motivation, facilitating conditions, and use behavior. The results showed that trust and behavioral intentions sequentially mediate the relationship between environmental concerns ($\beta = 0.022$, $p <$

0.05), price value ($\beta = 0.085$, $p < 0.05$), and hedonic motivation ($\beta = 0.041$, $p < 0.05$). However, it does not mediate between facilitating conditions ($\beta = 0.007$, $p > 0.05$) and use behavior.

This study highlights the pivotal function of trust as a mediator within the UTAUT2 framework, underscoring its essential contribution to converting intrinsic and extrinsic elements, such as hedonic motivation and environmental concerns, into behavioral intentions and usage behavior. In this instance, trust augments the model's explanatory capacity, particularly in scenarios when other factors, such as environmental considerations, do not directly influence usage behavior. As a sequential mediator, trust enhances the linkages among factors affecting adoption, hence enhancing the predictive capacity of UTAUT2. This underscores the significance of trust in the adoption of new technologies such as electric vehicles (EVs), indicating that UTAUT2 can be more comprehensive and contextually pertinent by integrating trust as a crucial mediator influencing customer perceptions and decisions. The integration of trust into UTAUT2 offers a more thorough and contextually refined perspective on technology adoption. Trust instills confidence in consumers' decisions, increasing their willingness to adopt new technologies, especially in industries characterized by uncertainty or perceived risk, such as electric automobiles. The study's findings confirm that trust serves as both a mediator and a crucial element within UTAUT2, influencing customer perceptions and decisions, especially with the adoption of innovative and high-risk technologies such as electric vehicles. This underscores the necessity of explicitly integrating trust into the model, guaranteeing that its predictive capacity encompasses not only technology attributes but also the psychological elements that influence consumer behavior.

In Thailand, price value does not substantially affect usage behavior via trust and behavioral intents. In Thailand and Pakistan, facilitating conditions do not affect use behavior via trust and behavioral intentions. This trend persists in both countries, indicating that enhancements in conducive environments may be essential for augmenting these elements. It is essential to underscore the significance of prioritizing infrastructure and support services necessary for fostering technology adoption, as these factors appear to play a considerable effect in influencing

consumer behavior. Emphasizing this in your investigation could offer significant insights for policymakers and marketers seeking to cultivate a conducive atmosphere for your target market.

Mediating effect of behavior intentions

The study also examined four indirect pathways, finding that effort expectancy ($\beta = 0.157$, $p < 0.05$) and social influence ($\beta = 0.257$, $p < 0.05$) substantially affect use behavior. Behavioral intentions act as a potent mediator in these pathways, but habit ($\beta = -0.115$, $p > 0.05$) and satisfaction with incentive policies ($\beta = 0.017$, $p < 0.05$) showed an insignificant relationship with the use of behavior through behavior intentions. While prior research has produced similar correlation constructs, few findings discuss trust and behavioral intention as a mediator and examine its impact (Ahmad et al., 2020; Baabdullah, 2018; Zhou et al., 2021). The results also exhibit simple mediation, showing that behavioral intentions mediate the relationship between habits and use behavior ($\beta = 0.107$, $p < 0.05$). However, effort expectancy ($\beta = 0.032$, $p > 0.05$), social influence ($\beta = 0.048$, $p > 0.05$), and satisfaction with policies ($\beta = 0.004$, $p > 0.05$) show no mediation through Behavioral intentions.

In the UTAUT2 framework, behavioral intentions serve as a vital mediator, converting the influence of elements like effort expectation and social influence into use behavior. This mediation underscores that behavioral intentions are crucial in forecasting technology adoption, as they signify the psychological commitment to utilizing a new technology. As a mediator, behavioral intents enhance the UTAUT2 model, elucidating the influence of external and intrinsic elements on consumer behavior, so rendering it a more effective instrument for comprehending adoption processes.

The results suggest that satisfaction with incentive policies does not significantly influence usage behavior via behavioral intentions in Thailand and Pakistan. This prevalent result indicates that merely implementing incentive schemes may be inadequate to affect user behavior. Both countries should reassess and improve their incentive and policy frameworks to align with consumer expectations and behavioral motives. This may entail customizing incentives to enhance

their relevance and attractiveness or executing supplementary techniques that bolster customer engagement and intent to utilize them. Emphasizing this component can yield significant insights for policy enhancement.

Moderating effect of charging infrastructure

Another worth-knowing finding of the study is the moderating effect of charging infrastructure. Charging infrastructure in Thailand was shown as an insignificant moderator between environmental concerns and behavior ($\beta = 0.002, p > 0.05$), environmental concerns and trust ($\beta = 0.015, p > 0.05$), price value and trust ($\beta = -0.006, p > 0.05$), hedonic motivation and trust ($\beta = -0.117, p > 0.05$), facilitating condition and trust ($\beta = -0.085, p > 0.05$). Similarly, in Pakistan, Environmental concerns and behavior ($\beta = 0.021, p > 0.05$), environmental concerns and trust ($\beta = -0.033, p > 0.05$), price value and trust ($\beta = -0.021, p > 0.05$), hedonic motivation and trust ($\beta = 0.035, p > 0.05$), facilitating condition and trust ($\beta = -0.086, p > 0.05$). Prior studies on EVs using UTAUT2 have used different moderators. For example, Jain et al. (2022) used environmental concerns and government support as moderators and showed significant moderation. Similarly, Khazaei and Tareq (2021) also showed that personal innovation is a significant moderator; however, driving experience is insignificant. The study's finding is the moderating impact of charging infrastructure. Previous research on EVs employing the Unified Theory of Acceptance and Use of Technology 2 (UTAUT2) framework has incorporated several moderators. For instance, Jain et al. (2022) investigated the influence of environmental concerns and government support as moderators and observed substantial moderating effects. In a similar situation, Khazaei and Tareq (2021) showed that personal innovativeness is a strong moderator, but driving experience had no meaningful impact. Incorporating a moderator into the UTAUT2 framework improves its capacity to analyze the impact of external factors on the links between the fundamental components and usage behavior. The incorporation of moderators facilitates a more sophisticated comprehension of technology adoption by accounting for contextual factors.

This is a crucial issue to consider. Thailand and Pakistan have difficulties due to the restricted accessibility of EV charging facilities, particularly in residential areas. The absence of home charging infrastructure is a substantial obstacle to the broad adoption of electric vehicles, in sharp contrast to nations that have made considerable investments in providing simple and adequate EV charging options for residences. Policymakers and stakeholders in Thailand and Pakistan should prioritize expanding EV charging infrastructure, especially in residential zones, university parking, and other extensive company parking, as a vital advancement. Incentives for homeowners to install chargers, collaborations with developers to incorporate EV charging into new residential buildings and extensive public-private partnerships could effectively bridge this gap and facilitate the uptake of electric vehicles.

5.3 Implication

Practical implication

In Thailand and Pakistan, environmental issues enhance trust but do not directly impact usage behavior. This suggests that although consumers may not promptly convert their environmental apprehensions into direct usage behavior, they are more inclined to trust electric vehicles when these worries are acknowledged. In Thailand, utilizing environmental issues to foster faith in electric vehicles might be an effective approach, particularly as people pursue dependable and ecological options to conventional automobiles. Similarly, in Pakistan, emphasizing the eco-friendly benefits of EVs can enhance consumer trust, fostering a positive perception that ultimately boosts behavioral intentions toward adoption. Policymakers and manufacturers in both nations should emphasize the environmental benefits of electric vehicles, including less emissions and enhanced energy efficiency, to bolster consumer confidence and promote adoption, despite the lack of immediate behavioral impact. In Thailand, where price does not substantially influence trust, officials should prioritize highlighting the long-term economic and environmental advantages of electric vehicles (EVs), such as fuel and maintenance savings, instead of depending predominantly

on price. Conversely, in Pakistan, where price perception greatly bolsters trust, officials ought to emphasize affordability by providing financial incentives or subsidies to increase the accessibility of electric vehicles. By synchronizing price tactics with consumer confidence and emphasizing the comprehensive value of electric vehicles, both nations can cultivate a favorable attitude and enhance adoption rates. Since hedonic motivation substantially bolsters trust in Thailand and Pakistan, officials need to highlight the pleasurable, joyful, and inventive features of electric cars (EVs) to attract consumers in these nations. In Thailand, where hedonic motivation exerts a more pronounced influence, marketing techniques should emphasize the thrill and modernity of electric vehicles, showcasing their advanced features and appealing design to attract tech-savvy and experience-oriented consumers. Although the impact is somewhat diminished in Pakistan, emphasizing the pleasurable driving experience and the entertainment attributes of electric vehicles, including advanced technologies and distinctive driving sensations, might nevertheless enhance trust. By synchronizing marketing and regulatory initiatives with the hedonic advantages of electric vehicles, both nations may enhance customer confidence and promote increased adoption. Given that conducive conditions exhibit a negligible correlation with trust in Thailand and Pakistan, governments should prioritize alternate ways to promote electric vehicle adoption. This entails providing financial incentives, such as tax refunds and subsidies, to enhance the affordability of electric vehicles, in conjunction with educational initiatives to promote understanding of their long-term advantages, including fuel savings and environmental effects. Moreover, cultivating public-private partnerships to develop EV charging infrastructure and providing adaptable financing choices could increase adoption rates. Although infrastructure may not directly affect trust, such initiatives can foster a more conducive environment for electric vehicles, resulting in heightened customer confidence and enhanced adoption in both nations. Considering the substantial positive correlation between trust, behavioral intentions, and use behavior in Thailand and Pakistan, policymakers should prioritize cultivating and preserving consumer trust in electric cars (EVs). To do this, they might adopt transparent marketing strategies

that emphasize the dependability, safety, and enduring advantages of electric vehicles, thereby instilling consumer confidence in their investment. Moreover, authorities can enhance trust by instituting explicit laws about EV performance and charging infrastructure and providing warranties and after-sales services to instill confidence in prospective purchasers. In both nations, cultivating alliances with reputable organizations or endorsing electric vehicle companies could augment trust, motivating more people to have favorable behavioral intentions toward adopting electric vehicles. Since habit positively affects behavioral intention in Pakistan but not in Thailand, policymakers should customize their approach accordingly. In Pakistan, utilizing habitual behavior might facilitate the promotion of electric cars (EVs) through incentives that ensure a smooth transition from conventional automobiles. Establishing a habit-forming experience for consumers via accessible charging stations, intuitive technology, and consistent participation in electric vehicle usage may reinforce the habit of utilizing EVs. Conversely, in Thailand, where habit is not a predominant factor, authorities may need to concentrate on alternative influential factors, such as price value, environmental concerns, and trust, to promote adoption rather than depending on habitual behavior. Given the divergent outcomes in Thailand and Pakistan, authorities must recalibrate their strategy for fostering the adoption of electric vehicles (EVs) in each nation. In Thailand, where effort expectancy markedly affects behavioral intention, initiatives to streamline the adoption process of electric vehicles—such as increasing user-friendly interfaces, offering explicit instructions, and improving general usability—are expected to boost adoption rates. Concentrated initiatives to diminish perceived complexity can accelerate electric vehicle adoption. Conversely, in Pakistan, where effort expectancy does not substantially influence behavioral intentions, price value or trust may play a more pivotal role in promoting EV adoption. Policymakers in Pakistan should prioritize enhancing these variables instead of streamlining the user experience, as the latter is unlikely to influence adoption behavior significantly. In Thailand, where social influence profoundly impacts behavioral intention, policymakers should utilize social networks, influencers, and community leaders to advocate for the adoption of electric vehicles

(EVs). Promoting word-of-mouth, social endorsements, and peer recommendations may significantly enhance electric vehicle adoption. Social campaigns or activities that emphasize the increasing trend of electric vehicle usage among esteemed persons or groups may further enhance adoption. Conversely, in Pakistan, where social influence is little, authorities ought to prioritize alternative variables, such as financial incentives or trust-building measures, to promote EV adoption, as social influence is unlikely to effect behavioral change in this context. Considering that satisfaction with incentive policies exhibits a negligible correlation with both behavioral intention and usage behavior in Thailand and Pakistan, policymakers ought to reevaluate the efficacy of current incentive frameworks. Rather than concentrating exclusively on incentives, they may investigate different strategies, such as augmenting consumer education regarding the advantages of electric vehicles or bolstering confidence in the technology. Furthermore, more explicit incentives linked to concrete, immediate advantages—such as diminished operational expenses or access to exclusive charging facilities—should be contemplated to more effectively match incentives with customer preferences and motivations in both nations. While the results indicate that charging infrastructure does not influence EV adoption in the model, it is an essential element for widespread adoption. Policymakers in Thailand and Pakistan should prioritize the augmentation of charging infrastructure by expanding the number of charging stations and guaranteeing their accessibility and dependability. This may entail encouraging investments from both the commercial and public sectors to enhance charging networks, especially in regions with strong demand. Moreover, developing cost-effective, standardized, and user-friendly charging systems would foster customer confidence and promote extensive electric vehicle adoption. A strong charging infrastructure is crucial for creating an environment that promotes EV adoption and sustains long-term market growth, even if it does not serve as a direct moderator in the model. Emphasis should be placed on these facets of marketing plan creation to sway prospective consumers to adopt EVs. By effectively incorporating these criteria, sustainable and competitive policies will enhance consumers' likelihood of using EVs. The government or policymakers should

assist electric vehicle makers and consumers of EVs. In addition, with regard to the need to use EVs in institutional settings, it is imperative for the state government to formulate a comprehensive plan for transitioning its current vehicle fleet and public transportation to EVs. Additionally, policymakers should work on a policy where all participating businesses must be integrated into a unified solution that facilitates collaborative work and allows each other to use their stations in order to grow. For instance, in the banking industry, clients can utilize automated teller machines (ATMs) from many institutions to withdraw and transfer funds. Furthermore, it is imperative for the state government to construct zero-emission zones for very popular tourist areas such as islands and small cities, which serve as major tourist attractions and hold ecological significance in Thailand. EV managers can utilize auto expo events and various platforms such as newspapers and social media to elucidate the environmental advantages of EVs to customers. They can offer test drives to showcase the enjoyable driving experience of EVs, create a sense of community by gathering like-minded individuals, and effectively influence their friends and family. Additionally, they can highlight the convenience and user-friendliness of EVs.

Theoretical implication

The objective was to investigate the acceptance of EV adoption in Thailand. EVs are no longer just a trendy term, but they are still in the early stages of development. Several research studies have used the UTAUT2 framework in EVs (Jain et al., 2022; Khazaei & Tareq, 2021; Zhang et al., 2022). Curiously, the research papers have yet to examine the rate of EV adoption in Thailand using the UTAUT2 model that incorporates additional factors such as environmental concerns, trust, satisfaction with incentive policies, and charging infrastructure. This study extended UTAUT2 with new perspectives in the EV context in Thailand, such as environmental and incentive policies, policies related to the government and policymakers, and how these factors contribute to the adoption level based on UTAUT2. Previously, studies have used UTAUT and considered only behavioral and technological perspectives. Another important implication is trust in the mechanism of UTAUT2, which plays an important role. This study has conducted a serial

mediation of trust and behavioral intentions analysis to understand better EVs and the Unified Theory of Acceptance and Use of Technology 2 (UTAUT2) in Thailand. Another significant contribution involves examining the moderating impact of changing infrastructure to understand better charging infrastructure, which is the most important part of EV growth. It is worth noting that only a limited number of studies have explored moderation in the context of EV research utilizing the Unified Theory of Acceptance and Use of Technology 2 (UTAUT2) framework (Jain et al., 2022; Khazaei & Tareq, 2021).

5.4 Limitation and Future Direction

The research was carried out in the EVs market of Pakistan and Thailand only. The findings can be utilized to forecast the uptake of electric vehicles in Thailand and Pakistan, although the outcomes may vary depending on the specific circumstances and countries. Hence, future researchers should conduct studies in countries where EVs are nascent. Future studies could consider incorporating other features to enhance the UTAUT2 model. This study employed charging infrastructure as a moderator and trust as a mediator. Consider including other factors, such as driving experience, for a more comprehensive understanding. The results showed insignificant satisfaction with incentive policies on behavior intentions and use behavior; it would be meaningful to explore it as it is one of the important factors in the adoption of EV (Zhou et al., 2021c). Another recommendation is to explore the effectiveness of different policies, such as tax policies and financial policies, in the context of EVs. The data was exclusively gathered from Thailand and Pakistan, as most users of EVs are in big cities, and it is more diverse. It would be intriguing to incorporate data from other places. Lastly, this study used a quantitative method. Conducting a mixed-method study, such as an explanatory sequential or exploratory sequential design, would be interesting.

REFERENCES

- Abbasi, H. A., Johl, S. K., Shaari, Z. B. H., Moughal, W., Mazhar, M., Musarat, M. A., Rafiq, W., Farooqi, A. S., & Aleksey, B. (2021). Consumer Motivation by Using Unified Theory of Acceptance and Use of Technology towards Electric Vehicles. *Sustainability*, *13*(21), 12177.
- Abraham, J., & Barker, K. (2015). Exploring gender difference in motivation, engagement and enrolment behaviour of senior secondary physics students in New South Wales. *Research in Science Education*, *45*(1), 59–73.
- Ahmad, S., Bhatti, S. H., & Hwang, Y. (2020). E-service quality and actual use of e-banking: Explanation through the Technology Acceptance Model. *Information Development*, *36*(4), Article 4.
- Ahmed, E. M., Rathinam, R., Dayalan, S., Fernandez, G. S., Ali, Z. M., Abdel Aleem, S. H., & Omar, A. I. (2021). A comprehensive analysis of demand response pricing strategies in a smart grid environment using particle swarm optimization and the strawberry optimization algorithm. *Mathematics*, *9*(18), 2338.
- Ajao, Q., Sadeeq, L., & Sodiq, O. O. (2024). Drivers of Electric Vehicle Adoption in Nigeria: An Extended UTAUT Framework Approach. *arXiv preprint arXiv:2410.17282*.
- Ajanovic, A., & Haas, R. (2016). Dissemination of electric vehicles in urban areas: Major factors for success. *Energy*, *115*, 1451–1458.
- Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes*, *50*(2), 179–211.
- Ajzen, I. (2002). *Constructing a TPB questionnaire: Conceptual and methodological considerations*.

- Akhlaq, A., & Ahmed, E. (2013). The effect of motivation on trust in the acceptance of internet banking in a low income country. *International Journal of Bank Marketing*.
- Alalwan, A. A., Dwivedi, Y. K., Rana, N. P., Lal, B., & Williams, M. D. (2015). Consumer adoption of Internet banking in Jordan: Examining the role of hedonic motivation, habit, self-efficacy and trust. *Journal of Financial Services Marketing*, 20(2), 145–157.
- Alalwan, A. A., Dwivedi, Y. K., Rana, N. P., & Williams, M. D. (2016). Consumer adoption of mobile banking in Jordan: Examining the role of usefulness, ease of use, perceived risk and self-efficacy. *Journal of Enterprise Information Management*.
- Albatayneh, A. (2024). The electric cars era transforming the car repairs and services landscape. *Advances in Mechanical Engineering*, 16(7), 16878132241266536. <https://doi.org/10.1177/16878132241266536>
- Albayrak, T., Aksoy, Ş., & Caber, M. (2013). The effect of environmental concern and scepticism on green purchase behaviour. *Marketing Intelligence & Planning*.
- Amrouni, K. I., Arshah, R. A., & Kadi, A. J. (2019). A Systematic Review: Factors Affecting Employees' Adoption of E-government Using an Integration of UTAUT & TTF Theories. *KnE Social Sciences*, 54–65.
- Amry, Y., Elbouchikhi, E., Le Gall, F., Ghogho, M., & El Hani, S. (2022). Electric Vehicle Traction Drives and Charging Station Power Electronics: Current Status and Challenges. *Energies*, 15(16), 6037.
- Anderson, J. C., & Gerbing, D. W. (1988). Structural equation modeling in practice: A review and recommended two-step approach. *Psychological Bulletin*, 103(3), 411.

- Arribas-Ibar, M., Nylund, P. A., & Brem, A. (2021). The risk of dissolution of sustainable innovation ecosystems in times of crisis: The electric vehicle during the COVID-19 pandemic. *Sustainability*, *13*(3), 1319.
- Asadi, S., Nilashi, M., Samad, S., Abdullah, R., Mahmoud, M., Alkinani, M. H., & Yadegaridehkordi, E. (2021). Factors impacting consumers' intention toward adoption of electric vehicles in Malaysia. *Journal of Cleaner Production*, *282*, 124474.
- Asadi, S., Pourhashemi, S. O., Nilashi, M., Abdullah, R., Samad, S., Yadegaridehkordi, E., Aljojo, N., & Razali, N. S. (2020). Investigating influence of green innovation on sustainability performance: A case on Malaysian hotel industry. *Journal of Cleaner Production*, *258*, 120860.
- Baabdullah, A. M. (2018a). Consumer adoption of Mobile Social Network Games (M-SNGs) in Saudi Arabia: The role of social influence, hedonic motivation and trust. *Technology in Society*, *53*, 91–102.
- Baishya, K., & Samalia, H. V. (2020a). Extending unified theory of acceptance and use of technology with perceived monetary value for smartphone adoption at the bottom of the pyramid. *International Journal of Information Management*, *51*, 102036.
- Bashir, S., Khwaja, M. G., Rashid, Y., Turi, J. A., & Waheed, T. (2020). Green brand benefits and brand outcomes: The mediating role of green brand image. *Sage Open*, *10*(3), 2158244020953156.
- Bauer, G. S., Greenblatt, J. B., & Gerke, B. F. (2018). Cost, energy, and environmental impact of automated electric taxi fleets in Manhattan. *Environmental Science & Technology*, *52*(8), 4920–4928.

- Blau, H. (1964). *The impossible theater: A manifesto*. Macmillan.
- Bockarjova, M., & Steg, L. (2014). Can Protection Motivation Theory predict pro-environmental behavior? Explaining the adoption of electric vehicles in the Netherlands. *Global Environmental Change*, *28*, 276–288.
- Bouguerra, S., & Layeb, S. B. (2019). Determining optimal deployment of electric vehicles charging stations: Case of Tunis City, Tunisia. *Case Studies on Transport Policy*, *7*(3), 628–642.
- Brenner, L., & Meyll, T. (2020). Robo-advisors: A substitute for human financial advice? *Journal of Behavioral and Experimental Finance*, *25*, 100275.
- Bridi, R. M., Jabra, M. B., & Hosani, N. A. (2022). An Examination of Consumers' Opinions toward Adopting Electric Vehicles in the United Arab Emirates: On the Effects of Functional and Symbolic Values. *Energies*, *15*(16), 6068.
- Brown, M., Pope, N., & Voges, K. (2003). Buying or browsing? An exploration of shopping orientations and online purchase intention. *European Journal of Marketing*.
- Buhmann, K. M., & Criado, J. R. (2023). Consumers' preferences for electric vehicles: The role of status and reputation. *Transportation Research Part D: Transport and Environment*, *114*, 103530.
<https://www.sciencedirect.com/science/article/pii/S136192092200356X>
- Bujang, M. A., Omar, E. D., Foo, D. H. P., & Hon, Y. K. (2024). Sample size determination for conducting a pilot study to assess reliability of a questionnaire. *Restorative Dentistry & Endodontics*, *49*(1).
<https://synapse.koreamed.org/articles/1516086380>

- Burns, A., & Bush, R. (2003). *Marketing research: Online research application*. New Jersey: Prentice Hall.
- Burra, L. T., Al-Khasawneh, M. B., & Cirillo, C. (2024). Impact of charging infrastructure on electric vehicle adoption: A synthetic population approach. *Travel Behaviour and Society*, 37, 100834.
<https://www.sciencedirect.com/science/article/pii/S2214367X24000978>
- Butler Jr, J. K. (1991). Toward understanding and measuring conditions of trust: Evolution of a conditions of trust inventory. *Journal of Management*, 17(3), 643–663.
- Cabrera-Sánchez, J.-P., & Villarejo-Ramos, Á. F. (2020). Acceptance and use of big data techniques in services companies. *Journal of Retailing and Consumer Services*, 52, 101888.
- Carley, S., Krause, R. M., Lane, B. W., & Graham, J. D. (2013). Intent to purchase a plug-in electric vehicle: A survey of early impressions in large US cities. *Transportation Research Part D: Transport and Environment*, 18, 39–45.
- Cavallaro, F., Costa, C., De Biasi, I., Fabio, A., & Nocera, S. (2024). Sustainable pathways for mitigating externalities in long-distance terrestrial transport. *Transport Policy*.
<https://www.sciencedirect.com/science/article/pii/S0967070X24001513>
- Chandra, A., Gulati, S., & Kandlikar, M. (2010). Green drivers or free riders? An analysis of tax rebates for hybrid vehicles. *Journal of Environmental Economics and Management*, 60(2), 78–93.
- Chang, C.-H., & Chen, Y.-S. (2014). Managing green brand equity: The perspective of perceived risk theory. *Quality & Quantity*, 48(3), 1753–1768.

- Chaouali, W., Yahia, I. B., & Souiden, N. (2016). The interplay of counter-conformity motivation, social influence, and trust in customers' intention to adopt Internet banking services: The case of an emerging country. *Journal of Retailing and Consumer Services*, 28, 209–218.
- Chemingui, H. (2013). Resistance, motivations, trust and intention to use mobile financial services. *International Journal of Bank Marketing*, 31(7), 574–592.
- Chen, Y.-S. (2013). Towards green loyalty: Driving from green perceived value, green satisfaction, and green trust. *Sustainable Development*, 21(5), 294–308.
- Chen, Y.-S., & Chang, C.-H. (2012). Enhance green purchase intentions: The roles of green perceived value, green perceived risk, and green trust. *Management Decision*.
- Chen, Y.-S., Lin, C.-Y., & Weng, C.-S. (2015). The influence of environmental friendliness on green trust: The mediation effects of green satisfaction and green perceived quality. *Sustainability*, 7(8), Article 8.
- Cheng, Z., Luo, L., Wang, S., Wang, Y., Sharma, S., Shimadera, H., Wang, X., Bressi, M., de Miranda, R. M., & Jiang, J. (2016). Status and characteristics of ambient PM2.5 pollution in global megacities. *Environment International*, 89, 212–221.
- Choi, Y. G., & Hyun, S. S. (2017). Relationships between brand experiences, personality traits, prestige, relationship quality, and loyalty: An empirical analysis of coffeehouse brands. *International Journal of Contemporary Hospitality Management*.
- Coad, A., De Haan, P., & Woersdorfer, J. S. (2009). Consumer support for environmental policies: An application to purchases of green cars. *Ecological Economics*, 68(7), 2078–2086.

- Comrey, A. L., & Lee, H. B. (1992). Interpretation and application of factor analytic results. *Comrey AL, Lee HB. A First Course in Factor Analysis, 2, 1992.*
- Cooper, D. R., Schindler, P. S., & Sun, J. (2006). *Business research methods (Vol. 9).* McGraw-Hill Irwin New York.
- Cooper, N. P., & Guinan, J. J. (2006). Efferent-mediated control of basilar membrane motion. *The Journal of Physiology, 576(1), 49–54.*
- Creswell, J. W. (2013). Araştırma deseni. *Ankara: Eğiten Kitap.*
- Creswell, J. W., Plano Clark, V. L., Gutmann, M. L., & Hanson, W. E. (2003). Advanced mixed methods research designs. *Handbook of Mixed Methods in Social and Behavioral Research, 209, 240.*
- Cruz, S. M., & Manata, B. (2020). Measurement of environmental concern: A review and analysis. *Frontiers in Psychology, 11, 363.*
- Curtale, R., Liao, F., & Rebalski, E. (2022a). Transitional behavioral intention to use autonomous electric car-sharing services: Evidence from four European countries. *Transportation Research Part C: Emerging Technologies, 135, 103516.*
- Curtale, R., Liao, F., & Rebalski, E. (2022b). Transitional behavioral intention to use autonomous electric car-sharing services: Evidence from four European countries. *Transportation Research Part C: Emerging Technologies, 135, 103516.*
- Curtale, R., Liao, F., & van der Waerden, P. (2021). User acceptance of electric car-sharing services: The case of the Netherlands. *Transportation Research Part A: Policy and Practice, 149, 266–282.*

- Davis, F. D., Bagozzi, R. P., & Warshaw, P. R. (1989). User acceptance of computer technology: A comparison of two theoretical models. *Management Science*, 35(8), 982–1003.
- de Oliveira, M. B., da Silva, H. M. R., Jugend, D., Fiorini, P. D. C., & Paro, C. E. (2022). Factors influencing the intention to use electric cars in Brazil. *Transportation Research Part A: Policy and Practice*, 155, 418–433.
- De Palma, A., Lindsey, R., Quinet, E., & Vickerman, R. (2011). *A handbook of transport economics*. Edward Elgar Publishing.
- Degirmenci, K., & Breitner, M. H. (2017). Consumer purchase intentions for electric vehicles: Is green more important than price and range? *Transportation Research Part D: Transport and Environment*, 51, 250–260.
- Demir, A., Budur, T., & Heshmati, A. (2021). Antecedents of trust, corporate image, and switching costs: A case in telecommunication services in the Kurdistan region of Iraq. *International Journal of Mobile Communications*, 19(1), Article 1.
- Deutsch, M. (1960). The effect of motivational orientation upon trust and suspicion. *Human Relations*, 13(2), 123–139.
- Diamond, D. (2009). The impact of government incentives for hybrid-electric vehicles: Evidence from US states. *Energy Policy*, 37(3), Article 3.
- do Paço, A., Alves, H., Shiel, C., & Filho, W. L. (2013a). Development of a green consumer behaviour model. *International Journal of Consumer Studies*, 37(4), 414–421.
- Doll, W. J., Xia, W., & Torkzadeh, G. (1994). A confirmatory factor analysis of the end-user computing satisfaction instrument. *MIS Quarterly*, 453–461.

- Dong, J., Liu, C., & Lin, Z. (2014). Charging infrastructure planning for promoting battery electric vehicles: An activity-based approach using multiday travel data. *Transportation Research Part C: Emerging Technologies*, 38, 44–55.
- Dwivedi, Y. K., Khan, N., & Papazafeiropoulou, A. (2007). Consumer adoption and usage of broadband in Bangladesh. *Electronic Government, an International Journal*, 4(3), 299–313.
- Dwivedi, Y. K., Rana, N. P., Jeyaraj, A., Clement, M., & Williams, M. D. (2019). Re-examining the unified theory of acceptance and use of technology (UTAUT): Towards a revised theoretical model. *Information Systems Frontiers*, 21(3), 719–734.
- Dwivedi, Y. K., & Weerakkody, V. (2007). Examining the factors affecting the adoption of broadband in the Kingdom of Saudi Arabia. *Electronic Government, an International Journal*, 4(1), 43–58.
- Efthymiou, D., Chrysostomou, K., Morfoulaki, M., & Aifantopoulou, G. (2017). Electric vehicles charging infrastructure location: A genetic algorithm approach. *European Transport Research Review*, 9(2), 1–9.
- Fairbrother, M., Sevä, I. J., & Kulin, J. (2019). Political trust and the relationship between climate change beliefs and support for fossil fuel taxes: Evidence from a survey of 23 European countries. *Global Environmental Change*, 59, 102003.
- Fernandes, T., & Calamote, A. (2016). Unfairness in consumer services: Outcomes of differential treatment of new and existing clients. *Journal of Retailing and Consumer Services*, 28, 36–44.

- Fishbein, M., & Ajzen, I. (1975). *Belief, attitude, intention and behavior: An introduction to theory and research*.
- Fishbein, M., Jaccard, J., Davidson, A. R., Ajzen, I., & Loken, B. (1980). Predicting and understanding family planning behaviors. In *Understanding attitudes and predicting social behavior*. Prentice Hall.
- Fornell, C., & Larcker, D. F. (1981). *Structural equation models with unobservable variables and measurement error: Algebra and statistics*. Sage Publications Sage CA: Los Angeles, CA.
- Foxman, E. R., Berger, P. W., & Cote, J. A. (1992). Consumer brand confusion: A conceptual framework. *Psychology & Marketing*, 9(2), 123–141.
- Gan, Y., Liang, C., Wang, X., & McConkey, B. (2011). Lowering carbon footprint of durum wheat by diversifying cropping systems. *Field Crops Research*, 122(3), 199–206.
- Gefen, D., Karahanna, E., & Straub, D. W. (2003). Trust and TAM in online shopping: An integrated model. *MIS Quarterly*, 51–90.
- Gorenflo, C., Golab, L., & Keshav, S. (2019a). Mitigating trust issues in electric vehicle charging using a blockchain. *Proceedings of the Tenth ACM International Conference on Future Energy Systems*, 160–164.
- Gorenflo, C., Golab, L., & Keshav, S. (2019b). Mitigating trust issues in electric vehicle charging using a blockchain. *Proceedings of the Tenth ACM International Conference on Future Energy Systems*, 160–164.

- Gorton, M., Tocco, B., Yeh, C.-H., & Hartmann, M. (2021). What determines consumers' use of eco-labels? Taking a close look at label trust. *Ecological Economics*, *189*, 107173.
- Goswami, A., & Sadhu, P. K. (2021). Stochastic firefly algorithm enabled fast charging of solar hybrid electric vehicles. *Ain Shams Engineering Journal*, *12*(1), 529–539.
- Groeneveld, R. A., & Meeden, G. (1984). Measuring skewness and kurtosis. *Journal of the Royal Statistical Society: Series D (The Statistician)*, *33*(4), 391–399.
- Grunert, S. C., & Juhl, H. J. (1995). Values, environmental attitudes, and buying of organic foods. *Journal of Economic Psychology*, *16*(1), 39–62.
- Gu, Z., Wei, J., & Xu, F. (2016). An empirical study on factors influencing consumers' initial trust in wearable commerce. *Journal of Computer Information Systems*, *56*(1), 79–85.
- Gunawan, I., Redi, A. A. N. P., Santosa, A. A., Maghfiroh, M. F. N., Pandyaswargo, A. H., & Kurniawan, A. C. (2022). Determinants of Customer Intentions to Use Electric Vehicle in Indonesia: An Integrated Model Analysis. *Sustainability*, *14*(4), 1972.
- Hagman, J., & Langbroek, J. H. (2019). Conditions for electric vehicle taxi: A case study in the Greater Stockholm region. *International Journal of Sustainable Transportation*, *13*(6), 450–459.
- Han, C. S., Hsu, Y. M., & Hsu, H. J. (2024). Charging forward: unveiling the dynamics of consumer EV adoption in Asia's transition to green mobility. *Asia Pacific Journal of Marketing and Logistics*.

- Han, L., Wang, S., Zhao, D., & Li, J. (2017). The intention to adopt electric vehicles: Driven by functional and non-functional values. *Transportation Research Part A: Policy and Practice*, *103*, 185–197.
- Hanif, M., Hafeez, S., & Riaz, A. (2010). Factors affecting customer satisfaction. *International Research Journal of Finance and Economics*, *60*(1), 44–52.
- Hao, X., Zhou, Y., Wang, H., & Ouyang, M. (2020). Plug-in electric vehicles in China and the USA: A technology and market comparison. *Mitigation and Adaptation Strategies for Global Change*, *25*(3), 329–353.
- Hardman, S. (2019). Understanding the impact of reoccurring and non-financial incentives on plug-in electric vehicle adoption—a review. *Transportation Research Part A: Policy and Practice*, *119*, 1–14.
- Haustein, S., & Hunecke, M. (2007). Reduced use of environmentally friendly modes of transportation caused by perceived mobility necessities: An extension of the theory of planned behavior 1. *Journal of Applied Social Psychology*, *37*(8), 1856–1883.
- Haustein, S., & Jensen, A. F. (2018). Factors of electric vehicle adoption: A comparison of conventional and electric car users based on an extended theory of planned behavior. *International Journal of Sustainable Transportation*, *12*(7), Article 7.
- He, X., & Hu, Y. (2022). Understanding the role of emotions in consumer adoption of electric vehicles: The mediating effect of perceived value. *Journal of Environmental Planning and Management*, *65*(1), 84–104.
- He, X., & Zhan, W. (2018). How to activate moral norm to adopt electric vehicles in China? An empirical study based on extended norm activation theory. *Journal of Cleaner Production*, *172*, 3546–3556.

- Hinkin, T. R. (1995). A review of scale development practices in the study of organizations. *Journal of Management, 21*(5), 967–988.
- Hoen, A., & Koetse, M. J. (2014). A choice experiment on alternative fuel vehicle preferences of private car owners in the Netherlands. *Transportation Research Part A: Policy and Practice, 61*, 199–215.
- Homburg, C., & Baumgartner, H. (1995). Beurteilung von Kausalmodellen. Bestandsaufnahme und Anwendungsempfehlungen. *Marketing ZfP, 17*(3), 162–176.
- Hu, Y., Wang, Z., & Li, X. (2020). Impact of policies on electric vehicle diffusion: An evolutionary game of small world network analysis. *Journal of Cleaner Production, 265*, 121703.
- Huang, X., & Ge, J. (2019). Electric vehicle development in Beijing: An analysis of consumer purchase intention. *Journal of Cleaner Production, 216*, 361–372.
- Jain, N. K., Bhaskar, K., & Jain, S. (2022a). What drives adoption intention of electric vehicles in India? An integrated UTAUT model with environmental concerns, perceived risk and government support. *Research in Transportation Business & Management, 42*, 100730.
- Jain, N. K., Bhaskar, K., & Jain, S. (2022b). What drives adoption intention of electric vehicles in India? An integrated UTAUT model with environmental concerns, perceived risk and government support. *Research in Transportation Business & Management, 42*, 100730.
- Jeaheng, Y., Al-Ansi, A., & Han, H. (2020). Impacts of Halal-friendly services, facilities, and food and Beverages on Muslim travelers' perceptions of service quality

- attributes, perceived price, satisfaction, trust, and loyalty. *Journal of Hospitality Marketing & Management*, 29(7), Article 7.
- Jian, Y., Yu, I. Y., Yang, M. X., & Zeng, K. J. (2020). The impacts of fear and uncertainty of COVID-19 on environmental concerns, brand trust, and behavioral intentions toward green hotels. *Sustainability*, 12(20), 8688.
- Jin, J., Zhao, Q., & Santibanez-Gonzalez, E. D. (2020). How Chinese consumers' intentions for purchasing eco-labeled products are influenced by psychological factors. *International Journal of Environmental Research and Public Health*, 17(1), 265.
- Joshi, N., Malhotra, M., & Singh, J. (2022b). Assessing adoption intention of electric vehicles in India: The mediating role of government policies. *European Journal of Transport and Infrastructure Research*, 22(1), 1–16.
- Kapoor, S., Sharma, H., Singh, M., Kumar, P., Ranjan, K., Kumari, A., & Khirbat, R. (2014). Equine herpesviruses: A brief review. *Nine*, 2014, 06–25.
- Kapser, S., Abdelrahman, M., & Bernecker, T. (2021). Autonomous delivery vehicles to fight the spread of Covid-19—How do men and women differ in their acceptance? *Transportation Research Part A: Policy and Practice*, 148, 183–198.
- Karolemeas, C., Tsigdinos, S., Tzouras, P. G., Nikitas, A., & Bakogiannis, E. (2021). Determining electric vehicle charging station location suitability: A qualitative study of greek stakeholders employing thematic analysis and analytical hierarchy process. *Sustainability*, 13(4), 2298.
- Khalid, M. R., Khan, I. A., Hameed, S., Asghar, M. S. J., & Ro, J.-S. (2021). A comprehensive review on structural topologies, power levels, energy storage

systems, and standards for electric vehicle charging stations and their impacts on grid. *IEEE Access*, 9, 128069–128094.

Khazaei, H. (2019a). The datasets of factors influencing adoption of electric cars in Malaysia: A structural equation modelling (SEM) analysis. *Data in Brief*, 27, 104644.

Khazaei, H., & Tareq, M. A. (2021a). Moderating effects of personal innovativeness and driving experience on factors influencing adoption of BEVs in Malaysia: An integrated SEM–BSEM approach. *Heliyon*, 7(9), e08072.

Kilbourne, W., & Pickett, G. (2008). How materialism affects environmental beliefs, concern, and environmentally responsible behavior. *Journal of Business Research*, 61(9), 885–893.

Kim, J. (2019). The impact of different price promotions on customer retention. *Journal of Retailing and Consumer Services*, 46, 95–102.

Kim, J. P., & Song, E. (2018). The effects of BlockChain technology benefits on acceptance intentions of BlockChain insurance services: Based on the UTAUT mode. *Journal of Information Technology Services*, 17(4), 163–189.

Kim, J., Rasouli, S., & Timmermans, H. (2014). Expanding scope of hybrid choice models allowing for mixture of social influences and latent attitudes: Application to intended purchase of electric cars. *Transportation Research Part A: Policy and Practice*, 69, 71–85.

Kline, R. B. (2005). Principles and practice of structural equation modeling The Guilford Press. New York.

- Klößner, C. A., & Matthies, E. (2004). How habits interfere with norm-directed behaviour: A normative decision-making model for travel mode choice. *Journal of Environmental Psychology, 24*(3), 319–327.
- Kongklaew, C., Phoungthong, K., Prabpayak, C., Chowdhury, M. S., Khan, I., Yuangyai, N., Yuangyai, C., & Techato, K. (2021). Barriers to Electric Vehicle Adoption in Thailand. *Sustainability, 13*(22), 12839.
- Konuk, F. A. (2018). Price fairness, satisfaction, and trust as antecedents of purchase intentions towards organic food. *Journal of Consumer Behaviour, 17*(2), 141–148.
- Koo, C., Chung, N., & Nam, K. (2015). Assessing the impact of intrinsic and extrinsic motivators on smart green IT device use: Reference group perspectives. *International Journal of Information Management, 35*(1), 64–79.
- Kumar, P., & Ghodeswar, B. M. (2015). Factors affecting consumers' green product purchase decisions. *Marketing Intelligence & Planning, 33*(3), 330–347.
- Lam, K. H., To, W. M., & Lee, P. K. (2023). Smart Building Management System (SBMS) for Commercial Buildings—Key Attributes and Usage Intentions from Building Professionals' Perspective. *Sustainability, 15*(1), 80.
- Larson, P. D., Viáfara, J., Parsons, R. V., & Elias, A. (2014). Consumer attitudes about electric cars: Pricing analysis and policy implications. *Transportation Research Part A: Policy and Practice, 69*, 299–314.
- Laufer, W. S. (2003). Social accountability and corporate greenwashing. *Journal of Business Ethics, 43*(3), 253–261.

- Leicht, T., Chtourou, A., & Youssef, K. B. (2018). Consumer innovativeness and intentioned autonomous car adoption. *The Journal of High Technology Management Research*, 29(1), 1–11.
- Lévay, P. Z., Drossinos, Y., & Thiel, C. (2017). The effect of fiscal incentives on market penetration of electric vehicles: A pairwise comparison of total cost of ownership. *Energy Policy*, 105, 524–533.
- Li, W., Long, R., Chen, H., & Geng, J. (2017a). A review of factors influencing consumer intentions to adopt battery electric vehicles. *Renewable and Sustainable Energy Reviews*, 78, 318–328.
- Li, W., Long, R., Chen, H., & Geng, J. (2017b). Household factors and adopting intention of battery electric vehicles: A multi-group structural equation model analysis among consumers in Jiangsu Province, China. *Natural Hazards*, 87(2), 945–960.
- Liébana-Cabanillas, F., Marinković, V., & Kalinić, Z. (2017). A SEM-neural network approach for predicting antecedents of m-commerce acceptance. *International Journal of Information Management*, 37(2), 14–24.
- Lin, B., & Wu, W. (2018). Why people want to buy electric vehicle: An empirical study in first-tier cities of China. *Energy Policy*, 112, 233–241.
- Lin, Z., & Greene, D. L. (2011). Promoting the market for plug-in hybrid and battery electric vehicles: Role of recharge availability. *Transportation Research Record*, 2252(1), 49–56.
- Lowry, P. B., & Gaskin, J. (2014a). Partial least squares (PLS) structural equation modeling (SEM) for building and testing behavioral causal theory: When to choose

- it and how to use it. *IEEE Transactions on Professional Communication*, 57(2), 123–146. <https://ieeexplore.ieee.org/abstract/document/6803892/>
- Lu, J., Yu, C.-S., & Liu, C. (2005). Facilitating conditions, wireless trust and adoption intention. *Journal of Computer Information Systems*, 46(1), 17–24.
- MacCallum, R. C., Browne, M. W., & Sugawara, H. M. (1996). Power analysis and determination of sample size for covariance structure modeling. *Psychological Methods*, 1(2), 130.
- Magnusson, M. K., Arvola, A., Hursti, U.-K. K., Åberg, L., & Sjöden, P.-O. (2003). Choice of organic foods is related to perceived consequences for human health and to environmentally friendly behaviour. *Appetite*, 40(2), 109–117.
- Maniatis, P. (2016). Investigating factors influencing consumer decision-making while choosing green products. *Journal of Cleaner Production*, 132, 215–228.
- Manutworakit, P., & Choocharukul, K. (2022). Factors Influencing Battery Electric Vehicle Adoption in Thailand—Expanding the Unified Theory of Acceptance and Use of Technology’s Variables. *Sustainability*, 14(14), 8482.
- Martin, W. C., Ponder, N., & Lueg, J. E. (2009a). Price fairness perceptions and customer loyalty in a retail context. *Journal of Business Research*, 62(6), 588–593.
- Martin, W. C., Ponder, N., & Lueg, J. E. (2009b). Price fairness perceptions and customer loyalty in a retail context. *Journal of Business Research*, 62(6), Article 6.
- Michaelidou, N., & Hassan, L. M. (2008). The role of health consciousness, food safety concern and ethical identity on attitudes and intentions towards organic food. *International Journal of Consumer Studies*, 32(2), 163–170.

- Mohamed, M., Ferguson, M., & Kanaroglou, P. (2018). What hinders adoption of the electric bus in Canadian transit? Perspectives of transit providers. *Transportation Research Part D: Transport and Environment*, 64, 134–149.
- Mohammed, L., Niesten, E., & Gagliardi, D. (2020). Adoption of alternative fuel vehicle fleets—a theoretical framework of barriers and enablers. *Transportation Research Part D: Transport and Environment*, 88, 102558.
- Moons, I., & De Pelsmacker, P. (2015). An extended decomposed theory of planned behaviour to predict the usage intention of the electric car: A multi-group comparison. *Sustainability*, 7(5), 6212–6245.
- Moorman, C., Zaltman, G., & Deshpande, R. (1992). Relationships between providers and users of market research: The dynamics of trust within and between organizations. *Journal of Marketing Research*, 29(3), 314–328.
- Morgan, R. M., & Hunt, S. D. (1994). The commitment-trust theory of relationship marketing. *Journal of Marketing*, 58(3), 20–38.
- Morrissey, P., Weldon, P., & O'Mahony, M. (2016). Future standard and fast charging infrastructure planning: An analysis of electric vehicle charging behaviour. *Energy Policy*, 89, 257–270.
- Morton, C., Lovelace, R., & Anable, J. (2017). Exploring the effect of local transport policies on the adoption of low emission vehicles: Evidence from the London Congestion Charge and Hybrid Electric Vehicles. *Transport Policy*, 60, 34–46.
- Mouhy-Ud-Din, M. A., Azeem, F., Memon, Z., & Arshad, J. (2024). Comparative techno-economic assessment of electric vehicle charging preferences: A quantitative study

- for sustainable EV policy in Pakistan. *Energy for Sustainable Development*, 78, 101355. <https://www.sciencedirect.com/science/article/pii/S0973082623002120>
- Murugan, M., & Marisamynathan, S. (2024). Policy analysis for sustainable EV charging facility adoption using SEM-ANN approach. *Transportation Research Part A: Policy and Practice*, 182, 104036. <https://www.sciencedirect.com/science/article/pii/S0965856424000843>
- Ng, M., Law, M., & Zhang, S. (2018a). Predicting purchase intention of electric vehicles in Hong Kong. *Australasian Marketing Journal (AMJ)*, 26(3), 272–280.
- Nguyen, D. M., Kishk, M. A., & Alouini, M.-S. (2024). Dynamic charging as a complementary approach in modern EV charging infrastructure. *Scientific Reports*, 14(1), 5785. <https://www.nature.com/articles/s41598-024-55863-3>
- Palau-Saumell, R., Forgas-Coll, S., Sánchez-García, J., & Robres, E. (2019). User acceptance of mobile apps for restaurants: An expanded and extended UTAUT-2. *Sustainability*, 11(4), 1210.
- Pappas, N. (2017). Effect of marketing activities, benefits, risks, confusion due to over-choice, price, quality and consumer trust on online tourism purchasing. *Journal of Marketing Communications*, 23(2), 195–218.
- Pavlou, P. A. (2003). Consumer acceptance of electronic commerce: Integrating trust and risk with the technology acceptance model. *International Journal of Electronic Commerce*, 7(3), 101–134.
- Peters, A., & Dütschke, E. (2014). How do consumers perceive electric vehicles? A comparison of German consumer groups. *Journal of Environmental Policy & Planning*, 16(3), 359–377.

- Prospects, U. W. (2014). United Nation. <https://www.un.org/en/development/desa/publications/2014-revision-world-urbanization-prospects.html>
- Queiroz, M. M., & Wamba, S. F. (2019). Blockchain adoption challenges in supply chain: An empirical investigation of the main drivers in India and the USA. *International Journal of Information Management*, *46*, 70–82.
- Qureshi, F. N., Bashir, S., Mahmood, A., Ahmad, S., Attiq, S., & Zeeshan, M. (2022). Impact of internal brand management on sustainable competitive advantage: An explanatory study based on the mediating roles of brand commitment and brand citizenship behavior. *Plos One*, *17*(3), e0264379.
- Raimi, K. T., & Leary, M. R. (2014). Belief superiority in the environmental domain: Attitude extremity and reactions to fracking. *Journal of Environmental Psychology*, *40*, 76–85.
- Ramírez-Correa, P., Rondán-Cataluña, F. J., Arenas-Gaitán, J., & Martín-Velicia, F. (2019). Analysing the acceptance of online games in mobile devices: An application of UTAUT2. *Journal of Retailing and Consumer Services*, *50*, 85–93.
- Ratnasingam, P. (2004). The role of facilitating conditions in developing trust for successful electronic marketplace participation. *Journal of Internet Commerce*, *3*(3), 95–110.
- Rehman, A. U., Bashir, S., Mahmood, A., Karim, H., & Nawaz, Z. (2022a). Does e-shopping service quality enhance customers'e-shopping adoption? An extended perspective of unified theory of acceptance and use of technology. *Plos One*, *17*(2), e0263652.

- Rehman, A. U., Bashir, S., Mahmood, A., Karim, H., & Nawaz, Z. (2022b). Does e-shopping service quality enhance customers' e-shopping adoption? An extended perspective of unified theory of acceptance and use of technology. *Plos One*, *17*(2), Article 2.
- Rezvani, Z., Jansson, J., & Bengtsson, M. (2017). Cause I'll feel good! An investigation into the effects of anticipated emotions and personal moral norms on consumer pro-environmental behavior. *Journal of Promotion Management*, *23*(1), 163–183.
- Rezvani, Z., Jansson, J., & Bengtsson, M. (2018). Consumer motivations for sustainable consumption: The interaction of gain, normative and hedonic motivations on electric vehicle adoption. *Business Strategy and the Environment*, *27*(8), Article 8.
- Riffai, M., Grant, K., & Edgar, D. (2012). Big TAM in Oman: Exploring the promise of on-line banking, its adoption by customers and the challenges of banking in Oman. *International Journal of Information Management*, *32*(3), 239–250.
- Sabri, M. F. M., Danapalasingam, K. A., & Rahmat, M. F. (2016). A review on hybrid electric vehicles architecture and energy management strategies. *Renewable and Sustainable Energy Reviews*, *53*, 1433–1442.
- Sang, Y.-N., & Bekhet, H. A. (2015). Modelling electric vehicle usage intentions: An empirical study in Malaysia. *Journal of Cleaner Production*, *92*, 75–83.
- Sargeant, A., & Lee, S. (2004). Trust and relationship commitment in the United Kingdom voluntary sector: Determinants of donor behavior. *Psychology & Marketing*, *21*(8), 613–635.
- Sarstedt, M., Ringle, C. M., Henseler, J., & Hair, J. F. (2014). On the emancipation of PLS-SEM: A commentary on Rigdon (2012). *Long Range Planning*, *47*(3), 154–160.

- Savari, G. F., Sathik, M. J., Raman, L. A., El-Shahat, A., Hasanien, H. M., Almakhles, D., Aleem, S. H. A., & Omar, A. I. (2022). Assessment of charging technologies, infrastructure and charging station recommendation schemes of electric vehicles: A review. *Ain Shams Engineering Journal*, 101938.
- Schill, M., Godefroit-Winkel, D., Diallo, M. F., & Barbarossa, C. (2019). Consumers' intentions to purchase smart home objects: Do environmental issues matter? *Ecological Economics*, 161, 176–185.
- Sekaran, U., & Bougie, J. R. G. (2009). *Research Methods for Business: A Skill Building Approach*.
- Sellmair, R., & Schelo, T. (2019). Analysis of the effect of charging infrastructure design on electric taxi driving profiles: A case study approach on the example of Singapore. *International Journal of Sustainable Transportation*, 13(7), 479–496.
- Shakeel, U. (2022). Electric vehicle development in Pakistan: Predicting consumer purchase intention. *Cleaner and Responsible Consumption*, 5, 100065.
- Shetty, A., & Rizwana, M. (2024). Sustainable mobility perspectives: exploring the impact of UTAUT2 model on fostering electric vehicle adoption in India. *Management of Environmental Quality: An International Journal*.
- Silvia, C., & Krause, R. M. (2016). Assessing the impact of policy interventions on the adoption of plug-in electric vehicles: An agent-based model. *Energy Policy*, 96, 105–118.
- Simsekoglu, Ö., & Nayum, A. (2019). Predictors of intention to buy a battery electric vehicle among conventional car drivers. *Transportation Research Part F: Traffic Psychology and Behaviour*, 60, 1–10.

- Singh, H., Singh, V., Singh, T., & Higuera-Castillo, E. (2023). Electric vehicle adoption intention in the Himalayan region using UTAUT2–NAM model. *Case Studies on Transport Policy*, *11*, 100946.
- Singh, V., Singh, T., Higuera-Castillo, E., & Liebana-Cabanillas, F. J. (2023). Sustainable road transportation adoption research: A meta and weight analysis, and moderation analysis. *Journal of Cleaner Production*, *392*, 136276.
<https://www.sciencedirect.com/science/article/pii/S0959652623004341>
- Siragusa, C., Tumino, A., Mangiaracina, R., & Perego, A. (2022). Electric vehicles performing last-mile delivery in B2C e-commerce: An economic and environmental assessment. *International Journal of Sustainable Transportation*, *16*(1), 22–33.
- Sirdeshmukh, D., Singh, J., & Sabol, B. (2002). Consumer trust, value, and loyalty in relational exchanges. *Journal of Marketing*, *66*(1), 15–37.
- Smith, J. B., & Barclay, D. W. (1997). The effects of organizational differences and trust on the effectiveness of selling partner relationships. *Journal of Marketing*, *61*(1), 3–21.
- Statistics, H. W. (2016). World Health Organization. <https://www.who.int/docs/default-source/gho-documents/world-health-statistic-reports/world-health-statistics-2016.pdf>
- Stern, P. C., & Dietz, T. (1994a). The value basis of environmental concern. *Journal of Social Issues*, *50*(3), 65–84.
- Stern, P. C., & Dietz, T. (1994b). The value basis of environmental concern. *Journal of Social Issues*, *50*(3), Article 3.

- Stokes, L. C., & Breetz, H. L. (2018). Politics in the US energy transition: Case studies of solar, wind, biofuels and electric vehicles policy. *Energy Policy*, *113*, 76–86.
- Sung, H.-N., Jeong, D.-Y., Jeong, Y.-S., & Shin, J.-I. (2015). The relationship among self-efficacy, social influence, performance expectancy, effort expectancy, and behavioral intention in mobile learning service. *International Journal of U-and e-Service, Science and Technology*, *8*(9), 197–206.
- Tamilmani, K., Rana, N. P., Prakasam, N., & Dwivedi, Y. K. (2019). The battle of Brain vs. Heart: A literature review and meta-analysis of “hedonic motivation” use in UTAUT2. *International Journal of Information Management*, *46*, 222–235.
- Tamilmani, K., Rana, N. P., Wamba, S. F., & Dwivedi, R. (2021). The extended Unified Theory of Acceptance and Use of Technology (UTAUT2): A systematic literature review and theory evaluation. *International Journal of Information Management*, *57*, 102269.
- Techa-Erawan, T., Ratisukpimol, W., & Bunditsakulchai, P. (2024). The Analysis of Consumer Preference on EV Adoption Barriers and Policy Stimulations in Thailand. *International Journal of Energy Economics and Policy*, *14*(4), 160–168. <https://econjournals.net.tr/index.php/ijeep/article/view/15987>
- Teddlie, C., & Yu, F. (2007). Mixed methods sampling: A typology with examples. *Journal of Mixed Methods Research*, *1*(1), 77–100.
- Thananusak, T., Punnakitikashem, P., Tanthasith, S., & Kongarchapatara, B. (2020). The development of electric vehicle charging stations in Thailand: Policies, players, and key issues (2015–2020). *World Electric Vehicle Journal*, *12*(1), 2. <https://www.mdpi.com/2032-6653/12/1/2>

- Thanatrakolsri, P., & Sirithian, D. (2024). Assessing the Additional Benefits of Thailand's Approaches to Reduce Motor Vehicle Emissions. *Energies*, *17*(10), 2336. <https://www.mdpi.com/1996-1073/17/10/2336>
- Tjernström, E., & Tietenberg, T. (2008). Do differences in attitudes explain differences in national climate change policies? *Ecological Economics*, *65*(2), 315–324.
- Trinko, D., Horesh, N., Zane, R., Song, Z., Kamineni, A., Konstantinou, T., Gkritza, K., Quinn, C., Bradley, T. H., & Quinn, J. C. (2022). Economic feasibility of in-motion wireless power transfer in a high-density traffic corridor. *eTransportation*, *11*, 100154.
- Trochim, W. M. (2006). *Units of analysis*.
- Tu, J.-C., & Yang, C. (2019). Key factors influencing consumers' purchase of electric vehicles. *Sustainability*, *11*(14), 3863.
- Ullah, N. (2019). Electric vehicles in Pakistan: Policy recommendations volume I cars. *Energy Inst., Lahore Univ. Manage. Sci., Lahore, Pakistan, Tech. Rep.*
- Usmani, O. A. (2015). *Policy recommendations and stakeholder actions towards effective integration of EVs in the EU*.
- Vairetti, C., González-Ramírez, R. G., Maldonado, S., Álvarez, C., & Voß, S. (2019). Facilitating conditions for successful adoption of inter-organizational information systems in seaports. *Transportation Research Part A: Policy and Practice*, *130*, 333–350.
- Vallerand, R. J. (1997). Toward a hierarchical model of intrinsic and extrinsic motivation. *Advances in Experimental Social Psychology*, *29*, 271–360.

- Van der Heijden, H. (2004). User acceptance of hedonic information systems. *MIS Quarterly*, 695–704.
- Van der Heijden, H., Verhagen, T., & Creemers, M. (2003). Understanding online purchase intentions: Contributions from technology and trust perspectives. *European Journal of Information Systems*, 12(1), 41–48.
- Van Vliet, O., Brouwer, A. S., Kuramochi, T., van Den Broek, M., & Faaij, A. (2011). Energy use, cost and CO2 emissions of electric cars. *Journal of Power Sources*, 196(4), 2298–2310.
- Vassileva, I., & Campillo, J. (2017). Adoption barriers for electric vehicles: Experiences from early adopters in Sweden. *Energy*, 120, 632–641.
- Venkatesh, V., Morris, M. G., Davis, G. B., & Davis, F. D. (2003a). User acceptance of information technology: Toward a unified view. *MIS Quarterly*, 425–478.
- Venkatesh, V., Thong, J. Y., & Xu, X. (2012). Consumer acceptance and use of information technology: Extending the unified theory of acceptance and use of technology. *MIS Quarterly*, 157–178.
- Venkatesh, V., Thong, J. Y., & Xu, X. (2016). Unified theory of acceptance and use of technology: A synthesis and the road ahead. *Journal of the Association for Information Systems*, 17(5), 328–376.
- Vražić, M., Vuljaj, D., Pavasović, A., & Pauković, H. (2014). Study of a vehicle conversion from internal combustion engine to electric drive. *2014 IEEE International Energy Conference (ENERGYCON)*, 1544–1548.

- Wakefield, R. L., Stocks, M. H., & Wilder, W. M. (2004). The role of web site characteristics in initial trust formation. *Journal of Computer Information Systems*, 45(1), 94–103.
- Wang, S., & Khan, A. (2024). Exploring the factors driving the sustainable consumer intentions for over-the-air updates in electric vehicles. *Energy Exploration & Exploitation*, 01445987241284101.
- Wang, B., Shen, Y., & Jin, Y. (2017a). Measurement of public awareness of climate change in China: Based on a national survey with 4,025 samples. *Chinese Journal of Population Resources and Environment*, 15(4), 285–291.
- Wang, B., Shen, Y., & Jin, Y. (2017b). Measurement of public awareness of climate change in China: Based on a national survey with 4,025 samples. *Chinese Journal of Population Resources and Environment*, 15(4), Article 4.
- Wang, J., Pham, T. L., & Dang, V. T. (2020). Environmental consciousness and organic food purchase intention: A moderated mediation model of perceived food quality and price sensitivity. *International Journal of Environmental Research and Public Health*, 17(3), 850.
- Wang, S. W., Ngamsiriudom, W., & Hsieh, C.-H. (2015). Trust disposition, trust antecedents, trust, and behavioral intention. *The Service Industries Journal*, 35(10), 555–572.
- Wang, S., Wang, J., Li, J., Wang, J., & Liang, L. (2018). Policy implications for promoting the adoption of electric vehicles: Do consumer's knowledge, perceived risk and financial incentive policy matter? *Transportation Research Part A: Policy and Practice*, 117, 58–69.

- Wang, T., Luo, H., Zeng, X., Yu, Z., Liu, A., & Sangaiyah, A. K. (2020). Mobility based trust evaluation for heterogeneous electric vehicles network in smart cities. *IEEE Transactions on Intelligent Transportation Systems*, 22(3), 1797–1806.
- Wang, Y., Huscroft, J. R., Hazen, B. T., & Zhang, M. (2018). Green information, green certification and consumer perceptions of remanufactured automobile parts. *Resources, Conservation and Recycling*, 128, 187–196.
- Warshaw, P. R. (1980). A new model for predicting behavioral intentions: An alternative to Fishbein. *Journal of Marketing Research*, 17(2), 153–172.
- Weigel, R., & Weigel, J. (1978). Environmental concern: The development of a measure. *Environment and Behavior*, 10(1), 3–15.
- Westbrook, R. A., & Oliver, R. L. (1981). Developing better measures of consumer satisfaction: Some preliminary results. *ACR North American Advances*.
- Wheaton, B., Muthen, B., Alwin, D. F., & Summers, G. F. (1977). Assessing reliability and stability in panel models. *Sociological Methodology*, 8, 84–136.
- White, L. V., & Sintov, N. D. (2017). You are what you drive: Environmentalist and social innovator symbolism drives electric vehicle adoption intentions. *Transportation Research Part A: Policy and Practice*, 99, 94–113.
- Woo, S., Choi, E. Y., Moura, S. J., & Borrelli, F. (2024). Saving energy with eco-friendly routing of an electric vehicle fleet. *Transportation Research Part E: Logistics and Transportation Review*, 189, 103644.
<https://www.sciencedirect.com/science/article/pii/S1366554524002357>

- Wu, D., Gu, H., Gu, S., & You, H. (2021). Individual motivation and social influence: A study of telemedicine adoption in China based on social cognitive theory. *Health Policy and Technology, 10*(3), 100525.
- Wu, J., Liao, H., Wang, J.-W., & Chen, T. (2019). The role of environmental concern in the public acceptance of autonomous electric vehicles: A survey from China. *Transportation Research Part F: Traffic Psychology and Behaviour, 60*, 37–46.
- Xu, X., Wang, S., & Yu, Y. (2020). Consumer's intention to purchase green furniture: Do health consciousness and environmental awareness matter? *Science of the Total Environment, 704*, 135275.
- Xu, Y., Zhang, W., Bao, H., Zhang, S., & Xiang, Y. (2019). A SEM–neural network approach to predict customers' intention to purchase battery electric vehicles in China's Zhejiang Province. *Sustainability, 11*(11), 3164.
- Yang, W. H., Wong, R. C. P., & Szeto, W. Y. (2018). Modeling the acceptance of taxi owners and drivers to operate premium electric taxis: Policy insights into improving taxi service quality and reducing air pollution. *Transportation Research Part A: Policy and Practice, 118*, 581–593.
- Yazar, E. E., & Burucuoğlu, M. (2019). Consumer attitude towards organic foods: A multigroup analysis across genders. *Istanbul Business Research, 48*(2), 176–196.
- Yogananda, A. P. Y., & Nair, P. B. (2019). Green food product purchase intention: Factors influencing Malaysian consumers. *Pertanika Journal of Social Sciences and Humanities, 27*(2), 1131–1144.
- Yousafzai, S. Y., Foxall, G. R., & Pallister, J. G. (2007). Technology acceptance: A meta-analysis of the TAM: Part 1. *Journal of Modelling in Management.*

- Yuen, K. F., Cai, L., Qi, G., & Wang, X. (2020). Factors influencing autonomous vehicle adoption: An application of the technology acceptance model and innovation diffusion theory. *Technology Analysis & Strategic Management*, 1–15.
- Zhang, W., Wang, S., Wan, L., Zhang, Z., & Zhao, D. (2022). Information perspective for understanding consumers' perceptions of electric vehicles and adoption intentions. *Transportation Research Part D: Transport and Environment*, 102, 103157.
- Zhang, X., Bai, X., & Shang, J. (2018). Is subsidized electric vehicles adoption sustainable: Consumers' perceptions and motivation toward incentive policies, environmental benefits, and risks. *Journal of Cleaner Production*, 192, 71–79.
- Zhou, M., Long, P., Kong, N., Zhao, L., Jia, F., & Campy, K. S. (2021a). Characterizing the motivational mechanism behind taxi driver's adoption of electric vehicles for living: Insights from China. *Transportation Research Part A: Policy and Practice*, 144, 134–152.
- Zhou, T. (2011). An empirical examination of initial trust in mobile banking. *Internet Research*.
- Zhou, Y., Wen, R., Wang, H., & Cai, H. (2020). Optimal battery electric vehicles range: A study considering heterogeneous travel patterns, charging behaviors, and access to charging infrastructure. *Energy*, 197, 116945.
<https://www.sciencedirect.com/science/article/pii/S0360544220300529>



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APPENDIX A

Survey Questionnaire

I am Sheraz Ahmad, the student of PhD Industrial business administration at KMITL business school. I am conducting a study as part of my degree requirement. For that matter I need your 3-5 minutes to fill this survey. I assure you that the data being collected is purely for research purposes and will not be shared with anyone and treated as strictly confidential.

Have you used or driven electric vehicles?

คุณเคยใช้งานหรือขับขีรถไฟฟ้าหรือไม่ ?

Yes, I am willing to participate เคยใช้	Continue รบกวนกรอกแบบสอบถามต่อ
No, I am not willing to participate ไม่เคยใช้	Thanks for your time -terminate ขอบคุณ และ หยุดทำแบบสอบถาม

1) Age อายุ

18-29 30-39 40-49 50 and above

2) Gender เพศ

Male ชาย Female หญิง

3) Education การศึกษา

Under Bachelors ต่ำกว่าปริญญาตรี Bachelors ปริญญาตรี

Master ปริญญาโท Doctorate ปริญญาเอก

Driving Experience in year's ประสบการณ์การขับขี่

0-5 Year ปี 6-10 Year ปี Above 10 year ปี

Driving Experience with EV in year's ประสบการณ์การขับขี่ด้วยรถยนต์ไฟฟ้า

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() 0-1 Year ปี () 2-4 Year ปี () above 5 year ปี

Attribute response scale คำอธิบายระดับความรู้สึกรู้สึก

Strongly Disagree (SD) ไม่เห็นด้วยอย่างยิ่ง	1
Disagree (D) ไม่เห็นด้วย	2
Neutral (N) เฉยๆ	3
Agree (A) เห็นด้วย	4
Strongly agree (SA) เห็นด้วยอย่างยิ่ง	5

	S#	Statement	SD	D	N	A	SA
Effort Expectancy	1	I assume a simple and understandable interaction while using the electric vehicle. ฉันคิดว่ารถยนต์ไฟฟ้าจะมีการตอบสนองที่เข้าใจได้ง่ายในขณะที่ใช้งาน	1	2	3	4	5
	2	I assume it would be easy to be skillful at using the electric vehicle. ฉันคิดว่าเป็นการง่ายที่จะพัฒนาทักษะในการใช้งานรถยนต์ไฟฟ้า	1	2	3	4	5
	3	I assume I would find the electric vehicle easy to use. ฉันคิดว่ารถยนต์ไฟฟ้าน่าจะใช้งานง่าย	1	2	3	4	5
	4	I assume learning to operate an electric vehicle is easy for me. ฉันคิดว่าการเรียนรู้และหัดใช้งานรถยนต์ไฟฟ้าจะเป็นเรื่องง่าย	1	2	3	4	5
Social Influence	1	People who influence my behavior think that I should use the electric vehicle. คนรอบข้างที่มีอิทธิพลต่อพฤติกรรมของฉันคิดว่าฉันควรใช้รถยนต์ไฟฟ้า	1	2	3	4	5
	2	People who are important to me think I should use an electric vehicle. คนรอบข้างมีส่วนสำคัญที่ทำให้ฉันคิดว่าฉันควรใช้รถยนต์ไฟฟ้า	1	2	3	4	5

	S#	Statement	SD	D	N	A	SA
	3	In general, society has supported the use of electric vehicles. โดยทั่วไปแล้วสังคมรอบตัวฉันมีส่วนสนับสนุนการใช้รถยนต์ไฟฟ้า	1	2	3	4	5
	4	Having an electric vehicle is a status symbol in my circle. ในสังคมรอบตัวฉัน การมีรถยนต์ไฟฟ้าใช้ ถือเป็น การแสดงสถานะอย่างหนึ่ง	1	2	3	4	5
Facilitating Conditions	1	The resources necessary to use electric cars are existed (e.g repair service, battery changes) มีสถานที่และสิ่งจำเป็นในการสนับสนุนให้ฉันใช้รถยนต์ไฟฟ้า เช่น ศูนย์ซ่อม เปลี่ยนแบตเตอรี่	1	2	3	4	5
	2	I have the knowledge necessary to use electric cars. ฉันมีความรู้เพียงพอเกี่ยวกับการใช้งานรถยนต์ไฟฟ้า	1	2	3	4	5
	3	Electric vehicle is compatible with other technologies I use (e.g. smart phone). รถยนต์ไฟฟ้าต้องเข้ากันได้กับเทคโนโลยีอื่นๆ ที่ฉันใช้งานอยู่ในปัจจุบัน เช่น Smart phone	1	2	3	4	5
	4	I can get help from others (e.g help line) when I have difficulties using electric car. ฉันสามารถขอความช่วยเหลือจากผู้ที่เกี่ยวข้องได้เมื่อฉันประสบปัญหาในการใช้รถยนต์ไฟฟ้า เช่น ศูนย์สายด่วนแก้ไขปัญหา	1	2	3	4	5
Hedonic Motivations	1	Using electric vehicle is fun . การใช้รถยนต์ไฟฟ้าเป็นเรื่องสนุก	1	2	3	4	5
	2	Using electric vehicle is enjoyable because of quietness. การใช้รถยนต์ไฟฟ้าทำให้ฉันรู้สึกสบายเนื่องจากความเงียบของภายในรถ	1	2	3	4	5

	S#	Statement	SD	D	N	A	SA
	3	Using electric vehicle is very entertaining because of accelerating performance การใช้รถยนต์ไฟฟ้านั้นสนุกสนานในด้านการตอบสนองต่อการขับขี่ เช่น อัตราการเร่งของเครื่องยนต์	1	2	3	4	5
Price Value	1	The price for electric Vehicles is reasonable. ราคาสำหรับรถยนต์ไฟฟ้านั้นสมเหตุสมผล	1	2	3	4	5
	2	Using an electric vehicle is worth the money. การใช้รถยนต์ไฟฟ้านั้นคุ้มค่างบเงินที่เสียไป	1	2	3	4	5
	3	At the current price, electric vehicle has high uses value e.g getting more value than the price. ในรากรถไฟฟ้าปัจจุบัน รถยนต์ไฟฟ้ามีความคุ้มค่าต่อการใช้งาน	1	2	3	4	5
Habit	1	The use of an electric vehicle has become a habit for me. การใช้รถยนต์ไฟฟ้ากลายเป็นนิสัยและคุ้นเคยของฉันไปแล้ว	1	2	3	4	5
	2	I am addicted to using an electric Vehicle. ฉันติดและต้องใช้รถยนต์ไฟฟ้าเสมอ	1	2	3	4	5
	3	I must use an electric vehicle as a habit (e.g familiarity of using or continuing using) ฉันต้องใช้รถยนต์ไฟฟ้าให้เป็นนิสัยและจะใช้งานต่อเนื่อง เช่น การใช้งานเป็นประจำ	1	2	3	4	5
	4	Using an electric vehicle has become natural to me. การใช้รถไฟฟ้ากลายเป็นเรื่องปกติสำหรับฉัน	1	2	3	4	5
Environmental Concerns	1	Protecting the environment while using electric vehicle will benefit me (e.g making good air).	1	2	3	4	5

S#	Statement	SD	D	N	A	SA	
	การปกป้องสิ่งแวดล้อมในขณะที่ใช้รถยนต์ไฟฟ้าจะเป็นประโยชน์ต่อฉัน เช่น ไม่ทำให้อากาศเป็นพิษ						
2	The pollutions caused by fossil fuels vehicles are worse than we imagine. มลพิษที่เกิดจากยานยนต์เชื้อเพลิงฟอสซิลนั้นเลวร้ายกว่าที่เราคิด	1	2	3	4	5	
3	Environmental protection while using electric vehicles will help people have a better quality of life. การใช้รถยนต์ไฟฟ้าจะช่วยในการรักษาสิ่งแวดล้อมทำให้ผู้คนมีคุณภาพชีวิตที่ดีขึ้น	1	2	3	4	5	
4	The electric vehicle will not just benefit humans but also other creatures. รถยนต์ไฟฟ้าไม่เพียงแต่ให้ประโยชน์แก่มนุษย์เท่านั้น แต่ยังรวมถึงสิ่งมีชีวิตอื่นๆ ด้วย	1	2	3	4	5	
Trust	1	Electric vehicles claims are honest (e.g less maintenance). ประโยชน์ของรถยนต์ไฟฟ้าถูกนำเสนออย่างตรงไปตรงมา เช่น การบำรุงรักษาน้อยลง	1	2	3	4	5
	2	I trust electric vehicle's reliability. ฉันเชื่อมั่นในความน่าเชื่อถือของรถยนต์ไฟฟ้า	1	2	3	4	5
	3	Electric vehicles are responsible in terms of environment. รถยนต์ไฟฟ้ามีความรับผิดชอบในแง่ของสิ่งแวดล้อม	1	2	3	4	5
	4	I trust that electric vehicles are dependable (e.g. feel safe while driving). ฉันเชื่อมั่นว่ารถยนต์ไฟฟ้าเป็นที่พึ่งได้ เช่น รู้สึกปลอดภัยขณะขับขี่	1	2	3	4	5
	5	Electric vehicles act with good intentions. (e.g making good environment รถยนต์ไฟฟ้าทำด้วยความตั้งใจที่ดีในการสร้างสภาพสิ่งแวดล้อมที่ดี	1	2	3	4	5

	S#	Statement	SD	D	N	A	SA
Satisfaction with Policies	1	I am satisfied with the purchase subsidy policies for electric vehicles. (e.g. Price discount) ฉันพอใจกับนโยบายการอุดหนุนในการซื้อรถยนต์ไฟฟ้า เช่น สนับสนุนให้ราคาลดลง	1	2	3	4	5
	2	I am satisfied with the operation subsidy policies of electric vehicles. (Replacing traditional vehicle will get you free charging pass or less pay.) ฉันพอใจกับนโยบายการอุดหนุนการดำเนินงานของรถยนต์ไฟฟ้า เช่น การเปลี่ยนและแลกรถน้ำมันไปเป็นรถไฟฟ้าจะทำให้ได้รถใหม่ในราคาที่ถูกลง หรือ ชาร์จไฟไม่เสียค่าใช้จ่ายหรือถูกลงตามสถานบริการ	1	2	3	4	5
	3	I am satisfied with the information provision policies of electric vehicles (e.g NEWS related to EV are from right source.) ฉันพอใจกับนโยบายกับการได้ข้อมูลของรถยนต์ไฟฟ้าจากแหล่งที่น่าเชื่อถือได้	1	2	3	4	5
Behavioral Intentions	4	I am satisfied with the facilitation policies of electric vehicles (e.g multiple charging stations or service centers). ฉันพอใจกับนโยบายการอำนวยความสะดวกของรถยนต์ไฟฟ้า เช่น มีสถานีบริการการชาร์จไฟ หรือ ศูนย์บริการอย่างเพียงพอ	1	2	3	4	5
	1	I intend to use electric vehicles in the future. ฉันตั้งใจจะใช้รถยนต์ไฟฟ้าในอนาคต	1	2	3	4	5
	2	I will always try to use electric vehicles in my daily life. ฉันจะพยายามใช้รถยนต์ไฟฟ้าในชีวิตประจำวันของฉันเสมอ	1	2	3	4	5
	3	I plan to use electric vehicles in future. ฉันวางแผนที่จะใช้รถยนต์ไฟฟ้าในอนาคต	1	2	3	4	5

	S#	Statement	SD	D	N	A	SA
	4	I predict I will use electric vehicles in the future. ฉันคาดการณ์ว่าฉันจะใช้รถยนต์ไฟฟ้าในอนาคต	1	2	3	4	5
Use Behavior	1	It is a pleasant experience to use electric vehicles. การใช้รถไฟฟ้าของฉันเป็นประสบการณ์ที่น่าพึงพอใจ	1	2	3	4	5
	2	Electric vehicles are my first choice When I need to replace a new one. รถยนต์ไฟฟ้าเป็นตัวเลือกแรกของฉันเมื่อต้องเปลี่ยนคันใหม่	1	2	3	4	5
	3	I will recommend to my friends to use electric vehicles if available. ฉันจะแนะนำให้เพื่อนใช้รถยนต์ไฟฟ้าเมื่อมีโอกาส	1	2	3	4	5
Charging station infrastructure	1	A lot of charging stations are required for uninterrupted journey. ฉันคิดว่าจำเป็นต้องมีสถานีชาร์จจำนวนมากเพื่อให้การเดินทางมีความต่อเนื่อง	1	2	3	4	5
	2	While driving an electric vehicle, I will always be worried about running out of charge. ในขณะที่ขับรถยนต์ไฟฟ้า ฉันมักจะกังวลว่าแบตเตอรี่จะหมดแลหาที่ชาร์จไม่ทัน	1	2	3	4	5
	3	The charging station makes electric vehicle more practical and convenient for daily use. จำนวนสถานีชาร์จไฟของรถไฟฟ้าทำให้ฉันรู้สึกมีความสะดวกและใช้รถไฟฟ้าได้อย่างสบายใจในชีวิตประจำวัน	1	2	3	4	5

APPENDIX B



No. 014

EC-KMITL_67_014

The Research Ethics Committee of
King Mongkut's Institute of Technology Ladkrabang
1, Chalongkrung Rd., Lat Krabang, Lat Krabang, Bangkok Thailand 10520
Tel. +66 2329 8000

Certificate of Exemption

The Research Ethics Committee of King Mongkut's Institute of Technology Ladkrabang has exempted the following study which is to be carried out in compliance with the International guidelines for human research protection as Declaration of Helsinki, The Belmont Report, CIOMS Guideline, International Conference on Harmonization in Good Clinical Practice (ICH-GCP) and 45CFR 46.101(b)

Study title : Factor affecting the adoption of electric vehicle (EV): A moderating effect of charging infrastructure based on extended unified theory of acceptance and use of technology (UTAUT2)

Study code : EC-KMITL_67_014

Principal investigator : Sheraz Ahmad

Co-Investigator : Assoc. Prof. Wornchanok Chaiyasoonthorn
Assoc. Prof. Singha Chaveesuk

Study center : KMITL Business School

Document reviewed :

1. Submission form version 1. date 24 November, 2023
2. Full protocol/proposal version 1. date 24 November, 2023
3. Participant information sheet 1. date 24 November, 2023
4. Informed consent form version 1. date 4 December, 2023
5. Data record form version 1. date 4 December, 2023
6. Curriculum Vitae

Signature *Pastraporn Thipayasothorn*

(Assoc. Prof. Dr. Pastraporn Thipayasothorn)

Chair of the Human Ethics Committee

King Mongkut's Institute of Technology Ladkrabang, 2022

Date of Exemption : 4 December, 2023

Note No continuing reviewer quired

APPENDIX C



ลำดับที่ 014

EC-KMITL_67_014

คณะกรรมการจริยธรรมการวิจัยในมนุษย์ประจำ สถาบันเทคโนโลยีพระจอมเกล้าเจ้าคุณทหารลาดกระบัง

เอกสารรับรองการยกเว้นพิจารณาจริยธรรมโครงการวิจัย

คณะกรรมการจริยธรรมการวิจัยในมนุษย์ สถาบันเทคโนโลยีพระจอมเกล้าเจ้าคุณทหารลาดกระบังดำเนินการให้การรับรองการยกเว้นพิจารณาจริยธรรมโครงการ ตามแนวทางหลักจริยธรรมการวิจัยในคน ที่เป็นมาตรฐานสากล ได้แก่ Declaration of Helsinki, The Belmont Report, CMOS Guideline, International Conference on Harmonization in Good Clinical Practice หรือ ICH-GCP

ชื่อโครงการวิจัย : Factor affecting the adoption of electric vehicle (EV): A moderating effect of charging infrastructure based on extended unified theory of acceptance and use of technology (UTAUT2)

รหัสโครงการ : EC-KMITL_67_014

ผู้วิจัยหลัก : Sheraz Ahmad

ผู้ร่วมวิจัย : รศ.ดร.วอนชนก ไชยสุนทร

รศ.ดร.สิงหะ ฉวีสุข

สังกัดหน่วยงาน : คณะบริหารธุรกิจ

เอกสารที่ได้รับการพิจารณา :

1. แบบเสนอโครงการวิจัย ฉบับที่ 1 ลงวันที่ 24 พฤศจิกายน พ.ศ. 2566
2. โครงการวิจัยฉบับเต็ม ฉบับที่ 1 ลงวันที่ 24 พฤศจิกายน พ.ศ. 2566
3. เอกสารชี้แจงอาสาสมัครผู้รับการวิจัย ฉบับที่ 1 ลงวันที่ 24 พฤศจิกายน พ.ศ. 2566
4. หนังสือแสดงเจตนายินยอมเข้าร่วมการวิจัย ฉบับที่ 1 ลงวันที่ 4 ธันวาคม พ.ศ. 2566
5. แบบสอบถาม ฉบับที่ 1 ลงวันที่ 4 ธันวาคม พ.ศ. 2566
6. ประวัติผู้วิจัย

ลงนาม

ลงชื่อ

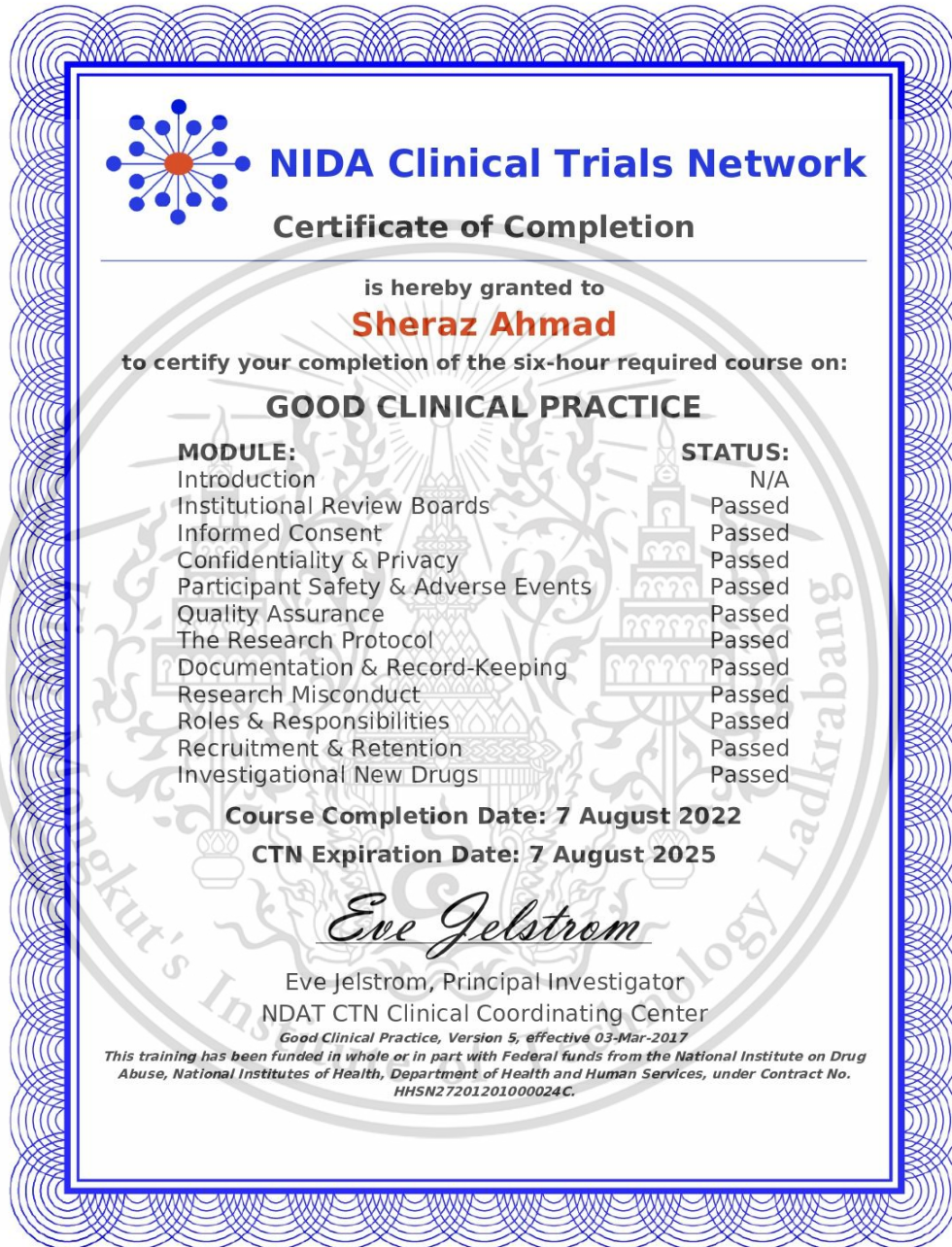
(รองศาสตราจารย์ ดร.พัสดรามรณ์ ทิพย์โสธร)

ประธานคณะกรรมการจริยธรรมการวิจัยในมนุษย์ ประจำ
สถาบันเทคโนโลยีพระจอมเกล้าเจ้าคุณทหารลาดกระบัง พ.ศ. 2565

วันที่รับรองการยกเว้น : 4 ธันวาคม พ.ศ. 2566

หมายเหตุ ไม่ต้องทบทวนต่อเนื่อง

APPENDIX D



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AUTHOR BIOGRAPHY

Sheraz Ahmad

Experience

- **Meezan Bank, Pakistan**
Personal Banking Officer (Sep-2021 - Dec-2021)
- **Islamabad Chamber of Commerce and Industry, Pakistan**
Intern (May-2018 - Aug-2018)

Education

- **Ph.D. Industrial Business Administration (International Program)** (Jan-2022 - Dec-2024)
KMITL Business School
King Mongkut's Institute of Technology Ladkrabang, Bangkok, Thailand
- **MS Management Sciences** (Sep-2016 - Mar-2019)
Faculty of Management Sciences
SZABIST Islamabad, Pakistan
- **BBA (Hons)** (Sep-2012 - Jun-2016)
Institute of Business & Management Sciences
The University of Agriculture, Peshawar

Grants and Awards

- **KMITL Doctoral Fully Funded Scholarship (Grant No. KDS2021/015)**
King Mongkut's Institute of Technology Ladkrabang, Thailand

Research Interest

- Technology Adoption
- Digital Marketing
- Consumer Behavior

Publications

1. Ahmad, S., Chaveesuk, S., Chaiyasoonthorn, W. (2024). The adoption of electric vehicle in Thailand with the moderating role of charging infrastructure: An Extension of a UTAUT.

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International Journal of Sustainable Energy, 43(1), 1-26.
<https://doi.org/10.1080/14786451.2024.2387908>

2. Ahmad, S., Chaveesuk, S., & Chaiyasoonthorn, W. (2024). Actual use of electric vehicle in Pakistan: a moderating role of charging infrastructure. *Urban, Planning and Transport Research*, 12(1), 2416415. <https://doi.org/10.1080/21650020.2024.2416415>
3. Ahmad, S., Chaveesuk, S., Chaiyasoonthorn, W., & Khan, S. (2024). Exploring the effect of social media on revisit intentions. *Anatolia*, 1-12. <https://doi.org/10.1080/13032917.2024.2324914>
4. Mansoor, M., Abbasi, A. Z., Abbasi, G. A., Ahmad, S., & Hwang, Y. (2023). Exploring the determinants affecting the usage of blockchain-based remittance services: an empirical study on the banking sector. *Behaviour & Information Technology*, 1-19. <https://doi.org/10.1080/0144929X.2023.2241564>
5. Qureshi, F. N., Bashir, S., Mahmood, A., Ahmad, S., Attiq, S., & Zeeshan, M. (2022). Impact of internal brand management on sustainable competitive advantage: An explanatory study based on the mediating roles of brand commitment and brand citizenship behavior. *Plos one*, 17(3), e0264379. <https://doi.org/10.1371/journal.pone.0264379>
6. Ahmad, S., Bhatti, S. H., & Hwang, Y. (2020). E-service quality and actual use of e-banking: Explanation through the Technology Acceptance Model. *Information Development*, 36(4), 503-519. <https://doi.org/10.1177/0266666919871611>

Conference Proceeding

1. Ahmed, S., & Bhatti, S. (2019, August). E-Service Quality and Actual Use of E-Banking: Explanation through Technology Acceptance Model. In *Academy of Management Annual Meeting Proceedings*. Academy of Management. <https://doi.org/10.5465/AMBPP.2019.14370abstract>.

Certifications

- **Pharma Salesforce Effectiveness.**
Institute of Management Sciences Peshawar
- **Pharma Sale Management.**
Institute of Management Sciences Peshawar