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Evaluation of Sustainable Behavior and Acceptance of Electric Public Transportation: A Perspective from the Philippines

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Abstract: Rapid urbanization has exerted pressure for development on public transportation infrastructure. The rise in population has driven consumers to seek efficient, cost-effective, and environmentally sustainable transportation. The objective of this study was to assess the determinants influencing consumers' behavioral intention and acceptance of utilizing electric public transportation. The integrated UTAUT2 and sustainable theory of planned behavior underwent a higher-order construct using partial least squares structural equation modeling analysis to thoroughly evaluate key factors influencing the intention to accept electric public transportation. The study utilized a 55-item questionnaire distributed to 438 respondents. The findings indicated that the domains of UTAUT2 had the most significant effect, with hedonic motivation as the predominant variable, followed by effort expectancy and performance expectancy. This study indicated hedonic motivation as the primary factor influencing the intention to use electric public transportation, followed by effort expectancy. This study highlights the importance of ensuring user-friendly and convenient experience in the design and delivery of electric public transportation services. Substantial implications, both theoretical and practical, are also posited. Considering the impactful variables, this study deduced that the government, transportation sectors, and electric vehicle developers should place increased emphasis on enhancing customers' intention to accept and use public transport in a sustainable manner.

Keywords: electric public transportation; green transportation; higher order UTAUT2; sustainability; sustainability theory of planned behavior

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1. Introduction

Public transportation is widely utilized across the world. As a measure to ease traffic congestion, public transportation utilized in urban areas includes several modalities such as buses, trains, vans, taxis, and ferries [1]. Travel time, the cost of travel, waiting time, comfort, and the number of transfers are a few of the factors influencing travelers' public transportation mode preference, proven throughout the years [2]. Table 1 offers a comparison among various countries.

Gatarin [11] reported that 87% of Filipinos are advocating for the government to give priority to active and public transportation. According to Vergel et al. [12], the Philippine transportation demand for energy is highest in road transportation, with a total of 11,936.63 ktoe, including vehicles using diesel and gasoline alone. Hence, the study recommended that the Land Transportation Office (LTO) reclassify vehicles to encompass emissions control the technology and age of vehicles. The study of Tiglao et al. [13] investigated the effectiveness of the SafeTravelPH app, a crowdsourcing technology in General Santos City, Philippines, to identify the challenges brought about by the public transportation modernization program. It was found that 51 out of 301 jeepneys are employing electricity as the power source. This

highlights the notion that despite the challenges involved in transitioning, local governments strive to promote environmental sustainability.

Table 1. Electric public transportation comparison and findings.

Country	Findings	References
Hungary	Passenger preference favors riding the bus for long distances. The study found that 60% of passengers who are commuting chose buses, while the other 40% chose railway transportation, mainly for comfort.	[3]
Sydney	Results showed that human transportation is carried out better using private cars, rather than sustainable (i.e., economic) choices such as public transport and active modes.	[4]
South Africa	Minibus taxis accounted for the majority of the working population. It was also found that due to a lack of policy regulation, users are dissatisfied with the country's public transport.	[5]
Asia	Shifting towards more ecologically sustainable means of transportation, with a particular focus on the adoption of electric vehicles, is a significant concern.	[6]
Vietnam	It was found that 99% of the adolescent population are bus users. This study also showed that young adults are not just interested in the environmental benefits, but also in the safety, security, and innovative aspects of electric transportation.	[7]
Japan	The increasing environmental consciousness among individuals has had a favorable influence on the inclination to purchase electric vehicles. The findings indicated that the direct impact of the environmental advantages of electric vehicles contributes to the intention of making a purchase.	[8]
China	Younger generations in China are foregoing psychological factors influencing the purchase of electric vehicles. That is, awareness of a behavior gap is seen and other people's influence overpowers social-psychological factors affecting purchase intention. More so, government support affects the intention for purchasing electric vehicles.	[9]
Indonesia	It was highlighted that consumers were not influenced by the environmental benefits of electric vehicles. Moreover, it was explained that consumers require a 50% reduction in electric vehicle prices before considering purchasing them.	[10]
Philippines	Current problem: In the Philippines, replacing transportation services has posed challenges on people, policies, and the whole public transportation system.	

Public transportation, from various accounts, has been proven to reduce traffic congestion and environmental impact, and enhance mobility [14,15]. However, it is also a cause of pollution. The rapid increase in human population, progressing socioeconomic conditions, urban growth, and scientific advancements have hastened the surge in carbon emissions across multiple sectors [16,17]. Evidence from India showed that emissions from transportation are further expected to increase in 2030. In Figure 1, Jain and Rankavat [18] inferred that the increase in carbon emissions was significantly due to the consumers' growing demand for flexibility and convenience. As seen in the figure, the majority of carbon emissions can be traced to roadway pollution.

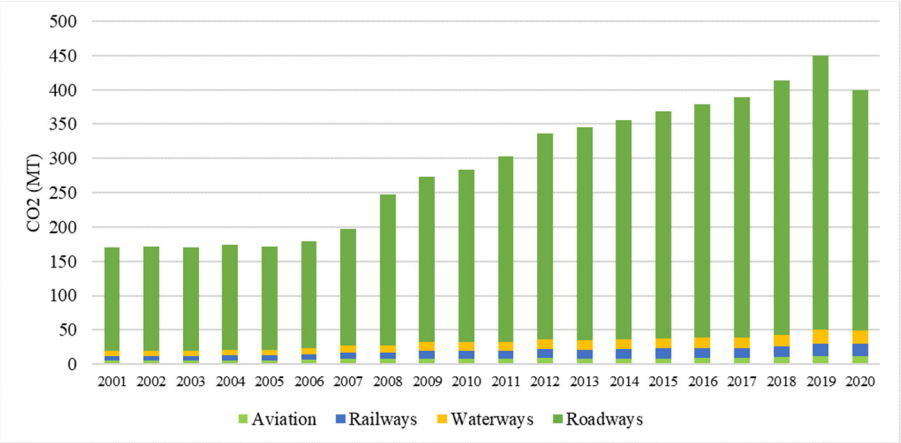

Figure 1. Carbon emissions based on mode of transportation; adapted from Jain and Rankavat [18].

Delving through the contributing factors of carbon emissions, a study in China showed that the majority of carbon emissions were traced back to the transportation sector [19]. In Turkey, a study proved that vehicle efficiency is an effective solution in reducing emissions, considering vehicle sizes [20]. Hence, Hussain et al. [21] recommended decreasing traffic congestion and allocating more funds towards the advancement of eco-friendly transportation systems.

With sustainability practices being implemented, the development of electric vehicles has been rising. Electric vehicles are increasingly taking the place of conventional combustion engines in public transportation systems because they offer reduced carbon emissions, minimal noise, and enhanced efficiency [22]. Electric vehicles come in different types, such as hybrid electric vehicles (HEVs), plug-in hybrid vehicles, and plug-in hybrid electric vehicles (PHEVs). Assessing the effectiveness of EVs, studies found that the use of EVs has a positive significant impact on reducing carbon emissions in numerous countries [23–25], the acceptance of which, across the world, has been established by studies.

Secinaro et al. [26] determined that factors such as knowledge and experience can impact consumers' behavioral intention towards electric vehicles according to the theory of planned behavior (TPB). Given the widespread acceptance among consumers, Yousif and Alsamydai [27] further identified influencing factors such as driving ranges, charging times, speed, emissions, and prices. In Pakistan, Butt and Singh [28] highlighted the effect of the acceptance of electric vehicles to reduce transportation emissions by 2024. In another study from India, Shanmugavel et al. [29] found significant acceptance among consumers concerning the intention to use electric vehicles. Even in the Philippines, Ong et al. [30] have established the intention for purchasing hybrid cars or electric vehicles. Being a developing country, the promotion, implementation, and constant development of sustainable vehicles have been challenging. Accordingly, the utility of public transportation was also explained to be widely considered in the Philippines. It was seen that jeepneys, buses, and ride-hailing applications have been widely utilized by employed workers and students [31]. This has also added to the increase in emissions since around 32% of the Philippine population widely considers different public transportation.

Recently, the use electric vehicles as a mode of public transportation has been pushed for implementation. In Europe, the European Environment Agency aims to cut down transportation emissions by 2025 through the promotion of battery electric vehicles (BEVs) and plug-in hybrid electric vehicles (PHEVs) [32]. Electric vehicles stand as a primary solution to sustainability, given their capacity to reduce carbon emissions and boost economic elements [33]. However, skepticism and challenges such as a lack of infrastructures for charging terminals, initial costs, limited user awareness, and misconceptions [34] have been widely prominent. According to Chang [35], the adoption of electric vehicles is faced by the challenges of car performance, safety standards, and driving range. These findings are similar to a study conducted in Malaysia, where it was identified that charging infrastructure,

policies and incentives, travel distance, and service points are the challenges hindering the adoption of electric vehicles [36]. Similar issues were also seen among consumers in the Philippines [31]. To resolve these issues, the study recommended making changes by increasing battery capacity and, in effect, increasing driving range. Consequently, the service quality of traditional public transportation has not been fully underscored.

Electric public transportation (electric public transportation) refers to the electric-powered vehicles used for public transportation. This could be a hybrid or full-on electric vehicle that does not run on fuel [31]. For electric public transportation, only studies such as Hou et al. [37] and Wang et al. [38] in China have been seen. According to Hou et al. [37], electrifying public transportation is a contributing factor towards public transport sustainability. With the increasing demand for EVs in the market, studies focused on factors affecting social acceptance are sufficient in the views of this research. However, other studies revealed a considerable debate concerning the sustainability of electric vehicles [39]. Moreover, Orsi et al. [40] recommended that future researchers delve deeper into the actual sustainability of electric transportation. It could be posited that establishing sustainable public transportation would benefit the community, the government, and the economy.

Given the rising concerns in environmental pollution linked to transportation, researchers have delved into investigating the key factors influencing people's inclination to use public transport as a sustainable option. Studies have shown that consumers perceived environmental concerns, economic concerns, and authority support as significantly affecting subjective norms, attitudes, and behavioral control [41–43]. Further studies have identified subjective norms, attitudes, and behavioral control to have a positive significant effect on consumer intention towards green behavior [44–46].

Accordingly, studies also found factors of the unified theory of acceptance and use of technology (UTAUT2) to have a significant effect towards green behavioral intentions [47–50]. UTAUT2 is a model covering aspects of initial variables affecting the behavioral intention and acceptance of certain technologies [51]. It was indicated that this theory is usually utilized when technology is yet to be established [52], relating to more probable reasons of acceptance compared to established technologies where the technology acceptance model (TAM) is commonly considered. The similarities of the two models were explained by Yigitcanlar et al. [53]. It was expressed that the performance and effort expectancy of UTAUT reflects the perceived usefulness and perceived ease of use under TAM. This indicates that standard measures under the technology frameworks are reflected in both theories, which could reflect the acceptance of technology. Studies such as that by Huang [54] explained that the higher order constructs of theory are beneficial as it presents several insights into the importance of variables affecting technology acceptance. They have also integrated TPB in assessing virtual reality tourism acceptance. From the available literature, it could be said that there is a need for more research to support the connection between consumers' acceptance of technology in public transportation and environmentally friendly behavioral intentions.

However, related studies have implied that TPB alone could not holistically and specifically measure overall behavior among individuals. As expressed by the model developer, Ajzen [55], TPB could be modified, extended, or integrated for a more holistic assessment of behavior. Since technology is considered, common theories implement UTAUT2 as a form of model assessing a newly recognized technology or system [52]. Since analyses of electric public transportation are scarce in the literature, especially regarding the acceptance of this technology or system, and sustainable behavior among commuters, an integration of both theories could provide better assessment with overall behavioral analyses. In the Philippine setting, since this is yet to be fully implemented, no research has been conducted on both technology acceptance and sustainable behavior.

Thus, this study aimed to examine the determinants influencing consumers' green behavioral intention and their acceptance of utilizing electric public transportation. Specifically, this study considered sustainable behavior including the influencing factors which

drive consumers' choices regarding public transportation through the extension of TPB. Focusing on electric public transportation, it uncovered the in-depth acceptability of electric vehicles in the context of a developing country. Studying these factors in the context of a developing country is significant as it explains behavioral, social, economic, and environmental factors affecting the acceptance of sustainable transportation. The findings of this study could therefore provide conclusive insights for policymakers, urban planners, and transportation agencies to increase acceptance and implement strategies for sustainable transportation. Moreover, this study could serve as a guide to authorities for the development of policies that would encourage sustainable behavior among electric public transportation systems. Finally, the results and framework of this study could be capitalized on by researchers, even in other countries, for evaluating sustainable transportation and its technological aspects. This study opted to answer the following:

1. What sustainability factors greatly affected the acceptance of electric public transportations?
2. What technology-related factors under the UTAUT2 domains affected the acceptance of electric public transportation?
3. How can the output relate to the practical aspects of the development of electric public transportation and smart city development?
4. Can the developed framework (the integration of UTAUT2, sustainability domains, and TPB) holistically measure sustainable behavior and technology adoption?

The paper has been structured in the following way to provide clarity among readers. Section 1 is the Introduction, providing the background, problem, comparison, research gap, and objective of the study. Section 2 covers the theory development, related studies, and conceptual framework. Section 3 provides the methodology and approach, while Section 4 highlights the results. Section 5 provides the discussion, implications, and limitations, and Section 6 highlights the conclusion of the study.

2. Related Studies and Conceptual Framework

2.1. Theory Development

As recommended by various studies, the behavioral intention of consumers should be evaluated to holistically assess consumers' purchasing intention. As proposed by Ajzen [55], TPB emphasizes the systematical evaluation of consumers' behavioral intention. However, recent studies have extended or modified the theory to encompass other latent variables. The study of Sniehotta et al. [56] explained that the model itself measures a general perspective of behavior, and thus a need for extension or integration is considered for the specification of behavior. The studies of Ruangkanjanases [57] and Shalender and Sharma [58] modified the model to encompass other latent variables affecting behavioral intention such as self-competence, convenience, environmental literacy, and moral norm. Ruangkanjanases [57] adopted TPB to provide additional perspective into the antecedents of purchase intention towards green products. On the other hand, Shalender and Sharma [58] incorporated personal norms and concern for environment to better understand customer intention to purchase electric vehicles. Both studies focused on the environmental factors, as extensions, that influence the latent variables within the employed model. It was explained that specific latent variables could provide a better behavioral measurement.

With environmental factors being considered by manufacturers, the public sector has also started to embrace green products and technologies [59]. It was seen from the study of German et al. [60] that people, especially in the Philippines, would consider green-technology transportation options. It was also highlighted that the concern for the environment and support from authorities would heighten their positive behavioral intentions. According to the study of Ong et al. [31], green transportation in the Philippines (i.e., hybrid cars) is considered due to its positive environmental impact. From other countries, the study by Sunitiyoso et al. [61] on the implementation of electric vehicle in Jakarta, Indonesia, showed that electric buses are preferable compared to non-electric buses as they can potentially reduce CO_2 emissions. As more users were found to be

attracted to this technology, it was recommended to enhance service reliability through the development of high-quality services.

Given the latest technological advancements in modern production and manufacturing, Hajishirzi et al. [62] elaborated on the enhancement of sustainability when all three domains were considered. Their study found that economic sustainability is affected more by competitive advantage when compared to environmental sustainability, thus implying that innovators should consider reducing costs for customers' needs. In the literature review by Mensah [63], it was suggested that the inclusion of environmental, economic, and societal domains as support from the government could ensure responsible human behaviors in promoting sustainable development. Thus, this study considered the extended TPB adapted from the study of Ong et al. [31], reflecting the extension of the UTAUT2 domains. The lower ordered model constructs offered the ability to holistically measure sustainable behavior and technology adoption intention. Their study was limited to only assessing the intention to purchase electric vehicles and highlighted several limitations present in methods such as multiple path analysis. As reflected by Sarstedt et al. [64], the higher order format of structural equation modeling (SEM) can present a more accurate analysis due to the analysis of fewer paths and relationships—presenting a better output. This, higher ordered SEM was applied to differentiate the model, provide better implications, and offer a holistic measurement.

2.2. Conceptual Framework

Presented in Figure 2 is the integrated model of Sustainability Theory of Planned Behavior (STPB) and UTAUT2 to holistically measure the actual behavior and acceptance to consider electronic public transportation. A total of fourteen hypotheses were created to encompass the developed framework: six for UTAUT2 domains, six for STPB domains, one for behavioral intention, and one for acceptance. The development of hypotheses is presented in this section, highlighting the interactions of the latent variables.

Based on related studies, it could be posited that green behavior as an extended model of TPB could holistically measure green behavioral intention [31,60]. Thus, the sustainability aspect of transportation may be evaluated using a modified theory of planned behavior with sustainability domains. Specific constructs within TPB, including attitude towards use, subjective norm, and perceived behavioral norm, are shown to have a positive influence towards adopting electric vehicles [65]. Ng and Phung [43] highlighted that attitude, perceived behavioral control, and subjective norm were found to significantly influence consumers' behavioral intention to use buses in Hanoi. However, in terms of sustainability, environmental concerns were also found to significantly influence attitude and perceived behavioral control [41,42]. In Taiwan and Indonesia, it was seen that attitude is the strongest factor affecting behavioral intention, while subjective norm is the weakest [44].

In Malaysia, a study was conducted to investigate the influence of extended TPB factors towards the intention to practice sustainable food waste management. The study found that all four factors are significant [66]. The study suggested that reusing leftovers, segregating waste, and home composting contribute towards a household's intention to practice sustainability. In Indonesia, an application of TPB towards environmental concern showed attitude as a positive predictor towards sustainable tourist behavior [46]. The study implied that environmental attitude is a significant stimulant in promoting environmentally friendly behavior. In another aspect highlighting the consumers' acceptance of autonomous vehicles, it was found that subjective norm is a strong predictor of a future intention to adopt autonomous vehicles [44]. Findings concluded that the users' decision towards adopting recent technology tends to be influenced by the opinions of their trusted peers. Additionally, the study by Dirgahayani and Sutanto [67] on commuter intention to use public transportation in Indonesia highlighted attitude as a positive factor of consumers' intention towards green behavior. It was concluded that the quality of public transportation including time travel and comfortability affects the users' attitude towards public transportation. On the other hand, subjective norms and perceived behavioral control

were also found to be significant. The findings suggest that promoting the use of public transportation through social media encourages users. Similarly, the study of Liao et al. [45] revealed attitude as a direct significant factor towards behavioral intention. As the study was conducted from an adolescent's perspective, subjective norm and perceived behavioral control were found to be insignificant but rather affecting other variables such as perceived usefulness and intention to use.

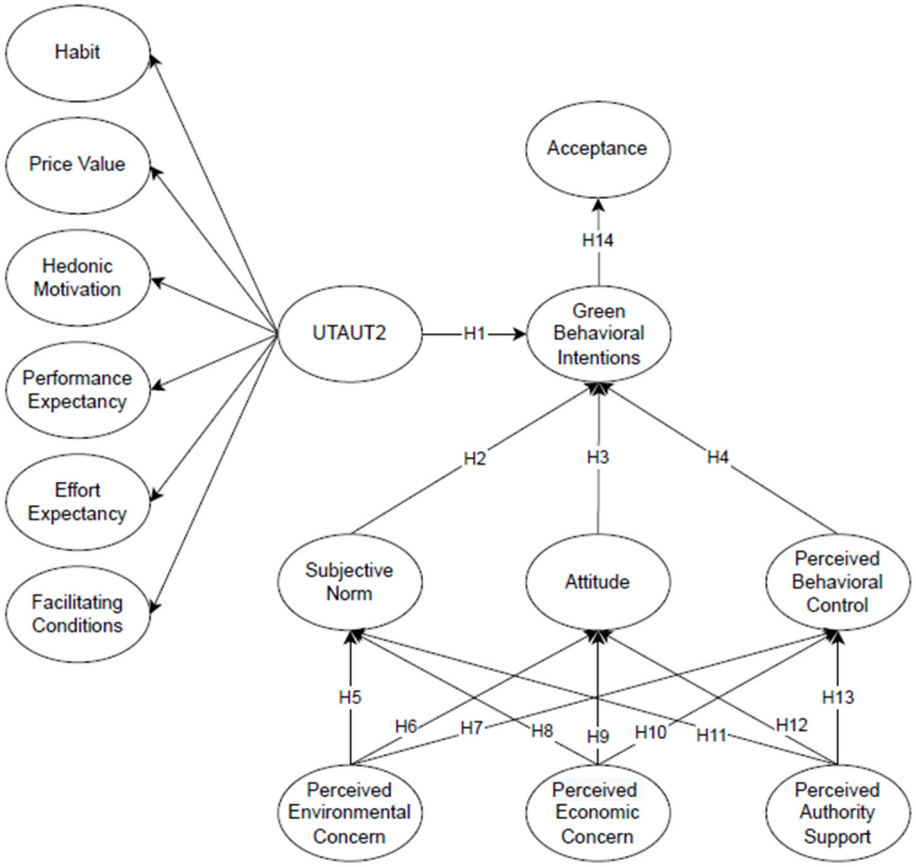

Figure 2. Conceptual framework.

In this study, subjective norm refers to the influence of other people on the behavior of individuals. Other people could be society, close relatives, friends, and the community. On the other hand, attitude refers to the objective attitude towards behavior among individuals—referring to the ideation of using, experience, knowledge, and insights of electric public transportation. Lastly, perceived behavioral control is the people's own behavioral inclination towards decision-making, utility, and the acceptance of electric public transportation. Thus, the following were hypothesized:

H1: *Subjective norm, in terms of societal, close relative and friend, and community influence, significantly influences green behavioral intentions.*

H2: *Attitude, in terms of objective attitude towards behavior, significantly influences green behavioral intentions.*

H3: *Perceived behavioral control, in terms of one's own inclination towards decision-making, significantly influences green behavioral intentions.*

In China, Wang et al. [38] discussed how the three domains of TPB influenced citizens' attitudes towards eco-friendly products. It was found that there is a significant negative impact between environmental concerns and attitudes, showing that students see

purchasing hybrid cars as less pleasant, unwise, and undesirable. Conversely, a positive behavioral influence was seen between perceived environmental concern and authority support in the Philippines when choosing delivery transportation options [60]. In the study by Min et al. [68] on taxi drivers' insights towards electric vehicles, the results showed that purchasing green products such as electric vehicles could affect behavioral control and subjective norms, least on attitude. The study of Wu et al. [69] revealed that environmental concern is an important stimulus influencing consumers' adoption of autonomous electric vehicles. Chen et al. [70] described human environmental concern as a form of human perception of whether to benefit or damage the natural environment. Consumers with preeminent environmental concern tend to express a favorable attitude towards adopting electric vehicles [71].

Different studies have therefore shown how culture and diversity affected people's green behavior. That is, studies in diverse cultural contexts have suggested that individuals' perceptions of environmental concerns dictate whether their behavioral intentions lean towards positive or negative consequences and actions on actual behavior. Shipley and Riper [72] concluded that pride and guilt are significantly related to pro-environmental behavior, indicating that feelings of pride and guilt are associated with environmentally friendly actions. In this study, perceived environmental concern refers to the inclination of individual behavior towards sustainable practices because of the negative impacts of fossil fuel use on the environment [31]. Since the behavioral aspects of environmental concerns have been established in the transportation sector, it was hypothesized that:

H4: *Perceived environmental concern, in terms of the inclination of individual behavior towards sustainable practices, significantly influences subjective norm.*

H5: *Perceived environmental concern, in terms of the inclination of individual behavior towards sustainable practices, significantly influences attitude.*

H6: *Perceived environmental concern, in terms of the inclination of individual behavior towards sustainable practices, significantly influences perceived behavioral control.*

Sustainability stands on the three pillars of development, namely, environmental, societal, and economic development. In the study by Saif et al. [73] on the adoption of technology, it was found that economic concern is positively significant for adoption behavior. In another study, Joshi et al. [74] found that economic value positively affects attitude towards the use of green products. Hence, the authors recommended to enhance economic value to stimulate consumers' positive attitude towards green products. Wang et al. [75] further added that economic factors have significant influences on customer behavioral intention. Consequently, studies found that a transition to electric vehicles brings convenient economic and environmental benefits to consumers. In India, it was found that economic incentives influenced behavioral intention through attitude [76]. According to another study, perceived behavioral control and economic characteristics have positive effects on consumer intention in terms of adopting electric vehicles [77]. As fuel costs are higher than those of electric vehicles, consumers with long driving ranges prefer electric vehicles more as operating costs are lower. Perceived economic benefit in this study refers to the exchange of quantifiable terminologies for either money, revenue, incentives, or social competition as perceived by individuals. For public transportation to convert from traditional to electric due to economic concerns, this study hypothesized that:

H7: *Perceived economic concern, in terms of the exchange of quantifiable terminologies for either money, revenue, incentives, or social competition as perceived by individuals, significantly influences subjective norm.*

H8: *Perceived economic concern, in terms of the exchange of quantifiable terminologies for either money, revenue, incentives, or social competition as perceived by individuals, significantly influences attitude.*

H9: *Perceived economic concern, in terms of the exchange of quantifiable terminologies for either money, revenue, incentives, or social competition as perceived by individuals, significantly influences perceived behavioral control.*

In this study, the authority lies in the government who are expected to encourage the use of electric public transportation. Perceived authority support was found to positively influence behavioral domains [78]. Contrary to this, perceived authority support and subjective norm had the least correlation but were still found to have a significant effect on behavioral intention [60]. As shown in the study, the positive sustainable behavior of consumers can be achieved through a supportive government. Further, the study of Jin and Rainey [79] found that positive outcomes from government sector employees surfaced when incentivized behaviors were implemented. These studies supported the idea of Ong et al. [30] that the greater the support and rewards from the government, the greater the likelihood that consumers will show positive behavior towards their intended actions. In this study, perceived authority support refers to the action and insights provided by the government, which are perceived to be either beneficial or aligned with the sustainable goal and the reasons why electric public transportation is being implemented. Therefore, this study inferred that consumer behaviors could be influenced by how they perceive support from authoritative figures, and hypothesized that:

H10: *Perceived authority support significantly influences subjective norm.*

H11: *Perceived authority support significantly influences attitude.*

H12: *Perceived authority support significantly influences perceived behavioral control.*

However, the need to encompass the technology aspect could also be considered. One of the highly utilized theories is UTAUT2, established by Venkatesh et al. [51]. In this study, the use of electric vehicles as a mode of public transportation is considered as new since the current system is still planning for full implementation. In a study conducted in India, UTAUT2 integrated with the norm activation model (NAM) was found to be useful in discussing electric vehicle adoption intention [80]. Recently, the study of Bhat et al. [81] applied an extended UTAUT model to analyze the effects on consumers' intention to adopt electric vehicles. The latent variables included were performance expectancy, perceived benefits, facilitating conditions, environmental enthusiasm, technology enthusiasm, anxiety (or perceived risk), social image, and social influence. Similarly, the study of Jain et al. [82] integrated UTAUT with Singh's electric vehicle adoption intention (EVADINT), including environmental concern, perceived risk, and government support. Their study showed that performance expectancy and facilitating conditions positively influence consumers' adoption intention of electric vehicles. Although these studies did not include habit and hedonic motivation, Khazaei and Tareq [83] found a positive influence of hedonic motivation on the adoption of electric vehicles.

In the study of Wahl et al. [49], the integrated UTAUT-NAM model showed that performance expectancy, effort expectancy, facilitating conditions, social influence, and personal norms significantly affected EVADINT. However, the variables habit, price value, and hedonic motivation were not considered in these studies. On the other hand, Korkmaz et al. [1] investigated the factors affecting the acceptance of autonomous public transport systems and found that performance expectancy, social influence, habit, and trust and safety were the only positively significant variables on behavioral intention. In the study of Koh and Yuen [84], performance expectancy was among the variables with the greatest total effect on the acceptance of autonomous vehicles. Similarly, Kapser and Abdelrahman [47] found

that performance expectancy, in relation to travel range, positively influences consumer adoption intention. On the other hand, Zheng and Gao [50] defined hedonic motivation as a stimulant of consumers' interest which is usually associated with positive emotions such as excitement and pleasure. In developing countries, hedonic motivation is seen as a strong factor affecting consumers' behavior to use electric vehicles [85]. As seen by Meyer-Waarden and Cloarec [86], hedonic benefits can be derived from entertainment functions. This implies that high hedonic motivation increases user experience and overall quality of life. Looking more into the interrelationships of the variables, hedonic motivation was also found to be the strongest factor of behavioral intention [87]. This supports the findings of Tran et al. [85], implying that consumers who have experienced the technology have enjoyed it. Nordhoff et al. [48] also found that facilitating conditions are a direct predictor of behavioral intention. As the variables mentioned above were found to have a positive relationship with behavioral intention, other studies have shown that not all variables are significant for behavioral intention when assessing technology acceptance.

In the study of Manutworakit [88], price value was found to be insignificant for behavioral intention. However, the study of Khazaei [89] showed that price value and behavioral intention are positively related, implying that consumers still find the value reasonable and have understood the effectivity and economic benefits of electric public transportation. Moreover, the study of Zhou et al. [68] found that all the variables of the figure representing the domains were significant, including performance expectancy, effort expectancy, facilitating conditions, hedonic motivation, price value, and habit. Thus, this study hypothesized that:

H13: *The UTAUT2 domains significantly influence green behavioral intention.*

In a specific context, Hayes et al. [90] defined acceptance as the voluntary adoption of an intentionally open, receptive, flexible, and nonjudgmental posture with respect to moment-to-moment experience. Similarly, Bordieri [91] characterized acceptance as a manifestation of willingness and openness to enable individuals to partake in purposeful actions and experience a fuller and more liberated life in the world. Considering the two provided definitions, this research adopted Bordieri's [91] definition of acceptance as the operational definition to be utilized in this study. Relatedly, Shahzad et al. [92] studied green technology and predicted that green behavioral intention has a strong direct effect on green innovation adoption. The study of Joo and Hwang [93] also presented a direct effect on positive behavioral intention towards acceptance when it comes to green consumers, public transportation [94], and green behavior [95]. Thus, it was hypothesized that:

H14: *Behavioral intention has a significant direct effect on the acceptance of electric public transportation.*

3. Research Approach

3.1. Participants

The survey was voluntarily completed by 438 respondents in total. The study considered respondents residing in the Philippines who were over 18 years of age. The sampling criteria encompassed individuals who had availed themselves of electric public transportation, including e-jeepneys, e-buses, and e-tricycles, within the National Capital Region (NCR), Philippines. The responses used in this study were gathered through Google Forms, collected from November 2023 to January 2024. The survey questionnaires were disseminated through social media platforms. The sample size was calculated using the Yamane Taro [96] formula show in the following equation:

$$n = \frac{N}{1 + N(e)^2},$$

Given a population of 69.4 million Filipino consumers aged 18 years and above [60,96], the determined sample size for a 95% confidence level was 400. The current study successfully obtained the anticipated number of participants during the data collection phase. Furthermore, there was a complete response rate, with all respondents providing answers to the questionnaire.

Table 2 displays the descriptive statistics detailing the demographic profiles of the target respondents. A total of 66.21% were female and 33.79% were male, with ages ranging from 18–26 years old (95.21%) to 27–35 years old (3.65%). The respondents were asked about their monthly salary, and it was found that 47.72% earned PHP 4000 or less, 20.78% earned PHP 4001–PHP 8000, 15.98% earned PHP 8001–PHP 15,000, 9.82% earned PHP 15,001–PHP 30,000, 2.74% earned PHP 30,001–PHP 50,000, and 2.97% earned more than PHP 50,000. In terms of occupational status, the sample comprised 88.58% students, 8.22% employees or self-employed, 1% employers or business owners, and 2.28% unemployed. Moreover, in terms of educational background, there were 70.09% high school graduates, 24.89% college graduates, 2.05% technical-vocation graduates, and 0.23% PhD degree holders. Furthermore, the respondents' intent of travel using electric public transportation was found as follows: 68.04% school-related, 12.33% recreational activities, 8.45% work-related, 6.39% family visitations, 1.60% business-related, and 3.20% for other reasons. In terms of utilizing electric public transportation, 15.53% have used e-jeepneys, 15.07% e-buses, 11.42% e-tricycles, 9.82% have used both e-jeepneys and e-buses, 15.30% have used both e-jeepneys and e-tricycles, 12.33% have used both e-buses and e-tricycles, and 20.55% have used all three modes of transportation. Meanwhile, the respondents' frequency of utilizing electric public transportation was as follows: 49.54% at least once a week, 24.43% more than 4 times a week, 17.81% twice a week, and 8.22% thrice a week.

Table 2. Demographic characteristics (n = 438).

Factor	Characteristics	N	%
Sex	Male	148	33.79
	Female	290	66.21
Age	18–26 years old	417	95.21
	27–35 years old	16	3.65
	36–44 years old	2	0.46
	45–53 years old	2	0.46
	54–60 years old	0	0.00
	60 years old and older	0	0.00
Monthly Salary/Allowance	PHP 4000 or less	209	47.72
	PHP 4001–8000	91	20.78
	PHP 8001–15,000	70	15.98
	PHP 15,001–30,000	43	9.82
	PHP 30,001–50,000	12	2.74
	more than PHP 50,000	13	2.97
Occupational Status	Student	388	88.58
	Employee/Self-Employed	36	8.22
	Employer/Business Owner	4	0.91
	Unemployed	10	2.28
Educational Background	High School Graduate	307	70.09
	Technical-Vocation Graduate	9	2.05
	College Graduate	109	24.89
	Master's Degree Holder	0	0.00
	PhD Degree Holder	1	0.23

Table 2. *Cont.*

Factor	Characteristics	N	%
Intent of Travel	Work-related	37	8.45
	School-related	298	68.04
	Business-related	7	1.60
	Recreation	54	12.33
	Family Visitation	28	6.39
	Other reasons	14	3.20
Utilized electric public transportation	e-jeepney	68	15.53
	e-bus	66	15.07
	e-tricycle	50	11.42
How often do you ride electric public transportation?	at least once a week	217	49.54
	twice a week	78	17.81
	thrice a week	36	8.22
	4 times or more	107	24.43

3.2. Questionnaire

The questionnaire utilized in this study was composed of three parts. The initial part of the questionnaire assessed the demographic profile of the respondents as presented in Table 1. The second part assessed the acceptability of electric public transportation in accordance with consumers' habits, hedonic motivation, price value, effort expectancy, facilitating conditions, and performance expectancy. Consequently, the third part assessed consumers' behavioral intentions, subjective norm, attitude, perceived behavioral control, perceived environmental concern, perceived authority support, and acceptance towards green behavioral intention. The questionnaire encompassed 14 latent variables with 3–5 constructs each, which were adapted from various studies: German et al. [60], Korkmaz et al. [1], and Ong et al. [31]. Following the studies, the questionnaire utilized a 5-point Likert scale ranging from "Strongly Disagree—1" to "Strongly Agree—5". In total, the questionnaire consisted of fourteen latent variables and fifty-five questions (Appendix A) encompassing two models, the UTAUT2 model and sustainable planned behavior theory.

3.3. Partial Least Squares Structural Equation Modeling

The study utilized structural equation modeling (SEM) in data analysis. According to Kang and Ahn [97], SEM is an efficient method of analyzing data to manage measurement inaccuracies, employ intervening factors, and assess the statistical validity of a theoretical framework. SEM is also a widely used multivariate analysis tool used by researchers in transportation engineering when exploring travel behavior [98]. The calculation of SEM, as adopted from Marcoulides [99], shows how the generalizability used in partial least squares SEM could be employed for any model. It was further explained that it encompasses error rates, any modification, and model structure—enabling researchers to explore and provide causal predictive purpose calculation. A three-stage approach is used for calculation.

Stage 1: Convergence among the correlational (whether simple or multiple) iterative schemes for the variable estimation is applied.

Stage 2: Coefficients are determined from path analysis, loadings, and mean estimate through a non-iterative approach.

Stage 3: Variables are then considered as deviations from the means calculated.

As a reflective construct was applied in this study (Figure 3), ε_i and η_i are considered as latent variables, reflected with their measure items, X_1, X_2, X_3. From here, the calculation proceeds with fitted functions from the parameter estimate (Σ), sample correlation (S), and number of indicators (X_n), where n is any number of indicators. Expressed in Equation (1) is the calculation for the base estimation. In the case of partial least squares calculation, these could be calculated back and forth for latent variable estimation, creating an estimate from one latent variable (ε_i) to another (η_i), or an estimate for weights, and their respective

relationship. Most commonly, a 0.70 weight is considered to be significant to provide higher confidence in the calculation [60,64].

$$\ln(\Sigma) + trace\left(\frac{S}{\Sigma}\right) - \ln|S| - X_n \quad (1)$$

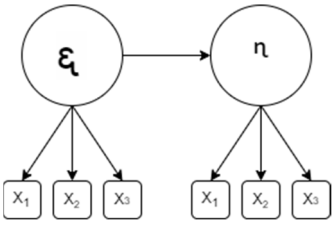

Figure 3. Reflective construct.

In Gopi et al. [100], SEM was proposed to examine electric bus adoption based on consumers' social values. The results showed that key influences like financial, infrastructure, technology, and institutional aspects impacted the adoption of e-buses. The model presented in the study used formative-reflective higher order constructs. In the study of German et al. [60], the latent variables considered in analyzing consumers' intention regarding package carriers were SERVQUAL variables, reflected as higher order constructs. This was deemed beneficial and created better accuracy in analysis due to reduced path analyses. Their study utilized partial least squares SEM (PLS-SEM), a type of SEM that considers variance-based analysis. Dash and Paul [101] argued that this is a more sensitive tool for analysis, especially when dealing with large construct models. Compared to its counterpart, co-variance-based SEM, it was expressed that several limitations are present. One of these is its capability to analyze higher order constructs. This is said to be advantageous when dealing with multiple path analysis since it reduces the path, thereby reducing the errors in calculation [60,64]. Thus, PLS-SEM is suitable for a more intricate analysis. As reflected in the study of Li et al. [102], PLS-SEM could be used to analyze a reflective construct.

A similar discussion on higher order SEM was offered by Sarstedt et al. [64], who promoted the use of this technique when numerous path analyses are seen. The UTAUT2 model was chosen for this study due to its proven effectiveness in representing consumer acceptance of technology, as studies have indicated its significant utility in enhancing comprehensiveness and efficacy [82,103]. Partial least squares SEM using the Smart PLS V3.0 was utilized in this study [104].

4. Results

Conducting the initial SEM (Figure 4), 11 out of 14 hypotheses were deemed significant. A dashed line indicates the non-significant relationship between subjective norm and behavioral intention, perceived authority support and attitude, and perceived authority support and perceived behavioral control. This is because their p-value is greater than 0.05 [105]. In addition, measure items with values less than 0.70 were considered insignificant. Therefore, these were recommended to be removed from the PLS-SEM algorithm to create the final SEM [104].

Shown in Table 3 are the lower order constructs' descriptive statistics, reliability, and factor loadings. As seen from the table, all final factor loadings (FLs) surpassed the specified threshold of 0.70 as recommended by Dash and Paul [101]. In addition to this, the construct reliability and validity, assessed through Cronbach's alpha (CA) and composite reliability (CR), were found to be acceptable, exceeding the 0.70 threshold suggested by Hair [104] and German et al. [60]. Moreover, the average variance extracted (AVE) for these constructs exceeded the recommended threshold of 0.50. Presented in Figure 5 is the summarized graphical output of the construct, showing that the majority of the responses were within

3.6–4.12, followed by 2.56–3.08, indicating the inclination towards the acceptance of electric public vehicles.

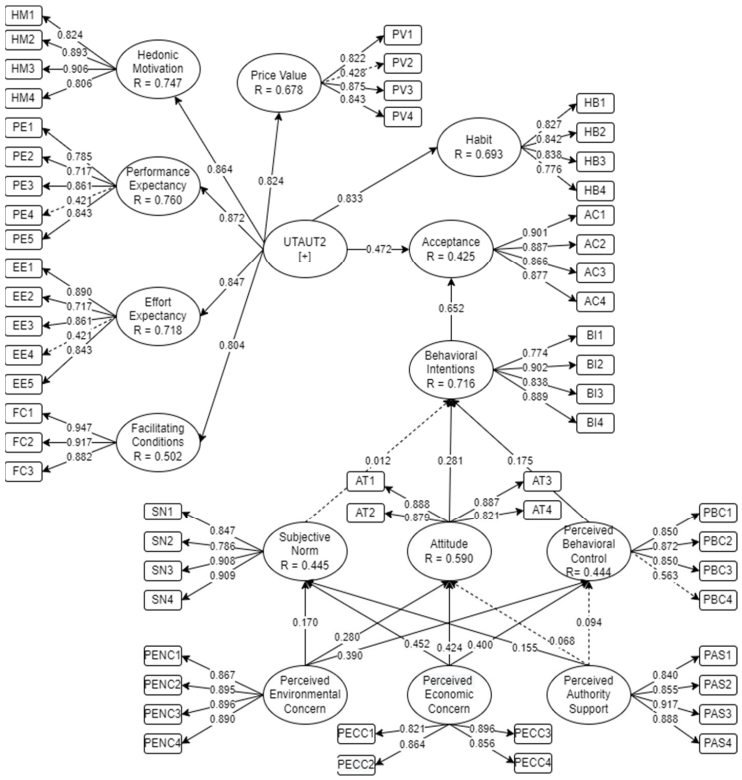

Figure 4. Initial structural equation modeling.

Table 3. Lower order construct validity and reliability.

Measure Items	Mean	StD	Initial FL	Final FL	CA	CR	AVE
HB1	3.605	1.125	0.827	0.823	0.839	0.892	0.674
HB2	3.941	0.963	0.842	0.849			
HB3	3.603	1.121	0.838	0.838			
HB4	3.283	1.223	0.776	0.774			
PV1	3.735	0.962	0.822	0.820	0.816	0.891	0.731
PV2	4.331	0.826	0.428	-			
PV3	3.813	0.930	0.875	0.889			
PV4	3.833	0.976	0.843	0.854			
HM1	3.692	0.992	0.894	0.896	0.898	0.929	0.767
HM2	3.523	1.028	0.893	0.895			
HM3	3.712	1.000	0.906	0.908			
HM4	3.769	0.979	0.806	0.801			
PE1	3.847	0.900	0.785	0.803	0.827	0.886	0.66
PE2	4.068	0.886	0.717	0.726			
PE3	3.516	1.068	0.861	0.871			
PE4	3.153	1.274	0.421	-			
PE5	3.315	1.088	0.843	0.843			
EE1	3.934	0.890	0.890	0.890	0.88	0.926	0.807
EE2	3.749	0.984	0.894	0.894			
EE3	3.954	0.877	0.911	0.911			
FC1	3.071	1.169	0.947	0.951	0.909	0.934	0.825
FC2	2.913	1.135	0.917	0.921			
FC3	2.993	1.109	0.882	0.865			

Table 3. *Cont.*

Measure Items	Mean	StD	Initial FL	Final FL	CA	CR	AVE
BI1	3.495	1.168	0.774	0.773	0.873	0.914	0.727
BI2	4.000	0.914	0.902	0.903			
BI3	4.103	0.910	0.838	0.839			
BI4	3.893	0.970	0.889	0.889			
SN1	3.249	1.151	0.847	0.849	0.887	0.922	0.747
SN2	3.244	1.175	0.786	0.793			
SN3	3.263	1.146	0.908	0.904			
SN4	3.256	1.130	0.909	0.906			
AT1	4.023	0.929	0.888	0.888	0.892	0.925	0.755
AT2	3.900	0.914	0.879	0.880			
AT3	4.023	0.865	0.887	0.887			
AT4	3.760	0.995	0.821	0.820			
PBC1	3.874	1.011	0.850	0.857	0.843	0.905	0.76
PBC2	3.742	1.025	0.872	0.893			
PBC3	3.806	0.984	0.850	0.865			
PBC4	4.185	0.948	0.563	-			
PENC1	4.007	0.872	0.867	0.867	0.91	0.937	0.787
PENC2	3.995	0.896	0.895	0.895			
PENC3	3.929	0.915	0.896	0.896			
PENC4	3.995	0.912	0.890	0.890			
PECC1	3.699	0.996	0.821	0.821	0.882	0.919	0.739
PECC2	3.256	1.138	0.864	0.864			
PECC3	3.486	1.048	0.896	0.896			
PECC4	3.680	0.997	0.856	0.856			
PAS1	3.192	1.161	0.840	0.843	0.898	0.929	0.765
PAS2	3.317	1.163	0.855	0.864			
PAS3	3.463	1.074	0.917	0.911			
PAS4	3.509	1.068	0.888	0.880			
AC1	3.911	0.903	0.901	0.901	0.906	0.934	0.779
AC2	3.918	0.898	0.887	0.887			
AC3	3.705	1.052	0.866	0.866			
AC4	3.872	0.942	0.877	0.877			

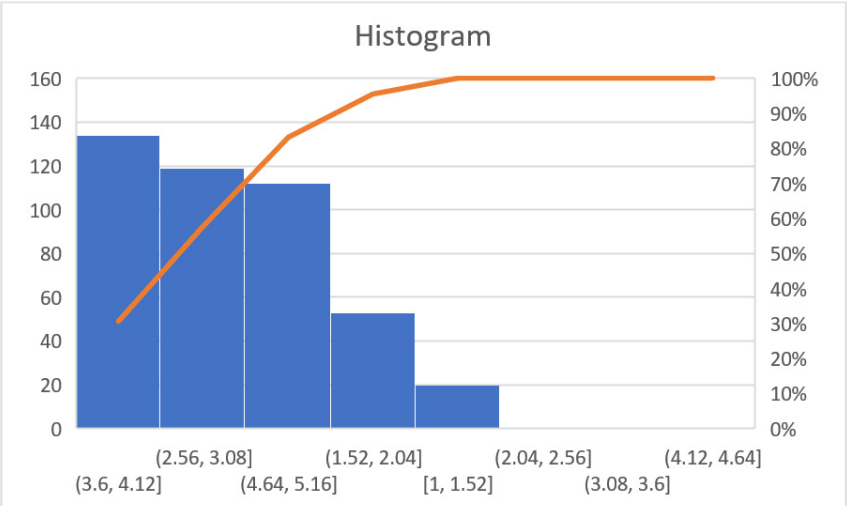

Figure 5. Summarized output—histogram. Note: The *y*-axis represents the average response on a 5-point Likert scale; the *y*-axis represents the respondents.

Table 4 presents the higher order constructs, wherein all variables were also found within the specified threshold. Hence, the final SEM was run and is presented in Figure 6.

Table 4. Higher order construct validity and reliability.

Higher Order	Items	Initial FL	Final FL	CA	CR	AVE
UTAUT2	EE1	0.753	0.764	0.929	0.971	0.591
	EE2	0.757	0.769			
	EE3	0.773	0.788			
	FC1	0.749	0.751			
	FC2	0.729	0.735			
	FC3	0.724	0.728			
	HB1	0.749	0.761			
	HB2	0.716	0.743			
	HB3	0.768	0.775			
	HB4	0.787	0.801			
	HM1	0.740	0.776			
	HM2	0.719	0.762			
	HM3	0.751	0.795			
	HM4	0.804	0.808			
	PE1	0.785	0.792			
	PE2	0.756	0.763			
	PE3	0.727	0.731			
	PE4	0.775	0.781			
	PE5	0.726	0.738			
	PV1	0.765	0.769			
	PV2	0.883	0.885			
	PV3	0.743	0.726			
	PV4	0.710	0.718			

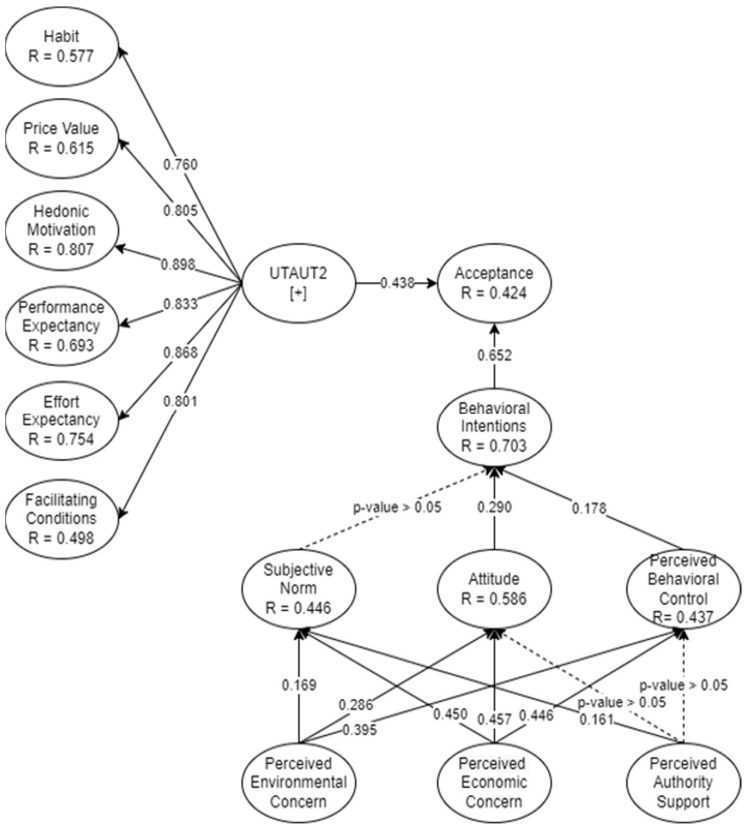

Figure 6. Final structural equation modeling.

In evaluating discriminant validity, the Fornell–Larker criterion and heterotrait–monotrait ratios (HTMT) were utilized. As seen in Table 5, the values representing the square root of AVE surpassed the values in their corresponding columns and rows, signifying discriminant validity [105]. To reinforce validation, the HTMT values, shown in Table 6, were below the 0.85 threshold, as recommended by Kline [106]. This affirms the attainment of validity.

Examining the model fit indices in Table 7, the results showed that all items fall within the specified threshold. This suggests that the model, designed to evaluate acceptance to use electric public transportation, is considered acceptable. The values of d_ULS and d_G were 5.316 and 1.205, respectively. From the output, it could be deduced that 5% of the data generated from the sample exhibited behavior consistent with the hypothesized model. Considering the qualities of d_ULS and d_G, the theoretical model used adequately explains the observed data. In Table 8, beta values, *p*-values, and corresponding decisions utilized in the discussion of results are presented.

Table 5. Fornell–Larcker criterion.

	AT	AC	PECC	EE	PENC	FC	BI	HM	HB	PAS	PBC	PE	PV	SN	UTAUT2
AT	0.869														
AC	0.677	0.883													
PECC	0.699	0.659	0.806												
EE	0.690	0.555	0.588	0.898											
PENC	0.676	0.716	0.615	0.595	0.887										
FC	0.553	0.512	0.536	0.602	0.815	0.908									
BI	0.773	0.652	0.64	0.746	0.642	0.617	0.852								
HM	0.712	0.584	0.654	0.648	0.516	0.629	0.646	0.876							
HB	0.615	0.580	0.579	0.625	0.522	0.480	0.728	0.617	0.821						
PAS	0.431	0.393	0.525	0.454	0.361	0.863	0.442	0.464	0.352	0.875					
PBC	0.728	0.555	0.622	0.704	0.560	0.735	0.714	0.613	0.597	0.404	0.872				
PE	0.675	0.588	0.674	0.678	0.521	0.601	0.656	0.738	0.616	0.478	0.651	0.812			
PV	0.678	0.611	0.635	0.662	0.584	0.706	0.692	0.610	0.679	0.383	0.611	0.608	0.855		
SN	0.552	0.559	0.638	0.455	0.503	0.819	0.498	0.512	0.462	0.458	0.452	0.502	0.435	0.864	
UTAUT2	0.707	0.676	0.725	0.868	0.643	0.721	0.704	0.698	0.706	0.499	0.744	0.733	0.705	0.546	0.769

Table 6. Heterotrait–monotrait ratio.

	AT	AC	PECC	EE	PENC	FC	BI	HM	HB	PAS	PBC	PE	PV	SN	UTAUT2
AT															
AC	0.749														
PECC	0.787	0.732													
EE	0.778	0.621	0.663												
PENC	0.750	0.790	0.685	0.665											
FC	0.536	0.535	0.547	0.520	0.541										
BI	0.838	0.724	0.721	0.850	0.715	0.352									
HM	0.795	0.643	0.732	0.726	0.569	0.535	0.724								
HB	0.707	0.660	0.671	0.725	0.594	0.559	0.847	0.705							
PAS	0.478	0.430	0.578	0.505	0.396	0.687	0.495	0.507	0.399						
PBC	0.838	0.638	0.712	0.801	0.623	0.441	0.825	0.710	0.722	0.457					
PE	0.786	0.678	0.786	0.795	0.600	0.530	0.771	0.832	0.741	0.541	0.785				
PV	0.789	0.702	0.745	0.780	0.673	0.665	0.811	0.706	0.816	0.444	0.750	0.739			
SN	0.616	0.614	0.713	0.512	0.551	0.745	0.555	0.570	0.531	0.502	0.511	0.578	0.501		
UTAUT2	0.837	0.734	0.799	0.754	0.697	0.736	0.788	0.754	0.823	0.538	0.847	0.752	0.819	0.596	

Table 7. Model fit indices.

Parameters	Estimates	Suggested Cut-off	Reference
SRMR	0.068	<0.08	Hu and Bentler [107]
Chi-Square	3.652	<5.00	Hooper et al. [108]
NFI	0.916	>0.90	Baumgartner and Homburg [109]

Table 8. Hypothesis results.

Hypotheses	Relationship	B-Values	*p*-Values	Decision
1	SN→BI	0.012	0.778	Reject
2	AT→BI	0.290	<0.001	Accept
3	PBC→BI	0.178	0.004	Accept
4	PENC→SN	0.169	<0.001	Accept
5	PENC→AT	0.395	<0.001	Accept
6	PENC→PBC	0.286	<0.001	Accept
7	PECC→SN	0.450	0.001	Accept
8	PECC→AT	0.457	<0.001	Accept
9	PECC→PBC	0.446	<0.001	Accept
10	PAS→SN	0.161	<0.001	Accept
11	PAS→AT	0.068	0.109	Reject
12	PAS→PBC	0.094	0.126	Reject
13	UTAUT2→BI	0.438	<0.001	Accept
14	BI→AC	0.652	<0.001	Accept
Higher Order	UTAUT2→EE	0.868	<0.001	Accept
	UTAUT2→FC	0.801	<0.001	Accept
	UTAUT2→HM	0.898	<0.001	Accept
	UTAUT2→HB	0.760	<0.001	Accept
	UTAUT2→PE	0.833	<0.001	Accept
	UTAUT2→PV	0.805	<0.001	Accept

5. Discussion

The present study investigated the acceptance of green behavioral intention among Filipino respondents who have utilized electric public transportation. Integrating UTAUT2 in a reflective-reflective format and sustainability theory of planned behavior (STPB), all latent variables were assessed for significant effect on green behavioral intentions, as presented in Table 7.

The results revealed that UTAUT2 and its domains showed the highest significant effects (β: 0.438, $p = 0.001$). Hedonic motivation was found to be the most reflective variable affecting green behavioral intention, followed by effort expectancy, performance expectancy, price value, and facilitating conditions, with habit being the least influencing variable. As integrated in the framework, hedonic motivation in the consumer context was found to be significant (β: 0.898, $p = 0.001$). Based on the constructs, consumers perceive electric public transportation not only as a functional means of travel, but also as an engaging and pleasurable experience. A study showed that social factors are significant in motivating individuals to adopt electric transportation [110]. Furthermore, results also suggest that electric public transportation increases personal satisfaction. Similarly, evidence from Beijing revealed that green space and highly urbanized environments affect consumers' intention towards the adoption of electric transportation [111]. This signifies that urban planning including design and management are important factors in promoting the use of electric public transportation, which should be promoted by the Philippine government as it is not currently available, but it is among the developments being proposed.

In relation to the previous variable, effort expectancy (β:0.868, $p = 0.001$) measures consumers' expectations regarding the ease of use and simplicity of interacting with the technology. Based on the constructs, the users' positive perception of the technology suggests a

potential for the widespread use and successful integration of electric public transportation into daily commuting routines, creating a user-friendly and accessible transportation system for the public. The findings are similar to those of the studies of Featherman et al. [6], Jaiswal et al. [112], and Gunawan et al. [65] on adopting e-transportation technologies, which indicate that electric transportation is easy to learn and to use. However, since electric public transportation has not yet been established, only the Filipinos' perception of it was obtained and implicated. The governing bodies could consider the output of this study, so that the use of electric public transportation in the country could be easily promoted, advertised, and implemented. As is evident from related studies [6,65,112], society would be accepting due to the ease of use. That is, there are no changes in utility; only the vehicles themselves are changed.

In the model, the third variable affecting green behavioral intention and acceptance is performance expectancy (β: 0.833, $p = 0.001$). This variable explores consumers' perception of the extent to which adopting a technology will enhance their job performance and overall productivity. Adopting electric public transportation not only enhances the safety of travel, but also contributes to comfortability and efficiency. Consumers with a positive attitude towards the adoption of technology believe that it can help them in their tasks [113]; thus, electric public transportation holds the potential to improve productivity. Compared to the study of Ong et al. [52] in Thailand, it could be posited that a contrast is seen since there are no significant differences in the action needed to be considered by passengers, making performance expectancy highly significant.

In addressing the cost of transportation from the consumers' perspective, price value was integrated into the UTAUT2 framework (β: 0.805, $p = 0.001$). The results imply that the cost of -electric -public transportation is justified and offers good value for consumers. In the Philippines, e-transportation trip fares range from PHP 14 (USD 0.25) for e-jeepneys to PHP 25 (USD 0.45) for e-tricycles and e-buses, varying according to distance traveled [114]. Additionally, people perceive electric public transportation as a worthwhile government investment as well as an important factor to incorporate into one's daily routine. Recently, the Philippine Department of Energy (DOE) launched the first electric buses in the country, aligning with the objective of shifting to electric vehicles by 2040 [115]. Overall, this suggests that people see transportation technology as both a beneficial service and a necessary component of their transportation needs.

Moreover, facilitating conditions are seen to have a significant effect on green behavioral intention to use electric public transportation (β: 0.801, $p = 0.001$). Facilitating conditions examine the role of external factors, resources, and support systems that may affect users' ability to adopt the technology [68,82]. From the constructs, users believe that they can receive assistance in using the technology. Moreover, users expect that electric public transportation will be able to integrate with other transportation options, highlighting a potential for compatible and convenient transportation networks. Other studies such as those of Kapser and Abdelrahman [47], Tarei et al. [116], and Wolbertus et al. [117] also covered charging infrastructures in adopting electric vehicles. In the context of electric public transportation, specifically in e-buses, Su et al. [118] suggested that charging stations should be deployed at the end of bus routes, improving charging efficiency. As expressed by Uy et al. [119], the Philippines has not yet established these infrastructures, and this needs to be considered for the wide adoption of electric vehicles.

The last variable under the UTAUT2 model, habit was found to be the least influencing factor on the intention to accept electric public transportation (β: 0.76, $p = 0.001$). Based on the established constructs, consumers believe that they would be encouraged to utilize electric public transportation and would be willing to pay more for the service. Similar to the results of Korkmaz et al. [1], habit was found to have a positive effect on behavioral intention. Meanwhile, Venkatesh et al. [51] related habit with the respondents' profile to theorize the effects of demographic characteristics on consumers' habitual intentions. The results showed that people aged 18–26 years old make more extensive use of electric public transportation—a reflection on the claim of Venkatesh et al. [51]. It is evident that most

people utilize electric public transportation for school and work commuting at least once a week, thus establishing the buildup of habit on utility.

Furthermore, STPB encompassed variables which provide significance and interactions influencing sustainable green behaviors, similarly to Hauslbauer et al. [120]. A statistically significant relationship was found between perceived environmental concern and attitude (β: 0.395, p = 0.001), perceived environmental concern and perceived behavioral control (β: 0.286, p = 0.001), and perceived environmental concern and subjective norm (β: 0.169, p = 0.001). Based on the measurements, users rationalize that electric public transportation stems from the belief that it can help protect the environment and positively contribute to addressing issues caused by human activities. This is similar to the findings of Adetola et al. [121], showing how environmental concern is an important antecedent in adopting green behavior in hotels. Highlighting the strong correlation between environmental concerns and advocating for electric public transportation, the results showed the potential impact of consumer belief and actions in supporting sustainable transportation [122–124]. Studies have not yet established a generalization among sustainable behavior in the Philippines, thereby creating a benchmark of implications for the sustainability aspects in the country.

In addition, perceived economic concern had a significant effect on perceived behavioral control (β: 0.446, p = 0.001), attitude (β: 0.457, p = 0.001), and subjective norms in terms of society, close relative and friends, and the community (β: 0.45, p = 0.001). Electric public transportation can be emphasized in terms of its competitiveness in the market, potential cost saving, efficiency in travel, and good warranties and economic incentives. From an economic and environmental perspective, traveling equivalent distances using an electric vehicle is more cost-saving and effective in reducing carbon dioxide emissions compared to using a vehicle powered by internal combustion [125]. Similar to the study of Agaton et al. [126], electric public transportation poses an opportunity for transport operators and investors. From the perspective of drivers of electric vehicles, the most significant financial factor is the funding after the initial introduction of the project, while their least concern involves the high battery cost of electric vehicles [119]. These studies suggested that the support and financial strategies for using electric vehicles are pivotal in encouraging and maintaining the adoption of electric vehicles in society. In the Philippines, only incentives are given for public electric vehicle adoption, and this has not yet proliferated in public transportation. This could be an area that the government may consider and develop for a smart vehicle and transportation system.

Lastly, perceived authority support was found to have a significant effect on subjective norm (β: 0.161, p = 0.001). Perceived behavioral control (β: 0.094, p = 0.001) and attitude (β: 0.068, p = 0.068), however, were found to be insignificant. Users perceive that the Philippine government does not actively provide infrastructure for electric public transportation and does not promote its utilization among citizens either. Based on the constructs, the government is not seen to demonstrate comprehensive commitment to promote and enable the adoption of electric public transportation by implementing specific regulations to facilitate and support the technology in the country. This contradicts the study of Gumasing et al. [127], where perceived authority support was seen as the highest and strongest significant influencing factor, proving that authority support positively affects Filipinos' environmental interests. This was the case of their study because they solely based this claim on their focus on renewable energy sources. As the government increases authority support, this also increases consumers' green behavioral intention, thus increasing the awareness of environmental concerns [128].

As for the TPB main domains, studies have used extended versions of the model in proving the positive relationship of the variables with the intention of adopting electric vehicles [57,129–131]. In this study, attitude was seen to have the strongest positive relationship with green behavioral intention (β: 0.29, p = 0.001), followed by perceived behavioral control (β: 0.178, p = 0.001). However, subjective norm was seen to have an insignificant effect on green behavioral intention (β: 0.012, p = 0.001). This contradicts the studies of Dutta and Hwang [132] and Javid et al. [133], proving that subjective norm is

essential for growing and developing the positive intention of consumers towards green behavioral actions. As such, consumers do not necessarily conform and are not likely to create a favorable impression on people whose opinions they value in using electric public transportation. Findings suggest that consumers may not be significantly influenced by the behavior of their surrounding peers in perceiving a positive image towards the use of electric public transportation.

Moreover, attitude was also seen to have a significant effect on green behavioral intention. This indicates that consumers can recognize the value of electric public transportation in positively contributing to the environment. Hasan [134] highlighted the significance of attitude on green behavioral intention, a finding supported by Zhang et al. [135], who also emphasized the role of attitude as a key influencing factor in adopting green behavioral behavior. These studies offer proof that recognizing and understanding the influence of attitude can promote sustainable behaviors and positively shape individual attitudes towards the environment.

Accordingly, perceived behavioral control was found to have a significant effect on green behavioral intention, indicating that consumers feel confident about using electric public transportation. Measurements implied that choosing electric public transportation aligns well with the preferences of consumers as well as positively contributing to reducing the carbon footprint. This highly supports the findings of Şimşekoğlu and Nayum [77], who examined the roles of different variables in predicting consumers' intention towards buying electric vehicles. It was found that perceived behavioral control explains consumers' financial capability to purchase the technology without affecting their intention to buy electric vehicles. On the other hand, the study of Karuppiah and Ramayah [136] indicated that price weakens the relationship between consumers' purchasing intentions and the services they consider. In essence, when price becomes a prominent factor in the decision-making process, it diminishes the strength of the relationship between what consumers intend to buy and their actual purchase behavior. With the respondents emphasizing the utility of electric public transportations, the price value in the current state could be posited as acceptable, which explains why the TPB domains are significant.

Understanding the correlation between individual green behavioral intentions and people's acceptance of environmentally sustainable practices is essential in shaping the trajectory towards an eco-conscious society. With a significant effect on acceptance (β: 0.652, $p = 0.001$), indicators of green behavioral intentions show that utilizing electric public transportation does not only align with the consumers' personal preferences but also supports environmental conservation efforts, minimizing harm to both the environment and human health. Due to its significant contribution to reducing transport emissions, the acceptance of electric vehicles is seen as an innovative opportunity in the field of human mobility [28]. Moreover, studies have shown that a commitment to environmental concerns increases an individual's acceptance of green practices [137]. As acceptance is driven by these factors, it is important to consider their integration into broader policy frameworks and public awareness campaigns to promote the widespread adoption of and support for sustainable transportation alternatives such as electric public transportation.

For acceptance to be highly promoted, constructs showed that consumers prefer using electric public transportation as it is less polluting, environmentally friendly, and energy efficient. This supports the findings of Doulgeris et al. [138] and Saray et al. [139], indicating that utilizing electric-powered vehicles as public transportation addresses various challenges in energy efficiency. Moreover, people prefer and choose to use electric public transportation as it brings less harm to other people. This further shows that people show their consideration towards others by using electric public transportation. Conclusively, utilizing electric public transportation reflects the consumers' attitude towards the environment as well as the good health of society. In this study, both UTAUT2 and STPB were integrated to analyze the interrelations of the variables and provide a deep analysis of how each factor affects the other.

5.1. Theoretical Implication

UTAUT2, as a higher order model, was found to predict the use of electric public transportation, providing a comprehensive understanding of the factors influencing its acceptance. For instance, the study of Korkmaz et al. [1] revealed that performance expectancy, social influence, and habit significantly affect behavioral intention. That study was performed in Istanbul; however, the current study considered Filipino users of the technology. In this context, the current study focused on individuals with financial capability and experience in using electric public transportation. Parallel to the findings, it was found that experience in using technology is important for measuring the perceptions and user acceptance of electric public transportation. While other variables exhibited positive relationships, emphasis is given on the influence of subjective norm and perceived authority support on attitude and perceived behavioral control. This confirms the study by Liao et al. [45] on the intention to use shared autonomous transportation. Moreover, the insignificance of perceived authority support suggests that the government should encourage and promote the use of electric public transportation. Furthermore, the variables measured with the least usage and significance indicate that consumers may be unaware of the advantages of using electric public transportation.

On the other hand, it is considered essential to place emphasis on STPB to comprehensively address both the behavioral and sustainability aspects of this study. As fossil fuel combustion is associated with air pollution, greenhouse gas emissions, and the presence of total solids [140], sustainability factors are considered in assessing various aspects of supply chains. As explained in the study of Nguyen and Pojani [7], environmental awareness is a strong motivator in reducing the environmental footprint. In this sense, fostering a heightened sense of environmental consciousness can serve as a powerful catalyst for individuals to actively engage in sustainable practices. Similar to the study of Arpaci et al. [141], consumers' positive perceptions of green practices should be evaluated through extraversion, agreeableness, openness, conscientiousness, and neuroticism. Hence, the study formulated the sustainability theory of planned behavior to comprehensively gauge both behavioral and sustainability aspects. With this framework, it is possible to extend its application to various studies relevant to product evaluation, industries, and related fields, as well as to different countries.

5.2. Practical and Managerial Implications

It could be presumed that with the sustainability benefits of electric public transportation, consumers show acceptance and an intention to purchase its services. Since the Philippines has yet to fully implement, cater for, and promote the use of electric vehicle, electric public transportation has only been in the early stages of development among government officials. The conducted analysis aimed to understand and benchmark passenger behavior to help governing bodies develop their promotion and message, encouraging the adoption of electric public transportation. The results proved that perceived environmental concern, economic concern, and authority support affect users' purchasing intention. Given the existing consumer focus on sustainability, there is a need to remodel the promotion, development, and utilization processes.

To encourage consumer adoption, the government should allocate funds to the advancement of electric vehicles tailored to local needs. Enhancing government funding through subsidies for purchases, operational support, and tax exemptions has the potential to foster widespread acceptance among the people. Transportation industries need to take sustainability factors into account when promoting electric-powered products for the masses. Companies ought to actively involve and cooperate with customers to formulate strategies for cost reduction and quality improvement that align with the needs of their customers. Moreover, it could be posited that the advertisement and marketing should focus on the environmental impact of electric public transportation, on how it could progress with environmental development, and on sustainability aspects. By considering social media, more consumers could be informed of the development and progression of the

planned enactment of public transportation redevelopment. Aligning with content creators, influencers, and media stars could influence other people regarding the acceptance and development of sustainable electric public transportation.

Furthermore, considering the impactful variables, it is reasonable to deduce that the government, transportation sectors, and electric vehicle developers should place increased emphasis on enhancing customers' intention to accept and use public transport in a sustainable manner. Strategies may include the development of eco-friendly infrastructure and collaborative initiatives among developers from developed countries that prioritize sustainability in public transportation planning and execution. Alongside the development of public transportation, one of the goals among developing countries would be to create smart cities. Adopting the suggestions made by Akopov and Beklaryan [142], it could be posited that smart traffic lights addressing heavy traffic flow, optimal stop-and-go signaling, and prioritization between pedestrian and vehicle flows could effectively impact traffic issues. Traffic issues are one of the main problems in the Philippines today, but the country could adopt the application made and developed by this study for a more time-efficient traffic flow. In addition, the study of Wang et al. [143] promotes the consideration of traffic rules and fluctuation. That is, the Internet of Things may help in optimum lane and intersection management and the development of vehicle stopping areas, smart traffic lights, road markings, etc. These were suggested improvements which could provide positive insights into traffic issues and increase community satisfaction that the Philippines could consider in smart city development. This collective effort aims not only to meet the immediate transportation needs of the public but also to significantly contribute to a more sustainable future.

5.3. Limitations and Future Research

While this study covered significant discoveries and insights concerning the sustainability and acceptance of electric public transportation, its limitations suggest potential directions for further exploration. First, the current study assessed UTAUT2 integrated with STPB. With this analysis, future research could investigate incorporating additional theories or variables, such as the value belief norm theory and social exchange theory, to gain alternative perspectives. Second, the current study generally focused on users of electric public transportation only. It is suggested to consider the perspectives of non-users such as private vehicle owners, to establish the viewpoints of both users and non-users. Third, the current study assessed the behavioral intention and acceptability of electric public transport. Future studies could consider exploring actual behavior, as distinctions may arise between behavioral intentions and actual behavior. In addition, different regions and contexts would provide a broader perspective on the factors influencing the acceptance of electric public transportation. Including comparative studies could highlight regional differences and similarities and measuring socio-demographic characteristics alongside acceptance when the electric public transportation is established could be beneficial for generalizability and comparison with other countries. Lastly, this study analyzed a significantly large model. Future research may try to consider other analysis tools like machine learning algorithms to provide a higher accuracy of findings. The results may be compared and contrasted from a methodological point of view to further prove the validity of the model, analyses made, and implications. Specifically, simulation-based optimization, econometric modeling, simultaneous equations modeling, and clustering could be proposed as study extension and further analysis employment.

6. Conclusions

The present study developed an integrated framework for evaluating the sustainable and behavioral dimensions of accepting electric public transportation. Based on 438 valid responses, it found that the UTAUT2 domains were identified as the most significant factors influencing the acceptance of electric public transportation, with the domains of STPB following closely behind. Assessed in a higher ordered construct, all factors of UTAUT2 were found to be significant for the green behavioral intention of accepting electric public

transportation. The STPB domains of subjective norm, attitude, and perceived behavioral control were also found to have a significantly positive effect on green behavioral intention.

Based on the findings of this study, it is advisable to promote the sustainable and environmental aspects of electric public transportation to enhance the consumption intent of people in the developing setting. With hedonic motivation found to be the highest contributing factor, followed by effort expectancy, this study strongly suggests that prioritizing consumers' pleasure and enjoyment aspects is crucial for assessing their intention to use electric public transportation. Promotions such as lottery or coupons in every ride may enhance customer experience. This can create an implication that consumers can be motivated by positive experiences when making decisions related to service acceptance. In addition, since effort expectancy was found to be significant, this study suggests that the perceived ease of use of the service is crucial for influencing consumer preference, implying that services requiring less effort are likely to be favored by the consumers. Conclusively, the practical and managerial implications of the study suggest that consumers exhibit acceptance and intent to utilize electric public transportation due to its sustainable benefits. Utilizing the established and validated framework, this study advocates for the assessment of sustainable behaviors through the integration of the sustainability theory of planned behavior and UTAUT2, aligning with the current behaviors of consumers.

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Appendix A

Latent Variable	Item	Measurement
Habit	HB 1	Using electric public transportation (EPT) would become a habit for me.
	HB 2	I would be encouraged to use electric public transportation (EPT).
	HB 3	I would think that I must use electric public transportation (EPT).
	HB 4	I am willing to pay more for electric public transportation (EPT).

Latent Variable	Item	Measurement
Price Value	PV 1	The use of electric public transportation (EPT) is reasonably priced.
	PV 2	The price of electric public transportation (EPT) is an important factor to consider before using daily.
	PV 3	Electric public transportation (EPT) would be good value for money.
	PV 4	I consider electric public transportation (EPT) a valuable purchase by authorities.
Hedonic Motivation	HM 1	Using electric public transportation (EPT) is fun.
	HM 2	Using electric public transportation (EPT) is entertaining.
	HM 3	Using electric public transportation (EPT) is enjoyable.
	HM 4	I feel more satisfied when I consider using electric public transportation (EPT).
Performance Expectancy	PE 1	Using electric public transportation (EPT) would help me reach my destination more safely.
	PE 2	Using electric public transportation (EPT) would help me reach my destination more comfortably.
	PE 3	Using electric public transportation (EPT) would help me accomplish things more quickly.
	PE 4	Using electronic public transportation (EPT) is the same as the traditional ones.
	PE 5	Using electric public transportation (EPT) would increase my productivity.
Effort Expectancy	EE 1	I find electric public transportation (EPT) easy to use.
	EE 2	It is easy for me to become skillful at using electric public transportation (EPT).
	EE 3	My interaction with electric public transportation (EPT) is clear and understandable.
Facilitating Conditions	FC 1	I would be able to get help from others when I have difficulties using electric public transportation (EPT).
	FC 2	I could acquire the necessary knowledge to use electric public transportation (EPT).
	FC 3	I would expect electric public transportation (EPT) to be compatible with other available transportation.
Behavioral Intentions	BI 1	I will always try to use electric public transportation (EPT) in my travel.
	BI 2	I intend to use electric public transportation (EPT) in the future.
	BI 3	I predict I would use electric public transportation (EPT) in the future.
	BI 4	I intend to recommend electric public transportation (EPT) to other people.
Subjective Norm	SN 1	Riding electric public transportation (EPT) would make a good impression about me on other people.
	SN 2	I assume that people who use electric public transportation (EPT) enjoy more prestige than those who do not.
	SN 3	I assume the people whose opinions I value would prefer that I use electric public transportation (EPT).
	SN 4	I expect that people influence my behavior that I should use electric public transportation (EPT).
Attitude	AT 1	I like the idea of using electric public transportation (EPT).
	AT 2	Using electric public transportation (EPT) is a wise choice.
	AT 3	Using electric public transportation (EPT) would be pleasant.
	AT 4	Considering using electric public transportation (EPT) can be a rewarding experience.
Perceived Behavioral Control	PBC 1	I could use electric public transportation (EPT) instead of a normal public transportation if I wanted to.
	PBC 2	I have no doubt that, if I so want, I will be able to select electric public transportation (EPT) as my next mode of public transportation.
	PBC 3	I am confident that I can use electric public transportation (EPT) easily.
	PBC 4	Whether or not I choose to use electric public transportation (EPT) is mostly up to me.

Latent Variable	Item	Measurement
Perceived Environmental Concerns	PENC 1	I am worried about the state of the world's environment and what it will mean for my future, so I suggest using electric public transportation (EPT) more.
	PENC 2	Humans frequently harm the environment, so I aim to contribute to its protection by using electric public transportation (EPT).
	PENC 3	Interfering with nature leads to disastrous consequences, so I use electric public transportation (EPT) to help protect it.
	PENC 4	Mankind is severely abusing the environment; hence electric public transportation (EPT) should be utilized.
Perceived Economic Concerns	PECC 1	I can easily use electric public transportation (EPT), given its competitive industry.
	PECC 2	Electric public transportation (EPT) can generate more savings for me, thus improving my economic standing in society, in the long run.
	PECC 3	Electric public transportation (EPT) can help me travel more efficiently so I can save up for more important endeavors in the future.
	PECC 4	There are good warranties and economic incentives for using electric public transportation (EPT).
Perceived Authority Support	PAS 1	The Philippine government is active in setting up the facilities that allow me to use electric public transportation (EPT).
	PAS 2	The Philippine government encourages me to use electric public transportation (EPT).
	PAS 3	The Philippine government endorses the regulation to allow the public to utilize electric public transportation (EPT).
	PAS 4	The government enacts regulations to allow me as a citizen to use electric public transportation (EPT).
Acceptance	AC 1	I prefer using electric public transportation (EPT) because it is environmentally friendly.
	AC 2	I prefer using electric public transportation (EPT) because it is an energy-saving product.
	AC 3	When I have a choice between two modes of transportation, I will prefer electric public transportation (EPT) as it brings less harm to other people.
	AC 4	Over the next month, I will consider using electric public transportation (EPT) as it is less polluting.

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