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Marketing Strategy and Preference Analysis of Electric Cars in a Developing Country: A Perspective from the Philippines

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Abstract: The wide-scale integration of electric vehicles (EVs) in developed countries represents a significant technological innovation and a step toward reducing carbon emissions from transportation. Conversely, in developing nations like the Philippines, the adoption and availability of EVs have not been as rapid or widespread compared to other countries. In identifying this gap, this study delved into the preferences and factors influencing Filipino consumers' willingness to purchase EVs. The study gathered 311 valid responses utilizing conjoint analysis with an orthogonal approach to assess the attributes influencing customers' purchase decisions. Conjoint analysis tools such as IBM SPSS v25 statistics were utilized to infer consumer preference. The results determined that cost is the primary concern for consumers by a considerable margin; followed by battery type and charging method; along with the type of EV, driving range, and charging speed; and most minor concern is regenerative brakes. Therefore, there is an apparent sensitivity to price and technology. This study is the first to apply conjoint analysis to the Philippine market, delivering in-depth consumer preference insights that can help manufacturers and policymakers customize their approach to making EVs more attractive and more viable in less developed markets. The results suggest that a targeted effort to overcome cost barriers and improve technological literacy among prospective buyers should be productive for speeding up EV adoption in the Philippines. The results could be extended in future research to a broader assessment of socioeconomic and environmental benefits, laying out a broader plan for promoting sustainable solutions in transportation.

Keywords: conjoint analysis; electric vehicle; electric vehicle adoption; electric vehicle preference

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1. Introduction

Electric cars have existed for over a decade and have gained popularity recently, especially in the Philippines. According to Jaeger [1], electric vehicle sales have grown exponentially in the last three years, exceeding 10 million in sales for 2022. With over 14% more vehicles sold compared to the previous year, this demonstrates changes in consumer preferences for automobiles. Jaeger [1] also stated the top five countries with the highest shares of EV sales are topped by Norway, with 80% of new consumers using electric and hybrid vehicles. Others include Iceland (41%), Sweden (32%), the Netherlands (24%), and China (22%). These countries demonstrate the attractiveness and practicality of electric vehicles which can inspire other countries to adapt for the sake of sustainability. It is also projected by Fortuna [2] that electric vehicle sales will triple in 2027, reaching 31 million in sales, promoting a shift to sustainable transportation. This trend can be applied to vehicles, electric buses, trucks, and even motorcycles to boost air quality and reduce greenhouse gas emissions.

Among automobiles, Ghoshal [3] presented how Byd has dominated the Asian market for electric vehicles with a market sale of 46%. This highlighted its impact and consumers' choices of electric vehicle brands in Southeast Asia (Figure 1). BYD's growth is due to its affordable range and good-quality batteries compared to other brands. The second highest sales are from Tesla, a premium brand with notable sales in Asia, securing a 12% sale in the market. The chart also includes other growing electric vehicle brands, such as Wuling and Aion, each with more minor sales, indicating a need that is open to new improvements with electric vehicles and new companies that may expand. Consumer preferences, infrastructure development, and government incentives influence the variety of electric car market sales in Asia [4].

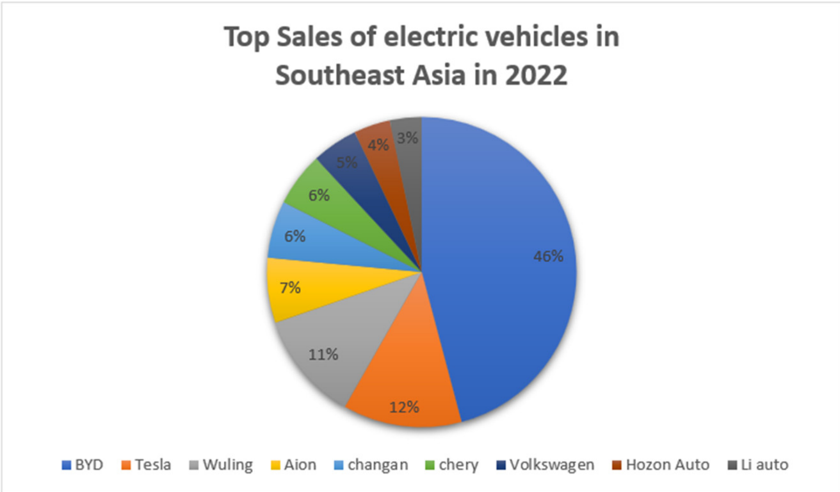

Figure 1. Top sales of electric vehicles in Asia.

According to Cheng [5], Byd is one of the most sought-after electric vehicles in the Philippines because of its affordability and lower maintenance cost than other Chinese brands. These factors and the brand's commitment to performance and affordability enhance the salability of BYD EVs. Additionally, Pascual [6] indicated that despite the considerable hype for Tesla selling EVs in the Philippines, consumers prefer Wuling because it is cheaper, especially in provinces like Cebu, with a growing interest in eco-friendly and innovative transportation solutions.

Despite the rapid increase in electric vehicles (EVs) worldwide, many consumers and countries are seriously considering using EVs. Several reasons include the prices of electric vehicles, scarcity of charging stations, high infrastructure cost, battery life, and limited driving range. Among these issues, battery is considered to have the most problems. In recent years, electric vehicles have been the main component of intelligent cities, accompanied by public transit and transportation systems. Another reason why consumers do not consider EVs is the lack of charging infrastructure [7]. According to Ibrahim et al. [8], it is challenging to construct additional charging stations because of the 'chicken and egg' problem. Numerous drivers will only buy electric cars when enough charging stations are established. However, if many consumers buy EVs, it is unlikely that charging service providers will invest in developing charging infrastructures. Regarding charging stations, range anxiety is another major problem that challenges EV consumers globally. Shrestha [9] stated that consumers must locate a charging station for short and long trips to avoid losing power in an EV. Overcoming this fear is mandatory to improve consumers' perception of EVs in the market.

Another primary concern in adopting EVs is range anxiety, which is the fear of running out of power due to scarce charging stations. Shrestha [9] pointed out that in the Philippines, this issue is worsened by high costs, limited infrastructure, and low consumer awareness. Kim et al. [10] also highlighted the problems of high prices and shorter driving ranges. Magkilat [11] survey revealed that only 13% of Filipinos are interested in EVs, mainly due to the need for charging stations. To address these challenges, the Philippines is taking steps to promote EVs. For example, the government reduced import tariffs on certain

EVs to increase accessibility. However, market limitations and inadequate infrastructure still hinder the growth of EVs. The Electric Vehicle Industry Development Act (EVIDA) provides a roadmap for commercializing EVs in the Philippines. Republic Act No. 11697, signed in April 2022 by then-President Rodrigo R. Duterte, required operators to include e-vehicles in at least 5% of their vehicle collection. Furthermore, President Ferdinand Marcos Jr., the current president, endorsed reducing tariffs on EVs and spare parts to zero, aiming to make EVs more appealing to consumers.

Recent studies showed that design, type, and status symbols are crucial factors influencing consumers' purchasing of EVs. Brescia et al. [12] highlighted that consumers dislike the sporty looks of vehicles and prefer elegant and quiet ones because they reflect an individual's economic status. Additionally, [13] noted that culture also affects consumer behavior in choosing EVs. An example is the Philippines, where electric vehicles are considered luxury items due to their high cost and rarity. Another factor is price, which consumers associate with the vehicle's status and quality, such as Tesla and other luxury vehicle brands. However, manufacturers face challenges, as evidenced by luxury brands like Lamborghini and Ferrari's reluctance to enter the EV market. The high costs and economic repercussions are central concerns in the development of EVs. Additionally, consumers are concerned about expenses and maintenance, particularly the battery lifespan of EVs (typically eight years) compared to the longer-lasting traditional fuel vehicles.

In the context of studies related to EVs in Asian countries, Lashari et al. [14] focused on the factors examined about attributes such as vehicle purchase price, government incentives, and environmental safety. Vehicle purchase price is integral to choosing an EV because most people consider EVs expensive, more so than gasoline vehicles. This was followed by Yang [15], who explained the importance of government incentives to promote electric vehicles, especially those that use gasoline cars. There are examples of government assistance that can convince people by implementing interest-free loans and incentives such as tax credits or exemptions from certain taxes and fees. Lastly, Alanazi [16] stated that environmental safety is crucial for consumers when choosing vehicles since reducing air pollution and decreasing greenhouse gasses' footprints can aid the environment. Despite the multiple factors discovered, there are limitations to these studies [17]. The study by Tuncel [17] stated that the price only refers to the vehicles and does not elaborate on other expenses, such as maintenance and operations costs. It was also indicated that government assistance only gave brief information about its importance but lacked specific details on the effectiveness and range of these incentives across Asian countries. Lastly, it was explained that the study needs more points regarding the limitations of the environmental impact of electric vehicles, such as the disposal and production of batteries and the materials used to produce these batteries.

Studies are needed regarding consumer behavior regarding EVs, especially in the Philippines. A closely related study was by Tanwir & Hamzah, [18], which only covered purchase intention on the transition to hybrid and EV for sustainable mobility and transportation in the Philippines. However, the study needed more information on the social, environmental, and economic impacts. Their study stated that studies regarding EVs demonstrated that consumers need more accurate information regarding government incentives, the negative environmental impacts of EVs, and the cost of ownership. The study highlighted that most respondents wanted to transition to electric cars. Therefore, no studies evaluated consumers' preferences in choosing the types of EVs.

Little of the literature follows the studies regarding consumer behavior in the context of EVs in the Philippines. Only two significant studies were seen [19]. Ong et al. [19] only covered the purchasing intention of hybrid cars, covering sustainability aspects and behavioral domains. The other similar study conducted was with the employment of a machine learning algorithm, with the same objective [20]. The research gap highlights a critical limitation in existing studies regarding EVs, especially in developing countries (e.g., focusing on predictions of purchase intentions using machine learning), without considering more significant influencing factors. The knowledge gap is seen in the lack of an analysis that integrates socioeconomic conditions, environmental consciousness, and the potential impact of policy measures on consumer behavior toward EVs. Addressing this gap is essential for developing a deep understanding of consumers' intricate decision-making process, which is crucial for making effective strategies to promote EV adoptions. The motivation to write this paper is driven by the need to understand the complex factors that influence consumers' decisions to purchase electric vehicles in developing countries.

While previous studies utilized different machine learning algorithms to predict purchasing intentions [19], they often do not fully consider the impact of socioeconomic conditions, environmental awareness, and the effectiveness of policy incentives on consumer behavior. The motivation for this research stems from the desire to develop a more distinct understanding of these influences, aiming to provide actionable insights that can help formulate strategies to encourage EV adoption, align with environmental sustainability goals, and meet the specific needs of consumers in Asian markets or developing markets. This comprehensive approach sought to enhance the forecasting of consumer behavior models and support policymakers and businesses in creating more effective and targeted interventions to boost the use of EVs.

The utility of conjoint analysis as a tool for assessing consumer preference was used and established to be accurate. Conjoint analysis is a tool commonly used in consumer research and marketing that shows respondents different combinations of attributes and levels for evaluation [21]. Multiple studies used conjoint analysis, such as a study by Li [20], which used conjoint analysis to find public preference for EVs using incentive policies in China. The results showed that many consumers needed to familiarize themselves with the incentive policies for electric cars, and the importance of different categories of policies varied among other socio-demographic groups. This information is crucial for designing EV incentive policies that resonate with the target audience, encouraging a shift from gasoline to electric vehicles and aiding environmental protection. The goal was to find the most effective policy mix to promote EV adoption in China. Lebeau et al. [22] also considered using conjoint analysis to assess the preference for plug-in hybrid cars and battery EVs in Flanders. This approach could, therefore, be deduced to help create policies, strategies, and interventions that align with consumers' needs and preferences, ensuring more effective marketing. Despite the considerable efforts of researchers, we only considered the mentioned related studies. None of which focused on the preference analysis of consumers in the Philippines for EVs. Since this is being established as a mode of sustainable transportation, the need for analysis is timely and required for government agencies to consider marketing strategies among automobile industries.

This study originates and focuses on the consumer preference for electric vehicles (EVs) in the Philippines, emphasizing the relationship between cost, battery type, charging methods, and additional factors like environmental impact and technological advancements, which were not dealt with. Unlike previous research that primarily relied on predictive models to understand purchasing intentions, this study employed a conjoint analysis approach to delve deeper into the specific attributes that influence consumer choices and preferences. The analysis could reveal the compromises consumers are willing to make between cost, convenience, and environmental considerations. This insight provides valuable information for manufacturers, policymakers, and marketers aiming to boost EV adoption, align products with consumer expectations with limited but important attributes, and contribute to sustainable solutions among developing countries opting for sustainable transportation. In this way, it presents not only a broad landscape of preferences but also the possibility of highlighting the importance of affordability and technological improvements in EV adoption, which sets up further research and the development of strategies in the EV industry.

The study's objective was to comprehensively examine the factors influencing consumer behavior in buying electric vehicles. The study employed conjoint analysis to determine the combination of EV attributes such as type of EV, charging method, regenerative brakes, driving range, charging speed, battery type, and cost—detailed in the succeeding section. Using the orthogonal design to evaluate consumers' preferences regarding EVs, an optimum representation of the combinations adapted from related studies was evaluated for a thorough analysis of customer preference. This study's findings benefit both the Philippines and other countries' establishments regarding EVs. The result of this study offers valuable insights into academia and the EV industry. Understanding the factors that affect consumer behavior toward EVs can assist in improving not just the EVs available and those that could be developed but also marketing strategies and additional knowledge to encourage people to use EVs. This could promote sustainable transportation, environmental friendliness, and the development of smart cities.

2. Methodology

2.1. Attributes and Levels

The advancement of technology has transformed the automotive industry, giving rise to electric and hybrid vehicles. The electric vehicle market has a variety of brands, with each brand having its specialties. Each specialty depends generally on attributes such as type of electric vehicle, charging method, type of regenerative brakes, type of suspension systems, charging speed, type of battery, and cost.

There are three types of electric vehicles: battery electric vehicles, plug-in hybrids, and electric vehicles with range extenders—where the charging methods range from battery, conductive charging, and wireless charging. On the other hand, regenerative brakes can be mechanical, electrical, or hydraulic systems, while electric vehicles can range from 100 km to 500 km. Depending on the charging method, the charging speed can range from 120 volts, 208 to 240 volts, and 400 to 900 volts. Moreover, lithium-ion, nickel metal hydride, and lead acid batteries can be battery types. Lastly, electric and hybrid vehicles can cost from P500 thousand to more than 7.1 million PHP or about 9 thousand to 128 thousand USD. Presented in Table 1 are the summaries of attributes and levels considered in this study.

Table 1. Attributes and levels.

Type of Electric Vehicle	Charging Method	Regenerative Brakes	Driving Range	Charging Speed	Battery Type	Cost (in PHP)
Battery Electric	Vehicle to grid (V2G)	Mechanical	100 km to 200 km	120 Volts/h	Lithium Ion Batteries	500 thousand to 3 million
Plug in Electric	Conductive	Electrical	201 km to 300 km	208 to 240 Volts/h	Nickel–Metal Hydride Batteries	3.1 million to 7 million
Electric Vehicle with range extender	Wireless	Hydraulic	301 km to 500 km	400 to 900 Volts/h	Lead Acid Batteries	7.1 million and above

One of the first attributes that consumers consider when buying an electric vehicle is the type of electric vehicle. Electric vehicles can be categorized under battery electric vehicles (BEVs), Plug-in Electric Vehicles (PHEVs), and electric vehicles with range extenders (EREVs). Cremades and Casals [23] highlighted that BEVs have a limited electric range, prompting users to plan their trips carefully. On the other hand, PHEVs are more flexible because they can smoothly switch between electric and gasoline power depending on how they are being driven. As for PEVs, Williams et al. [24] enumerated the factors affecting consumer preference, such as the convenience of using battery electric motors for short drives and the flexibility of transitioning to the use of gasoline for longer journeys. According to Al-Saadi et al. [25], consumers gravitate to PEVs because of improved battery lifespan, energy density, and better charging efficiency. On the other hand, EREVs are the least preferred type of EV due to their challenges. Krawczyk et al. [26] explained that there is a difference in operational efficiency between electric-only and range-extended modes of EREVs. Electric-only mode is much more efficient for shorter distances, while range-extended modes are suitable for longer distances and provide self-sufficiency and adaptability. However, Benavides [27] stated that the difference in operational efficiency leads only to minor damage. It was indicated that consumers do not mind the issue of operational efficiency as this is outweighed by the flexibility of changing modes depending on the duration of travel.

Charging method is the second attribute consumers consider when buying electric vehicles. Chen and Chung [28] investigated how consumers perceive the technological aspects of various charging methods. The study examined factors such as perceived reliability, ease of use, and the level of familiarity consumers have with vehicle-to-grid, conductive charging, and wireless charging. It is also evident in multiple studies that charging speed is a significant factor when deciding on an electric vehicle. Yang et al. [29] investigated consumers' behavior when choosing an EV for its charging speed. The research showed that consumers prefer faster charging times offered by vehicle-to-grid (V2G) over traditional conductive charging methods. Furthermore, the addition of grid balancing to V2G systems contributes to a lower overall carbon footprint, resulting in a more sustainable and efficient ecosystem. On the other hand, consumers' preference for conductive charging is due to accessibility of charging stations from shopping centers, workplaces, and even residential areas [30]. Aside from V2G and conductive charging, there is also wireless charging that is seen as a premium feature since it can be seamlessly integrated with smart technology [31]. The study about user acceptance of wireless charging using the technology acceptance model (TAM) by Fett et al. [32] further supported the consumers' preference for wireless charging. It was seen that it is not only perceived as user-friendly, efficient, and convenient compared to traditional plug-in vehicles but also has high return on investment and has little to no maintenance.

The next attribute considered by consumers is the type of regenerative brake. One of the key technological advancements in EVs is regenerative braking—a system that captures and converts kinetic energy during braking into usable electrical energy. There are different types, such as mechanical, electrical, and hydraulic. Jamadar et al. [33] found that consumers prefer mechanical brakes because they are much more reliable, low cost, and have a redundant braking system that is effective during rapid deceleration or emergency stops. In contrast, traditional internal combustion engine vehicles, which rely on conventional friction brakes, make the latter less reliable in dire situations. Another type of regenerative brake is electrical break. Li et al. [34] explained that it is the most efficient and responsive. It also provides better control and stability by adjusting the braking force to each wheel individually according to the driving conditions. Electrical break also has warning system for when the break is about to wear or has passed their timely maintenance. While considered the most efficient and responsive, electric brakes, unfortunately, are less effective at high speeds or under heavy loads because it has lower braking torque and generate more heat than the two brakes [34]. Unlike electrical breaks, hydraulic brakes have high breaking torque and good reliability. However, even having the best torque, hydraulic brakes have a prolonged response compared to electric brakes and require high maintenance.

With the rise of electric vehicles in the market, consumers usually consider the driving range of electric vehicles in full battery. The driving range levels are 100 km to 200 km, 201 to 300 km, and 301 to 500 km. According to Yanan et al. [35], they found that EVs with ranges up to 200 km are focused on consumers that have short daily travel needs. Additionally, Mruzek [36] stated that it is for people who prioritize short travels over long distances and is cost-effective. Another range is 201 to 300 km. Thingvad [37] highlighted that consumers choosing this range seek a reliable and cost-effective option for daily commutes while having the option to go on longer trips without the need for frequent charging. It is also stated by Liu [38] that consumers also have the option to buy cheaper EVs and have an extended travel distance with the use of range extenders. Sanguesa et al. [39] stated that for ranges of 301 to 500 km, these vehicles are suitable for long-distance travel and can be compared to gasoline vehicles in terms of range. Despite the large range they provide, consumers hesitate due to the high cost and maintenance compared to electric vehicles with range extenders.

Since electric vehicles need to be charged, consumer usually considers the charging speed. There are 3 levels of charging speed, where level 1 is up to 120 volts, level 2 is from 208 up to 240 volts, and level 3 is from 400 to 900 volts. According to Mastoi [40], level 1, with charging speed of 120 volts, is appropriate for homeowners, especially those with parking space, since this is aligned with standard rate of charging in residential areas. However, level 1 is considered slow as it only results in an average of 2 to 5 miles worth of charge per hour, which will usually require overnight charging. EVs with level 2 charging speed of 208 to 250 volts have an average rate of 10 to 25 miles worth of charge per hour, which is a substantial increase compared to level 1. Level 3 charging, also known as dc fast charging, operates at higher voltages ranging from 400 to 900 volts. This provides a rapid charging experience where an average of 100 miles worth of charge can be obtained for around 20 to 30 min. Level 3 charging greatly minimizes the charging downtime.

The charging aspect of EVs always comes with batteries. Different types of batteries, such as lithium-ion batteries, nickel–metal hydride batteries, and lead acid batteries, are usually considered [41]. According to Chen et al. [41], lithium batteries' high energy efficiency and light weight are the two main factors consumers consider. Lithium-ion batteries have a lower chance of overheating, which minimizes the possibility of fire-related accidents. The second is Nickel–metal hydride. Consumers prefer nickel–metal hydride batteries due to their inexpensiveness, high power density, and the fact that they produce less toxic material, such as cobalt, found in lithium-ion batteries [42]. The downsides of nickel–metal hydride batteries are that they are more costly than other batteries and are less durable, making them one of consumers' least preferred batteries. The third type of battery are lead acid batteries. Lencwe et al. [43] found that consumers prefer this type of battery due to its cost-effectiveness, high power-to-weight ratio, and familiarity. The consumer's dislike of lead–acid batteries stems from this type of battery being expensive, high maintenance, slow charging, and shorter lifespan [44], a crucial aspect of an electric vehicle.

The last attribute consumers consider is the cost. The cost is divided into different price ranges: the first category ranges from PHP 500 thousand to PHP 3 million, the second from PHP 3.1 million to PHP 7 million, and lastly, PHP 7.1 million and above. Galvez [45] indicated that more customers tend to go for the lowest price range, with options such as the Wuling Macaron for as low as PHP 663,000, offering 120 to 170 km and more than 170 km in one battery life. Another option for an affordable 4-seater electric vehicle is the Nissan E Kicks e-power, a compact crossover EV priced at PHP 1.239 million and PHP 1.539 million, with a range of 300 km. The second price ranges from PHP 3.1 million to PHP 7 million. Martinčić et al. [46] stated that consumers prefer a balance between performance features and affordability with a selection of higher-priced vehicles. Martinčić [46] also stated that dynamics, speed, and comfort are what consumers also seek for EVs in this price bracket. An example is the Kia EV6, a mid-range crossover EV priced at PHP 3.788 million with a range of 450 km and 510 km. Lastly, Ocampo [47] states that consumers' choice for this price range, from PHP 7.1 million to PHP 10 million, is spurred by a desire for luxury and high-performance electric vehicles. Two examples are the BMW i7, which costs PHP 10.39 million with a range above 500 km, and the E-Tron GT, priced at PHP 15.5 million and with a range of 504 km.

2.2. Participants

The study employed purposive sampling to gather respondents via online surveys. The survey was available from November 2023 to February 2024. A total of 311 respondents from the Philippines took part in the survey, which included 29 mixed attributes related to preferences for electric vehicles in the Philippines.

The demographics are provided in Table 2. It could be seen that 68.1% are male, 23.5% are female, and 7.7% prefer not to say. Most of the respondents were 46–55 years old (27.7%), 36–45 years old (24.8%), 26–35 years old (21.9%), 55 years and older (17.4%), and 18–25 years old (8.1%). Around 33.9% had a monthly PHP salary of 70,001–100,000, followed by 40,001–70,000 (21.6%), 100,001–130,000 (17.4%), more than 130,000 (15.8%), and less than 40,000 (11.3%). Approximately 99.7% have a driver's license. Additionally, most of the respondents live in the urban areas (85.2%).

Table 2. Demographic characteristics.

Characteristic	Category	n	%
Gender	Male	213	68.7
	Female	73	23.5
	Prefer not to say	24	7.70
Age	18–25 years old	25	8.10
	26–35 years old	68	21.9
	36–45 years old	77	24.8
	46–55 years old	86	27.7
	Older than 55 years old	54	17.4
Location	Urban	264	85.2
	Rural	46	14.8
Number of vehicles per respondent	1	129	41.6
	2	119	38.4
	3	30	9.70
	More than 3	32	10.3
Availability of car insurance	Yes	288	92.9
	No	22	7.10
Type of vehicles owned	Sedan	72	23.2
	SUV	86	27.7
	Hatchback	99	31.9
	Pickup Truck	78	25.2
	Convertible	21	6.80
	Electric	140	45.2
	Hybrid	39	12.6
	Sports Car	8	2.60

2.3. Conjoint Design

An orthogonal design was used for conjoint analysis and was conducted using SPSS25 [48], generating 29 combinations. This design approach was chosen to maintain a manageable number of combinations for participant evaluation, presenting the optimum combination to determine the objective of the study. In addition, Table 3 presents the 29 combinations, which were evaluated using a 7-point Likert scale, with 1 indicating strongly unpreferred and 7 signifying strongly preferred.

Table 3. Stimulus.

Combination	Type of Electric Vehicle	Charging Method	Regenerative Brakes	Driving Range	Charging Speed	Battery Type	Cost (in PHP)
1	Battery Electric Vehicle	Vehicle to Grid	Electrical	100 km to 200 km	400 to 900 Volts/h	Lead Acid	PHP 7.1 million and above
2	Electric Vehicle with Range Extender	Vehicle to Grid	Mechanical	201 km to 300 km	400 to 900 Volts/h	Lead Acid	PHP 500 thousand to 3 million
3	Battery Electric Vehicle	Conductive	Electrical	301 km to 500 km	400 to 900 Volts/h	Lithium-Ion	PHP 3.1 million to 7 million

Table 3. *Cont.*

Combination	Type of Electric Vehicle	Charging Method	Regenerative Brakes	Driving Range	Charging Speed	Battery Type	Cost (in PHP)
4	Electric Vehicle with Range Extender	Conductive	Electrical	100 km to 200 km	208 to 240 Volts/h	Lead Acid	PHP 3.1 million to 7 million
5	Plug-in Hybrid	Vehicle to Grid	Hydraulic	301 km to 500 km	400 to 900 Volts/h	Lead Acid	PHP 3.1 million to 7 million
6	Plug in Electric	Wireless	Mechanical	100 km to 200 km	208 to 240 Volts/h	Lithium-Ion	PHP 3.1 million to 7 million
7	Plug in Electric	Conductive	Hydraulic	201 km to 300 km	400 to 900 Volts/h	Lithium-Ion	PHP 500 thousand to 3 million
8	Electric Vehicle with range extender	Wireless	Mechanical	301 km to 500 km	400 to 900 Volts/h	Nickel–Metal Hydride	PHP 3.1 million to 7 million
9	Electric Vehicle with range extender	Conductive	Mechanical	100 km to 200 km	400 to 900 Volts/h	Lithium-Ion	PHP 7.1 million and above
10	Battery Electric	Wireless	Hydraulic	201 km to 300 km	208 to 240 Volts/h	Lithium-Ion	PHP 7.1 million and above
11	Electric Vehicle with range extender	Vehicle to Grid	Electrical	100 km to 200 km	400 to 900 Volts/h	Nickel–Metal Hydride	PHP 500 thousand to 3 million
12	Electric Vehicle with range extender	Wireless	Electrical	301 km to 500 km	208 to 240 Volts/h	Lithium-Ion	PHP 500 thousand to 3 million
13	Battery Electric	Wireless	Mechanical	201 km to 300 km	120 Volts/h	Lead Acid	PHP 3.1 million to 7 million
14	Battery Electric	Wireless	Electrical	201 km to 300 km	400 to 900 Volts/h	Nickel–Metal Hydride	PHP 500 thousand to 3 million
15	Plug-in Electric	Vehicle to Grid	Electrical	301 km to 500 km	120 Volts/h	Lithium Ion	PHP 7.1 million and above
16	Battery Electric	Conductive	Mechanical	301 km to 500 km	120 Volts/h	Nickel–Metal Hydride	PHP 7.1 million and above
17	Battery Electric	Vehicle to Grid	Mechanical	100 km to 200 km	120 Volts/h	Lithium Ion	PHP 500 thousand to 3 million
18	Plug-in Electric	Wireless	Electrical	100 km to 200 km	120 Volts/h	Lead Acid	PHP 500 thousand to 3 million
19	Plug-in Electric	Conductive	Electrical	201 km to 300 km	120 Volts/h	Nickel–Metal Hydride	PHP 3.1 million to 7 million
20	Plug-in Electric	Vehicle to Grid	Hydraulic	301 km to 500 km	120 Volts/h	Lithium Ion	PHP 7.1 million and above
21	Electric Vehicle with range extender	Wireless	Hydraulic	301 km to 500 km	120 Volts/h	Lead Acid	PHP 7.1 million and above
22	Plug-in Electric	Conductive	Mechanical	201 km to 300 km	208 to 240 Volts/h	Lead Acid	PHP 3.1 million to 7 million
23	Plug-in Electric	Vehicle to Grid	Mechanical	301 km to 500 km	208 to 240 Volts/h	Nickel–Metal Hydride	PHP 500 thousand to 3 million
24	Battery Electric	Vehicle to Grid	Hydraulic	100 km to 200 km	208 to 240 Volts/h	Nickel–Metal Hydride	PHP 3.1 million to 7 million
25	Electric Vehicle with range extender	Vehicle to Grid	Hydraulic	201 km to 300 km	120 Volts/h	Lithium-Ion	PHP 3.1 million to 7 million
26	Electric Vehicle with range extender	Vehicle to Grid	Electrical	201 km to 300 km	208 to 240 Volts/h	Nickel–Metal Hydride	PHP 7.1 million and above

Table 3. *Cont.*

Combination	Type of Electric Vehicle	Charging Method	Regenerative Brakes	Driving Range	Charging Speed	Battery Type	Cost (in PHP)
27	Plug in Electric	Wireless	Hydraulic	100 km to 200 km	120 Volts/h	Nickel–Metal Hydride	PHP 500 thousand to 3 million
28	Electric Vehicle with range extender	Conductive	Hydraulic	100 km to 200 km	120 Volts/h	Nickel–Metal Hydride	PHP 500 thousand to 3 million
29	Battery Electric	Conductive	Hydraulic	301 km to 500 km	208 to 240 Volts/h	Lead Acid	PHP 500 thousand to 3 million

The resulting stimuli served as the combination of each level among the different attributes considered. One per attribute was considered in this study to represent an overall electric car product, which was evaluated as strongly preferred product to least preferred. For example, the first combination presents the type of electric car as battery electric vehicle, with vehicle to grind charging method, electrical regenerative brakes, 100–200 km driving range, 400–900 volts/h charging speed, lead acid battery type, and costing about 7.1 million PHP and above.

3. Results and Discussion

3.1. Results

The following results (Table 4) represent the utilities on the preferences of electric vehicles among consumers in the Philippines. The utilities based on Table 4 were used to determine the set of attributes using utility estimates obtained from each attribute. The utilities serve as the basis (path-worth scores) of common units presenting what individuals would consider. The more positive the output, the more people would choose it, and otherwise. Adding the values of the utility for every level could be the basis of the total scores.

Table 4. Utilities.

Attributes	Preference	Utility Estimates	Std. Error
Type of electric vehicle	Battery Electric	0.126	0.080
	Plug-in Electric	−0.013	0.080
	Electric Vehicle with range extender	−0.113	0.080
Charging Method	Vehicle to Grid	−0.060	0.080
	Conductive	0.169	0.080
	Wireless	−0.109	0.080
Regenerative Brakes	Mechanical	−0.012	0.080
	Electrical	0.079	0.080
	Hydraulic	−0.067	0.080
Driving Range	100 km to 200 km	−0.113	0.080
	201 km to 300 km	0.042	0.080
	301 km to 500 km	0.071	0.080
Charging Speed	120 Volts/h	−0.104	0.080
	208 to 240 Volts/h	0.023	0.080
	400 to 900 Volts/h	0.081	0.080
Battery Type	Lithium-Ion Batteries	0.045	0.080
	Nickel–Metal Hydride Batteries	−0.172	0.080
	Lead Acid Batteries	0.127	0.080
Cost	PHP 500 thousand to 3 million	0.462	0.080
	PHP 3.1 million to 7 million	−0.074	0.080
	PHP 7.1 million and above	−0.388	0.080

Therefore, for the first attribute, a battery electric vehicle would be preferred, having the only positive output, followed by a plug-in electric vehicle nearing zero, while the least considered is an electric vehicle with a range extender as it has the highest negative output. From the charging method, conductive was the most preferred among consumers, followed by vehicle to grid, and wireless was the least preferred. Moreover, for the regenerative brakes attribute, electrical was the most preferred by consumers, followed by mechanical, while consumers did not highlight hydraulics. Fourth, 301 km to 500 km is the consumers' most preferred driving range. Additionally, 400 to 900 volts is the most preferred charging speed. Moreover, among battery types, electrical is the most preferred, while nickel–metal hydride was the least. Lastly, PHP 500 thousand to 3 million was the most preferred, followed by PHP 3.1 million to 7 million, and PHP 7.1 million and above was the least preferred.

Moreover, the average score of importance (Table 5) presented how the cost is the most considered attribute (38.914%), followed by battery type (13.731%), charging method (12.762%), type of electric vehicle (10.958%), driving range (8.457), charging speed (8.474%), and regenerative brakes (6.704%). This was the basis of the discussion flow in the succeeding section. The table presents a summarized interpretation of which attribute (in general) respondents find important for consideration—in this case, among electric vehicle attributes.

Table 5. Averaged importance score.

Importance Value	Score
Cost	38.914
Battery Type	13.731
Charging Method	12.762
Type of Electric Vehicle	10.958
Driving Range	8.4570
Charing Speed	8.4740
Regenerative Brakes	6.7040

Table 6 presents the validity of the stimulus in the paper. The value for Pearson's R is 0.907, and Kendall's tau is 0.719, with a significance of 0.000. The obtained values are near 1, indicating a significant relationship between the observed and predicted preferences [45]. Additionally, this study added two holdouts for Kendall's tau to determine the consistency of answers among the respondents. Kendall's tau for holdouts has a value of 1.000, signifying the excellent quality of the collected data.

Table 6. Validity.

Parameters	Value	Significance
Pearson's R	0.907	0.000
Kendall's Tau	0.719	0.000
Kendall's Tau for Holdouts	1.000	

Presented in the Appendix section (Appendix B) is the response correlation output. Following the suggestion of Hair et al. [49], individual responses to the correlational output may result in both negative and positive values. However, an indication of acceptance is still with the p-value output, to which the current result showed all items to be within less than the 0.05 threshold, deeming correlation analysis to be significant. Though acceptable, the individual correlation output is presented as individual shares on each combination as a concept among respondents' preferences and not the overall share of importance. It was suggested that the overall correlation should be considered (Table 6) for the acceptance of the result [50].

The conjoint analysis ranked attributes based on consumers' preferences in the electric vehicle industry. The highest attributes preferred by the stimulus are battery electric, conductive, electrical, 301 to 500 km, 400 to 900 volts/h, lead–acid batteries, and PHP 500 thousand to 3 million, with a total utility score of 1.115. The least chosen stimulus is an electric vehicle with a range extender, wireless, hydraulic, 100 km to 200 km, 120 volts/h, nickel–metal hydride batteries, PHP 7.1 million and above, with a total utility score of −1.066. Moreover, the ranking of attribute combinations is presented in the Appendix section (Appendix A). Table 7 presents the summarized key attributes consumers would and would not prefer.

Table 7. Summarized results.

Attribute	Most Preferred	Least Preferred
Cost	PHP 500 thousand to 3 million	PHP 7.1 million and above
Battery Type	Lead–acid batteries	Nickel–metal hydride batteries
Charging Method	Conductive	Wireless
Type of Electric Vehicle	Battery electric	Electric vehicle with a range extender
Driving Range	301 km to 500 km	100 km to 200 km
Charing Speed	400 to 900 Volts/h	120 Volts/h
Regenerative Brakes	Electrical	Hydraulic
Total Score	1.115	−1.066

3.2. Discussion

Among the presented attributes, the attribute that consumers prefer the most is cost, with a score of 38.914. Under the attribute cost, PHP 500 thousand to 3 million was the most preferred by consumers, and PHP 7.1 million and above was the least preferred. Conversely, the least desired attributes by consumers are driving range and regenerative brakes, with scores of 8.457 and 6.704, respectively. Following the development of technology worldwide, electric vehicles have also been evolving, giving consumers another choice for transportation, with cost being the most crucial factor when purchasing electric vehicles [51].

Cost is one of the integral factors looking at electric vehicles (EVs) as an answer to consumer assessments reflective of value perceptions and willingness-to-pay by a significant proportion [52]. When it comes to EVs, price sensitivity is well-acknowledged and relevant in the purchasing context. Studies demonstrated that price transparency encourages consumers to make informed purchase decisions [53]. Younger consumers comprise a significant share of the EV markets and are more generally price sensitive. Moreover, research highlighted that price consciousness is a common trait across all age groups and genders, potentially increasing the global market for EVs [54]. The diverse age groups collected in this study indicate that all age groups are persuaded by the EV costs for their purchase decision. Furthermore, affordability is a crucial decision factor for consumers with limited budgets [55]. Another research work by Xia et al. [56] echoed the sentiment that, while consumers seek affordability, they are also unwilling to compromise on the quality of the EVs. This means that other factors may also be considered as a compromise to the costs, such as its environmental effects and political aspects [56]. Thus, EV manufacturers must balance cost-effectiveness and quality to satisfy and retain consumers.

Second, the type of battery was seen to be the second highest attribute affecting consumers' preference for electric vehicles, with a score of 13.731. The results show consumers' preferences for batteries are lead–acid as the highest and lithium-ion as the lowest, with a utility estimate of −0.172. Consumers experienced an interest in lead–acid vehicles due to the everyday use of lithium batteries in EVs. These findings are supported by Zhang et al. [57], who believe that this interest comes from the recyclability and cost-effectiveness that lead acid batteries provide. This was posited to create an appeal among consumers. Additionally, consumers would buy EVs if a newly improved battery using lead–acid is used for electric vehicles that rival lithium batteries, especially with electric car companies implementing nickel–metal hydride batteries [58]. Consumers' dislike of nickel–

metal hydride batteries comes from their heavy weight and slower charge rate compared to lithium-ion, which is said to be much lighter and faster [59]. Interviewed consumers wanted an improved battery like that from lithium batteries. Still, manufacturing was much cheaper and more straightforward, especially with the rise of electricity prices in the Philippines because of inflation [60].

Third, the charging method is a significant attribute for consumers when deciding what electric vehicle to purchase, with an importance score of 12.762. The data show a distinct preference for conductive charging, being the highest, with a utility score of 0.169, and the lowest for wireless, with a score of −0.109. Togre [61] supported the findings, explaining that consumers' preference for conductive charging positively affects users because of its reliability and convenience compared to vehicle-to-grid and wireless, which are affected based on their availability and complexity. Therefore, while innovative solutions for charging methods are emerging, consumers would still prefer much simpler and established charging methods for EVs. As expressed by Ong et al. [19], the Philippines has yet to establish more charging stations for EVs, leaving consumers with low intentions for purchase. Therefore, this indicates that consumers would want to establish the basics of the technology before dealing with advanced mechanisms for their EVs.

Fourth, the type of EV was an attribute that consumers considered, where battery electric was the most preferred by consumers because it is the most ecological EV without exhaust emissions [62]. It is the best for people who love to protect the environment [63]. The second level was followed by plug-in hybrid electric vehicles, which present a blend of electric power and a petrol engine, which makes it a good option because of its flexibility of modes. Additionally, it provides easy driving without a plug for short distances [64]. Lastly, EVs with range extenders are less preferred because of the complexity and unnecessary need for an additional engine. While people do have extended-range electric vehicles, consumers do not necessarily use them because the usual journey is enough for the electric battery pack, and using gasoline to drive the remaining miles would cost more than the charge of an electric battery pack [65].

Fifth, the preferred attribute for consumers choosing EVs is the charging speed, with an importance value of 8.474. Compared to other attributes, these are lower in significance but still considered important as consumers have an established perception of the charging speed capabilities of EVs. The most desired level under this attribute is 301 to 500 volts/h. This specific range explains the consumer's preference for enhancing EVs' overall usability and convenience. This range demand can also be due to technological advancements of EVs using silicon carbide semiconductors that improve efficiency and power conversion [66]. The second charging speed consumers prefer is 208 to 240 volts/h. Deilami et al. [67] stated that 208 to 240 volts are standard and have a reasonably fast charging time; this is also the speed available in public charging stations compared to the other options, especially in Asia and specifically in the Philippines.

Sixth, driving range is an attribute consumers consider in purchasing electric vehicles, with an importance factor of 8.457. Among the different driving ranges, 301 km to 500 km is the most preferred by consumers, followed by 201 km to 300 km and 100 km to 200 km. Consumers like the driving range of EVs because of their capability for longer trips and less charging in a single journey. This presents a helpful vehicle for long holiday driving [68]. In addition, this also appeals to various driving needs, from occasionally longer trips to daily commutes [68]. Lastly, the least preferred range is 100 km to 200 km due to value and daily commute. Consumers would perceive EVs with 100 km to 200 km less valuable than other vehicles, especially if there is no significant price difference. Additionally, with a 100 km to 200 km range, consumers will choose vehicles with a more extended range for less frequent charging, especially for daily commutes, as evident in the Philippines [69].

Lastly, based on the results, regenerative brakes were the least significant in the list of attributes, with an importance factor of 6.704. It was also discovered that consumers preferred electrical breaks over mechanical and hydraulic ones. Mechanical brakes are more robust and easier to maintain than other brake options; however, they require more maintenance despite being cheap because of dirt and grime attaching because of the cable stretching, which can affect the vehicle's performance [34]. Electrical breaks, referred to as regenerative brakes, are preferred more than hydraulic because it is the standard regenerative brakes that all-electric vehicles are built with and are the best for new consumers who are switching to EVs and have little to no idea about the different types of regenerative brakes [70]. Hydraulic systems, on the other hand, are the least popular due to their complexity and higher maintenance [71]. This justifies the finding of this study.

3.3. Study Implications

The study offers significant insight, showcasing that consumers prioritize cost and the type of battery. The result of this study can provide information for electric vehicle manufacturers on what to improve to garner more consumers opting for electric vehicles. Businesses for electric vehicles should adjust the price according to the country's cost of living.

The results emphasized the sensitivity of consumers regarding the cost of electric vehicles, especially with high inflation and a surge of high electricity costs in the Philippines, showcasing the importance of affordability. It is suggested that manufacturers invest in improving battery technology, which could help lower production costs and help decrease the overall cost of EVs, making them more accessible to consumers in the Philippines. An essential aspect of the cost and battery type study is to obtain partnerships with financial and government institutions to offer subsidies, incentives, or financing options that make EVs more affordable. This includes providing tax reductions or offering low-interest rates and reducing upfront costs. Additionally, investing in improving battery technology could help lower production costs and help decrease the overall cost of EVs, making them more accessible and economical for consumers in the Philippines.

Battery type was considered because of its importance on the vehicle's performance and environmental impact. Considering this finding, the researcher suggests that company manufacturers should improve batteries that are cheap, can hold high energy that is safe, and can last longer, such as the improvement of lead–acid in terms of sustainability. In response to the study's results, actionable recommendations include improving and advancing research in battery technology, especially those in warmer areas. For stakeholders, it is important to collaborate with industry standards for battery technology to ensure safety, compatibility, and recyclability. Lastly, the government can support these efforts by implementing policies encouraging the use of efficient and sustainable batteries, such as incentives for using recycled items as materials, grants for clean technology research, and stricter regulations for battery disposals.

3.4. Limitations and Future Research

The study, while in-depth, has some limitations. Initially, the study focuses on the Philippines alone. While it provides information and understanding about local consumer behavior, it may limit the study's applicability to other developing countries with different consumer behaviors and socioeconomics. It is suggested that future research should perform a comparative study across different developing countries to explore broader behaviors of consumer behavior. This would assist in comparing the preferences of individuals toward electric vehicles. Additionally, while the paper provides attributes such as charging method, battery, and cost, other factors that may affect consumer behavior and preferences, such as after-sales quality, brand loyalty, and other socio-cultural implications, were not considered [72]. As a benchmark, this study only considered the general attributes that future researchers could extend. Moreover, other variables could be informative when the preferences based on brand-related aspects could be considered. Lastly, market segmentation may be performed using other statistical tools, such as K-Means or even C-Means clustering.

4. Conclusions

Electric vehicles were first made in 1884 and have been a great invention, especially with their popularity from the late 90s to the present. The study's findings emphasized the attributes and their significance, such as battery type and charging method, as primary factors influencing consumers' preferences for electric vehicles in the Philippines. The study considered conjoint analysis using the orthogonal approach to identify consumers' preferences using combinations of electric vehicle attributes. A total of 311 respondents actively participated in the survey, which comprised 29 combinations. The evaluated attributes used were types of batteries, charging method, regenerative brakes, driving range, charging speed, battery type, and cost. From the results, it was concluded that cost is the primary attribute affecting consumers' preferences when buying electric vehicles. This is followed by the type of battery, charging method, type of electric vehicle, charging speed, driving range, and lastly, regenerative brakes, which are the least preferred attribute for consumers.

It could be deduced from the study that consumer preferences for electric vehicles in the Philippines are influenced by cost, battery type, charging method, and other factors. This provides information regarding the awareness and valuation of EV technology's performance and environmental impact. The findings emphasized the importance of these preferences to enhance the adoption rate of EVs and develop marketing strategies to increase the purchase, consideration, and eventual usage of EVs. Manufacturers and policymakers should consider these insights to tailor the approach that focuses on making EVs more affordable, environmentally friendly, and efficient, aligning with consumers' preferences and expectations and contributing to sustainable mobility in the Philippines.

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Appendix A. Combination Ranking

Combination	Type of Electric Vehicle	Charging Method	Regenerative Brakes	Driving Range	Charging Speed	Battery Type	Cost (in PHP)	Total	Rank
1	Battery Electric Vehicle	Vehicle to Grid	Electrical	100 km to 200 km	400 to 900 Volts/h	Lead–Acid	PHP 7.1 million and above	−0.148	18
2	Electric Vehicle with Range Extender	Vehicle to Grid	Mechanical	201 km to 300 km	400 to 900 Volts/h	Lead–Acid	PHP 500 thousand to 3 million	0.527	4

Combination	Type of Electric Vehicle	Charging Method	Regenerative Brakes	Driving Range	Charging Speed	Battery Type	Cost (in PHP)	Total	Rank
3	Battery Electric Vehicle	Conductive	Electrical	301 km to 500 km	400 to 900 Volts/h	Lithium-Ion	PHP 3.1 million to 7 million	1.033	1
4	Electric Vehicle with Range Extender	Conductive	Electrical	100 km to 200 km	208 to 240 Volts/h	Lead–Acid	PHP 3.1 million to 7 million	0.634	3
5	Plug-in Hybrid	Vehicle to Grid	Hydraulic	301 km to 500 km	400 to 900 Volts/h	Lead–Acid	PHP 3.1 million to 7 million	0.519	5
6	Plug in Electric	Wireless	Mechanical	100 km to 200 km	208 to 240 Volts/h	Lithium-Ion	PHP 3.1 million to 7 million	−0.343	24
7	Plug in Electric	Conductive	Hydraulic	201 km to 300 km	400 to 900 Volts/h	Lithium-Ion	PHP 500 thousand to 3 million	−0.034	14
8	Electric Vehicle with range extender	Wireless	Mechanical	301 km to 500 km	400 to 900 Volts/h	Nickel–Metal Hydride	PHP 3.1 million to 7 million	−0.399	26
9	Electric Vehicle with range extender	Conductive	Mechanical	100 km to 200 km	400 to 900 Volts/h	Lithium-Ion	PHP 7.1 million and above	−0.331	21
10	Battery Electric	Wireless	Hydraulic	201 km to 300 km	208 to 240 Volts/h	Lithium-Ion	PHP 7.1 million and above	−0.328	20
11	Electric Vehicle with range extender	Vehicle to Grid	Electrical	100 km to 200 km	400 to 900 Volts/h	Nickel–Metal Hydride	PHP 500 thousand to 3 million	0.164	11
12	Electric Vehicle with range extender	Wireless	Electrical	301 km to 500 km	208 to 240 Volts/h	Lithium-Ion	PHP 500 thousand to 3 million	0.458	7
13	Battery Electric	Wireless	Mechanical	201 km to 300 km	120 Volts/h	Lead–Acid	PHP 3.1 million to 7 million	−0.004	13
14	Battery Electric	Wireless	Electrical	201 km to 300 km	400 to 900 Volts/h	Nickel–Metal Hydride	PHP 500 thousand to 3 million	0.509	6
15	Plug in Electric	Vehicle to Grid	Electrical	301 km to 500 km	120 Volts/h	Lithium-Ion	PHP 7.1 million and above	−0.37	25
16	Battery Electric	Conductive	Mechanical	301 km to 500 km	120 Volts/h	Nickel–metal Hydride	PHP 7.1 million and above	−0.31	19
17	Battery Electric	Vehicle to Grid	Mechanical	100 km to 200 km	120 Volts/h	Lithium-Ion	PHP 500 thousand to 3 million	0.344	8
18	Plug in Electric	Wireless	Electrical	100 km to 200 km	120 Volts/h	Lead–Acid	PHP 500 thousand to 3 million	0.329	9
19	Plug in Electric	Conductive	Electrical	201 km to 300 km	120 Volts/h	Nickel–Metal Hydride	PHP 3.1 million to 7 million	−0.073	15
20	Plug in Electric	Vehicle to Grid	Hydraulic	301 km to 500 km	120 Volts/h	Lithium-Ion	PHP 7.1 million and above	−0.516	27
21	Electric Vehicle with range extender	Wireless	Hydraulic	301 km to 500 km	120 Volts/h	Lead–Acid	PHP 7.1 million and above	−0.583	28
22	Plug in Electric	Conductive	Mechanical	201 km to 300 km	208 to 240 Volts/h	Lead–Acid	PHP 3.1 million to 7 million	−0.076	16
23	Plug in Electric	Vehicle to Grid	Mechanical	301 km to 500 km	208 to 240 Volts/h	Nickel–Metal Hydride	PHP 500 thousand to 3 million	0.299	10
24	Battery Electric	Vehicle to Grid	Hydraulic	100 km to 200 km	208 to 240 Volts/h	Nickel–Metal Hydride	PHP 3.1 million to 7 million	−0.337	23
25	Electric Vehicle with range extender	Vehicle to Grid	Hydraulic	201 km to 300 km	120 Volts/h	Lithium-Ion	PHP 3.1 million to 7 million	−0.331	22

Combination	Type of Electric Vehicle	Charging Method	Regenerative Brakes	Driving Range	Charging Speed	Battery Type	Cost (in PHP)	Total	Rank
26	Electric Vehicle with range extender	Vehicle to Grid	Electrical	201 km to 300 km	208 to 240 Volts/h	Nickel–Metal Hydride	PHP 7.1 million and above	−0.589	29
27	Plug in Electric	Wireless	Hydraulic	100 km to 200 km	120 Volts/h	Nickel–Metal Hydride	PHP 500 thousand to 3 million	−0.116	17
28	Electric Vehicle with range extender	Conductive	Hydraulic	100 km to 200 km	120 Volts/h	Nickel–Metal Hydride	PHP 500 thousand to 3 million	0.062	12
29	Battery Electric	Conductive	Hydraulic	301 km to 500 km	208 to 240 Volts/h	Lead–Acid	PHP 500 thousand to 3 million	0.911	2

Appendix B. Response Correlation

	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18	C19	C20	C21	C22	C23	C24	C25	C26	C27	C28
C2	0.07																											
C3	0.40	0.07																										
C4	0.38	0.42	0.20																									
C5	0.32	0.25	0.28	0.44																								
C6	0.36	0.20	0.31	0.48	0.39																							
C7	0.02	0.21	0.25	0.08	0.21	0.20																						
C8	0.26	0.30	0.10	0.31	0.34	0.32	0.22																					
C9	0.36	−0.03	0.39	0.19	0.12	0.21	0.14	0.17																				
C10	0.39	−0.10	0.40	0.12	0.21	0.26	0.11	0.22	0.60																			
C11	−0.04	0.36	−0.07	0.15	0.23	0.05	0.15	0.29	−0.03	0.01																		
C12	−0.04	0.29	0.16	0.09	0.15	0.05	0.28	0.06	0.17	0.18	0.37																	
C13	0.27	0.32	0.10	0.31	0.30	0.12	0.06	0.25	0.27	0.26	0.20	0.35																
C14	0.10	0.26	0.15	0.19	0.18	0.18	0.14	0.17	−0.13	−0.06	0.27	0.21	0.24															
C15	0.34	−0.08	0.35	0.03	0.14	0.16	0.08	0.01	0.45	0.46	−0.14	0.17	0.29	0.15														
C16	0.43	0.14	0.20	0.22	0.31	0.28	−0.03	0.37	0.27	0.23	0.00	−0.06	0.32	0.18	0.29													
C17	0.02	0.18	0.13	0.06	0.06	0.11	0.10	0.14	0.06	0.03	0.14	0.20	0.08	0.23	0.18	0.20												
C18	−0.01	0.23	−0.16	0.17	0.08	0.08	0.08	0.22	−0.07	−0.10	0.30	0.10	0.12	0.20	−0.05	0.19	0.49											
C19	0.29	0.07	0.23	0.30	0.29	0.40	−0.02	0.34	0.17	0.20	0.03	−0.10	0.07	0.24	0.12	0.45	0.31	0.31										
C20	0.39	−0.09	0.40	0.14	0.13	0.21	0.14	0.12	0.48	0.47	−0.15	0.05	0.09	−0.07	0.36	0.27	0.12	0.04	0.31									
C21	0.42	0.03	0.24	0.28	0.23	0.21	−0.07	0.26	0.23	0.20	−0.06	−0.10	0.15	0.06	0.17	0.41	0.09	0.24	0.46	0.42								
C22	0.14	0.26	0.10	0.24	0.22	0.22	0.03	0.19	0.02	0.01	0.13	0.10	0.00	0.11	−0.07	0.27	0.17	0.20	0.30	0.31	0.44							
C23	−0.06	0.36	−0.13	0.12	0.18	0.01	0.09	0.20	−0.14	−0.14	0.35	0.18	0.09	0.19	−0.18	0.09	0.25	0.31	0.07	−0.07	0.13	0.44						
C24	0.15	0.21	0.05	0.15	0.24	0.15	0.09	0.23	0.14	0.12	0.14	0.22	0.27	0.13	0.15	0.29	0.09	0.19	0.21	0.23	0.14	0.35	0.30					
C25	0.14	0.05	0.24	0.04	0.09	0.14	0.15	0.01	0.31	0.16	−0.02	0.13	0.13	−0.05	0.26	0.13	0.11	0.00	0.10	0.26	0.08	0.14	0.15	0.44				
C26	0.37	−0.02	0.06	0.21	0.23	0.18	−0.01	0.22	0.24	0.23	−0.08	−0.05	0.20	0.06	0.20	0.42	0.01	0.12	0.28	0.23	0.39	0.18	0.16	0.33	0.29			
C27	0.25	−0.05	0.13	0.05	0.13	0.04	0.05	0.03	0.31	0.34	−0.11	0.15	0.32	0.06	0.36	0.24	−0.03	−0.07	0.00	0.28	0.09	0.05	0.05	0.36	0.29	0.41		
C28	−0.08	0.30	−0.21	0.15	0.25	0.08	0.06	0.30	−0.16	−0.19	0.34	0.12	0.22	0.28	−0.23	0.12	0.13	0.32	0.15	−0.12	0.09	0.29	0.45	0.31	0.05	0.34	0.21	
C29	0.09	0.10	0.21	0.06	0.16	0.21	0.05	0.21	0.05	0.05	0.06	−0.01	0.01	0.27	0.04	0.23	0.18	0.04	0.24	0.06	0.12	0.15	0.15	0.03	0.11	0.24	0.12	0.36

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