Investigating Consumer Satisfaction and Price Sensitivity for Electric Vehicle Charging Infrastructure: An Irish Case Study

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Abstract

Introduction:

Electric vehicles (EVs) are becoming more popular as society moves towards sustainable transportation. Strengthening EV adoption from a human-needs perspective is vital for transport sustainability and ecological preservation. This change raises the difficulty of establishing and sustaining an effective nationwide charging infrastructure to fulfill the expanding demand for EVS. In addition to technological and economic factors, charging infrastructure plans must address social factors and consumer inclusivity. The literature stresses the charging network significance in the EV purchase decisions of consumers and that currently, EV sales are hindered by a shortage of charging infrastructure.

Objective:

Factors that influence customers' satisfaction with EV charging infrastructure are investigated in this research. Many elements, including the infrastructure's accessibility, availability, and dependability are examined. Additionally, we investigate consumer preferences regarding charging infrastructure and lastly provide insight into sensitivity to charging price increase.

Method:

This study collected cross sectional primary data from a representative sample of Irish adults who own, or intend to own, an EV. An original questionnaire was developed to capture respondent characteristics and preferences regarding EV charging infrastructure.
The questionnaire consisted of socio-demographic questions and a range of questions on respondents EV charging habits and preferences, in addition to specific questions on charging infrastructure satisfaction and respondent sensitivity to price changes in public charging in Ireland. The questionnaire was sent out between March 20th and April 16th, 2023, employing a combined convenience and snowballing sampling approach. A total of 324 responses were received, and after applying strict inclusion criteria, a total of 294 relevant responses were considered. A range of descriptive and inferential statistics were used to describe and investigate quantitative data. Three hierarchical logistic regression models were employed to examine:

1. Customer satisfaction levels with EV charging, 2. Customer preferences towards EV charging and 3. Customer price sensitivity to EV charging prices.

Results:

Empirical results indicated that the wait time at public charging stations is a key factor related to customer satisfaction. In addition, respondents who resided outside of Dublin in cities such as Limerick and Galway indicated lower levels of satisfaction with the EV charging infrastructure in their locations. Amongst the private charging networks include in this study, consumers using Circle K charging infrastructure displayed high satisfaction. In terms of price sensitivity, employment status and education were found to be important for respondents charging choices. Retired respondents exhibited greater sensitivity to EV charging price increases compared to other employment status groups, while those who reported lower levels of education likewise indicated greater sensitive to price changes. The results also indicated that price sensitive consumers tend to shift their charging time to non-peak hours following a charging price increase.

Conclusion:

There is currently a drive from Ireland's government policy to expand the usage of EVs across the country due to sustainability and environmental concerns. The growth of efficient EV infrastructure is crucial to the widespread use of EVs. This study is very timely and sheds light on the importance of EV charging infrastructure to EV customer satisfaction, but also explores the role of important predictors of satisfaction such as price sensitivity, charge waiting time and preferences for public and private infrastructures. The results of the study will provide key stakeholders with important insight into the most important drivers of EV adoption through an analysis of satisfaction and areas to focus on to improve satisfaction with EV infrastructure on the island.

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LIST OF ABBREVIATIONS

EV: Electric Vehicles

IPA: Importance-Performance Analysis

EDT: Expectation - Disconfirmation Theory

CHAPTER 1: INTRODUCTION

1.1 Introduction:

Technology's importance in customer-business interaction is becoming increasingly obvious. Therefore, technological interactions are destined to become a crucial metric for gauging the overall efficacy of a business and competitive edge in the market. If businesses fail to recognize technology's role in customer service, firms risk falling behind in the dynamic commercial environment and technological opportunity (Meuter *et al*., 2000).

However, Naik, Gantasala and Prabhakar (2010) argues in contrast that satisfaction of customers which pertains to individuals who have either made a purchase for an item or service or experienced themselves such products and services. There are instances highlighted by Sathiyavany and Shivany (2018) where understanding customer satisfaction has nowadays compelled bank executives to undertake greater challenges in devising strategies that facilitate the expansion and continuation of e-banking services. It is also investigated how businesses can use technology to personalize service offerings, anticipate customer needs, and create a seamless omnichannel experience (Meuter *et al*., 2000). On the contrary, people's opinions are influenced by their emotions and convictions, which change over time. There is limited data on how this change in consumer perceptions contributes to satisfaction or dissatisfaction towards the acceptance and expansion of technologies (Li, 2021).

EVs have recently seen a rise in market adoption because of efforts to reduce transportation-related air pollution and oil consumption. (Das *et al*., 2020). Electric vehicle market share quadrupled to 10% of new car sales in 2021. The electric car market has grown significantly, with a 75% growth from 2021 to 2022, with two million EVs sold in Q1 of that year (IEA, 2023). The development and quick adoption of these EVs advances the transportation sustainability effort. They are more fuel-efficient, cheaper, and environmentally friendly (Gupta *et al.*, 2021). Norway has the biggest percentage of EVs on the road right now (IEA, 2017). Probable reason as Hertzke, Müller, and Henk (2017) stated the most significant subsidies for the purchase of EVs are found in Norway and Denmark.

While major global campaigns and policy drives have been implemented to boost EV sales, consumer acceptability remains notably low, hindering the potential for any significant mainstream impact (IEA, 2016). Numerous obstacles observed by Nair *et al*., (2017) such as the expense of energy distribution, the lack of a widespread charging network, the duration needed to fully charge an EV that make widespread EV adoption difficult. The current study has explored various Financial, performance, and infrastructure barriers.

It has been noticed at times that the significance of challenges tends to vary depending on the conditions that exist in distinct locations and economies. Biresselioglu, Kaplan, and Yilmaz (2018) found that the cost of EVs, waiting times for charging, and the lack of a widespread infrastructure were impediments to broad adoption in Europe. Whereas EV barriers studied by Vassileva and Campillo (2017) argued, limited programs and initiatives are significant factors in Sweden. However, few studies have highlighted inadequate charging infrastructure to be a major hindrance to potential EV adoption (Berkeley, Jarvis, and Jones, 2018; Nair *et al.*, 2017). This thought is also supported by (IEA, 2023) realizing that public charging may not be enough to support the size of the target EV market.

Despite a drop in 2013 adoption rates, EV market diffusion in Ireland remains substantial. (Mukherjee and Ryan, 2020). Since, to improve charging infrastructure accessibility and affordability and encourage electric vehicle usage, Ireland's 2023 climate action strategy target of having 30% of private vehicles be electric by 2030, so reducing transportation emissions by 51% (Department of Transport, 2021). Establishing an accessible network of charging stations is crucial in stimulating the proliferation of the EV industry.
The EV adoption of such extent will be difficult to achieve. This can be explained by Hardman *et al*. (2021) that present infrastructure for electric vehicle charging exhibits inequitable distribution, while incentives disappoint low-income people. Similarly, Turkey EV adoption faces challenges as charging infrastructure is not homogeneously distributed across the country (Gönül, Duman and Güler, 2021). Due to Ireland's dispersed land use patterns, vehicles will remain the main source of transportation for years, necessitating specific decarbonization initiatives (Department of Transport, 2021).

In addition to the above-discussed factors impacting charging infrastructure usage, this study also aims to explore another significant element around price sensitivity. When considering EVs, consumers may weigh the benefits of owning one against its cost. Therefore, understanding the role of price consciousness in EVs' purchase motivation is essential in designing effective marketing strategies and pricing policies for EVs (Cui *et al*., 2021).

1.2 Research Aim:

The significance of customers' satisfaction with EV charging stations is investigated in current study. The past researchers Visaria *et al*., 2022 and Shi *et al.*, 2021 emphasized the significance of charging network. Further, several studies explored charging infrastructure in Malaysia by Adnan, Nordin, and Rahman (2017), China by Huang and Qian (2018) and Amsterdam by Van Den Hoed *et al.* (2013). Whereas some research like Yan (2018) focused on providing insight on EV technology advancement contribution to EV adoption in Norway and France. However, literature addressing the challenges of charging infrastructure from customer’s perspective in Ireland is not developed more.

Current study builds on the existing research by Chen and Lin (2022) performed in China and advances it to Ireland’s EV market. Research is lacking in this field because previous studies performed investigation on the fast charger’s usage in Ireland through charging stations data. Merely integrating technology without considering the customer's needs will result in negative outcomes (Meuter *et al*., 2000). While delving into Irish market O'Neill (2019) concluded from a case study that lack of compensation scheme to be a major roadblock. Thus, to properly understand the dynamics that affect consumer satisfaction, research must integrate both technical elements and the consumer service experience. (Lee and Joshi, 2007).

Hence, exploring Ireland’s charging infrastructure and understanding consumer demands and preferences for charging EV at public a private infrastructure is the principal aim of this investigation. In addition, goal to understand consumer preferences for charging infrastructure so it can mitigate inconvenience and easy usage of charging facilities and further determine the price sensitivity in the current energy crisis which has resulted in inflation. Therefore, formulating these questions for research:

- What aspects impact consumer satisfaction for charging infrastructure?
- Which factors contribute towards consumer’s choices regarding charging stations?

- Are customers sensitive to rate changes?

1.3 Dissertation Structure:

Chapter 1 briefly discusses the EV industry, significance of infrastructure for charging, and satisfaction. It also explains why research on charging infrastructure is necessary for Ireland's EV market.

Chapter 2 critically analyses customer satisfaction, EV adoption, and its barriers along with charging infrastructure preferences and price sensitivity from the literature, which is useful for this study.

Chapter 3 details the study's research methodology. The research framework, philosophy, data collection tool, and hypothesis are included. It also supports the chosen research method. The chapter also discusses the approach's drawbacks.

Chapter 4 provides brief descriptions of the statistical tests performed on the gathered data to understand their purpose and meaning.

Chapter 5 covers survey data and statistical descriptive evaluation. Based on univariate analysis, and regression models, hypothesis conclusions are highlighted.

Chapter 6 summarises analytical findings. It compares outcomes to previous research. Managerial and theoretical consequences are discussed.

Chapter 7 presents findings, constraints, and recommendations for additional study.

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction:

This chapter reviews the existing research to examine electric vehicle charging infrastructure and consumer satisfaction theories. Comprehensive research review starts with a broad picture of EV adoption. A further evaluation highlighted charging infrastructure hurdles to EV adoption. The thematic approach for this chapter moves on to review the elements of customer satisfaction with further delving into customer satisfaction for charging infrastructure. The next focus of this research is on discovering what kind of charging infrastructure is most popular amongst consumers. Lastly to conclude with reviewing the research on price sensitivity of customers

2.2 EV Adoption:

Electric vehicle adoption and market success are intrinsically tied to the expansion of charging infrastructure. Shi *et al*. (2021) argues that there is a complex web of interdependence between a commodity's growth and that of its supplementary goods, giving rise to a dynamic relationship between them. For the EV market to thrive and expand, the charging infrastructure must continue to evolve. This is highlighted by Adnan *et al*. (2017) that to encourage EV adoption 25,000 charging stations are scheduled to be installed across Malaysia, owing to the initiatives of Malaysian Green Technology. In contrast, Madina, Zamora, and Zabala (2016) continue to defend the shortage of charging facilities by arguing that the arrangement has not yet proven financially sustainable because there are not too many EVs out there. However, Yang *et al.* (2023) justifies the initial argument by the fact that EVs made up as much as 64.5% of Norway's auto market in 2021 as urban Norwegians with larger charging infrastructure are more inclined to buy EVs. Therefore, such observations can support the charging infrastructure and can further promote the expansion of the EV industry.

However, these two have always had a paradoxical relationship, particularly in the initial stages of EV development. This paradox arises from a dilemma of chicken and egg. Melliger, van Vliet, and Liimatainen (2018) examined the results of implementing charging stations in residential areas of Finland and Switzerland to discover that users were happier after they had easy access to a charging facility. Such evidence supports the need of charging network to expediate EV adoption. On the contrary, Springel (2021) pointed out in the preliminary stages of EV development investors struggled to make a profit as most chargers are underutilized despite the high initial cost of installing them. This paradox highlights the importance of a coordinated approach to developing charging infrastructure and EV market (Visaria *et al*., 2022; Shi *et al.*, 2021). Through optimal development of charging networks considering the charging demand, it is possible to overcome this dilemma. A similar thought is concluded that the gradual disappearance of the above discussed dilemma is evidenced by the charge utilization at Amsterdam growing charging facilities (Van Den Hoed *et al*., 2013).

As observed through the discussed literatures, positive association can be found between charging infrastructure and EV market diffusion. Hence a more organized deployment of charging networks would contribute to overcoming the challenges faced in achieving the mentioned goals of EV adoption. This highlights to identify variables influencing charging infrastructure usage and the need to conduct this research in the current market.

2.3 EV Barriers:

The government of Ireland is currently implementing policies to encourage EV adoption. Since the impact of adopting electric cars is not as expected, researchers have attempted to pinpoint the underlying factors and impediments to EV purchase. Proximity to charging infrastructure, EV prices compared to classic cars, and the prominent cultural standards and beliefs in a particular community are a few illustrations of these factors (Cui *et al.,* 2021). On the contrary, EV sales growth has lagged below industry predictions even though impediments to EV adoption like price, range constraint, and charging infrastructure are reducing (Priessner, Sposato, and Hampl, 2018).

Falcão, Teixeira, and Sodré (2017) conducted a comparative analysis which determined that owning an electric vehicle is more than twice as much than that of traditional vehicles. The vehicle's battery has a significant impact on the final cost. However, if battery prices stay low, it may become a major factor in the spread of EVs (Quak, Nesterova, and van Rooijen, 2016). Supporting this argument Yan (2018) states that in Norway and France, EVs have already surpassed ICE vehicles in terms of affordability. As mentioned before, EV use has increased, but battery technology restricts its range. EV owners may experience "range anxiety," worrying that their batteries would run out mid-trip. To resolve this, more EV charging stations are being installed. However, in 2016 the International Energy Agency (IEA, 2016) announced that EV ranges have increased due to technological advancements. In contrast, increasing the EV range does not alleviate the fear of running out of charge Chen and Lin (2022). Therefore, Large-scale EV adoption is impossible without establishing an adequate charging infrastructure.

Currently, as highlighted by Gönül *et al.* (2021), most of the Turkey's charging infrastructure is concentrated in its largest cities. This uneven distribution of EV charging facilities contributes to the slow uptake of electric vehicles there. On the contrary, installing these charging stations evenly everywhere to increase the uptake of the EV market can give rise to supplementary problems such as voltage instability, frequency instability, and overloading. Because of this, it is crucial to ensure the charging facilities are built and operated in some way that minimizes these potential problems (Gupta *et al.,* 2021). However, there is still a lot of ambiguity about the extent of this impact and how future charging infrastructure will best support EV adoption.

While it is clear from the arguments of a few studies that EV users need convenient and reliable charging options, the correlation between charging infrastructure and EV adoption is complex and multifaceted. Moreover, the influence of charging stations on EV uptake may also vary depending on geographical location and other factors. In metropolitan locations with public transit and ride sharing, charging infrastructure may not affect EV adoption. In rural locations with limited transit, charging facilities may be more important to EV adoption. (Wolbertus *et al*., 2021).

In addition, cost remains a significant barrier to EV adoption with many models priced higher than their gasoline-powered counterparts. Huang and Qian (2018) report that the price of an electric vehicle is the most important factor along its associated financial and service incentives for buyers in China's cities of the second and third categories. Despite a greater cost of purchasing an EV, Parker *et al.* (2021) demonstrated that EVs can save households over 17% of their total mileage. In addition, government incentives and grants may also help to lower the initial cost of buying an EV. Market shares of EV are highest in Norway, Japan, and the US were EVs are cheaper (Sierzchula, 2014).

While there is an abundance of empirical evidence on the use of electric vehicles, there exists ambiguous evidence of how charging facilities can help and promote the broad adoption of EVs. To elaborate further, research into EV adoption has typically focused on the technology itself, such as battery capacity and range, as well as consumer behavior and policy incentives. However, the contribution of charging facilities in boosting the switch to EVs has received little attention. This includes the development of charging infrastructure that is conveniently located, easily accessible, and reliable. To address this gap Visaria *et al*. (2022) recommend that studies explore how charging networks are built in the future and their role in promoting EV adoption. Factors such as location, accessibility, payment methods, and amenities provided at charging stations should be considered in designing an effective and supportive charging network. Hence by reviewing the findings of all these previous pieces of literature, the current study identifies the inadequacy of charging infrastructure as the most significant hurdle for consumers when considering buying an EV. It focuses on learning more about how public infrastructure can encourage the use of EVs and accelerate the transition to a mode of transportation that is less harmful to the ecosystem and economically viable.

2.4 Customer satisfaction:

Satisfied customers bring in business and revenue for companies (Abd Razaka, Shamsudinb and Abdul, 2020). Tracking customer happiness is crucial to a company's long-term viability and revenue growth (Larsson and Broström, 2020). Researchers are intrigued by how people's perceptions of technology affect their decision-making and adoption of technology (Meuter *et al*., 2000). Stakeholders are worried about low adoption. Thus, understanding the reasons why individuals hesitate to utilize these services is crucial (Li *et al.*, 2021). However, Dissatisfaction can be ambiguous. This study investigates Ireland's electric vehicle charging infrastructure based on these findings.

Initial evaluation of customer satisfaction was based on the dissonance theory. Cardozo (1965) explains that Cognitive conflict is predicted by the dissonance theory to occur when a person's expectations for a product's value are not matched. Customers may change their product opinion to reduce stress from a mismatch between expectations and performance (Yi, 1990). In contrast to dissonance theory, there is no significant obligation for consumers to address the disparity between performance and expectations. Instead, dissonance may cause satisfaction or dissatisfaction. Since the dissonance theory's foundation disregards the tolerance threshold, it indicates that customers are willing to tolerate some performance variation so long as it is within reason (Woodruff, Cadotte and Jenkins, 1983).

In contrast, satisfaction is the difference between what was expected and what was delivered after consumption. Dissatisfaction may result from underperformance (Oliver, 1980). In similar lines, satisfaction depends on the buyer's mindset, according to Howard and Sheth (1969), namely whether they feel they got fair value for the decisions they made. Marketing studies on consumer satisfaction have primarily concentrated on the disconfirmation theory. The concept states that consumer satisfaction depends on how successfully a service matches expectations. However, applying it consistently across all product categories can be challenging. This is because the factors that influence customer satisfaction may vary depending on the specific characteristics of the product or service (Li *et al*., 2021).

Critics of this disconfirmation theory, Halstead, Hartman, and Schmidt (1994); McGill and Iacobucci (1992) have noted there is lack of consensus about the processes that lead to customer satisfaction. Consequently, there is currently an effort for the development of context-specific customer satisfaction measures. Similar arguments are observed by (Eren, 2021) that customer satisfaction is not related to customer expectations or how well they are acknowledged.

Westbrook and Reilly (1983) suggested that consumer pleasure and discontent might be explained by product value rather than expectations. Conversely, this model is not comprehensive because it ignores the effects of time, contextual differences in purchases, and individual differences in preferences. These elements influence model suitability (Cote, 1989).

The idea of IPA originated by Martilla and James (1977), and it argues that the level of customer satisfaction is determined by their assessment of performance and the significance of the attribute. These aid in recognizing and establishing priorities of areas for improvement (Sampson and Showalter, 1999). Barsky (1992) argued overall satisfaction or dissatisfaction is assessed by the relevance of products or service attributes and the magnitude to which it exhibits those qualities. This theory is observed as an extended version of disconfirmation theory. In the current study, various attributes of electric vehicles charging infrastructure are explored and utilized to determine the level of satisfaction. Therefore, this study adopts IPA for performing this research.

Further, consumers' satisfaction is affected not only by their present experience with the vehicles but also by their expectations for the future of innovations in electric vehicles. To ensure consumer satisfaction, it is crucial to understand and resolve electric vehicle customers' concerns.

2.5 Customer preferences for Charging infrastructure that leads to satisfaction:

Individuals regularly charge their electric cars at a few favorite spots. The driver's favorite place is often home or work, where people spend most of their time. EVSE data revealed the most common site to charge an EV is at home, followed by places where people work and public stations. (Tal *et al*., 2020). As a result, EV owners often develop a regular charging schedule that coincides with their daily plans and activities (Wolbertus *et al.,* 2021). Moreover, Private charging facilities may be available to some EV drivers at their residences or places of business, reinforcing their charging habits and preferences (Visaria *et al.,* 2022).

Contrary to the location preferences of consumers (Visaria *et al.,* 2022), preliminary results from the evaluation suggest a strong inclination toward pricing models that offer comprehensive and fixed fees. Additionally, they value the capability of charging networks to connect and operate seamlessly with each other, regardless of location. This demonstrates that customers place a premium on having a smooth and easy time while utilizing charging networks. To elaborate, the results show that people will change their driving routes to take advantage of cheaper charging stations (Chen and Lin, 2022). It was evident that electric vehicle users had to make trade-offs between convenience and cost when charging their cars. While various charging options were available, some users charged their vehicles at home or work to save time and money. Others preferred charging their cars in public locations due to factors such as parking availability or distance from their destination.

Hence, designing innovative solutions to optimize the use of available land resources is crucial to overcoming these obstacles. A survey conducted by Sun *et al.* (2017) on EV drivers found that eighty percent of EV users typically plug into public outlets which demonstrates the importance of these locations, with parking lots being the most common choice. After doing a qualitative investigation, Caperello et al. (2015) found that to expand EV markets, public charging infrastructure is essential. Amidst all the advantages of personal chargers, some issues still need to be resolved. For example, installing private charging stations requires sufficient space and access to electricity. Additionally, the installation cost can be a barrier for some individuals, particularly those living in apartment complexes or rented properties (Chen and Lin, 2022).

The current statistics of Ireland show that publicly available charging stations are where the deficit is most severe (Government of Ireland, 2023). Also, membership, pricing, and payment methods vary between public charging facilities, preventing a consistent, user-friendly experience nationwide. Developing a framework that allows electric car owners to seamlessly access charging stations regardless of charging network provider will streamline the charging process and make it more comfortable and convenient. This thought is supported by Schäuble *et al.* (2016) which argues that interoperability induces favorable feedback from consumers. This will require cooperation among various charging network providers and stakeholders to develop standardized protocols for charging infrastructure (Das *et al.,* 2020).

Lack of study is highlighted by Hardman et al. (2018) on consumer preferences and compatibility in their analysis. Similarly, Zhang *et al*. (2018) advocate for a further in-depth investigation into practical solutions that can enhance the economic efficiency of charging infrastructure. This study considers the shortcomings of the previous studies and intends to apply its findings to the electric vehicle market in Ireland. To successfully execute Ireland's charging infrastructure policy, consumers' viewpoints must be included. (Government of Ireland, 2023) Therefore, this study aims to quantify important determinants of customer's satisfaction with charging facilities to close this gap.

2.6 Price sensitivity:

Despite the factors discussed in earlier sections that influenced charging behavior, the cost of running an electric car was discovered to be a significant driving force for users. Therefore, users were willing to make trade-offs between convenience and cost to optimize their charging experience and achieve cost savings. (Visaria *et al*., 2022)

However, incentives such as free charging being commonly offered can lead to congestion and overuse of charging stations, especially as more EVs hit the road. Due to electric vehicle popularity, pricing plans alter the geographical and temporal distribution of charging demands at publicly accessible charging facilities and their revenue. Hence quantifying recharging demand's price elasticity is vital to measure pricing fluctuations and modelling customer behavior (Bao *et al*., 2021).

On the other side, there is a lack of research about how much willingness is shown by people to spend on charging an EV. The notion of cost-saving is used to describe user’s desires to cut back on expenses. The conventional method for determining the price elasticity of electricity consumption involves obtaining variations in consumption caused by changes in power prices. However, electric vehicles have dynamic charging consumption; at various times, multiple charging points can meet their electricity needs (Bao *et al.,* 2021). Thus, a deeper knowledge is required regarding consumer behavior related to charging infrastructure and charging price change (Visaria *et al*., 2022). This paper will quantify the relation between the price and charging demand to understand this dynamic electricity consumption.

It is observed existing research ignores essential factors about end-user perceptions of charging solutions. Therefore, future research on EV charging solutions must consider a broader range of factors, including the cost and dynamic pricing strategies, to gain a better knowledge of the end-user requirements and preferences (Visaria *et al.,* 2022).

2.7 Conclusion:

Therefore, a comprehensive understanding of consumer preferences and decision-making processes is vital for successfully deploying charging infrastructure. By considering consumer preferences and behaviors, Policymakers could use consumer data to determine where to deploy charging stations, what types to install, and how to price charging services, thereby promoting the widespread adoption of electric vehicles (Chen and Lin, 2022; Cui, *et al.*, 2021). This review made aware of the existing frameworks on which the study was done and helped to focus on the limitations so that this study will contribute to adding value to the adoption of electric vehicles.

CHAPTER 3: METHODOLOGY

3.1 Introduction:

This part covers rationale for selecting these research strategies, as well as the methodologies used to implement them are explored. It starts with a brief discussion of the philosophy and methodology of research, then moves on to an explanation of the study's hypotheses and continues with an outline of the techniques and approaches taken in current study. Methods for gathering data and analyzing that data for answering the study topics are then detailed. The next part will concentrate on the various methods of sampling, and the research instrument. Also, the questionnaire's development and piloting trial are discussed. Lastly concluding with comments on some ethical considerations along with the constraints on the investigation.

3.2 Research Philosophy:

The study of philosophy is spread out along a set of continuous lines between two opposite ends i.e., objectivism (Positivism) and subjectivism (interpretivism). Realism may be seen as the ontological viewpoint held by positivism. The goal of the positivist approach to methodology is to explain linkages. Positivists try to find the reasons why things happen the way they do (Scotland, 2012). Positivism is consistent with the hypothetico-deductive framework (Park, Konge, and Artino, 2020) which depicts a circular process of creating hypotheses based on existing theories and evaluating it (Saunders, Lewis, and Thornhill, 2009). Finally concluding with the findings which support or denies the hypothesis (Park *et al.*, 2020). This displays relevance with current study's research approach of investigating customer satisfaction of electric vehicles charging infrastructure.

A good research philosophy provides the foundation for any approach, research plan, data-gathering methods, and evaluation metrics (Saunders *et al.*, 2009). Empirical research should be founded on numerous basic philosophical assumptions, including the investigation's purpose, data to prove it, and methodology (Alharahsheh and Pius, 2020). Assumptions occur throughout the research process and invariably influence how the researcher comprehends the research methodological decisions.

The current study's focus on the relation between customer satisfaction and electric vehicles charging infrastructure inclines towards a positivist approach as it displays various similar characteristics. A few aspects of positivists are to test the hypotheses (Park *et al*., 2020). The current study plans to evaluate the hypothesis and identify the independent variable's considerable effect on customer satisfaction. Further, to prevent the results from being biased, positivists advocate being rational and impartial throughout the study process (Scotland, 2012; Saunders *et al.,* 2009) and careful consideration of unadulterated data and facts, uninfluenced by human interpretations of bias (Alharahsheh and Pius, 2020). Samples for this study were gathered via an online, self-reported survey of questions which minimizes the risk of biased responses. Finally, positivist research utilizes systematic methods so that it can be replicated in future research. Also, the research will be focusing on data that can be easily measured and analyzed statistically (Saunders *et al*., 2009). The numerical data of the current investigation is analyzed statistically and then the findings confirm or reject the hypothesis.

3.3 Research Approach:

An essential topic to consider when planning research is whether the goal is inclined more in testing theories or developing new ones. Two opposing philosophical viewpoints are used to illustrate this: the deductive and the inductive. When a study's goals include formulating a theory and a set of hypotheses to test, as well as planning out how to conduct that research, a deductive method is appropriate. Data collection and then theory formation because of that data analysis should follow the inductive method (Saunders *et al*., 2009).

This investigation opted for a deductive strategy, based on the prevalence of well-defined theory in the customer satisfaction research landscape and the intention to assess this theory empirically based on developing hypotheses to the test against observational data. This research reviewed various exiting literature theories regarding customer satisfaction, electric vehicles adoption and barriers, and its complementary service of charging infrastructure. Based on the review, various hypotheses were deducted from existing theories. Hence, the foundation of this study is theory which is derived from the process of examining research papers and developing a research strategy to test a hypothesis. (Saunders *et al*.,

2009). In contrast, qualitative research does not seek to test existing theory but to produce a theory, making it analogous to an inductive method (Newman, 2000). This study does not demonstrate this behavior as it is primarily concerned with quantitative analysis of established causal relationships of various dependent variables of charging infrastructure and customer satisfaction.
Therefore, considering the stated goals of the study, a deductive methodology is the most appropriate choice for investigating this study.

3.4 Key theoretical framework:

The repetitive process of observation is at the center of sociological research, explanation, gathering more data to assess the hypothesis, refining the explanation, and so on. There are two interconnected steps in the formation of convincing explanations: theory building and theory testing (Saunders *et al*., 2009). The current study tends to build hypothesis on the exiting theories and intends to use the results of this study to evaluate the hypothesis. A significant challenge associated with utilizing pre-existing hypotheses and ideas is the potential lack of receptiveness towards alternatives, particularly when there is firm commitment to a particular viewpoint. In contrast to the above argument, theories may assist us in formulating challenging concerns and making us more aware of certain issues (De Vaus and de Vaus 2013).

The customer will be unsatisfied if the demand is not met, but it is not enough to merely meet these parameters. Knowing what makes customers loyal can help businesses better tailor their offerings to them (Fu *et al.,* 2018), therefore this knowledge is essential. Among the many relevant ideas, the Expectation - Disconfirmation Theory (EDT) stands out as a useful tool for modelling consumer loyalty and word-of-mouth advertising. User’s post-adoption expectations will increase if they have a positive experience, as will their expectations after more encounters. Nevertheless, this theory presented some limitations and therefore, current research inclines towards IPA theory which is an extension of EDT. IPA signifies the importance of certain attributes in determining satisfaction or dissatisfaction along with the performance of said commodity or service. As a result, the after-purchase behaviors of consumers are as important as their pre-purchase perspectives. This demonstrates insufficient knowledge on the determinants of satisfaction with customers. (Zhang *et al.,* 2019).

3.5 Hypothesis:

Below Table 1 introduces various hypotheses formulated through reviewing the literature.

Table 1: Hypotheses list

Hypothesis	Alternate Hypothesis
H1.1	Employment is associated with higher levels of customer satisfaction for charging infrastructure
H1.2	Different public providers is associated with different levels of customer satisfaction for charging infrastructure
H1.3	Charging time preference is associated with higher levels of customer satisfaction for charging infrastructure
H1.4	Driven mileage is associated with higher levels of customer satisfaction for charging infrastructure
H1.5	Shorter wait time is associated with higher levels of customer satisfaction for charging infrastructure
H1.6	Close proximity location is associated with higher levels of customer satisfaction for charging infrastructure
H1.7	Age is associated with higher levels of customer satisfaction for charging infrastructure
H1.8	Gender is associated with higher levels of customer satisfaction for charging infrastructure
H1.9	City is associated with higher levels of customer satisfaction for charging infrastructure
H1.10	The number of charging stations is associated with higher levels of customer satisfaction for charging infrastructure
H1.11	Government grant and incentive is associated with higher levels of customer satisfaction with charging infrastructure

H2.1	Different public provider is associated with a preference for charging infrastructure
H2.2	Charging time preference is associated with a preference for charging infrastructure
H2.3	Price sensitivity is associated with a preference for charging infrastructure
H2.4	Age is associated with a preference for charging infrastructure
H2.5	Income is associated with a preference for charging infrastructure
H2.6	Driven mileage is associated with a preference for charging infrastructure
H3.1	Shift to non peak hours is associated with price sensitivity
H3.2	Gender is associated with price sensitivity
H3.3	Education is associated with price sensitivity
H3.4	Employment is associated with price sensitivity
H3.5	Income is associated with price sensitivity

3.6 Research Strategy and Design:

Research design is essential since it is the process through which the intent of the study is transformed into actual research. The procedure for conducting research and its components, including research methodologies, strategy for investigation, and sample technique, are all determined in a substantial way by the study's design (Al-Ababneh, 2020). This chapter will disclose the following layers, including selection of methodologies and strategies to conduct research.

Current research seeks to understand information regarding the present state of customer satisfaction for charging infrastructure of electric vehicles. The Information is created via the use of quantitative methods by examining attributes that can be measured. The study is built on the exiting research conducted in China by Chen and Lin (2022).

Finding different variables within the study's settings with the aim of establishing dependency, relationships, and a link between events is the major goal of most quantitative research designs. This methodology prioritizes the use of numerical data and variables that can be measured. The current study seeks to quantitatively investigate the correlation between charging facilities and consumer satisfaction, leveraging diverse statistical techniques to evaluate the proposed hypotheses. When doing quantitative research, the primary emphasis is on formulating precise, closed-ended questions that are designed to examine variables that are derived from the hypotheses (Soiferman, 2010). This characteristic of quantitative approach is observed with the use of survey in the Present Research.

Current research clearly demonstrates the above-described process and in addition employs a variety of statistical techniques using numerical data from the survey. Statistical findings are quickly generated through the utilization of software applications such as SPSS or Microsoft Excel to assess the hypothesized connection between infrastructure for charging and satisfaction.

The studies' primary concern is particularly on Ireland's geographic area to analyze the state of charging infrastructure which results in customer satisfaction or dissatisfaction. Significantly more samples are required representing all the regions of Ireland. Such an approach is supported by quantitative research which utilizes large samples to gain a comprehensive perspective of a particular area and uncover patterns and gaps in knowledge. An extensive survey is conducted to learn about and explain the current state of a certain population (Park and Park, 2016). Hence, discussed characteristics of quantitative approach suits well for research's strategy.

On the other side, by studying phenomena in their natural settings qualitative researchers hope to provide insights into both practical and theoretical concerns. Quantitative research uses statistics. Conversely, a case study exemplifies a qualitative research approach (Park and Park, 2016). The purpose of interviews and focus groups in qualitative research is to gather information from the people who take part. As a result, participants are often asked broad questions that give them room to elaborate on the nuances of a particular concept or occurrence (Soiferman, 2010). Accordingly, the qualitative technique has been eliminated from this investigation owing to its characteristics we have already discussed.

In accordance with the philosophical notion that positivist theory, deductive reasoning, and quantitative techniques of research are closely intertwined, the choice of prior components of methodology leans the research towards quantitative analysis (Saunders *et al.,* 2009).

3.7 Population and Sampling:

The ideal approach in any type of research is to examine the issue involving the entire population. However, it is never feasible to examine the full population (Acharya *et al.,* 2013). This phenomenon may arise in situations where it is not feasible to identify or reach all individuals of a population, or when the population size is too extensive to facilitate a census-based investigation that involves inviting every citizen into taking part in the research (Stratton, 2021). In such instances the selection of a sample is necessary to address research inquiries (Saunders *et al.,* 2009).

Research and statistical principles demand that sampling strategies consider a wide range of contextual elements, such as variation in the target population, the magnitude of the sample, the purpose of the research, intended accuracy in outcomes, monetary implications, the methods of sampling, and the reliability required in drawing conclusions about the population under study (Sharma, 2017).

The key to defining a study's scope is choosing a population representative sample (Saunders *et al*., 2009). The study's demographic group of interest includes adults over the age of 18, from any educational or economic background. To account for the dispersed population of Ireland, there is a need to include large samples to conduct a reliable study into how charging infrastructure affects consumer fulfilment. The sample does not need to be a full set of groups from the population. In this case, the samples would consist of all electric automobile drivers.

In the process of sample selection for research purposes, it is imperative that the chosen sample truly represents the population under study with respect to addressing the research question and fulfilling the purpose at hand (Acharya *et al*., 2013; Saunders *et al*., 2009). Following are the inclusion criteria for this study:

- The respondents should have an EV, or they are planning to purchase.
- The respondents should have used the charging infrastructure either private or public.
- The respondents should be adults over the age of 18, from any educational or economic class.

However, it is worth noting that respondents who do not meet the criteria are still qualified to respond to inquiries regarding passenger satisfaction, to ascertain the rationale behind their decision not to utilize the charging infrastructure.

Increased sample size reduces the margin of error when generalizing about the target population (Saunders *et al.,* 2009). Since overly high percentages of samples can sometimes not be necessary, determining a suitable sample size requires a carefully designed study approach (Pace, 2021).

Data collection methods, sampling count, and frequency of responses affect sample precision (Acharya *et al.,* 2013). The following are the two primary classification of sampling approach:

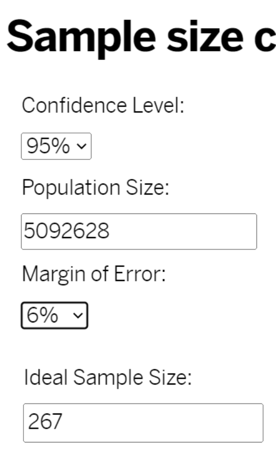
- Probability sampling
- Non-Probability sampling

Methods based on random sampling are encouraged to achieve sample representativeness and enhance the generalizability of findings to the intended population. The ability to avoid the inherent bias and subjectivity of human assessment is the primary advantage of random sampling (Pace, 2021). If they are not used, significant consideration must be taken when interpreting the findings of the research (Acharya *et al*., 2013). Nonetheless, probability sampling has its downsides such as the requirement of substantial resources, including financial, time-based, and human resources (Pace, 2021). The need for a comprehensive list of all members of the community is one of the main apparent shortcomings. However, such a list is often unavailable for widespread populations (Sharma, 2017). Probability random sampling is the method of choice for statistical authorities. However, Researchers favors non-probability sampling in business sample surveys because it increases the likelihood that respondents would freely and honestly answer all the survey questions (Etikan and Bala, 2017).

Non-probabilistic is the sampling technique adopted in this study since surveying every adult in the population about their experiences with or intentions for purchasing electric cars would be costly and time intensive to conduct. This approach represents the sole viable option in cases where the identification of the intended population poses significant challenges. The mentioned option is comparatively more cost-effective and facilitates expedited outcomes in comparison to alternative choices. The determination of sample size for non-random sampling lacks a definitive calculation formula (Rozalia. 2007).

However, according to Taherdoost (2016) confidence level refers to the degree to which the researcher is satisfied that the features of the public have been accurately represented by the sample. According to Cohen, Manion, and Morrison (2017), the confidence levels of 90%, 95%, and 99% implies that 90, 95, or 99 individuals out of a total of 100 will accurately represent the entire population. Concerning the study of societal issues, the margin of error that is considered acceptable is 5 percent (Pace, 2021). The current study's sample size was determined using an online sample calculator (qualtrics.com2). Required samples for a 6% error margin and a 95% confidence interval based on a population of 5.1 million are displayed below. Although, the population figure includes individuals below 18 years of age and not all the population be a current or prospect EV owner. Hence, the relevant population will be less than 5.1 million.

Figure 1: Sample Size Calculator (Qualtrics, 2023)



Convenience sampling is particularly valuable when a community is highly diverse and geographically dispersed. In addition, the advantages of this approach include its cost-effectiveness in both temporal and monetary aspects, as stated by Taherdoost (2016). These characteristics tend to suit current pilot study as conveniently few participants are approach to fill the questionnaire survey.

Participants in snowball sampling are not selected at random; this is one of two methods that rely on their own free choice. The convenience sampling method has two variants: quota and snowball sampling. Saunders *et al.,* (2009) state that it is widely applied in situations where it is challenging to figure out participants in the target group, which is the case here. While in quota sampling to consider all the various groups it may take longer and cost more to complete the study since a higher sample size is required. Also, it can be possible for the investigator's findings to be biased (Sharma, 2017). As a result, the quota sampling strategy does not fit for current study and is suited to qualitative research designs (Taherdoost, 2017). Contacting one or two individuals and asking them to recommend others is the optimal method of snowball sampling. In addition, the newly identified respondents found even more cases and so on. When no more cases can be added, the sample size has grown to the maximum feasible size, or the amount of available data is complete (Saunders *et al.,* 2009).

Though, potential drawback of employing a snowball sampling method is the potential for non-response or inability to broaden the sample. However, the widespread use of social media sites has witnessed a surge in the application of snowball sampling. The application of snowball sampling to collect data has been demonstrated in quantitative studies (Parker, Scott, and Geddes, 2019). To meet the specified requirements, this study's research methodology utilizes snowball sampling for the study. However, convenience sampling limits the representativeness of the population as it does not include participants randomly which inclines biases for sample selection. This skews the sampling towards specific aspect of population as in this study convenience sampling covered urban locations and more employed individuals.

3.8 Data Collection:

Data should only be obtained using proven collecting techniques, such as surveys and interview scripts. The gathering of relevant research evidence requires a significant amount of data collection, which must therefore be carried out in a systematic manner (Sadan, 2017). Data is gathered by obtaining information on similar variables or aspects resulting in the creation of a data matrix. In this study's context, it can be inferred that each row denotes an individual case or person, while each column indicates a variable or specific information that has been gathered for each case (De Vaus and de Vaus, 2013). It is imperative to establish clarity regarding the level of detail at which the relationships will be measured during the design phase, as they are expected to undergo statistical evaluation through the analysis of the data (Saunders *et al*., 2009). The present investigation employs a survey methodology to gather data, utilizing a combination of multiple-choice questions (MCQs) and Likert scale inquiries to assess satisfaction levels.

The questionnaire has become the standard method of collecting information in survey studies. Due to the uniformity of the questions answered, this technique is useful for collecting data from a sizable population in advance of quantitative analysis (Saunders *et al*., 2009). As discussed earlier, the current study aims to capture responses from large samples to evaluate factors influencing customer satisfaction for charging infrastructure.

Questionnaires are commonly employed for the purpose of descriptive or explanatory research. As this study conducts descriptive research, Questionnaires are designed to gauge participants' points of view that sheds light on variations in situations (Saunders *et al*., 2009). The primary goal of conducting a survey is to provide a snapshot of the characteristics and habits shared by a sample of the population. Survey investigators are also concerned with identifying the underlying causes of observed phenomena and identify causal relationships through the comparative analysis of cases while the results are utilized to determine if one variable influence another (De Vaus and de Vaus, 2013). This type of research is usually perceived to be quantitative and positivistic by design. This aligns with the research approach of the current study. The survey is the standard method of collecting information for quantitative studies (Moises, 2020).

Despite the fact that a survey approach has been taken for this study, there are certain drawbacks raised through various existing literature. Even while a trustworthy questionnaire is required for reliability, it is not enough. A question in the survey could be read one way by respondents even if you intended it to be read another. This could be because of a misunderstanding of the wording. Thus, the question is trustworthy but lacks internal validity, thus it cannot address your research issue. Another possibility is that responders' answers are inconsistent because of misunderstandings of the instructions. Five to nine percent of those who fill out a questionnaire do not bother to read the instructions. In certain cases, individuals may engage in uninformed responses, a phenomenon characterized by intentionally guessing at an answer due to a lack of adequate knowledge or experience. It is possible that individuals may engage in discussions with others, potentially leading to the contamination of their responses (Saunders *et al.,* 2009).

However, current research has implemented measures to minimize the potential impact of mentioned shortcomings to the greatest extent possible. Firstly, it utilized methodologies aimed at avoiding non-response. If respondents know their answers will remain anonymous, the level of accuracy of their answers should increase. The current survey participant's responses were kept anonymous to achieve validity of the answers. Also, to prevent nonresponse, self-administered online surveys were used to provide online explanations to guide respondents if they get stuck (De Vaus and de Vaus, 2013).

On March 20th, 2023, the public link was made available through all the social network channels. The survey received a total of 324 responses by the closing date of April 16th, 2023. In conclusion, an online distributed survey via Google Forms was employed to get appropriate data for a quantitative study utilizing convenience and snowball sampling.

3.9 Questionnaire Design:

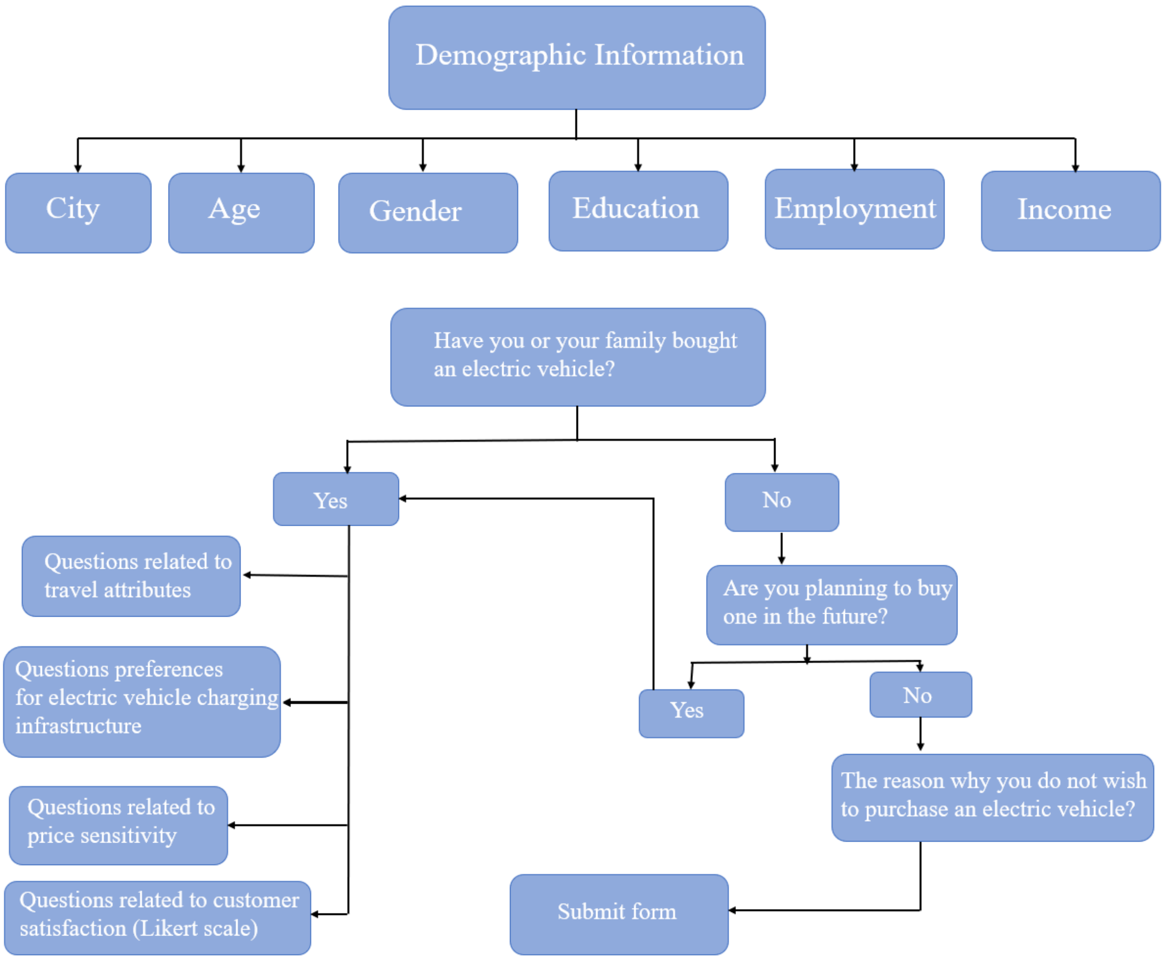
Questionnaires were used as the research tool for current research. The questionnaire used in this investigation is of the structured kind, comprising mostly closed-ended items and some open-ended ones.

The sequence of questions should be organized in a hierarchical manner, starting with broad questions and progressing towards more specific ones, while also being grouped by topic. It is advisable to address sensitive questions toward the final part (Sadan, 2017).

The following questionnaire is designed to gather socio-demographic information from participants and assess their eligibility to take part in this research. Respondents are required to state their sexual orientation, age, range, country of origin, and degree of education. The survey asks if respondents own or intend to purchase an electric vehicle. Non-electric car adopters are asked to provide a reason from a list of multiple-choice options. Participants are also asked about their travel behavior and the distance they typically drive. This information is seeking to understand the potential inclination towards EV. The questionnaire also includes questions about participant's charging infrastructure preferences. Current study concentrates on the availability and convenience of charging stations, as well as the preferences for charging infrastructure and charging time. EV charging price sensitivity is assessed. This section examines how charging cost variations may affect electric vehicle adoption. Consumer satisfaction with electric vehicle charging infrastructure concludes the questionnaire.

Participants in a study are asked to choose the appropriate replies from a list of options presented to them in a structured questionnaire. Participants in an open-ended question contribute their personal responses, whereas, in a question that is closed-ended, participants must choose the best possible answer from a predetermined set of options (Sadan, 2017).

Figure 2: Flow of questionnaire and sections



When it comes to measuring human qualities or features, it is crucial to ensure that any scales used have been well-tested for reliability and validity. Hence, satisfaction scale questions were tested for reliability and a value greater than 0.7 was obtained for Cronbach's alpha to ensure a high degree of internal consistency. Existing grading systems may be used. Each criterion on the scale is assigned a score.

A rating scale is a collection of categories, usually ordered, that describe the event under study. Each category is given a numerical value, and the thresholds for transitioning between them are flexible. People rate how well each category describes their own personal experience (Sadan, 2017).

Existing literature by Chen and Lin (2022) served as the basis for the questionnaire which was adopted to perform Ireland specific study. A few questions were included in the rating scale from this exiting study to capture participant’s perspective regarding consumer preferences and satisfaction. As there are various charging provider in Ireland, this study seeks to identify preferred charging infrastructure and does it contribute to consumer satisfaction.

- Ranking of charging infrastructure locations where you want to charge your electric vehicle.
- Key factors for your satisfaction with the current charging infrastructure
- Key factors for your dissatisfaction with the current charging infrastructure

Similarly, another set of questions that follow were formulated using a Likert scale to investigate whether factors such as quality service, accessible operating hours, proximity, and wait time while utilizing present charging infrastructure have an impact on customer satisfaction. As these scales were verified for reliability in mentioned existing literature, current study adopts these questions. These questions signify consumers requirements for charging infrastructure and to figure out what contributes to satisfaction most significantly

- based on personal experience and the opinions of others associated with respondents, how satisfied respondents are with the current charging infrastructure.
- satisfaction with individuals current preferred charging infrastructure options.

- satisfaction with the overall density of nearby charging options.
- satisfaction with the current grants and incentives provided by the Ireland government for charging infrastructure.
- The likelihood of making a purchase of an electric car is affected by the general state of the charging infrastructure in your community.

According to Jamieson (2004), this type of response format provides a quantitative measure of the respondent's attitudes or opinions, allowing for statistical analysis.

The five-point Likert scale is utilized in this research. Scales with five options, where one is a strong disapproval and five is a strong approval. The overall score on a Likert scale ranges from the minimum possible score (e.g., 5, 7, or 10) to the maximum possible score (e.g., 25, 35, or 50), with higher scores indicating more positive attitudes or opinions.

Table 2: Questionnaire items and the response scale.

Questions	Options	Variable type
Where do you live in?	▪Dublin ▪Cork ▪Limerick ▪Galway ▪Waterford ▪Kilkenny ▪Other	Nominal
What gender do you identify as?	▪Male ▪Female ▪Gay or Lesbian ▪Bisexual ▪Other sexual orientation ▪Prefer not to say ▪Straight or Heterosexual ▪Other sexual orientation	Nominal
How old are you?	▪18–30 ▪31–40 ▪41–50 ▪51–60 ▪Over 60	Ordinal
What is the highest degree or level of education you have completed?	▪Secondary school and below ▪Bachelor's degree ▪Master's degree ▪Ph.D. degree and above	Nominal
What is your current employment status?	▪Employed Full-Time ▪Employed Part-Time ▪Seeking opportunities ▪Self employed ▪Retired ▪Prefer not to say ▪Student	Nominal
What is your annual personal income?	▪20,000 Euro and below ▪20,000–40,000 Euro ▪40,000-60,000 Euro ▪60,000–80,000 Euro ▪80,000–120,000 Euro ▪120,000 Euro and above	Scale

Have you or your family bought an electric vehicle?	•Yes •No	Nominal
Are you planning to buy one in the fut	•Yes •No	Nominal
What is the reason why you do not wish to purchase an electric vehicle?	•Charging cost •Unavailability of infrastructure to install home charging unit •limited public charging infrastructure •Range anxiety •Charging time •Congestion at charging station	Nominal
What is the annual driven mileage of electric vehicles for you or your family if you are not an electric vehicle user now then how much do you estimate to drive as per your requirement after you purchase an	•10,000 km and below •10,000–15,000 km •15,000–20,000 km •20,000–25,000 km •25,000–30,000 km •30,000–35,000 km	Scale
Do you prefer to choose public or private charging infrastructure?	•Public charging infrastructure •Private charging infrastructure •Both charging infrastructure	Nominal
Which public service provider do you frequently use or plan to use to charge your electric vehicle?	•ESB ecars •EasyGo •Circle K •Apple green •Ionity Tesla •Other	Nominal
What are the key determinants to choose the preferred charging infrastructure? kindly rank them on a scale of 1-5 where 1 is the most important and 5 is the least important to you.	•Location of charging station •Charging cost •Wait line •Charging speed •Service quality •Compatible charging technology	Interval
When do you prefer to charge your electric vehicle at home or other private charging infrastructure?	•Daytime (6:01–18:00) •Night-time (18:01–6:00)	Nominal
When do you prefer to charge your electric vehicle at public charging infrastructure?	•Daytime (6:01–18:00) •Night-time (18:01–6:00)	Nominal
How long can you generally wait each time you charge the electric vehicle at public charging units such as workplaces, grocery places, shopping centers, or motorway	•1 hour and below •1–2 hour •2–3 hour •3 hour and above •It varies	Ordinal

What is your attitude toward waiting in line while charging?	▪Totally unacceptable ▪Occasionally acceptable ▪Not sure ▪Occasionally unacceptable ▪Totally acceptable	Ordinal
How far do you wish the nearest charging infrastructure to be from your home?	▪1 km and below ▪1–2 km ▪2–3 km ▪3 km and above	Ordinal
Please rank the following charging infrastructure locations where you want to charge your electric vehicle in order of 1 being the most preferred location and 5 being the least preferred location to you.	▪Residential area ▪Park Shopping center ▪Street Grocery place ▪School ▪Workplace area	Interval
If the property management company or power operator supports it, do you want to install private charging facilities?	▪I extremely don't want to do that ▪I don't want to do that ▪I don't care about that ▪I want to do that ▪I extremely want to do that ▪I have already installed	Ordinal
How much of your electric vehicle usage will be reduced when the charging prices are increased by 10%?	▪2% ▪5% ▪10% ▪20% ▪30% ▪40% ▪50% ▪> 50%	Ordinal
How much of your electric vehicle usage will be reduced when the charging prices are increased by 25%?	▪2% ▪5% ▪10% ▪20% ▪30% ▪40% ▪50% ▪> 50%	Ordinal
How much of your electric vehicle usage will be reduced when the charging prices are increased by 50%?	▪2% ▪5% ▪10% ▪20% ▪30% ▪40% ▪50% ▪> 50%	Ordinal

How much of your electric vehicle usage will be reduced when the charging prices are increased by 100%?	▪2% ▪5% ▪10% ▪20% ▪30% ▪40% ▪50% ▪> 50%	Ordinal
Does an increase in electricity tariff during peak hours shift your electric vehicle charging to non-peak hours at home?	▪Yes ▪No	Nominal
Does an increase in overall charging cost affect your decision of purchasing an electric vehicle?	▪Extremely affected ▪Little affected ▪Not sure ▪Not affected ▪Do not care	Ordinal
What do you think is a more reasonable charging fee for private charging facilities?	▪Significantly lower than the charging fee of public charging infrastructure ▪Slightly lower than the charging fee of public charging infrastructure ▪Equal to the charging fee of public charging infrastructure ▪Slightly higher than the charging fee of public charging infrastructure ▪Significantly higher than the charging fee of public charging infrastructure	Ordinal
Are you satisfied with the current charging infrastructure, based on your experience and feedback from your family and friends?	▪Very dissatisfied ▪Dissatisfied ▪Not sure ▪Not sure ▪Satisfied ▪Very satisfied	Interval
What are the key factors for your satisfaction with the current charging infrastructure? Please rank them on a scale of 1-5 where 1 is the most important and 5 is the least important to you.	▪Good service ▪Well known service provider ▪Up-to-date technology ▪Convenient operating hours ▪Close proximity ▪Needs are fulfilled ▪Queue waiting time	Interval

What are the key factors for your dissatisfaction with the current charging infrastructure? kindly rank them on a scale of 1-5 where 1 is the most important and 5 is the least important to you.	▪Charging cost ▪Unavailability of infrastructure to install home charging unit ▪limited public charging infrastructure ▪Range anxiety ▪Charging time ▪Congestion at charging station ▪Location of charging station	Interval
Are you satisfied with your current preferred charging infrastructure options?	▪Very dissatisfied ▪Dissatisfied ▪Not sure ▪Not sure ▪Satisfied ▪Very satisfied	Interval
Are you satisfied with the total number of available charging station points in your area or your most frequently used route?	▪Very dissatisfied ▪Dissatisfied ▪Not sure ▪Not sure ▪Satisfied ▪Very satisfied	Interval
Are you satisfied with the current grants and incentives provided by the Ireland government for charging infrastructure?	▪Very dissatisfied ▪Dissatisfied ▪Not sure ▪Not sure ▪Satisfied ▪Very satisfied	Interval
Do you think the overall state of your city's charging infrastructure will affect your willingness to buy an electric vehicle?	▪Very dissatisfied ▪Dissatisfied ▪Not sure ▪Not sure ▪Satisfied ▪Very satisfied	Interval

3.10 Pilot Study:

Following the development of the interview questions, the instrument is subjected to content validation by industry professionals. Any issues with the questionnaire's questions, sequence of presentation, or data collection process may be uncovered via a pilot study (Sadan, 2017). Pilot testing is done to improve the efficiency of the questionnaire. by ensuring that respondents can answer the questions with ease and that there are no constraints on documenting the responses. The data from the pilot study may be analyzed beforehand to make sure it will be sufficient to address your research questions (Saunders *et al.*, 2009). As discussed earlier, convenient sampling was employed to distribute questionnaires among five participants for the pilot study. The feedback that was commonly received pertained to the interpretation of specific terminology. The following aspects in Table 3 were evaluated by the respondents:

Table 3: Pilot test feedback

Aspect for evaluation	Feedback
The duration of the questionnaire completion:	Appropriate time is allocated to complete the survey.
The comprehensibility of instructions.	1. The participants earlier did not understand after selecting not interested why they are asked about the reasons for their selection. So modification was made to the instructions to clearly state: let us know the reasons for your unwillingness to buy an electric vehicle. 2. Regrading Rank questions, the most important and least important numbers representation was not clearly stated in the options sections. So necessary modifications were made.
Any questions that were perceived as vague or confusing.	Questions seemed accurate and covered most of the scenarios for EV users.
Any questions that caused discomfort to the respondents.	There was no discomfort caused as sensitive questions like gender were optional
Any significant issue of negligence.	There was no issue of negligence
The visual appeal of the questionnaire presentation.	The cover page and questions structure was articulated well

Overall, feedback and suggestions obtained from a pilot study are crucial in refining the questionnaire and ensuring that it is effective in collecting the necessary data for the research project.

3.11 Ethical Consideration:

Ethical considerations should be made for each study strategy to eliminate or at least diminish potential problems. Research ethics are the moral principles that should be followed while dealing with the rights of individuals who will be involved in or affected by your research (Saunders *et al*., 2009).

Participation is entirely voluntary. At any time throughout the survey, a respondent may choose to stop participating, and their replies will be eliminated. If the participants express willingness to participate in the survey, all responses provided will be given the highest priority confidentiality and anonymity (Saunders *et al*., 2009). The information will be securely stored in a password-protected document, with restricted access granted solely to the dissertation supervisor and the researcher. All collected information will be evaluated and addressed in the thesis. None of the respondents' individual answers will be shown. According to NCI regulations, it will be wiped from existence after the specified time frame.

The collection of data for this study complies with all the ethical standards established by the National College of Ireland (NCI), and the code of ethics form was completed and validated by the NCI's ethics committee. The study has been deemed to be ethically sound, with no apparent ethical concerns in its implementation.

3.12 Research Design Limitations:

Non-probability sampling has limitations such as potential bias, a lack of generalizability, and limited statistical inference. Quantitative analysis has the potential downside of failing to reflect the depth and variety of people's actual life experiences. Also, current research is based on a cross-sectional design to analyze consumers opinions and preferences for charging infrastructure. However, these options change over time due to different social and economic influences. Hence, dependence of one factor on another is not likely to be determined perfectly through this approach suggesting limitation for the study.

3.13 Conclusion:

In conclusion, the research methodology study has successfully adopted positivism and quantified deductive analysis to investigate the factors influencing customer satisfaction for charging infrastructure. The utilization of descriptive and inferential statistical survey methods enabled the research to determine what aspects of service really make an impact to customers, thus providing valuable insights to stakeholders.

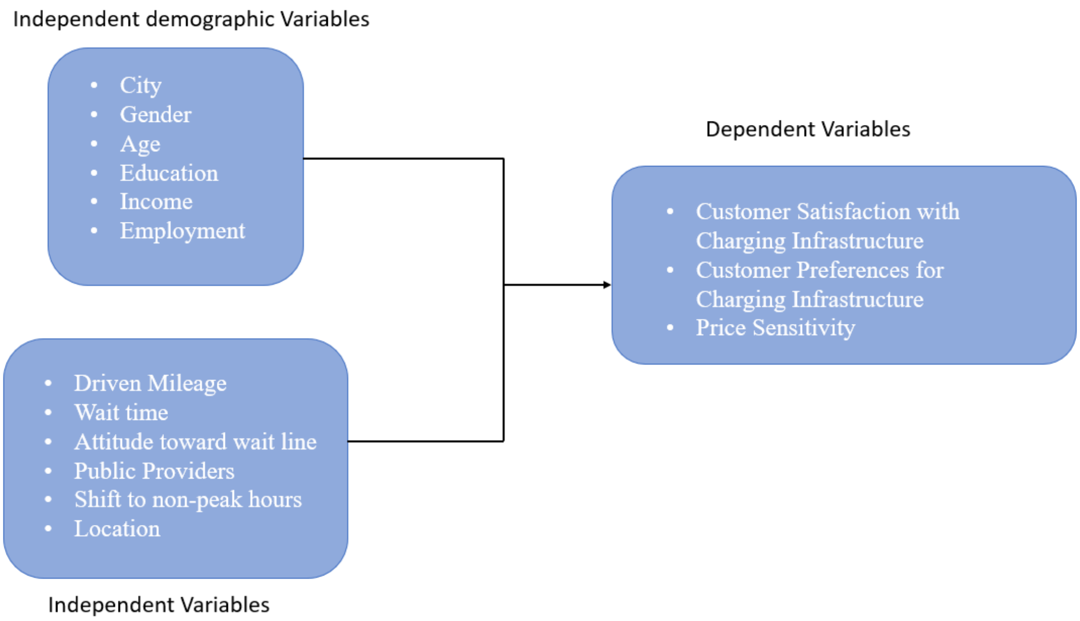
CHAPTER 4: STATISTICAL ANALYSIS

4.1 Dependent Independent variables:

A variable can be defined as a feature that holds multiple values (Zikmund, 2002). One of the goals of this study is to determine the factors that cause dependent variable to change. During data analysis and design, variables of two categories can be measured: dependent and independent variables. The variable that is anticipated to be impacted by another variable is known as the dependent variable. According to Taheri *et al.* (2015), independent variables are expected to have an influence on dependent variables. Researchers must have a solid understanding of the techniques for calculating variables and the the kind of information that will be gathered on each relevant variable (Khalid *et al*., 2012).

Current study seeks to find casual relation of Customer Satisfaction as a dependent variable and below mentioned independent variables in Figure 3.

Figure 3: Dependent and Independent Variables



The current section provides a concise overview of all statistical tests performed in the research, along with an explanation of the interpretation of the outcomes of each test.

4.2 Reliability Test:

The concept of reliability in measurement pertains to the degree of consistency and precision exhibited by the measurement. Cronbach's alpha coefficient is a prominent internal consistency measure, and it is frequently employed in the development of multi-item measuring instruments. (Amirrudin, Nasution and Supahar, 2021). The degree of internal consistency is satisfactory if the value is more than 0.7.

4.3 Mann-Whitney test

When comparing two sets of data that deviate from a normal distribution, the Mann Whitney test is a useful nonparametric statistic. The test sees if there is a statistically notable disparity among the two groupings medians. For the Mann Whitney test, the assumption of no correlation between the two groups is the "null hypothesis." When comparing two groups, the null hypothesis is rejected, and a difference is declared if the value of the p is below 0.05.

4.4 Kruskal-Wallis's test:

Kruskal-Wallis's non-parametric statistical test compares three or more independent data groupings. It is similar to the Mann-Whitney test but allows for comparisons across multiple groups. The test is used when the assumption of normality is violated or when the data is ordinal. The null hypothesis for Kruskal-Wallis's test is that there is no statistically significant variation in the middle values of the groups being compared. If the p-value is lower than the significance level of 0.05, this indicates rejection of the null hypothesis. This leads to the conclusion that there exists a significant distinction between at least the two groups.

4.5 Spearman Test:

Spearman's ranking correlation coefficient is a statistical test that comes under the category of non-parametric methods which can be used to assess the consistency and direction of a causal connection between two independent variables. It's implemented in situations where the test variables don't fit a normal distribution. The null hypothesis for the Spearman test is that there is no strong association between the two factors being tested. To perform the Spearman test, the data is first ranked, and the rank correlation coefficient is calculated.

The p-value is calculated by observing the statistical distribution. In hypothesis testing, a significant correlation is assumed to exist between two variables when the p-value is lower 0.05).

4.7 Regression Test:

Logistic regression analyses the association between a binary outcome variable (one of two potential values) and a combination of predictor factors. The result variable is commonly a categorical variable.

Logistic regression models outcome probability as a function of predictor variables using a logistic function. The logistic function, an S-shaped curve, transfers every actual value input to a score ranging from zero to one, signifying the chance of that outcome variable falling into a certain category.
Logistic function:

$$P(y=1|x) = 1 / (1 + \exp(-(b0 + b1x1 + ... + bnxn)))$$

Given a set of predictors x1, x2..., xn, the likelihood that the result will be 1 may be written as P(y=1|x), where b0 is an intercept or bias term and b1..., bn are the coefficients or weights correlated with the predictors. Statistical tests like the Hosmer-Lemeshow test or the deviance test can be used to evaluate the logistic regression model's goodness-of-fit.

4.8 Equation of the model:

Regression Model Equation for Customer Satisfaction for Charging Infrastructure:

P (y = 1) = 1 / (1 + exp (-(0.070 + (-3.130) x City + (1.620) x Employment + (1.102) x Provider Circle K + (1.137) x Wait time)))

Where P (y = 1) is the probability of the customer satisfaction for charging infrastructure variable being satisfied

Regression Model Equation for Customer Preferences for Charging Infrastructure:

P (y = 1) = 1 / (1 + exp (-((-0.746) + (-1.233) x Provider ESB + (2.264) x Charging time preference at home + (1.281) x Price sensitivity 50% increase + (-1.128) x Age)))

Where P (y = 1) is the probability of the customer preference for charging infrastructure variable being private infrastructure

Regression Model Equation for Price Sensitivity:

P (y = 1) = 1 / (1 + exp (-(3.813 + (-1.416) x Charging shift to non-peak hours + (-2.056) x Education + (-0.881) x Employment + (-0.616) x Income)))

Where P (y = 1) is the probability of the Price sensitivity variable being sensitive or affected by price increase

CHAPTER 5: RESULTS

5.1 Introduction:

The findings of the statistical analyses conducted on the data gathered are presented in this chapter. After reporting the outcomes of statistical descriptions of every variable that are dependent or independent, the findings of reliability tests are listed. To carry out the univariate analysis, non-parametric tests were carried out. The factors that could influence satisfaction were subjected to a series of univariate tests. The hypotheses were then examined using logistic regression techniques.

5.2 Descriptive Statistics:

A total of 324 responses were collected following distribution of the questionnaire. From this total, 2 participants did not provided consent for the survey and the inclusion requirements outlined earlier were not satisfied by 28 responders out of a total of 324. Consequently, the resulting sample consists of 294 valid respondents. APPENDIX A displays the descriptive statistics results in detail.

Independent Variables:

1. **Demographic Variables:**

   Respondents' demographic information in Table 4 which reveals that 48.6% of identify as male and 32.7% as female. Most participants fell within the age range of 18 to 30 years old, comprising 29.3% of the sample. However, it is observed that 41-50 age groups are the highest adopters of an EV. It is noteworthy that the adoption rate of EV is comparatively higher in Dublin with 34.7% than Cork (14.6%), Limerick and Galway (13.3%). 115 respondents (or 39.1%) have a Secondary school or below education. Also, most participants have a full-time job (44.6%). Lastly, 24.8%) of the population fall into the income brackets of "20,000-40,000 Euro" annually.

Table 4: Descriptive statistics for Socio-Demographic Variables

Variables	Values	Frequency	Percent
City	Dublin	102	34.7
	Cork	43	14.6
	Limerick	39	13.3
	Galway	39	13.3
	Waterford	5	1.7
	Kilkenny	4	1.4
	Meath	27	9.2
	Kildare	26	8.8
	Swords	6	2
	Wexford	1	0.3
	Newbridge	1	0.3
	Athlone	1	0.3
Gender	Male	143	48.6
	Female	96	32.7
	Gay or Lesbian	24	8.2
	Bisexual	9	3.1
	Other sexual orientation	6	2
	Prefer not to say	12	4.1
Age	18–30	86	29.3
	31–40	70	23.8
	41–50	90	30.6
	51–60	33	11.2
	Over 60	15	5.1
Education	Secondary school and below	115	39.1
	Bachelor's degree	75	25.5
	Master's degree	101	34.4
	Ph.D. degree and above	3	1
Employment	Employed Full-Time	131	44.6
	Employed Part-Time	44	15
	Seeking opportunities	12	4.1
	Self employed	75	25.5
	Retired	31	10.5
	Student	1	0.3
Income	20,000 Euro and below	59	20.1
	20,000-40,000 Euro	73	24.8
	40,000-60,000 Euro	65	22.1
	60,000–80,000 Euro	70	23.8
	80,000–120,000 Euro	25	8.5
	120,000 Euro and above	2	0.7

2. Charging Infrastructure dimensions variables:

Below Table 5 displays the frequency and percentage of participants choice. 38.78% of the respondents reported having a driving mileage of 15,000-20,000 km, while 10,000 km and below and 10,000 km-15,000 km were preferred by 20.41% and 24.15% respectively.

Most of the participants favor utilizing both charging infrastructure with 53.06%. While 54.76%, 58.84%, 56.46%, 87.07%, 72.79% and 99.66% of participants expressed no preference to use ESB, Easy Go, Apple green, Ionity, Tesla and Metro, respectively. On the contrary, Circle K was observed to be preferred by 57.14% of respondents. Also, the charging time preferences suggest that 90.82% of individuals are inclined to charging in night-time at home and 85.71% in daytime at Public. 47.28% of individuals are inclined to wait time of 1 hour or below, while it varies for 22.11% of respondents. The Wait line is found to be occasionally acceptable for 40.48% of participants and 40.88% individuals prefer 1 km and below proximity for public charging stations.

Table 5: Descriptives statistics for charging infrastructure dimensions variables

Driven Mileage	Frequency	Percentage
10,000 km and below	60	20.41
10,000–15,000 km	71	24.15
15,000–20,000 km	114	38.78
20,000–25,000 km	42	14.29
25,000–30,000 km	3	1.02
30,000–35,000 km	4	1.36
Charging Infrastructure Preference	Frequency	Percentage
Public charging infrastructure	91	30.95
Private charging infrastructure	47	15.99
Both charging infrastructure	156	53.06
Public Provider ESB ecars	Frequency	Percentage
Not preferred	161	54.76
Preferred	133	45.24
Public Provider EasyGo	Frequency	Percentage
Not preferred	173	58.84
Preferred	121	41.16
Public Provider CircleK	Frequency	Percentage
Not preferred	126	42.86
Preferred	168	57.14
Public Provider Applegreen	Frequency	Percentage
Not preferred	166	56.46
Preferred	128	43.54
Public Provider Ionity	Frequency	Percentage
Not preferred	256	87.07
Preferred	38	12.93
Public Provider Tesla	Frequency	Percentage
Not preferred	214	72.79
Preferred	80	27.21

Public Provider Metro	Frequency	Percentage
Not preferred	293	99.66
Preferred	1	0.34
Charging time preference at home	Frequency	Percentage
Daytime (6:01–18:00)	27	9.18
Night-time (18:01–6:00)	267	90.82
Charging time preference at Public	Frequency	Percentage
Daytime (6:01–18:00)	252	85.71
Night-time (18:01–6:00)	42	14.29
Wait time at Public Charging station	Frequency	Percentage
1 hour and below	139	47.28
1–2 hour	53	18.03
2–3 hour	36	12.24
3 hour and above	1	0.34
It varies	65	22.11
Attitude towards waitline	Frequency	Percentage
Totally unacceptable	46	15.65
Occasionally unacceptable	66	22.45
Not sure	30	10.20
Occasionally acceptable	119	40.48
Totally acceptable	33	11.22
Chargingstationproximitypreference	Frequency	Percentage
1 km and below	129	43.88
1-2 km	87	29.59
2–3 km	41	13.95
3 km and above	37	12.59

3. Independent Variable:

The Likert scale is characterized by subjective scores such as strongly disagree to strongly agree, which presents challenges to figure out the outcomes. Therefore, we classify them as interval variables. It is observed that 40.14% of respondents are satisfied with the charging infrastructure, however 31.97% have expressed dissatisfaction and 12.59% are very dissatisfied. Most of the participants favor utilizing both charging infrastructure with 53.06%. Also, 72.79% of respondents are indicated to be not affected by charging price increase while 27.21% are price sensitive. Below, Table 6, displays these values.

Table 6: Descriptive statistics for independent variable

Driven Mileage	Frequency	Percentage
Very dissatisfied	37	12.59
Dissatisfied	94	31.97
Not sure	41	13.95
Satisfied	118	40.14
Very satisfied	4	1.36
Charging Infrastructure Preference	Frequency	Percentage
Public charging infrastructure	91	30.95
Private charging infrastructure	47	15.99
Both charging infrastructure	156	53.06
Overall price sensitivity	Frequency	Percentage
Affected	80	27.21
Not affected	214	72.79

5.3 Reliability Test:

To verify the research model's efficacy, a reliability analysis was performed on 16 questions which measures a common satisfaction scale. Table 7 demonstrates the calculated Cronbach's Alpha was 0.804, a value greater than 0.7 demonstrates outstanding internal uniformity.

Table 7: Reliability coefficient dependent variable

Reliability Statistics		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
0.804	0.82	16

Detailed findings are provided in APPENDIX B.

Normality tests:

Non-probability sampling is applied according to the study's methodology. Hence, it is inferred that the null hypothesis must be rejected, whereas the data deviates from normal distribution.

5.4 Univariate Tests:

5.4.1 Mann-Whitney Tests:

The Mann-Whitney U test is a statistical method employed to assess difference in satisfaction across categories of EV ownership and Provider Circle K.

- **Satisfaction and EV ownership:**

The findings displayed that there exists a significant variation in satisfaction levels between the two categories of EV ownership. The mean rank of yes is 127.7 and no is 150.8, also the p-value is 0.04 which is less than 0.05, reflecting that the difference in mean rank is statistically significant. This means that the null hypothesis is rejected.

- **Satisfaction and Provider Circle K:**

The mean rank of Not preferred is 136.67 and Preferred is 155.63, also the p-value is 0.02 which is less than 0.05, reflecting that the difference in mean rank is statistically significant. This means that the null hypothesis is rejected.

The Mann-Whitney U test is a statistical method employed to assess difference in infrastructure preference below independent variables.

- **Charging Infrastructure preference and Provider Circle K:**

The statistical significance level, p-value of <0.001, falls below the commonly accepted threshold of 0.05, indicating significant difference between preferred and not preferred. The difference in mean rank is statistically significant. This means that the null hypothesis is rejected.

- **Charging Infrastructure preference and ESB, other providers:**

The mean rank of preferred is 1324.23 and not preferred is 166.72, also the p-value is less than 0.05, reflecting there is significant difference between two categories of independent variable. Similarly, as indicated in Table 9 the p value 0.026 for other providers is less than 0.05. Hence the null hypothesis is rejected.

- **Charging Infrastructure preference and charging time preference at home:**

Results from this study were statistically significant (p value 0.001), indicating a difference between daytime and night-time values. The difference in mean rank 81.48 (daytime) and 151.18 (night-time) is statistically significant. This means that the null hypothesis is rejected.

- **Price sensitivity and provider Circle K:**

The findings suggest that a statistically significant difference exists in satisfaction levels between the two categories of Provider. The mean rank of preferred is 154.2 and not preferred is 138.5, also the p-value is 0.04, indicating the difference in mean rank is significant. Therefore, the null hypothesis is rejected.

- **Price sensitivity and charging time shift to nonpeak hours:**

A statistically significant difference was discovered in price sensitivity between the yes and no categories of independent variables. The p-value is 0.003, indicating the difference in mean rank is significant. Therefore, the null hypothesis is rejected.

Statistically significant findings are presented in the below Table.8. Further detailed results are provided in APPENDIX C.

Table 8: Mann-Whitney Test Results

Dependent Variable	Independent Variable	Values	N	Mean Rank	Sig Value	Mann-Whitney U
Satisfaction for preferred charging infrastructure	EVOwnership	Yes	43	127.77	0.045	4548
		No	251	150.88		
Satisfaction for preferred charging infrastructure	Public Provider CircleK	Not preferred	126	136.67	0.021	9219
		Preferred	168	155.63		
Charging Infrastructure Preference	Public Provider CircleK	Not preferred	126	172.9	<0.001	7383
		Preferred	168	128.45		
Price Sensitivity Overall price increase impact	Public Provider CircleK	Not preferred	126	138.5	0.041	9450
		Preferred	168	154.25		
Charging Infrastructure Preference	ESB	Not preferred	161	166.72	<0.001	7611.5
		Preferred	133	124.23		
Charging Infrastructure Preference	Other provider	Not preferred	288	146.06	0.026	450
		Preferred	6	216.5		
Charging Infrastructure Preference	Charging time preference at home	Daytime (6:01–18:00)	27	81.48	<.001	1822
		Night-time (18:01–6:00)	267	154.18		
Price Sensitivity Overall price increase impact	Price Sensitivity Shift to non peak hours	Yes	210	154.6	0.003	7329
		No	84	129.75		

5.4.2 Kruskal Wallis Tests:

The study utilized the Kruskal-Wallis's test to examine potential variations in passenger satisfaction levels, charging infrastructure preference and price sensitivity among city, gender, education, employment groupings. Table 9 presents the test outcomes.

- **Customer Satisfaction and City:**

There is a significant difference between categories of city as indicated by mean ranks. Also, p value 0.008 is less than 0.05. This implies that satisfaction levels are different in different cities of Ireland.

- **Customer Satisfaction and Employment:**

The difference in mean ranks is statistically significant between different employment groupings. Furthermore, there is a variation in consumer satisfaction (p value 0.001) for customers with different employment categories.
Hence, the null hypothesis for employment and city are rejected.

- **Customer preferences for charging infrastructure:**

Table 9 displays the outcomes of the test, indicating a p-value <0.001 less than 0.05 for preferences for charging infrastructure across different categories of city, education, and employment. The mean ranking findings reveal that there exists a statistical difference in preferences among separate categories of city, education and employment types indicating preferences for charging infrastructure changes with different cities and consumers with different education and employment backgrounds. Based on this, we must reject the null hypothesis.

- **Price sensitivity:**

Similarly, statistically significant difference was discovered for charging price increase across city, gender, education, and employment categories as indicated by the mean values in Table 9. Also, the values of $p <0.001$ for city, education, and employment whereas 0.02 for gender is less than 0.05. This implies that there is difference in price sensitivity for male and female and other gender category consumers in different cities with different education and employment backgrounds. Therefore, the null hypothesis is rejected.

More details are provided in APPENDIX D.

Table 9: Kruskal Wallis's Test Results

Dependent Variable	Independent Variable	Values	N	Mean	Sig Value	Kruskal Wallis
Satisfaction for preferred charging infrastructure	City	Dublin	102	141.68	0.008	13.746
		Cork	43	131.19		
		Limerick	39	176.15		
		Galway	39	130.92		
		Other Counties	71	159.11		
Charging Infrastructure Preference	City	Dublin	102	160.78	<.001	107.841
		Cork	43	69.03		
		Limerick	39	97.63		
		Galway	39	140.09		
		Other Counties	71	207.41		
Price Sensitivity Overall price increase impact	City	Dublin	102	157.24	<.001	57.623
		Cork	43	180.66		
		Limerick	39	93.27		
		Galway	39	179.96		
		Other Counties	71	125.39		
Price Sensitivity Overall price increase impact	Gender	Male	143	140.88	0.021	7.774
		Female	96	159.82		
		Other	51	131.48		
Charging Infrastructure Preference	Education	Secondary school and below	115	116.77	<0.001	47.33
		Bachelor's degree	75	139.26		
		Master's degree	101	187.56		
		Ph.D. degree and above	3	182.67		
Price Sensitivity Overall price increase impact	Education	Secondary school and below	115	152.99	<0.001	20.622
		Bachelor's degree	75	118.9		
		Master's degree	101	162.76		
		Ph.D. degree and above	3	138.5		
Satisfaction for preferred charging	Employment	Employed Full-Time	131	123.93	<0.001	35.264
		Employed Part-Time	44	163.82		
		Self employed	75	181.28		
		Retired	31	139.68		
		Other	13	153.54		
Charging Infrastructure Preference	Employment	Employed Full-Time	131	152.01	<0.001	32.657
		Employed Part-Time	44	197.95		
		Self employed	75	118.75		
		Retired	31	124.82		
		Other	13	151.23		
Price Sensitivity Overall price increase impact	Employment	Employed Full-Time	131	162.81	<0.001	72.313
		Employed Part-Time	44	177.48		
		Self employed	75	93.42		
		Retired	31	173.27		
		Other	13	142.27		

5.4.3 Spearman Test:

The intention of the current research was to discover a relationship between the various aspects that constitute the independent variables and the level of customer satisfaction, infrastructure preference and price sensitivity as the dependent variable. The significant outcomes of the Spearman test are presented in Table 10.

- **Consumer satisfaction for charging infrastructure:**

The analysis revealed that a weak positive correlation was noticed among driven mileage and wait time for public stations, wait line attitudes with correlation coefficient of 0.124, 0.139, 0.155 and respectively. Conversely, overall wait time is observed to be negatively correlated with a weak coefficient of -0.168. The remaining two dimensions of satisfaction for number of charging stations and grants variable demonstrated a significant strong positive correlation of 0.573 and 0.754 respectively. Also, the p values as displayed in Table 10 are less than 0.05 for all variables. Hence, this null hypothesis is rejected. Appendix E shows detailed results.

- **Preference for charging infrastructure:**

Further, it is observed that a weak negative correlation exists among age, income, driven mileage and wait line attitudes with correlation coefficient of - 0.367, - 0.205, - 0.221 and - 0.148 respectively. On the other side, 10 % and 20 % price increase are observed to be positively correlated with a weak coefficient of 0.125 and 0.238. While 50% and 100% price increase demonstrated a significant medium positive correlation of 0.311 and 0.312 respectively. Also, the p values as displayed in Table 10 are less than 0.05 for all variables. Hence, this null hypothesis is rejected. Appendix E shows detailed results.

- **Price sensitivity:**

Lastly, income and driven mileage also negatively had a correlation of -0.325 and -0.25 with Price sensitivity. P value <0.001 for both variables resulted in rejection of null hypothesis.

Table 10: Spearman Correlation Test Results

Dependent Variable	Independent Variable	Sig Value	Correlation Coefficient	Correlation Strength
Satisfaction for preferred charging infrastructure	Driven Mileage	0.034	0.124	Weak Positive Correlation
	Waittime	0.017	0.139	Weak Positive Correlation
	Attitude towards waittime	0.008	0.155	Weak Positive Correlation
	Satisfaction for total number of available charging stations	<.001	0.573	Strong Positive Correlation
	Satisfaction for grants and incentives	<.001	0.754	Strong Positive Correlation
	Overall waittime	0.005	-0.168	Weak Negative Correlation
Charging Infrastructure Preference	Age	<.001	-0.367	Weak Negative Correlation
	Income	<.001	-0.205	Weak Negative Correlation
	Driven Mileage	<.001	-0.221	Weak Negative Correlation
	Attitude towards waittime	0.011	-0.148	Weak Negative Correlation
	Price sensitivity 10	0.032	0.125	Weak Positive Correlation
	Price sensitivity 20	<.001	0.238	Weak Positive Correlation
	Price sensitivity 50	<.001	0.311	Medium Positive Correlation
	Price sensitivity 100	<.001	0.312	Medium Positive Correlation
Price Sensitivity Overall price increase impact	Income	<.001	-0.325	Medium Negative Correlation
	Driven Mileage	<.001	-0.25	Weak Negative Correlation

5.5 Regression:

VIF values for both models were under 10, and tolerance levels were over 0.1, indicating that there was no multicollinearity violating relationship between the independent variables. Appendices F, G, and H include these results.

Customer satisfaction (1, 2 to 0 and 3,4,5 to 1) converted to a dichotomous dependent variable so that it could be used in a logistic regression model.

Given that the model is primarily grounded in theoretical and literary frameworks, the covariates are incorporated into the model in a manner that is relevant and introduced via the Forward LR incrementally approach based on demographic and EV dimensions variables.

5.5.1 Model 1: Hierarchical Binary Logistic Regression

A hierarchical binary regression analysis was conducted on a total of 294 cases where two categories of the dependent variable satisfied and dissatisfied were considered.

The study found that there was a correlation of driven mileage, attitudes towards wait line, satisfaction for total number of stations and EV grants with customer satisfaction, as indicated by the results of the univariate tests analysis conducted in Appendix E. Nevertheless, the incorporation of additional crucial variables into the framework of regression led to the exclusion of its correlation with satisfaction. The presence of additional important factors with greater predictive power may account for this observation.

Initial block 0 does not contain any independent variables. The model fit as indicated by the Omnibus model coefficients test is significant for both blocks implying better fit compared to block 0 null model. In the final model, the model's chi-square statistic was 125.6, with a significance level of 0.00, indicating that it is more efficient than the earlier model. (APPENDIX F). The final model was able to explain between 37.1% and 49.8% of the variability observed in the satisfaction levels. Moreover, the model which had city, employment, and public provider as significant predictor in block 1 exhibited a Cox & Snell R2 change of 3.6 % and Nagelkerke R2 change of 4.9 %. According to the results conducted by Hosmer and Lemeshow, the initial block 1 including the demographic variables demonstrates insignificant value. However, the final block of the model after adding other relevant variables displays reliable predictors, as reflected by the achieved significance value of 0.76.

According to the evidence, there exists a positive association of 1 hour and below (p = 0.01), 1-2 hours (p = 0.027) and it varies (p = 0.035) categories of wait time at public stations with satisfaction. While the odds ratio indicates consumer who wait for 1-2 hours (OR: 3.118) for charging exhibits high level of satisfaction than who wait for 1 hour and below. In addition, when wait time varies (OR: 0.335), consumers are likely to report lower level of satisfaction than 1 hour and below wait. Further, the analysis discovered that Cork (p = <0.001), Limerick (p = 0.019) and Galway (p = 0.026) cities are significant negatively correlated than Dublin (p = <0.001). The results indicate consumers in Cork are 0.004 times less satisfied with charging infrastructure than Dublin. Similarly, Limerick and Galway are 0.275 and 0.258 times are likely to report lower levels of satisfaction. Lastly, there is a significant positive relation of employed (p = <0.001) and seeking opportunities (p = <0.008) categories of employment. However, retired consumers exhibit significant negative correlation (p = <0.001) with odds ratio of 0.134 implying respondents who are retired are express lower level of satisfaction than employed.

After integrating all relevant predictors, the model exhibits a predictive accuracy of 81.2 %.

As a result, we conclude that the null hypothesis of city, employment and wait time at public stations have no relation with customer satisfaction can be rejected as discussed above results indicate that they are significant. Conversely, there is no significant relation of driven mileage, wait line attitudes, satisfaction aspects of number of charging stations and EV grants with satisfaction. Therefore, the null hypothesis that there is no relation with satisfaction is not rejected.

Detail analysis can be found in APPENDIX F. Table 11 presents a concise overview of the primary outcomes.

Table 11: Regression Model 1 Result

Model 1					
	β	p	OR	95% CI	
Predictors					
City	-3.13	<0.001	0.044	0.13	0.147
Employment	1.62	0.008	5.05	1.54	16.57
Public Provider Cricle K	1.1	0.005	3.01	1.38	6.53
Wait time at public stations	1.14	0.027	3.12	1.14	8.53

5.5.2 Model 2: Binary Logistic Regression

Here, we employ the binary logit technique to inquire about how customers feel about various charging infrastructure alternatives. The primary goal of this research is to analyze market preferences for public versus private infrastructure.

The statistical analysis yielded a model chi-square statistic of 123.6, which suggests that the accuracy higher than that of the null model ($p < 0.01$) in determining customer preferences for charging infrastructure. Also, 34.3 %-45.8 % of the variation accounted for consumer preferences. Additionally, Hosmer and Lemeshow's findings demonstrate that the charging provider companies and charging time preference at home in addition with price sensitivity is a reliable indicator of choosing preferred charging infrastructure, as evidenced by its significance level of 0.36. On the contrary, it is observed the significance level slightly decreases to 0.329 after adding demographic variable age in the model.

Customer preferences for charging infrastructure was found to have a positive correlation with charging time preference at home (p = <0.001) and price sensitivity at 50 % price increase (p = 0.001). This result suggests consumers who seek to charge EV at home are likely to prefer private charging infrastructure. Similarly, 3.6 times higher chances of choosing private facilities are expressed by respondents who are price sensitive to 50% increase in charging rates. However, ESB providers are negatively correlated with charging infrastructure preferences, it is observed consumers using ESB are 0.291 times likely to prefer public charging stations than private. While it is observed that middle (p = 0.003) and old age (p = <0.001) consumers are 0.324 and 0.031 times more likely to charge at public stations than young consumers. The model has a 79.3% accuracy in prediction.

Thus, in conclusion, the null hypothesis that the different charging provider, time preference for charging, price sensitivity and age is not related to charging infrastructure preferences is rejected considering their significance in above result's discussion. However, null hypothesis is not rejected for income (0.055) and driving mileage (0.512) as the results indicate that they do not have significance with infrastructure preferences.

Table 12 lists the major conclusions, while Appendix G provides more detailed information.

Table 12: Regression Model 2 Result

Model 1					
	β	p	OR	95% CI	
Predictors					
Charging time preference at home	2.26	0.001		2.43	37.9
Price sesnsitivity at 50% increase	1.28	0.008	3.6	1.97	6.58
Public Provider ESB ecars	-1.23	<0.001	0.29	0.15	0.56
Age	-1.13	0.003	0.32	0.15	0.69

5.5.3 Model 3: Binary Logistic Regression

A study was conducted applying binary logistic regression to investigate the potential impact of different demographic and price related independent variables on consumer's price sensitivity for charging infrastructures.

The initial stage of the model involved demographic dimensions of consumers, with shift of charging to non-peak hours and driven mileage in determining price sensitivity. Including variables in block 1 demonstrate the high predictor capacity of the model. This can be indicated by the omnibus coefficient significance result of 0.00.
Furthermore, the variation between 14 % to 20.3 % was observed and R2 change of 6. 1 % and Nagelkerke R2 change of 8.8 % was noticed in block 2. The Hosmer and Lemeshow test demonstrated a significant value 0.57.

Variables charging time shift to non-peak hours and income did reach statistically significant levels as indicated by p value <0.001 for both which is greater than 0.05. Consumers who display shift in charging behavior to non-peak are 0.243 times more likely to be sensitive to price increase than others who do not shift their charging time. Similarly, income demonstrates 0.541 times for a consumer to be sensitive. On the contrary, gender (p = 0.165) and driven mileage (p = 0.88) did not have significance with price increase. However, retired customers (p = 0.028) display 0.414 times to be price sensitive than other employment categories. Further, Bachelor (p = <0.001) and qualifications equivalent to a master's (p = <0.027) consumers exhibit 0.128 and 0.302 times more likely to be sensitive to charging price increase than consumer who have secondary education.

Above discussed results concluded that the null hypothesis for charge time shift to non-peak hours, education, employment, and income to not have relation with price sensitivity is rejected. While null hypothesis for gender and driving mileage is not rejected.
Preliminary results are disputed in table 13 while detailed outcomes are documented in Appendix H.

Table 13: Regression Model 3 Result

Model 1					
	β	p	OR	95% CI	
Predictors					
Shift to non peak hours	-1.42	<0.001	0.24	0.11	0.53
Education	-2.06	<0.001	0.13	0.05	0.31
Employment	-0.36	0.03	0.41	0.2	0.9
Income	-0.61	<0.001	0.54	0.41	0.72

CHAPTER 6: DISCUSSION AND IMPLICATION

6.1 Introduction:

The present chapter provides an overview of the most important results from the statistical analyses presented previously. A comprehensive summary of the three logistic regression models will be provided. This chapter will also present insights derived from univariate tests, accompanied by relevant evidence from the literature that either contrasts or aligns with the results, where applicable. Implications for management and theory are discussed at length in the conclusion.

6.2 Discussion on Model 1:

The Spearman correlation test revealed noteworthy findings. While customer satisfaction correlation between EV subsidies and the amount of charging point is strongest (0.754, 0.573), whereas driving mileage (0.124) and wait time (0.139) and attitude towards wait time (0.155) is comparatively weak. However, in regression model only consumers who expressed 1-2 hours of wait time at public stations have higher level of satisfaction than other wait times. Also, employed consumers using Circle K charging infrastructure displayed high satisfaction. While those who live in other cities than Dublin has a low level of satisfaction. Driven Mileage, satisfaction attributes for overall wait time, number of charging stations, EV grants were not included in the final model despite their high correlation in univariate tests as they are not linked to levels of satisfaction with consumers.

Chen and Lin (2022) argue that wait time for Public charging is connected to the satisfaction with charging infrastructure. Drivers who experience longer queues wait time for charging are less satisfied with the facilities. The wait time for 1-2 hours exhibited the most favorable positive odd's ratio, however as the time increases it is observed that odd's ratio of customer getting satisfied decreases indicating that customers are more likely to be satisfied if their wait times are less. The research of Philipsen et al. (2016) provides evidence to this argument using an online questionnaire poll to discover that, in Germany, EV drivers would rather take a diversion than wait in a queue for charging. Prospective EV owners consider the ease of charging as a crucial factor in their vehicle purchasing decision (Wolbertus, 2021). This low acceptance of wait time suggests consumers inclination towards fast charging time. This observation aligns with the study performed in Ireland by Morrissey *et al*. (2016) which analyzed data from 83 quick chargers involving 11,000 rapid charging occurrences. The Irish study found that consumers are using fast chargers like utilizing a traditional petrol station. This implies there is demand for such fast chargers. Similar findings are observed with Neaimeh *et al*. (2017) which incorporated information gathered from the UK and the US quick-charging networks. In contrast, the researchers (Visaria *et al.*, 2022) found that individuals developed greater satisfaction with EV by engaging in activities such as taking breaks during slowly recharging for long journeys. However, Ireland has relatively small geographical distance country wide and from statistics, most individuals are employed and use EV for work commute, hence consumers expect to travel in shorter time. This may explain why this factor was shown to be the highest correlated with satisfaction.

According to the value of the odd's ratio, the providers of charging stations is the next most important indicator of satisfaction of customers towards charging infrastructure. Under current circumstances, it is necessary for customers to enroll with charging network providers to facilitate seamless accessibility (Visaria *et al*., 2022). However, it is not convenient to enroll in every provider facility. EV consumers in the current sample displays large usage of Circle K followed by ESB ecars and Apple green providers. As discussed earlier the odds ratio of consumers getting satisfied with circle K is higher indicating more usage of public providers is associated with higher likelihood of customer satisfaction. Wolbertus (2021) explains, EV drivers using regular preferred station spend less time driving around to find one, hence this can be seen as time efficient by consumers to get satisfied. However, it is achieved at the expense of charging availability. On the contrary, the charging infrastructure of various companies in different locations exhibits a diverse range of charging facility layouts. Hence, there is a need for standardized networks for charging, like that of conventional gasoline-powered stations, which might accelerate electric vehicle penetration (Das *et al.*, 2020). This can be verified by Herrmann *et al.* (2007) who argued that customers in the automotive sector who express dissatisfaction with dealer services during the purchase of a vehicle tend to exhibit lower levels of satisfaction with the product (Kwon *et al.*, 2020). Therefore, correlation between complementary service (charging provider) and product (charging service) can be seen as the possible determinant to evaluate customer satisfaction.

It is observed that the counties with the highest population density in Sweden are the primary regions where most electric vehicle drivers are located (Vassileva and Campillo, 2017), but the charging infrastructure distribution is not homogenous across all regions. Due to Ireland's housing crisis, densely populated Dublin city residents are moving to other counties to avoid higher rents. In contrast, development of charging stations is predominantly observed in Dublin with 203 charging stations, while Cork (72), Limerick (38) and Galway (58) (Electromaps, 2023). Hence, it could be the possible rationale for dissatisfied customers who reside in cities other than Dublin pertaining to the large gap in number of public charging stations between cities. This argument is supported through the odds ratio in the final model of regression. Hence the perceived value of charging infrastructure and EV does not meet the expectations of the consumers leading to dissatisfaction. This eventually affects the EV market diffusion as supported by the study Gönül *et al.*, (2021) that uneven distribution of EVCS infrastructure across Turkey is one factor holding back the country's electric vehicle market.

The number of people who drive electric vehicles might increase by more than 50% if the quantity of charging facilities is doubled (Wolbertus, 2021). Insufficient charging infrastructure hinders seamless transportation and results in drivers experiencing range anxiety (Gönül *et al.*, 2021). Spottle *et al.* (2018), on the other hand, say that having a lot of charging sites does not mean that a lot of EVs will be purchased. This study supports the latter study's findings as the sample does not exhibit any association of satisfaction with the amount of available charging stations. In Ireland, recharging an at home is the most feasible and affordable alternative. It is accountable for over 80% of all EV charging activities at present. This could be a likely reason as samples in current study are using a more private charging option.

Kwon *et al.* (2020) argues, limited driving range of electric vehicles is associated with lower user satisfaction. But EV drivers with more experience will probably be pleased with the charging facilities. Having seen the evolution of the charging system firsthand, people may be more tolerant of the process. (Chen and Lin, 2022). Based on research done in the UK, the initial range anxiety for EVs diminished over time as drivers gained experience and confidence through prolonged usage (Egbue and Long, 2012). This could be the possible rationale for driven mileage failing to stand out as a key determinant of satisfaction.

Therefore, it is concluded that the likelihood of getting higher satisfaction is related to lower wait time, employed consumers with considerable income source and higher education background.

6.3 Discussion Model 2:

In model one, various factors impacting satisfaction for charging infrastructure were explored. However, factors contributing to consumers' decision to choose either private or public infrastructure for charging is not determined. Hence, this Binary regression model was used to investigate whether consumers preference for charging infrastructure type in this section. EV users who display a preference for charging their vehicles during night hours tend to express favorable opinions for private charging (Chen and Lin, 2022). Odds ratio for charging time preference displays a higher possibility of customers choosing private charging option. This conclusion is supported by Morrissey *et al*. (2016) study using empirical charging information collected in Ireland, revealed that EV users tend to prefer charging their vehicles during night-time hours. Furthermore, electric vehicles are primarily utilized for personal use, and charging occurs at residences during night hours (Vassileva and Campillo, 2017).

Even though private charging station are mostly preferred, it is still a challenge for EV owners to set up private charging stations, like at home, without the necessary permits from regional authorities, energy providers, and governments (Das *et al.,* 2020). Contrary, Gupta *et al.*, (2021) implied that a majority of EV are utilizing residential charging infrastructure for their charging needs. According to Bunce, Harris, and Burgess (2014) individuals who utilize electric vehicles have taken measures to install chargers within their residences and most charging habits to facilitate more convenient and consistent charging (Kwon *et al.,* 2020).

However, dissatisfaction with the current state of public charging infrastructure can be depicted through the odd's ratio of other provider where customers prefer using private charging indicating lower satisfaction and less usage of public providers is associated with higher likelihood of consumers choosing private infrastructure than the providers which are comparatively more utilized.

This concludes, the likelihood of consumers choosing private infrastructure is related to night charging time inclination and lower level of usage with public providers.

6.4 Discussion Model 3:

Since the rising rate of EVs, profitability and load distribution at public charging stations will be significantly impacted by the pricing tactics employed by these stations (Bao *et al*., 2021).

In general, customers are not keen on paying extra for charging services. We are still in the phase of developing the EV charging facilities and the related market size may grow if the government reduces the cost of charging (Jhala, 2017). This is in alignment with income as it has emerged as the highest predictor in estimating price sensitivity in current study indicating lower income levels are associated with higher likelihood of consumers to be price sensitive. As income will change, it has an influence in determining the price sensitivity towards charging rates. Hence, the usage and growth of charging infrastructure is directly impacted. Electric vehicles are popular in Norway because of the country's low power prices (Sierzchula, 2014), which are especially appealing to younger generations with lower incomes (Vassileva and Campillo, 2017). However, in contrast consumers may be prepared to pay extra for electric vehicle charging once the charging infrastructure is fully implemented (Chen and Lin, 2022). Yet, according to a study, a considerable proportion of Norwegian consumers (41%) who purchased electric vehicles cited cost savings as their primary motivation for selecting this mode of transportation (McKinsey, 2014). This highlights the consumer's behavior to maximum benefit from the received services, as expected by economic theory when a firm's marginal cost of capital equals its marginal benefit (Yang and Huang, 1998). The determination of vehicle usage is significantly influenced by cost benefits due to the continuous operational expenses associated with the use of a vehicle (Lamberton and Rose, 2012). As income will change, it has an influence in determining the price sensitivity towards charging rates. Hence, the usage and growth of charging infrastructure is directly impacted which will further impact EV market.

Russian invasion of Ukraine had various repercussions in EU regions and inflation in fossil fuels was major economic impact. This is forecasted to last till 2026 (Ari *et al.,* 2022) and thus to reduce the consequences of such surge in fuel prices, transition to EV is a viable solution. Electric vehicle demand raised to 10% of purchases of new cars in 2021 (IEA, 2021). Therefore, to maintain growth of this cheaper alternative, charging rates need to be cost efficient.

However, the results from Huang and Kockelman (2020) imply that station owners should think about measures to safeguard the grid and reduce costs of charging, such as implementing higher charging speeds and pricing based on the time of use. Increasing prices during peak hours at popular stations can be utilized to control demand, reduce wait times, and increase revenue. Results from the current study adheres to the previous conclusion as consumers are observed to shift their electric vehicle charging to non-peak hours to consume cost efficient service. It implies that consumers are sensitive to price increase and display their willingness to shift their charging behavior according to lowest tariff hours. It was also discovered that load-shifting methods need to be created to avoid overloading electric networks in the evening times of high demand when most EV drivers return home to charge their vehicles (Vassileva and Campillo, 2017).

Present study's observation from regression displays there is no association of driving mileage with price sensitivity. It is implied how much a consumer drives an EV and further use the charging infrastructure; this does not have influence on the sensitivity towards charging rate increase. On the contrary, if users are provided with information regarding the charging prices of different piles or stations, it is likely that their driving behaviors will be influenced by the comparative prices across different regions (Li *et al.,* 2022). However, customers are not always seeking the best deal; some are unwilling to compromise on journey time despite being time conscious (Latinopoulos, Sivakumar, Polak, 2017).

6.5 Managerial implications:

This study implies that in the process of developing and constructing charging infrastructure, governmental organizations should account not only the monetary investment and the technical specifications, but also the preferences of consumers and the psychological elements that come into play when making purchasing decisions.

During the process of gathering respondents' viewpoints, it was noted that a substantial number of consumers exhibit a low wait time preference to charge their vehicle. Also, few charging providers like Circle K and ESB ecars are seen to be the used mostly by EV users and this demonstrates that more usage leads to satisfaction. However, not all public provider's charging services are widely consumed by EV population of Ireland. Hence, from managerial implications perspective charging infrastructure developers and stakeholders need to focus on growing customers' acceptance for other charging providers. This can be achieved by reducing the wait time at charging stations through fast charging implementation. However, from a business point of view it would be a costly investment in installing the fast-charging technology and as it is implied by the regression model three consumers are price sensitive. Hence, charging providers need to be careful in formulating charging rates for fast charging.

Furthermore, results for the satisfaction of charging station at different cities of Ireland implied that consumers of electric vehicle charging infrastructure are more satisfied in Dublin than other cities. Thus, the policy makers and infrastructure developers need to assure a homogeneous development of charging network across Ireland.

While Income was not a predictor of customer preferences, there is a significant correlation between income and price sensitivity of customers in using charging infrastructure. Hence it is clear for policy makers that consumers will not pay for extravagant charges and try to be cost effective in using electric vehicle as in the first place they bought electric vehicle considering its long-term cost saving benefit in comparison to high-cost fuel for traditional vehicles. Hence, considering managerial implications, policy makers need to update public provider pricing schemes to account for consumer price sensitivity and the threshold at which they can raise rates. In a current study this threshold is observed from results in APPENDIX G that 50% price increase leads to shift consumers from public to cheaper private alternative.

Thus, balancing the benefits of both stakeholders to reach Nash equilibrium in terms of game theory model. This echoes with the behavior of consumers to shift to non-peak hours for charging to save money.

To conclude, governments can improve policies by using consumer input and ongoing analysis to understand changing customer preferences and patterns. Governments can encourage customers to use eco-friendly transportation through these efforts.

6.6 Literature Implications:

The findings of this study created substantial depth to a repository of information concerning market for charging stations for an EV. This study contributes to the existing literature Chen and Lin (2022) by expanding the research in Ireland where factor influencing customer satisfaction for charging infrastructure has been understudied. The EV market is growing in this country and a more comprehensive outlook is provided through the latest analysis of various socio-economic factors. In addition, significant focus on price sensitivity aspect is undertaken during the current energy crisis due to Russia-Ukraine war. Current study's findings provided insights that there are variations in factors impacting the satisfaction levels for charging infrastructure as the geographical region of study changes. Also, satisfaction is also associated with factors beyond those in the exiting literature such as consumer employment, city, and different public providers. Examining the usage of wide range of charging providers provided current situation insight for infrastructure developers and stakeholders about consumer requirements. Hence, there is a great value addition to exiting literature from the findings of this research.

CHAPTER 7: CONCLUSION

7.1 Limitations and future scope:

The next part discusses the study's limitations, which are inevitable in any research project, along with suggestions for further research are made.

Driving an electric vehicle needs recharging and usage of charging infrastructure is inevitable for electric vehicles. However, in this investigation, it was not found to be a significant predictor of satisfaction. Chen and Lin, (2022) conclusions contradict the current study's result. The current sampling strategy may explain why socio-demographic variables do not have any effect on satisfaction. Future research might benefit from using probabilistic sampling, which entails randomly choosing a section of a larger group.

The current study includes a wide range of private owners or potential buyers of electric vehicles using charging infrastructure. However, it does not account the classification of different purpose of using vehicles or types of drivers. This could change their usage of according to the intent of using the electric vehicles and service of charging infrastructure Wolbertus, (2021) has examined this similar element through the modelling approach to account for the wide variety of charging practices found in modern cities.

Lasty, the current investigation into price elasticity was conducted from the perspective of consumers in context of them using the service offered by various charging providers. Delving into the price elasticity from the outlook of these service providers and how it is beneficial for them to increase or decrease the price can be a potential area for future research and it would provide deeper holistic view of the price elasticity of charging infrastructure domain. (Bao *et al.,* 2021) Also, the influence of charging demand needs to be explored further as this has major consequences for the power grid (Das *et al*., 2020).

7.2 Conclusion:

There is currently a drive from Ireland's government policy to expand the usage of EVs across country due to a range of sustainability and environmental global warning reasons (Department of Transport, 2023). The expansion of EV use is, amongst other things is influenced by the development of EV infrastructure. This study is very timely and important to illuminate the importance of EV charging infrastructure to EV customer satisfaction, but also explores the role of important predictors of satisfaction such as price sensitivity, charge waiting time, preferences for public and private infrastructures. This provides governments and private EV operators with important insight into the key drivers of EV adoption through an analysis of satisfaction.

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APPENDIX

APPENDIX A:

Frequencies

Statistics

		City	Age	Gender	Education	Employment	Income
N	Valid	294	294	290	294	294	294
	Missing	1	1	5	1	1	1
Mean		2.38	1.39	.88	.97	1.44	1.78
Std. Deviation		2.610	1.166	1.241	.882	1.535	1.283
Variance		6.810	1.358	1.539	.777	2.356	1.647
Skewness		.945	.409	1.906	.143	.484	.166
Std. Error of Skewness		.142	.142	.143	.142	.142	.142
Minimum		0	0	0	0	0	0
Maximum		11	4	5	3	6	5

Frequency Table

City

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Dublin	102	34.6	34.7	34.7
	Cork	43	14.6	14.6	49.3
	Limerick	39	13.2	13.3	62.6
	Galway	39	13.2	13.3	75.9
	Waterford	5	1.7	1.7	77.6
	Kilkenny	4	1.4	1.4	78.9
	Meath	27	9.2	9.2	88.1
	Kildare	26	8.8	8.8	96.9
	Swords	6	2.0	2.0	99.0
	Wexford	1	.3	.3	99.3
	Newbridge	1	.3	.3	99.7
	Athlone	1	.3	.3	100.0
	Total	294	99.7	100.0	
Missing	System	1	.3		
Total		295	100.0		

Age

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	18–30	86	29.2	29.3	29.3
	31–40	70	23.7	23.8	53.1
	41–50	90	30.5	30.6	83.7
	51–60	33	11.2	11.2	94.9
	Over 60	15	5.1	5.1	100.0
	Total	294	99.7	100.0	
Missing	System	1	.3		
Total		295	100.0		

Gender

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	143	48.5	49.3	49.3
	Female	96	32.5	33.1	82.4
	Gay or Lesbian	24	8.1	8.3	90.7
	Bisexual	9	3.1	3.1	93.8
	Other sexual orientation	6	2.0	2.1	95.9
	Prefer not to say	12	4.1	4.1	100.0
	Total	290	98.3	100.0	
Missing	System	5	1.7		
Total		295	100.0		

Education

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Secondary school and below	115	39.0	39.1	39.1
	Bachelor's degree	75	25.4	25.5	64.6
	Master's degree	101	34.2	34.4	99.0
	Ph.D. degree and above	3	1.0	1.0	100.0
	Total	294	99.7	100.0	
Missing	System	1	.3		
Total		295	100.0		

Employment

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Employed Full-Time	131	44.4	44.6	44.6
	Employed Part-Time	44	14.9	15.0	59.5
	Seeking opportunities	12	4.1	4.1	63.6
	Self employed	75	25.4	25.5	89.1
	Retired	31	10.5	10.5	99.7
	Student	1	.3	.3	100.0
	Total	294	99.7	100.0	
Missing	System	1	.3		
Total		295	100.0		

Income

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	20,000 Euro and below	59	20.0	20.1	20.1
	20,000-40,000 Euro	73	24.7	24.8	44.9
	40,000-60,000 Euro	65	22.0	22.1	67.0
	60,000–80,000 Euro	70	23.7	23.8	90.8
	80,000–120,000 Euro	25	8.5	8.5	99.3
	120,000 Euro and above	2	.7	.7	100.0
	Total	294	99.7	100.0	
Missing	System	1	.3		
Total		295	100.0		

Satisfactionwithpreferredcharginginfrastructure

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Very dissatisfied	37	12.6	12.6	12.6
	Dissatisfied	94	32.0	32.0	44.6
	Not sure	41	13.9	13.9	58.5
	Satisfied	118	40.1	40.1	98.6
	Very satisfied	4	1.4	1.4	100.0
	Total	294	100.0	100.0	

ChargingInfrastructurePreference

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Public charging infrastructure	91	31.0	31.0	31.0
	Private charging infrastructure	47	16.0	16.0	46.9
	Both	156	53.1	53.1	100.0
	Total	294	100.0	100.0	

PriceSensitivityOverallpriceincreaseimpact

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Affected	80	27.2	27.2	27.2
	Not affected	214	72.8	72.8	100.0
	Total	294	100.0	100.0	

Frequencies

Statistics

		DrivenMileage	ChargingInfrastructurePreference	PublicProvider ESBecars	PublicProvider EasyGo	PublicProvider CircleK	PublicProvider Applegreen	PublicProviderIonity	PublicProvider Tesla	PublicProvider Metro
N	Valid	294	294	294	294	294	294	294	294	294
	Missing	0	0	0	0	0	0	0	0	0
Mean		1.55	1.22	.45	.41	.57	.44	.13	.27	.00
Median		2.00	2.00	.00	.00	1.00	.00	.00	.00	.00
Std. Deviation		1.081	.891	.499	.493	.496	.497	.336	.446	.058
Variance		1.169	.794	.249	.243	.246	.247	.113	.199	.003
Skewness		.291	-.449	.192	.361	-.290	.262	2.222	1.029	17.146
Std. Error of Skewness		.142	.142	.142	.142	.142	.142	.142	.142	.142
Minimum		0	0	0	0	0	0	0	0	0
Maximum		5	2	1	1	1	1	1	1	1

		Chargingtimepreferenceathome	ChargingtimepreferenceatPublic	WaittimeatPublicChargingstation	Attitudetowards waitline	Chargingstationproximitypreference	WillingnessToInstallprivatechargingunit
N	Valid	294	294	294	294	294	294
	Missing	0	0	0	0	0	0
Mean		.91	.14	1.32	2.09	.95	2.87
Median		1.00	.00	1.00	3.00	1.00	3.00
Std. Deviation		.289	.351	1.583	1.304	1.041	1.196
Variance		.084	.123	2.505	1.701	1.083	1.430
Skewness		-2.841	2.052	.820	-.292	.772	-.195
Std. Error of Skewness		.142	.142	.142	.142	.142	.142
Minimum		0	0	0	0	0	0
Maximum		1	1	4	4	3	5

APPENDIX B:

Reliability

Scale: ALL VARIABLES

Case Processing Summary

		N	%
Cases	Valid	272	92.5
	Excluded[a]	22	7.5
	Total	294	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.804	.820	16

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
Goodservicesatisfaction	41.24	62.389	.598	.837	.777
Knownserviceprovidersatisfaction	41.09	70.940	.188	.479	.808
Uptodatetechnologysatisfaction	40.99	63.181	.682	.778	.774
Convinientoperatinghourssatisfaction	40.19	69.493	.402	.685	.794
Closeproximitysatisfaction	40.53	67.814	.446	.723	.791
Needsarefulfilledsatisfaction	40.89	67.461	.467	.722	.789
Queuewaitingtimesatisfaction	41.24	61.147	.633	.840	.774
ChargingCostDissatisfaction	40.59	67.276	.443	.728	.790
UnavalibilitytoinstallhomechargingunitDissatisfaction	41.12	67.421	.336	.726	.798
LimitedPublicInfrastructureDissatisfaction	40.52	67.461	.515	.628	.787
RangeanxietyDissatisfaction	40.57	71.670	.175	.686	.807
ChargingTimeDissatisfaction	40.86	65.238	.654	.800	.779
CongestionDissatisfaction	41.35	61.416	.643	.865	.773
LocationofchargingstationDissatisfaction	40.53	65.682	.623	.713	.780
Satisfactionfortotalnumberofavailablechargingstations	42.21	72.663	.077	.616	.817
Satisfactionforgrantsandincentives	41.49	75.594	-.081	.609	.835

Summary Item Statistics

	Mean	Minimum	Maximum	Range	Maximum / Minimum	Variance	N of Items
Item Means	2.731	1.482	3.500	2.018	2.362	.243	16
Item Variances	1.166	.657	1.965	1.308	2.991	.148	16

APPENDIX C:

- **Customer Satisfaction**

Mann-Whitney Test

Ranks

	EVOwnership	N	Mean Rank	Sum of Ranks
Satisfactionforpreferredchanginginfrastructure	Yes	43	127.77	5494.00
	No	251	150.88	37871.00
	Total	294		

Test Statistics[a]

	Satisfactionforpreferredcharginginfrastructure
Mann-Whitney U	4548.000
Wilcoxon W	5494.000
Z	-2.003
Asymp. Sig. (2-tailed)	.045

a. Grouping Variable: EVOwnership

Mann-Whitney Test

Ranks

	PublicProviderCircleK	N	Mean Rank	Sum of Ranks
Satisfactionforpreferredcharginginfrastructure	Not preferred	126	136.67	17220.00
	Preferred	168	155.63	26145.00
	Total	294		

Test Statistics[a]

	Satisfactionforpreferredcharginginfrastructure
Mann-Whitney U	9219.000
Wilcoxon W	17220.000
Z	-2.300
Asymp. Sig. (2-tailed)	.021

a. Grouping Variable: PublicProviderCircleK

Mann-Whitney Test

Ranks

	PublicProviderESBecars	N	Mean Rank	Sum of Ranks
Satisfactionforpreferredchanginginfrastructure	Not preferred	161	154.52	24878.00
	Preferred	133	139.00	18487.00
	Total	294		

Test Statistics[a]

	Satisfactionforpreferredcharginginfrastructure
Mann-Whitney U	9576.000
Wilcoxon W	18487.000
Z	-1.894
Asymp. Sig. (2-tailed)	.058

a. Grouping Variable: PublicProviderESBecars

Mann-Whitney Test

Ranks

	OverallOtherprovider	N	Mean Rank	Sum of Ranks
Satisfactionforpreferredcharginginfrastructure	0	288	148.04	42636.00
	1	6	121.50	729.00
	Total	294		

Test Statistics[a]

	Satisfactionforpreferredcharginginfrastructure
Mann-Whitney U	708.000
Wilcoxon W	729.000
Z	-.920
Asymp. Sig. (2-tailed)	.357

a. Grouping Variable: OverallOtherprovider

Mann-Whitney Test

Ranks

	Chargingtimepreferenceat home	N	Mean Rank	Sum of Ranks
Satisfactionforpreferredchargingingfrastructure	Daytime (6:01–18:00)	27	162.33	4383.00
	Night-time (18:01–6:00)	267	146.00	38982.00
	Total	294		

Test Statistics[a]

	Satisfactionforpreferredcharginginfrastructure
Mann-Whitney U	3204.000
Wilcoxon W	38982.000
Z	-1.157
Asymp. Sig. (2-tailed)	.247

a. Grouping Variable: Chargingtimepreferenceathome

Mann-Whitney Test

Ranks

	Chargingtimepreferenceat Public	N	Mean Rank	Sum of Ranks
Satisfactionforpreferredcharginginfrastructure	Daytime (6:01–18:00)	252	145.42	36645.00
	Night-time (18:01–6:00)	42	160.00	6720.00
	Total	294		

Test Statistics[a]

	Satisfactionforpreferredcharginginfrastructure
Mann-Whitney U	4767.000
Wilcoxon W	36645.000
Z	-1.251
Asymp. Sig. (2-tailed)	.211

a. Grouping Variable: ChargingtimepreferenceatPublic

Mann-Whitney Test

Ranks

	PriceSensitivityShifttononpeakhours	N	Mean Rank	Sum of Ranks
Satisfactionforpreferredcharginginfrastructure	Yes	210	149.50	31395.00
	No	84	142.50	11970.00
	Total	294		

Test Statistics[a]

	Satisfactionforpreferredcharginginfrastructure
Mann-Whitney U	8400.000
Wilcoxon W	11970.000
Z	-.775
Asymp. Sig. (2-tailed)	.438

a. Grouping Variable: PriceSensitivityShifttononpeakhours

- **Charging Infrastructure Preference**

Mann-Whitney Test

Ranks

	EVOwnership	N	Mean Rank	Sum of Ranks
OverallChargingInfrastructurePreference	No	251	149.74	37583.50
	Yes	43	134.45	5781.50
	Total	294		

Test Statistics[a]

	OverallChargingInfrastructurePreference
Mann-Whitney U	4835.500
Wilcoxon W	5781.500
Z	-1.260
Asymp. Sig. (2-tailed)	.208

a. Grouping Variable: EVOwnership

Mann-Whitney Test

Ranks

	PublicProviderCircleK	N	Mean Rank	Sum of Ranks
OverallChargingInfrastructurePreference	Not preferred	126	172.90	21786.00
	Preferred	168	128.45	21579.00
	Total	294		

Test Statistics[a]

	OverallChargingInfrastructure Preference
Mann-Whitney U	7383.000
Wilcoxon W	21579.000
Z	-4.910
Asymp. Sig. (2-tailed)	<.001

a. Grouping Variable: PublicProviderCircleK

Mann-Whitney Test

Ranks

	PublicProviderESBecars	N	Mean Rank	Sum of Ranks
OverallChargingInfrastructurePreference	Not preferred	161	166.72	26842.50
	Preferred	133	124.23	16522.50
	Total	294		

Test Statistics[a]

	OverallChargingInfrastructure Preference
Mann-Whitney U	7611.500
Wilcoxon W	16522.500
Z	-4.720
Asymp. Sig. (2-tailed)	<.001

a. Grouping Variable: PublicProviderESBecars

Mann-Whitney Test

Ranks

	OverallOtherprovider	N	Mean Rank	Sum of Ranks
OverallChargingInfrastructurePreference	0	288	146.06	42066.00
	1	6	216.50	1299.00
	Total	294		

Test Statistics[a]

	OverallChargingInfrastructurePreference
Mann-Whitney U	450.000
Wilcoxon W	42066.000
Z	-2.222
Asymp. Sig. (2-tailed)	.026

a. Grouping Variable: OverallOtherprovider

Mann-Whitney Test

Ranks

	Chargingtimepreferenceathome	N	Mean Rank	Sum of Ranks
OverallChargingInfrastructurePreference	Daytime (6:01–18:00)	27	81.48	2200.00
	Night-time (18:01–6:00)	267	154.18	41165.00
	Total	294		

Test Statistics[a]

	OverallChargingInfrastructurePreference
Mann-Whitney U	1822.000
Wilcoxon W	2200.000
Z	-4.685
Asymp. Sig. (2-tailed)	<.001

a. Grouping Variable: Chargingtimepreferenceathome

Mann-Whitney Test

Ranks

	Chargingtimepreferenceat Public	N	Mean Rank	Sum of Ranks
OverallChargingInfrastructurePreference	Daytime (6:01–18:00)	252	150.47	37917.50
	Night-time (18:01–6:00)	42	129.70	5447.50
	Total	294		

Test Statistics[a]

	OverallChargingInfrastructure Preference
Mann-Whitney U	4544.500
Wilcoxon W	5447.500
Z	-1.621
Asymp. Sig. (2-tailed)	.105

a. Grouping Variable: ChargingtimepreferenceatPublic

Mann-Whitney Test

Ranks

	PriceSensitivityShifttononpeakhours	N	Mean Rank	Sum of Ranks
OverallChargingInfrastructurePreference	Yes	210	149.77	31451.00
	No	84	141.83	11914.00
	Total	294		

Test Statistics[a]

	OverallChargingInfrastructure Preference
Mann-Whitney U	8344.000
Wilcoxon W	11914.000
Z	-.800
Asymp. Sig. (2-tailed)	.424

a. Grouping Variable: PriceSensitivityShifttononpeakhours

- **Price Sensitivity**

Mann-Whitney Test

Ranks

	EVOwnership	N	Mean Rank	Sum of Ranks
PriceSensitivityOverallpriceincreaseimpact	Yes	43	149.90	6445.50
	No	251	147.09	36919.50
	Total	294		

Test Statistics[a]

	PriceSensitivityOverallpriceincreaseimpact
Mann-Whitney U	5293.500
Wilcoxon W	36919.500
Z	-.259
Asymp. Sig. (2-tailed)	.795

a. Grouping Variable: EVOwnership

Mann-Whitney Test

Ranks

	PublicProviderCircleK	N	Mean Rank	Sum of Ranks
PriceSensitivityOverallpriceincreaseimpact	Not preferred	126	138.50	17451.00
	Preferred	168	154.25	25914.00
	Total	294		

Test Statistics[a]

	PriceSensitivityOverallpriceincreaseimpact
Mann-Whitney U	9450.000
Wilcoxon W	17451.000
Z	-2.039
Asymp. Sig. (2-tailed)	.041

a. Grouping Variable: PublicProviderCircleK

Mann-Whitney Test

Ranks

	PublicProviderESBecars	N	Mean Rank	Sum of Ranks
PriceSensitivityOverallpriceincreaseimpact	Not preferred	161	149.15	24013.50
	Preferred	133	145.50	19351.50
	Total	294		

Test Statistics[a]

	PriceSensitivityOverallpriceincreaseimpact
Mann-Whitney U	10440.500
Wilcoxon W	19351.500
Z	-.476
Asymp. Sig. (2-tailed)	.634

a. Grouping Variable: PublicProviderESBecars

Mann-Whitney Test

Ranks

	OverallOtherprovider	N	Mean Rank	Sum of Ranks
PriceSensitivityOverallpriceincreaseimpact	0	288	147.69	42534.00
	1	6	138.50	831.00
	Total	294		

Test Statistics[a]

	PriceSensitivityOverallpriceincreaseimpact
Mann-Whitney U	810.000
Wilcoxon W	831.000
Z	-.340
Asymp. Sig. (2-tailed)	.734

a. Grouping Variable: OverallOtherprovider

Mann-Whitney Test

Ranks

	Chargingtimepreferenceat home	N	Mean Rank	Sum of Ranks
PriceSensitivityOverallpriceincreaseimpact	Daytime (6:01–18:00)	27	165.72	4474.50
	Night-time (18:01–6:00)	267	145.66	38890.50
	Total	294		

Test Statistics[a]

	PriceSensitivityOverallpriceincreaseimpact
Mann-Whitney U	3112.500
Wilcoxon W	38890.500
Z	-1.516
Asymp. Sig. (2-tailed)	.129

a. Grouping Variable: Chargingtimepreferenceathome

Mann-Whitney Test

Ranks

	Chargingtimepreferenceat Public	N	Mean Rank	Sum of Ranks
PriceSensitivityOverallpriceincreaseimpact	Daytime (6:01–18:00)	252	146.67	36960.00
	Night-time (18:01–6:00)	42	152.50	6405.00
	Total	294		

Test Statistics[a]

	PriceSensitivityOverallpriceincreaseimpact
Mann-Whitney U	5082.000
Wilcoxon W	36960.000
Z	-.534
Asymp. Sig. (2-tailed)	.593

a. Grouping Variable: ChargingtimepreferenceatPublic

Mann-Whitney Test

Ranks

	PriceSensitivityShifttononpeakhours	N	Mean Rank	Sum of Ranks
PriceSensitivityOverallpriceincreaseimpact	Yes	210	154.60	32466.00
	No	84	129.75	10899.00
	Total	294		

Test Statistics[a]

	PriceSensitivityOverallpriceincreaseimpact
Mann-Whitney U	7329.000
Wilcoxon W	10899.000
Z	-2.937
Asymp. Sig. (2-tailed)	.003

a. Grouping Variable: PriceSensitivityShifttononpeakhours

Appendix D:

- **Customer Satisfaction**

Kruskal-Wallis Test

Ranks

	City	N	Mean Rank
Satisfactionforpreferredcharginginfrastructure	Dublin	102	141.68
	Cork	43	131.19
	Limerick	39	176.15
	Galway	39	130.92
	Other Counties	71	159.11
	Total	294	

Test Statistics[a,b]

	Satisfactionforpreferredcharginginfrastructure
Kruskal-Wallis H	13.746
df	4
Asymp. Sig.	.008

a. Kruskal Wallis Test

b. Grouping Variable: City

Kruskal-Wallis Test

Ranks

	Gender	N	Mean Rank
Satisfactionforpreferredchar gingininfrastructure	Male	143	143.67
	Female	96	144.84
	Other	51	151.86
	Total	290	

Test Statistics[a,b]

	Satisfactionfor preferredchargi nginfrastructur e
Kruskal-Wallis H	.540
df	2
Asymp. Sig.	.764

a. Kruskal Wallis Test

b. Grouping Variable: Gender

Kruskal-Wallis Test

Ranks

	Education	N	Mean Rank
Satisfactionforpreferredcha rginginfrastructure	Secondary school and below	115	148.13
	Bachelor's degree	75	149.92
	Master's degree	101	145.03
	Ph.D. degree and above	3	146.00
	Total	294	

Test Statistics[a,b]

	Satisfactionfor preferredchargi nginfrastructur e
Kruskal-Wallis H	.227
df	3
Asymp. Sig.	.973

a. Kruskal Wallis Test

b. Grouping Variable: Education

Kruskal-Wallis Test

Ranks

	Employment	N	Mean Rank
SatisfactionforpreferredchargingInfrastructure	Employed Full-Time	131	123.93
	Employed Part-Time	44	163.82
	Self employed	75	181.28
	Retired	31	139.68
	Other	13	153.54
	Total	294	

Test Statistics[a,b]

	Satisfactionforpreferredcharginginfrastructure
Kruskal-Wallis H	35.264
df	4
Asymp. Sig.	<.001

a. Kruskal Wallis Test

b. Grouping Variable: Employment

- **Charging Infrastructure Preference**

Kruskal-Wallis Test

Ranks

	City	N	Mean Rank
OverallChargingInfrastructurePreference	Dublin	102	160.78
	Cork	43	69.03
	Limerick	39	97.63
	Galway	39	140.09
	Other Counties	71	207.41
	Total	294	

Test Statistics[a,b]

	OverallChargingInfrastructurePreference
Kruskal-Wallis H	107.841
df	4
Asymp. Sig.	<.001

a. Kruskal Wallis Test

b. Grouping Variable: City

Kruskal-Wallis Test

Ranks

	Gender	N	Mean Rank
OverallChargingInfrastructurePreference	Male	143	142.79
	Female	96	150.66
	Other	51	143.38
	Total	290	

Test Statistics[a,b]

	OverallChargingInfrastructurePreference
Kruskal-Wallis H	.665
df	2
Asymp. Sig.	.717

a. Kruskal Wallis Test

b. Grouping Variable: Gender

Kruskal-Wallis Test

Ranks

	Education	N	Mean Rank
OverallChargingInfrastructurePreference	Secondary school and below	115	116.77
	Bachelor's degree	75	139.26
	Master's degree	101	187.56
	Ph.D. degree and above	3	182.67
	Total	294	

Test Statistics[a,b]

	OverallChargingInfrastructurePreference
Kruskal-Wallis H	47.333
df	3
Asymp. Sig.	<.001

a. Kruskal Wallis Test

b. Grouping Variable: Education

Kruskal-Wallis Test

Ranks

	Employment	N	Mean Rank
OverallChargingInfrastructurePreference	Employed Full-Time	131	152.01
	Employed Part-Time	44	197.95
	Self employed	75	118.75
	Retired	31	124.82
	Other	13	151.23
	Total	294	

Test Statistics[a,b]

	OverallChargingInfrastructurePreference
Kruskal-Wallis H	32.657
df	4
Asymp. Sig.	<.001

a. Kruskal Wallis Test

b. Grouping Variable: Employment

- **Price Sensitivity**

Kruskal-Wallis Test

Ranks

	City	N	Mean Rank
PriceSensitivityOverallpriceincreaseimpact	Dublin	102	157.24
	Cork	43	180.66
	Limerick	39	93.27
	Galway	39	179.96
	Other Counties	71	125.39
	Total	294	

Test Statistics[a,b]

	PriceSensitivityOverallpriceincreaseimpact
Kruskal-Wallis H	57.623
df	4
Asymp. Sig.	<.001

a. Kruskal Wallis Test

b. Grouping Variable: City

Kruskal-Wallis Test

Ranks

	Gender	N	Mean Rank
PriceSensitivityOverallpriceincreaseimpact	Male	143	140.88
	Female	96	159.82
	Other	51	131.48
	Total	290	

Test Statistics[a,b]

	PriceSensitivityOverallpriceincreaseimpact
Kruskal-Wallis H	7.774
df	2
Asymp. Sig.	.021

a. Kruskal Wallis Test

b. Grouping Variable: Gender

Kruskal-Wallis Test

Ranks

	Education	N	Mean Rank
PriceSensitivityOverallpriceincreaseimpact	Secondary school and below	115	152.99
	Bachelor's degree	75	118.90
	Master's degree	101	162.76
	Ph.D. degree and above	3	138.50
	Total	294	

Test Statistics[a,b]

	PriceSensitivityOverallpriceincreaseimpact
Kruskal-Wallis H	20.622
df	3
Asymp. Sig.	<.001

a. Kruskal Wallis Test

b. Grouping Variable: Education

Kruskal-Wallis Test

Ranks

	Employment	N	Mean Rank
PriceSensitivityOverallpriceincreaseimpact	Employed Full-Time	131	162.81
	Employed Part-Time	44	177.48
	Self employed	75	93.42
	Retired	31	173.27
	Other	13	142.27
	Total	294	

Test Statistics[a,b]

	PriceSensitivityOverallpriceincreaseimpact
Kruskal-Wallis H	72.313
df	4
Asymp. Sig.	<.001

a. Kruskal Wallis Test

b. Grouping Variable: Employment

Appendix E:

- **Customer Satisfaction**

Correlations

			Age	Income	DrivenMileage	WaittimeatPublicChargingstation	Attitudetowardswaitline	Chargingstationproximitypreference	WillingnessToInstallprivatechargingunit	Uptodatetechnologysatisfaction	ChargingCostDissatisfaction	UnavalibilitytoinstallhomechargingunitDissatisfaction	LimitedPublicInfrastructureDissatisfaction	RangeanxietyDissatisfaction	ChargingTimeDissatisfaction	OverallServiceQualitySatisfaction	OverallWaittimeSatisfaction	OverallLocationSatisfaction	Satisfactionfortotalnumberofavailablechargingstations	Satisfactionforgrantsandincentives	WillingnesstopurchaseEV	Satisfactionforpreferredcharginginfrastructure
Spearman's rho	Age	Correlation Coefficient	1.000	.179**	.093	-.195**	.142*	-.274**	-.212**	.130*	-.280**	-.244**	.314**	.138*	.058	-.101	-.112	-.018	-.166**	-.088	-.025	-.027
		Sig. (2-tailed)	.	.002	.112	<.001	.015	<.001	<.001	.032	<.001	<.001	<.001	.023	.342	.098	.064	.767	.004	.133	.667	.639
		N	294	294	294	294	294	294	294	272	272	272	272	272	272	272	272	272	294	294	294	294
	Income	Correlation Coefficient	.179**	1.000	.511**	-.124*	.337**	-.231**	-.029	.134*	-.034	-.322**	-.115	-.127*	.160**	.057	.038	.213**	-.128*	.121*	-.098	.102
		Sig. (2-tailed)	.002	.	<.001	.034	<.001	<.001	.621	.028	.580	<.001	.058	.036	.008	.346	.530	<.001	.028	.038	.094	.082
		N	294	294	294	294	294	294	294	272	272	272	272	272	272	272	272	272	294	294	294	294
	DrivenMileage	Correlation Coefficient	.093	.511**	1.000	-.214**	.240**	-.334**	.160**	.117	.021	-.233**	-.027	.006	.261**	.025	.203**	.244**	-.098	.108	-.156**	.124*
		Sig. (2-tailed)	.112	<.001	.	<.001	<.001	<.001	.006	.053	.731	<.001	.657	.922	<.001	.676	<.001	<.001	.095	.065	.007	.034
		N	294	294	294	294	294	294	294	272	272	272	272	272	272	272	272	272	294	294	294	294
	WaittimeatPublicChargingstation	Correlation Coefficient	-.195**	-.124*	-.214**	1.000	-.331**	.599**	-.292**	-.220**	-.263**	-.006	-.002	-.146*	-.337**	-.030	-.452**	-.324**	.333**	.229**	.487**	.139*
		Sig. (2-tailed)	<.001	.034	<.001	.	<.001	<.001	<.001	<.001	<.001	.924	.971	.016	<.001	.622	<.001	<.001	<.001	<.001	<.001	.017
		N	294	294	294	294	294	294	294	272	272	272	272	272	272	272	272	272	294	294	294	294
	Attitudetowardswaitline	Correlation Coefficient	.142*	.337**	.240**	-.331**	1.000	-.340**	.294**	-.086	.172**	-.130*	-.237**	-.057	-.085	-.081	-.059	.279**	-.252**	.099	-.452**	.155**
		Sig. (2-tailed)	.015	<.001	<.001	<.001	.	<.001	<.001	.157	.004	.032	<.001	.351	.161	.184	.334	<.001	<.001	.092	<.001	.008
		N	294	294	294	294	294	294	294	272	272	272	272	272	272	272	272	272	294	294	294	294
	Chargingstationproximitypreference	Correlation Coefficient	-.274**	-.231**	-.334**	.599**	-.340**	1.000	-.168**	-.318**	-.202**	.094	-.002	-.045	-.408**	-.072	-.400**	-.369**	.282**	.176**	.462**	.102
		Sig. (2-tailed)	<.001	<.001	<.001	<.001	<.001	.	.004	<.001	<.001	.121	.969	.460	<.001	.236	<.001	<.001	<.001	.002	<.001	.081
		N	294	294	294	294	294	294	294	272	272	272	272	272	272	272	272	272	294	294	294	294
	WillingnessToInstallprivatechargingunit	Correlation Coefficient	-.212**	-.029	.160**	-.292**	.294**	-.168**	1.000	-.119*	.271**	.196**	-.249**	-.024	-.043	.106	.190**	.182**	-.249**	-.075	-.354**	-.029
		Sig. (2-tailed)	<.001	.621	.006	<.001	<.001	.004	.	.050	<.001	.001	<.001	.688	.479	.080	.002	.003	<.001	.197	<.001	.620
		N	294	294	294	294	294	294	294	272	272	272	272	272	272	272	272	272	294	294	294	294
	Uptodatetechnologysatisfaction	Correlation Coefficient	.130*	.134*	.117	-.220**	-.086	-.318**	-.119*	1.000	.292**	.130*	.550**	-.025	.681**	.555**	.586**	.463**	.073	-.067	-.133*	-.093
		Sig. (2-tailed)	.032	.028	.053	<.001	.157	<.001	.050	.	<.001	.032	<.001	.687	<.001	<.001	<.001	<.001	.227	.269	.028	.125
		N	272	272	272	272	272	272	272	272	272	272	272	272	272	272	272	272	272	272	272	272
	ChargingCostDissatisfaction	Correlation Coefficient	-.280**	-.034	.021	-.263**	.172**	-.202**	.271**	.292**	1.000	.621**	-.067	-.149*	.233**	.515**	.413**	.538**	-.185**	-.122*	-.259**	-.096
		Sig. (2-tailed)	<.001	.580	.731	<.001	.004	<.001	<.001	<.001	.	<.001	.273	.014	<.001	<.001	<.001	<.001	.002	.044	<.001	.116
		N	272	272	272	272	272	272	272	272	272	272	272	272	272	272	272	272	272	272	272	272
	UnavalibilitytoinstallhomechargingunitDissatisfaction	Correlation Coefficient	-.244**	-.322**	-.233**	-.006	-.130*	.094	.196**	.130*	.621**	1.000	.087	-.083	.047	.557**	.227**	.202**	-.027	-.130*	-.022	-.081
		Sig. (2-tailed)	<.001	<.001	<.001	.924	.032	.121	.001	.032	<.001	.	.153	.173	.437	<.001	<.001	<.001	.663	.032	.720	.183
		N	272	272	272	272	272	272	272	272	272	272	272	272	272	272	272	272	272	272	272	272
	LimitedPublicInfrastructureDissatisfaction	Correlation Coefficient	.314**	-.115	-.027	-.002	-.237**	-.002	-.249**	.550**	-.067	.087	1.000	.275**	.418**	.283**	.306**	.184**	.155*	-.036	.126*	.025
		Sig. (2-tailed)	<.001	.058	.657	.971	<.001	.969	<.001	<.001	.273	.153	.	<.001	<.001	<.001	<.001	.002	.010	.549	.038	.687
		N	272	272	272	272	272	272	272	272	272	272	272	272	272	272	272	272	272	272	272	272
	RangeanxietyDissatisfaction	Correlation Coefficient	.138*	-.127*	.006	-.146*	-.057	-.045	-.024	-.025	-.149*	-.083	.275**	1.000	.302**	-.320**	.174**	.212**	-.027	-.034	.034	.110
		Sig. (2-tailed)	.023	.036	.922	.016	.351	.460	.688	.687	.014	.173	<.001	.	<.001	<.001	.004	<.001	.655	.580	.582	.070
		N	272	272	272	272	272	272	272	272	272	272	272	272	272	272	272	272	272	272	272	272
	ChargingTimeDissatisfaction	Correlation Coefficient	.058	.160**	.261**	-.337**	-.085	-.408**	-.043	.681**	.233**	.047	.418**	.302**	1.000	.410**	.722**	.502**	.058	-.106	-.152*	-.065
		Sig. (2-tailed)	.342	.008	<.001	<.001	.161	<.001	.479	<.001	<.001	.437	<.001	<.001	.	<.001	<.001	<.001	.340	.081	.012	.284
		N	272	272	272	272	272	272	272	272	272	272	272	272	272	272	272	272	272	272	272	272
	OverallServiceQualitySatisfaction	Correlation Coefficient	-.101	.057	.025	-.030	-.081	-.072	.106	.555**	.515**	.557**	.283**	-.320**	.410**	1.000	.412**	.417**	.064	-.083	-.058	-.090
		Sig. (2-tailed)	.098	.346	.676	.622	.184	.236	.080	<.001	<.001	<.001	<.001	<.001	<.001	.	<.001	<.001	.290	.173	.344	.138
		N	272	272	272	272	272	272	272	272	272	272	272	272	272	272	272	272	272	272	272	272
	OverallWaittimeSatisfaction	Correlation Coefficient	-.112	.038	.203**	-.452**	-.059	-.400**	.190**	.586**	.413**	.227**	.306**	.174**	.722**	.412**	1.000	.509**	-.116	-.273**	-.250**	-.168**
		Sig. (2-tailed)	.064	.530	<.001	<.001	.334	<.001	.002	<.001	<.001	<.001	<.001	.004	<.001	<.001	.	<.001	.056	<.001	<.001	.005
		N	272	272	272	272	272	272	272	272	272	272	272	272	272	272	272	272	272	272	272	272
	OverallLocationSatisfaction	Correlation Coefficient	-.018	.213**	.244**	-.324**	.279**	-.369**	.182**	.463**	.538**	.202**	.184**	.212**	.502**	.417**	.509**	1.000	-.169**	-.043	-.272**	-.001
		Sig. (2-tailed)	.767	<.001	<.001	<.001	<.001	<.001	.003	<.001	<.001	<.001	.002	<.001	<.001	<.001	<.001	.	.005	.480	<.001	.985
		N	272	272	272	272	272	272	272	272	272	272	272	272	272	272	272	272	272	272	272	272
	Satisfactionfortotalnumberofavailablechargingstations	Correlation Coefficient	-.166**	-.128*	-.098	.333**	-.252**	.282**	-.249**	.073	-.185**	-.027	.155*	-.027	.058	.064	-.116	-.169**	1.000	.690**	.260**	.573**
		Sig. (2-tailed)	.004	.028	.095	<.001	<.001	<.001	<.001	.227	.002	.663	.010	.655	.340	.290	.056	.005	.	<.001	<.001	<.001
		N	294	294	294	294	294	294	294	272	272	272	272	272	272	272	272	272	294	294	294	294
	Satisfactionforgrantsandincentives	Correlation Coefficient	-.088	.121*	.108	.229**	.099	.176**	-.075	-.067	-.122*	-.130*	-.036	-.034	-.106	-.083	-.273**	-.043	.690**	1.000	.181**	.754**
		Sig. (2-tailed)	.133	.038	.065	<.001	.092	.002	.197	.269	.044	.032	.549	.580	.081	.173	<.001	.480	<.001	.	.002	<.001
		N	294	294	294	294	294	294	294	272	272	272	272	272	272	272	272	272	294	294	294	294
	WillingnesstopurchaseEV	Correlation Coefficient	-.025	-.098	-.156**	.487**	-.452**	.462**	-.354**	-.133*	-.259**	-.022	.126*	.034	-.152*	-.058	-.250**	-.272**	.260**	.181**	1.000	.077
		Sig. (2-tailed)	.667	.094	.007	<.001	<.001	<.001	<.001	.028	<.001	.720	.038	.582	.012	.344	<.001	<.001	<.001	.002	.	.190
		N	294	294	294	294	294	294	294	272	272	272	272	272	272	272	272	272	294	294	294	294
	Satisfactionforpreferredcharginginfrastructure	Correlation Coefficient	-.027	.102	.124*	.139*	.155**	.102	-.029	-.093	-.096	-.081	.025	.110	-.065	-.090	-.168**	-.001	.573**	.754**	.077	1.000
		Sig. (2-tailed)	.639	.082	.034	.017	.008	.081	.620	.125	.116	.183	.687	.070	.284	.138	.005	.985	<.001	<.001	.190	.
		N	294	294	294	294	294	294	294	272	272	272	272	272	272	272	272	272	294	294	294	294

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

- **Charging Infrastructure Preference**

Correlations

			Age	Income	DrivenMileage	WaittimeatPublicChargingstation	Attitudetowardswaitline	Chargingstationproximitypreference	WillingnessToInstallprivatechargingunit	WillingnesstopurchaseEV	PriceSensitivity10Modified	PriceSensitivity20Modified	PriceSensitivity50Modified	PriceSensitivity100Modified	Feepreferenceforprivatechargingfacilities	OverallChargingInfrastructurePreference
Spearman's rho	Age	Correlation Coefficient	1.000	.179**	.093	-.195**	.142*	-.274**	-.212**	-.025	-.150*	-.273**	-.076	-.088	-.156**	-.367**
		Sig. (2-tailed)	.	.002	.112	<.001	.015	<.001	<.001	.667	.010	<.001	.194	.134	.007	<.001
		N	294	294	294	294	294	294	294	294	294	294	294	294	294	294
	Income	Correlation Coefficient	.179**	1.000	.511**	-.124*	.337**	-.231**	-.029	-.098	-.076	-.050	-.264**	-.305**	.038	-.205**
		Sig. (2-tailed)	.002	.	<.001	.034	<.001	<.001	.621	.094	.192	.396	<.001	<.001	.517	<.001
		N	294	294	294	294	294	294	294	294	294	294	294	294	294	294
	DrivenMileage	Correlation Coefficient	.093	.511**	1.000	-.214**	.240**	-.334**	.160**	-.156**	-.059	-.025	-.290**	-.275**	.252**	-.221**
		Sig. (2-tailed)	.112	<.001	.	<.001	<.001	<.001	.006	.007	.313	.668	<.001	<.001	<.001	<.001
		N	294	294	294	294	294	294	294	294	294	294	294	294	294	294
	WaittimeatPublicChargingstation	Correlation Coefficient	-.195**	-.124*	-.214**	1.000	-.331**	.599**	-.292**	.487**	.083	-.070	.027	-.001	-.296**	.027
		Sig. (2-tailed)	<.001	.034	<.001	.	<.001	<.001	<.001	<.001	.154	.230	.640	.990	<.001	.647
		N	294	294	294	294	294	294	294	294	294	294	294	294	294	294
	Attitudetowardswaitline	Correlation Coefficient	.142*	.337**	.240**	-.331**	1.000	-.340**	.294**	-.452**	-.100	-.198**	-.163**	-.188**	.240**	-.148*
		Sig. (2-tailed)	.015	<.001	<.001	<.001	.	<.001	<.001	<.001	.086	<.001	.005	.001	<.001	.011
		N	294	294	294	294	294	294	294	294	294	294	294	294	294	294
	Chargingstationproximitypreference	Correlation Coefficient	-.274**	-.231**	-.334**	.599**	-.340**	1.000	-.168**	.462**	.061	-.007	.202**	.179**	-.286**	.030
		Sig. (2-tailed)	<.001	<.001	<.001	<.001	<.001	.	.004	<.001	.298	.899	<.001	.002	<.001	.612
		N	294	294	294	294	294	294	294	294	294	294	294	294	294	294
	WillingnessToInstallprivatechargingunit	Correlation Coefficient	-.212**	-.029	.160**	-.292**	.294**	-.168**	1.000	-.354**	-.212**	-.126*	-.035	-.048	.524**	-.040
		Sig. (2-tailed)	<.001	.621	.006	<.001	<.001	.004	.	<.001	<.001	.031	.546	.415	<.001	.490
		N	294	294	294	294	294	294	294	294	294	294	294	294	294	294
	WillingnesstopurchaseEV	Correlation Coefficient	-.025	-.098	-.156**	.487**	-.452**	.462**	-.354**	1.000	-.037	-.089	.108	.049	-.184**	-.010
		Sig. (2-tailed)	.667	.094	.007	<.001	<.001	<.001	<.001	.	.530	.126	.064	.401	.002	.864
		N	294	294	294	294	294	294	294	294	294	294	294	294	294	294
	PriceSensitivity10Modified	Correlation Coefficient	-.150*	-.076	-.059	.083	-.100	.061	-.212**	-.037	1.000	.450**	.098	.137*	-.187**	.125*
		Sig. (2-tailed)	.010	.192	.313	.154	.086	.298	<.001	.530	.	<.001	.092	.019	.001	.032
		N	294	294	294	294	294	294	294	294	294	294	294	294	294	294
	PriceSensitivity20Modified	Correlation Coefficient	-.273**	-.050	-.025	-.070	-.198**	-.007	-.126*	-.089	.450**	1.000	.295**	.263**	-.058	.238**
		Sig. (2-tailed)	<.001	.396	.668	.230	<.001	.899	.031	.126	<.001	.	<.001	<.001	.323	<.001
		N	294	294	294	294	294	294	294	294	294	294	294	294	294	294
	PriceSensitivity50Modified	Correlation Coefficient	-.076	-.264**	-.290**	.027	-.163**	.202**	-.035	.108	.098	.295**	1.000	.813**	-.122*	.311**
		Sig. (2-tailed)	.194	<.001	<.001	.640	.005	<.001	.546	.064	.092	<.001	.	<.001	.036	<.001
		N	294	294	294	294	294	294	294	294	294	294	294	294	294	294
	PriceSensitivity100Modified	Correlation Coefficient	-.088	-.305**	-.275**	-.001	-.188**	.179**	-.048	.049	.137*	.263**	.813**	1.000	-.114	.312**
		Sig. (2-tailed)	.134	<.001	<.001	.990	.001	.002	.415	.401	.019	<.001	<.001	.	.050	<.001
		N	294	294	294	294	294	294	294	294	294	294	294	294	294	294
	Feepreferenceforprivatechargingfacilities	Correlation Coefficient	-.156**	.038	.252**	-.296**	.240**	-.286**	.524**	-.184**	-.187**	-.058	-.122*	-.114	1.000	-.045
		Sig. (2-tailed)	.007	.517	<.001	<.001	<.001	<.001	<.001	.002	.001	.323	.036	.050	.	.440
		N	294	294	294	294	294	294	294	294	294	294	294	294	294	294
	OverallChargingInfrastructurePreference	Correlation Coefficient	-.367**	-.205**	-.221**	.027	-.148*	.030	-.040	-.010	.125*	.238**	.311**	.312**	-.045	1.000
		Sig. (2-tailed)	<.001	<.001	<.001	.647	.011	.612	.490	.864	.032	<.001	<.001	<.001	.440	.
		N	294	294	294	294	294	294	294	294	294	294	294	294	294	294

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

- **Price Sensitivity**

Correlations

			Age	Income	DrivenMileage	WillingnessToInstallprivatechargingunit	WillingnesstopurchaseEV	PriceSensitivityShifttonopeakhours	PriceSensitivityOverallpriceincreaseimpact
Spearman's rho	Age	Correlation Coefficient	1.000	.179**	.093	-.212**	-.025	.273**	.089
		Sig. (2-tailed)	.	.002	.112	<.001	.667	<.001	.128
		N	294	294	294	294	294	294	294
	Income	Correlation Coefficient	.179**	1.000	.511**	-.029	-.098	.134*	-.325**
		Sig. (2-tailed)	.002	.	<.001	.621	.094	.021	<.001
		N	294	294	294	294	294	294	294
	DrivenMileage	Correlation Coefficient	.093	.511**	1.000	.160**	-.156**	.217**	-.250**
		Sig. (2-tailed)	.112	<.001	.	.006	.007	<.001	<.001
		N	294	294	294	294	294	294	294
	WillingnessToInstallprivatechargingunit	Correlation Coefficient	-.212**	-.029	.160**	1.000	-.354**	.319**	.096
		Sig. (2-tailed)	<.001	.621	.006	.	<.001	<.001	.102
		N	294	294	294	294	294	294	294
	WillingnesstopurchaseEV	Correlation Coefficient	-.025	-.098	-.156**	-.354**	1.000	-.366**	.045
		Sig. (2-tailed)	.667	.094	.007	<.001	.	<.001	.446
		N	294	294	294	294	294	294	294
	PriceSensitivityShifttonopeakhours	Correlation Coefficient	.273**	.134*	.217**	.319**	-.366**	1.000	-.172**
		Sig. (2-tailed)	<.001	.021	<.001	<.001	<.001	.	.003
		N	294	294	294	294	294	294	294
	PriceSensitivityOverallpriceincreaseimpact	Correlation Coefficient	.089	-.325**	-.250**	.096	.045	-.172**	1.000
		Sig. (2-tailed)	.128	<.001	<.001	.102	.446	.003	.
		N	294	294	294	294	294	294	294

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Appendix F:

Model 1

Linearity:

Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)
Step 1[a]	City	.228	.163	1.971	1	.160	1.257
	Employment	-.042	.321	.017	1	.897	.959
	PublicProviderCircleK	-.034	.406	.007	1	.932	.966
	WaittimeatPublicChargingstation	-1.289	.823	2.458	1	.117	.275
	OverallWaittimeSatisfaction	-.839	.659	1.620	1	.203	.432
	LN_Waittime by WaittimeatPublicChargingstation	.653	.458	2.031	1	.154	1.921
	LN_WaittimeSatisfaction by OverallWaittimeSatisfaction	-.043	.739	.003	1	.954	.958
	DATW	-5.333	4.962	1.155	1	.282	.005
	DATW by LN_DATW	1.319	1.633	.653	1	.419	3.741
	DSN	-.606	.755	.645	1	.422	.545
	DSN by LN_DSN	.062	.270	.053	1	.818	1.064
	DSG	1.053	.701	2.257	1	.133	2.867
	DSG by LN_DSG	-.124	.251	.244	1	.621	.883
	DrivenMileage	.209	.163	1.633	1	.201	1.232
	Constant	.794	1.023	.603	1	.437	2.213

Multicollinearity

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	.367	.076		4.803	<.001		
	Employment	-.038	.036	-.068	-1.054	.293	.785	1.274
	PublicProviderCircleK	-.063	.054	-.070	-1.164	.245	.894	1.119
	WaittimeatPublicChargingstation	.028	.020	.096	1.358	.175	.649	1.541
	OverallWaittimeSatisfaction	-.193	.058	-.214	-3.307	.001	.780	1.283
	DATW	-.152	.070	-.139	-2.182	.030	.804	1.244
	DSN	-.107	.065	-.116	-1.639	.102	.646	1.547
	DSG	.141	.068	.154	2.083	.038	.591	1.692
	DrivenMileage	.014	.022	.037	.637	.524	.975	1.026
	City	.018	.021	.052	.859	.391	.897	1.114

Logistic Regression

Case Processing Summary

Unweighted Cases[a]		N	Percent
Selected Cases	Included in Analysis	271	92.2
	Missing Cases	23	7.8
	Total	294	100.0
Unselected Cases		0	.0
Total		294	100.0

a. If weight is in effect, see classification table for the total number of cases.

Dependent Variable Encoding

Original Value	Internal Value
Dissatisfied	0
Satisfied	1

Categorical Variables Codings

		Frequency	Parameter coding (1)	(2)	(3)	(4)
WaittimeatPublicChargingstation	1 hour and below	129	.000	.000	.000	.000
	1–2 hour	49	1.000	.000	.000	.000
	2–3 hour	33	.000	1.000	.000	.000
	3 hour and above	1	.000	.000	1.000	.000
	It varies	59	.000	.000	.000	1.000
City	Dublin	83	.000	.000	.000	.000
	Cork	42	1.000	.000	.000	.000
	Limerick	39	.000	1.000	.000	.000
	Galway	38	.000	.000	1.000	.000
	Other Counties	69	.000	.000	.000	1.000
Employment	Employed	169	.000	.000		
	Seeking Opportnities	46	1.000	.000		
	Retired	56	.000	1.000		

Block 0: Beginning Block

Classification Table[a,b]

Observed			Predicted DCSFCI Dissatisfied	Predicted DCSFCI Satisfied	Percentage Correct
Step 0	DCSFCI	Dissatisfied	154	0	100.0
		Satisfied	117	0	.0
	Overall Percentage				56.8

a. Constant is included in the model.

b. The cut value is .500

Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)
Step 0	Constant	-.275	.123	5.020	1	.025	.760

Variables not in the Equation

			Score	df	Sig.
Step 0	Variables	DrivenMileage	.010	1	.919
		City	37.550	4	<.001
		City(1)	19.808	1	<.001
		City(2)	4.636	1	.031
		City(3)	11.037	1	<.001
		City(4)	3.057	1	.080
		Employment	54.030	2	<.001
		Employment(1)	39.098	1	<.001
		Employment(2)	27.069	1	<.001
		PublicProviderCircleK	15.768	1	<.001
	Overall Statistics		96.302	8	<.001

Block 1: Method = Forward Stepwise (Likelihood Ratio)

Omnibus Tests of Model Coefficients

		Chi-square	df	Sig.
Step 3	Step	8.532	1	.003
	Block	110.392	7	<.001
	Model	110.392	7	<.001

Model Summary

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
3	260.226[a]	.335	.449

a. Estimation terminated at iteration number 5 because parameter estimates changed by less than .001.

Hosmer and Lemeshow Test

Step	Chi-square	df	Sig.
3	10.487	7	.163

Contingency Table for Hosmer and Lemeshow Test

		DCSFCI = Dissatisfied		DCSFCI = Satisfied		
		Observed	Expected	Observed	Expected	Total
Step 3	1	40	40.251	5	4.749	45
	2	26	23.724	1	3.276	27
	3	17	19.400	6	3.600	23
	4	27	27.098	7	6.902	34
	5	10	8.585	10	11.415	20
	6	11	12.639	20	18.361	31
	7	17	15.954	29	30.046	46
	8	1	3.966	25	22.034	26
	9	5	2.383	14	16.617	19

Classification Table[a]

			Predicted		
			DCSFCI		Percentage Correct
Observed			Dissatisfied	Satisfied	
Step 3	DCSFCI	Dissatisfied	116	38	75.3
		Satisfied	19	98	83.8
	Overall Percentage				79.0

a. The cut value is .500

		B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B) Lower	Upper
Step 3[a]	City			35.550	4	<.001			
	City(1)	-3.035	.579	27.466	1	<.001	.048	.015	.150
	City(2)	-.496	.453	1.196	1	.274	.609	.251	1.481
	City(3)	-1.760	.521	11.412	1	<.001	.172	.062	.478
	City(4)	-.080	.438	.034	1	.855	.923	.391	2.177
	Employment			34.885	2	<.001			
	Employment(1)	1.001	.511	3.842	1	.050	2.721	1.000	7.402
	Employment(2)	-2.379	.483	24.304	1	<.001	.093	.036	.238
	PublicProviderCircleK	1.012	.349	8.423	1	.004	2.752	1.389	5.452
	Constant	.105	.337	.097	1	.755	1.111		

Variables in the Equation

a. Variable(s) entered on step 3: PublicProviderCircleK.

Variables not in the Equation

			Score	df	Sig.
Step 3	Variables	DrivenMileage	.027	1	.870
	Overall Statistics		.027	1	.870

Step Summary[a,b]

Step	Improvement Chi-square	df	Sig.	Model Chi-square	df	Sig.	Correct Class %	Variable
1	59.234	2	<.001	59.234	2	<.001	68.6%	IN: Employment
2	42.626	4	<.001	101.860	6	<.001	77.1%	IN: City
3	8.532	1	.003	110.392	7	<.001	79.0%	IN: PublicProvider CircleK

a. No more variables can be deleted from or added to the current model.

b. End block: 1

Block 2: Method = Forward Stepwise (Likelihood Ratio)

Omnibus Tests of Model Coefficients

		Chi-square	df	Sig.
Step 1	Step	15.214	4	.004
	Block	15.214	4	.004
	Model	125.607	11	<.001

Model Summary

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	245.012[a]	.371	.498

a. Estimation terminated at iteration number 20 because maximum iterations has been reached. Final solution cannot be found.

Hosmer and Lemeshow Test

Step	Chi-square	df	Sig.
1	4.159	7	.761

Contingency Table for Hosmer and Lemeshow Test

		DCSFCI = Dissatisfied		DCSFCI = Satisfied		
		Observed	Expected	Observed	Expected	Total
Step 1	1	33	32.589	2	2.411	35
	2	34	35.049	6	4.951	40
	3	23	22.680	4	4.320	27
	4	21	20.778	7	7.222	28
	5	10	8.908	7	8.092	17
	6	13	12.075	13	13.925	26
	7	6	9.084	20	16.916	26
	8	11	8.295	22	24.705	33
	9	3	4.541	36	34.459	39

Classification Table[a]

	Observed		Predicted DCSFCI Dissatisfied	Predicted DCSFCI Satisfied	Percentage Correct
Step 1	DCSFCI	Dissatisfied	124	30	80.5
		Satisfied	21	96	82.1
	Overall Percentage				81.2

a. The cut value is .500

Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B) Lower	Upper
Step 1[a]	City			29.168	4	<.001			
	City(1)	-3.130	.620	25.501	1	<.001	.044	.013	.147
	City(2)	-1.290	.549	5.512	1	.019	.275	.094	.808
	City(3)	-1.355	.607	4.981	1	.026	.258	.079	.848
	City(4)	.001	.458	.000	1	.997	1.001	.408	2.459
	Employment			32.101	2	<.001			
	Employment(1)	1.620	.606	7.145	1	.008	5.052	1.541	16.570
	Employment(2)	-2.009	.502	16.013	1	<.001	.134	.050	.359
	PublicProviderCircleK	1.102	.395	7.770	1	.005	3.010	1.387	6.532
	WaittimeatPublicChargingstation			13.386	4	.010			
	WaittimeatPublicChargingstation(1)	1.137	.513	4.907	1	.027	3.118	1.140	8.527
	WaittimeatPublicChargingstation(2)	-.740	.665	1.237	1	.266	.477	.130	1.758
	WaittimeatPublicChargingstation(3)	18.411	40192.969	.000	1	1.000	99071126.042	.000	.
	WaittimeatPublicChargingstation(4)	-1.094	.518	4.466	1	.035	.335	.121	.924
	Constant	.070	.384	.033	1	.856	1.072		

a. Variable(s) entered on step 1: WaittimeatPublicChargingstation.

Variables not in the Equation

			Score	df	Sig.
Step 1	Variables	OverallWaittimeSatisfaction	3.795	1	.051
		DATW	3.148	1	.076
		DSN	1.677	1	.195
		DSG	1.732	1	.188
	Overall Statistics		8.736	4	.068

Step Summary[a,b]

Step	Improvement Chi-square	df	Sig.	Model Chi-square	df	Sig.	Correct Class %	Variable
1	15.214	4	.004	15.214	4	.004	81.2%	IN: WaittimeatPublicChargingstation

a. No more variables can be deleted from or added to the current model.

b. End block: 2

Appendix G:

Model 2

Linearity

Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)
Step 1[a]	PublicProviderCircleK	-.278	.343	.659	1	.417	.757
	PublicProviderESBecars	-.384	.464	.687	1	.407	.681
	OverallOtherprovider	1.799	.977	3.392	1	.066	6.041
	Income	-.569	.574	.983	1	.321	.566
	DrivenMileage	-.008	.136	.003	1	.953	.992
	Income by LN_Income	.193	.348	.308	1	.579	1.213
	DA	-1.714	1.139	2.265	1	.132	.180
	DA by LN_DA	.661	.827	.639	1	.424	1.937
	Chargingtimepreferenceat home	1.868	1.024	3.325	1	.068	6.472
	Constant	1.013	1.767	.328	1	.567	2.753

Multicollinearity

Coefficients[a]

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.	Collinearity Statistics Tolerance	Collinearity Statistics VIF
1	(Constant)	.355	.141		2.523	.012		
	PublicProviderCircleK	.022	.055	.022	.398	.691	.846	1.182
	PublicProviderESBecars	-.073	.072	-.051	-1.009	.314	.961	1.041
	Age	-.150	.023	-.349	-6.394	<.001	.840	1.191
	Income	.019	.023	.048	.824	.411	.729	1.372
	DrivenMileage	.010	.021	.024	.463	.644	.963	1.038
	Chargingtimepreferenceat home	.225	.100	.130	2.249	.025	.743	1.345
	PriceSensitivity10Modified	.018	.072	.018	.254	.800	.479	2.089
	PriceSensitivity20Modified	-.090	.091	-.088	-.990	.323	.317	3.159
	PriceSensitivity50Modified	.339	.088	.333	3.846	<.001	.333	3.001
	PriceSensitivity100Modified	.000	.073	.000	-.005	.996	.490	2.042
	OverallOtherprovider	.257	.097	.135	2.655	.008	.961	1.040

Logistic Regression

Case Processing Summary

Unweighted Cases[a]		N	Percent
Selected Cases	Included in Analysis	294	100.0
	Missing Cases	0	.0
	Total	294	100.0
Unselected Cases		0	.0
Total		294	100.0

a. If weight is in effect, see classification table for the total number of cases.

Dependent Variable Encoding

Original Value	Internal Value
Public charging infrastructure	0
Private charging infrastructure	1

Categorical Variables Codings

			Parameter coding	
		Frequency	(1)	(2)
DA	Young	86	.000	.000
	Middle age	160	1.000	.000
	Old	48	.000	1.000

Block 0: Beginning Block

Classification Table[a,b]

			Predicted		
			OverallChargingInfrastructurePreference		
	Observed		Public charging infrastructure	Private charging infrastructure	Percentage Correct
Step 0	OverallChargingInfrastructurePreference	Public charging infrastructure	0	138	.0
		Private charging infrastructure	0	156	100.0
	Overall Percentage				53.1

a. Constant is included in the model.

b. The cut value is .500

Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)
Step 0	Constant	.123	.117	1.101	1	.294	1.130

Variables not in the Equation

			Score	df	Sig.
Step 0	Variables	PublicProviderESBecars	7.381	1	.007
		PublicProviderCircleK	6.924	1	.009
		Chargingtimepreferenceat home	17.461	1	<.001
		PriceSensitivity10Modified	.926	1	.336
		PriceSensitivity20Modified	7.035	1	.008
		PriceSensitivity50Modified	33.805	1	<.001
		PriceSensitivity100Modified	13.825	1	<.001
		OverallOtherprovider	5.418	1	.020
	Overall Statistics		66.674	8	<.001

Block 1: Method = Forward Stepwise (Likelihood Ratio)

Omnibus Tests of Model Coefficients

		Chi-square	df	Sig.
Step 4	Step	7.909	1	.005
	Block	72.487	4	<.001
	Model	72.487	4	<.001

Model Summary

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
4	333.981[a]	.219	.292

a. Estimation terminated at iteration number 20 because maximum iterations has been reached. Final solution cannot be found.

Hosmer and Lemeshow Test

Step	Chi-square	df	Sig.
4	4.308	4	.366

Contingency Table for Hosmer and Lemeshow Test

		OverallChargingInfrastructurePreference = Public charging infrastructure		OverallChargingInfrastructurePreference = Private charging infrastructure		
		Observed	Expected	Observed	Expected	Total
Step 4	1	18	18.946	3	2.054	21
	2	54	54.981	27	26.019	81
	3	5	4.054	1	1.946	6
	4	36	34.752	40	41.248	76
	5	19	15.423	29	32.577	48
	6	6	9.845	56	52.155	62

Classification Table[a]

Observed			Predicted: OverallChargingInfrastructurePreference - Public charging infrastructure	Predicted: OverallChargingInfrastructurePreference - Private charging infrastructure	Percentage Correct
Step 4	OverallChargingInfrastructurePreference	Public charging infrastructure	77	61	55.8
		Private charging infrastructure	29	127	81.4
	Overall Percentage				69.4

a. The cut value is .500

Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B) Lower	95% C.I.for EXP(B) Upper
Step 4[a]	PublicProviderESBecars	-1.015	.270	14.083	1	<.001	.363	.213	.616
	Chargingtimepreferenceathome	2.385	.591	16.300	1	<.001	10.862	3.412	34.580
	PriceSensitivity50Modified	1.472	.279	27.752	1	<.001	4.356	2.520	7.531
	OverallOtherprovider	21.232	15712.572	.000	1	.999	1663815260.1	.000	.
	Constant	-2.208	.580	14.498	1	<.001	.110		

a. Variable(s) entered on step 4: OverallOtherprovider.

Variables not in the Equation

			Score	df	Sig.
Step 4	Variables	PublicProviderCircleK	.922	1	.337
		PriceSensitivity10Modified	.453	1	.501
		PriceSensitivity20Modified	.034	1	.853
		PriceSensitivity100Modified	1.445	1	.229
	Overall Statistics		3.027	4	.553

Step Summary[a,b]

Step	Improvement Chi-square	Improvement df	Improvement Sig.	Model Chi-square	Model df	Model Sig.	Correct Class %	Variable
1	34.843	1	<.001	34.843	1	<.001	66.0%	IN: PriceSensitivity50Modified
2	17.489	1	<.001	52.332	2	<.001	67.3%	IN: Chargingtimepreferenceathome
3	12.246	1	<.001	64.578	3	<.001	68.7%	IN: PublicProviderESBecars
4	7.909	1	.005	72.487	4	<.001	69.4%	IN: OverallOtherprovider

a. No more variables can be deleted from or added to the current model.

b. End block: 1

Block 2: Method = Forward Stepwise (Likelihood Ratio)

Omnibus Tests of Model Coefficients

		Chi-square	df	Sig.
Step 1	Step	51.136	2	<.001
	Block	51.136	2	<.001
	Model	123.624	6	<.001

Model Summary

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	282.844[a]	.343	.458

a. Estimation terminated at iteration number 20 because maximum iterations has been reached. Final solution cannot be found.

Hosmer and Lemeshow Test

Step	Chi-square	df	Sig.
1	4.620	4	.329

Contingency Table for Hosmer and Lemeshow Test

		OverallChargingInfrastructurePreference = Public charging infrastructure		OverallChargingInfrastructurePreference = Private charging infrastructure		
		Observed	Expected	Observed	Expected	Total
Step 1	1	18	18.943	3	2.057	21
	2	54	55.128	25	23.872	79
	3	5	4.057	1	1.943	6
	4	36	34.633	40	41.367	76
	5	19	15.244	25	28.756	44
	6	6	9.995	62	58.005	68

Classification Table[a]

			Predicted		
			OverallChargingInfrastructurePreference		
	Observed		Public charging infrastructure	Private charging infrastructure	Percentage Correct
Step 1	OverallChargingInfrastructurePreference	Public charging infrastructure	103	35	74.6
		Private charging infrastructure	26	130	83.3
	Overall Percentage				79.3

a. The cut value is .500

Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B) Lower	Upper
Step 1[a]	PublicProviderESBecars	-1.233	.333	13.669	1	<.001	.291	.152	.560
	Chargingtimepreferenceat home	2.264	.701	10.431	1	.001	9.617	2.435	37.984
	PriceSensitivity50Modified	1.281	.308	17.344	1	<.001	3.601	1.970	6.580
	OverallOtherprovider	20.374	15936.366	.000	1	.999	705428895.34	.000	.
	DA			36.027	2	<.001			
	DA(1)	-1.128	.386	8.557	1	.003	.324	.152	.689
	DA(2)	-3.483	.583	35.638	1	<.001	.031	.010	.096
	Constant	-.746	.701	1.133	1	.287	.474		

a. Variable(s) entered on step 1: DA.

Variables not in the Equation

			Score	df	Sig.
Step 1	Variables	Income	.347	1	.556
		DrivenMileage	.430	1	.512
	Overall Statistics		.712	2	.700

Step Summary[a,b]

Step	Improvement Chi-square	df	Sig.	Model Chi-square	df	Sig.	Correct Class %	Variable
1	51.136	2	<.001	51.136	2	<.001	79.3%	IN: DA

a. No more variables can be deleted from or added to the current model.

b. End block: 2

Appendix H:

Model 3

Linearity:

Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)
Step 1[a]	Gender	.173	.199	.755	1	.385	1.189
	Education	-.080	.218	.133	1	.715	.923
	Employment	-.160	.199	.642	1	.423	.852
	Income	-.266	.590	.203	1	.652	.766
	DrivenMileage	-.005	.126	.002	1	.966	.995
	PriceSensitivityShifttonon peakhours	-.090	.364	.062	1	.804	.914
	Income by LN_Income	-.206	.333	.383	1	.536	.814
	Constant	1.992	.879	5.139	1	.023	7.334

Multicollinearity

Coefficients[a]

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.	Collinearity Statistics Tolerance	Collinearity Statistics VIF
1	(Constant)	.931	.071		13.203	<.001		
	Gender	.011	.034	.018	.319	.750	.981	1.019
	Education	-.020	.031	-.039	-.632	.528	.848	1.180
	Employment	-.037	.033	-.066	-1.128	.260	.933	1.072
	Income	-.093	.021	-.268	-4.470	<.001	.902	1.109
	DrivenMileage	.001	.022	.003	.050	.960	.961	1.041
	PriceSensitivityShifttonopeakhours	-.042	.059	-.044	-.711	.477	.839	1.191

Logistic Regression

Case Processing Summary

Unweighted Cases[a]		N	Percent
Selected Cases	Included in Analysis	290	98.6
	Missing Cases	4	1.4
	Total	294	100.0
Unselected Cases		0	.0
Total		294	100.0

a. If weight is in effect, see classification table for the total number of cases.

Dependent Variable Encoding

Original Value	Internal Value
Affected	0
Not affected	1

Categorical Variables Codings

		Frequency	Parameter coding (1)	(2)	(3)
Education	Secondary school and below	115	.000	.000	.000
	Bachelor's degree	74	1.000	.000	.000
	Master's degree	98	.000	1.000	.000
	Ph.D. degree and above	3	.000	.000	1.000
Employment	Seeking Opportunities	185	.000	.000	
	Employed	47	1.000	.000	
	Retired	58	.000	1.000	
Gender	Male	143	.000	.000	
	Female	96	1.000	.000	
	Other	51	.000	1.000	

Block 0: Beginning Block

Classification Table[a,b]

Observed			Predicted PriceSensitivityOverallpriceincreaseimpact: Affected	Not affected	Percentage Correct
Step 0	PriceSensitivityOverallpriceincreaseimpact	Affected	0	80	.0
		Not affected	0	210	100.0
	Overall Percentage				72.4

a. Constant is included in the model.

b. The cut value is .500

Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)
Step 0	Constant	.965	.131	53.956	1	<.001	2.625

Variables not in the Equation

			Score	df	Sig.
Step 0	Variables	PriceSensitivityShifttononpeakhours	8.625	1	.003
		DrivenMileage	.179	1	.673
		Gender	7.801	2	.020
		Gender(1)	7.009	1	.008
		Gender(2)	2.896	1	.089
		Education	20.557	3	<.001
		Education(1)	19.323	1	<.001
		Education(2)	7.769	1	.005
		Education(3)	.050	1	.823
		Employment	5.326	2	.070
		Employment(1)	.491	1	.483
		Employment(2)	5.286	1	.021
	Overall Statistics		42.264	9	<.001

Block 1: Method = Forward Stepwise (Likelihood Ratio)

Omnibus Tests of Model Coefficients

		Chi-square	df	Sig.
Step 4	Step	7.078	2	.029
	Block	43.838	8	<.001
	Model	43.838	8	<.001

Model Summary

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
4	297.783[a]	.140	.203

a. Estimation terminated at iteration number 5 because parameter estimates changed by less than .001.

Hosmer and Lemeshow Test

Step	Chi-square	df	Sig.
4	9.524	7	.217

Contingency Table for Hosmer and Lemeshow Test

		PriceSensitivityOverallpriceincreaseimpact = Affected		PriceSensitivityOverallpriceincreaseimpact = Not affected		
		Observed	Expected	Observed	Expected	Total
Step 4	1	15	16.026	11	9.974	26
	2	24	18.551	17	22.449	41
	3	14	13.207	23	23.793	37
	4	5	7.721	24	21.279	29
	5	6	7.270	27	25.730	33
	6	8	8.335	37	36.665	45
	7	1	3.771	23	20.229	24
	8	6	3.468	29	31.532	35
	9	1	1.653	19	18.347	20

Classification Table[a]

	Observed		Predicted: PriceSensitivityOverallpriceincreaseimpact Affected	Predicted: PriceSensitivityOverallpriceincreaseimpact Not affected	Percentage Correct
Step 4	PriceSensitivityOverallpriceincreaseimpact	Affected	13	67	16.3
		Not affected	10	200	95.2
	Overall Percentage				73.4

a. The cut value is .500

Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B) Lower	95% C.I.for EXP(B) Upper
Step 4[a]	PriceSensitivityShifttononpeakhours	-1.095	.351	9.715	1	.002	.335	.168	.666
	Gender			7.551	2	.023			
	Gender(1)	.765	.352	4.716	1	.030	2.150	1.077	4.289
	Gender(2)	-.374	.375	.998	1	.318	.688	.330	1.433
	Education			22.323	3	<.001			
	Education(1)	-1.692	.387	19.158	1	<.001	.184	.086	.393
	Education(2)	-.472	.455	1.080	1	.299	.623	.256	1.520
	Education(3)	-.401	1.324	.092	1	.762	.670	.050	8.971
	Employment			7.063	2	.029			
	Employment(1)	-.162	.445	.132	1	.716	.851	.355	2.037
	Employment(2)	-.979	.368	7.060	1	.008	.376	.183	.774
	Constant	2.085	.397	27.645	1	<.001	8.044		

a. Variable(s) entered on step 4: Employment.

Variables not in the Equation

			Score	df	Sig.
Step 4	Variables	DrivenMileage	.022	1	.881
	Overall Statistics		.022	1	.881

Step Summary[a,b]

Step	Improvement			Model			Correct Class %	Variable
	Chi-square	df	Sig.	Chi-square	df	Sig.		
1	19.661	3	<.001	19.661	3	<.001	72.4%	IN: Education
2	8.126	1	.004	27.788	4	<.001	69.7%	IN: PriceSensitivity Shifttononpeak hours
3	8.973	2	.011	36.761	6	<.001	71.7%	IN: Gender
4	7.078	2	.029	43.838	8	<.001	73.4%	IN: Employment

a. No more variables can be deleted from or added to the current model.

b. End block: 1

Block 2: Method = Forward Stepwise (Likelihood Ratio)

Omnibus Tests of Model Coefficients

		Chi-square	df	Sig.
Step 1	Step	21.397	1	<.001
	Block	21.397	1	<.001
	Model	65.235	9	<.001

Model Summary

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	276.386[a]	.201	.291

a. Estimation terminated at iteration number 5 because parameter estimates changed by less than .001.

Hosmer and Lemeshow Test

Step	Chi-square	df	Sig.
1	15.133	8	.057

Contingency Table for Hosmer and Lemeshow Test

		PriceSensitivityOverallpriceincreaseimpact = Affected		PriceSensitivityOverallpriceincreaseimpact = Not affected		
		Observed	Expected	Observed	Expected	Total
Step 1	1	22	19.679	10	12.321	32
	2	15	13.906	14	15.094	29
	3	13	10.504	14	16.496	27
	4	9	11.357	30	27.643	39
	5	3	7.773	29	24.227	32
	6	3	4.419	20	18.581	23
	7	7	4.566	21	23.434	28
	8	1	4.088	31	27.912	32
	9	6	2.824	26	29.176	32
	10	1	.884	15	15.116	16

Classification Table[a]

Observed			Predicted: PriceSensitivityOverallpriceincreaseimpact: Affected	Predicted: PriceSensitivityOverallpriceincreaseimpact: Not affected	Percentage Correct
Step 1	PriceSensitivityOverallpriceincreaseimpact	Affected	42	38	52.5
		Not affected	15	195	92.9
	Overall Percentage				81.7

a. The cut value is .500

Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B) Lower	95% C.I.for EXP(B) Upper
Step 1[a]	PriceSensitivityShifttonopeakhours	-1.416	.399	12.567	1	<.001	.243	.111	.531
	Gender			3.607	2	.165			
	Gender(1)	.580	.362	2.565	1	.109	1.787	.878	3.636
	Gender(2)	-.209	.397	.276	1	.599	.812	.373	1.766
	Education			22.292	3	<.001			
	Education(1)	-2.056	.451	20.814	1	<.001	.128	.053	.310
	Education(2)	-1.196	.541	4.897	1	.027	.302	.105	.872
	Education(3)	-.523	1.298	.162	1	.687	.593	.047	7.548
	Employment			5.022	2	.081			
	Employment(1)	-.357	.456	.614	1	.433	.700	.286	1.709
	Employment(2)	-.881	.402	4.805	1	.028	.414	.188	.911
	Income	-.614	.143	18.439	1	<.001	.541	.409	.716
	Constant	3.813	.666	32.809	1	<.001	45.281		

a. Variable(s) entered on step 1: Income.

Step Summary[a,b]

Step	Improvement Chi-square	Improvement df	Improvement Sig.	Model Chi-square	Model df	Model Sig.	Correct Class %	Variable
1	21.397	1	<.001	21.397	1	<.001	81.7%	IN: Income

a. No more variables can be deleted from or added to the current model.

b. End block: 2

APPENDIX I

Survey: Consumer Satisfaction for Electric Vehicle Charging Infrastructure in Ireland

Greetings!

This page provides you with detailed information regarding the present study. Please read it fully before completing the questionnaire.

Who is conducting this study?

I am Gauri Jaykumar Patil, a student of MSc Management from the National College of Ireland (NCI). I am completing this study as part of the fulfillment of my dissertation work.

This study is mentored by Associate Professor Paul Hanly, Ph.D., Vice Dean of Postgraduate Studies, and Research in the NCI.

What is the purpose of this study?

This research focuses on the impact of Consumer Satisfaction and Preferences for Electric Vehicle Charging Infrastructure in Ireland

Do I have to take part?

Participation is voluntary. You can opt to withdraw from the survey at any given point and your responses will not be recorded. If you are happy to complete this questionnaire, all responses will remain anonymous and confidential. The data will be stored securely in a password-protected file and will be accessed by my thesis guide and myself.

What does the questionnaire involve?

The questionnaire is divided into a few sections which capture general information, your experience of using the Electric Vehicle Charging Infrastructure, and your overall satisfaction level. The survey will not take more than 10 minutes to complete.

What will happen to the results of the research study?

All aggregated data will be analyzed and discussed in the thesis. Individual responses will not be presented. It will be then deleted after the timeframe, which is a part of the NCI guidelines.

For further queries kindly feel free to email me at gauripatil26apr@gmail.com or x21143447@student.ncirl.ie

Thank You!

gauripatil26apr@gmail.com Switch account

Not shared

* Indicates required question

This questionnaire has been sent out by Gauri Jaykumar Patil as a part of the fulfillment of her dissertation study. The data collected will be used to analyze Consumer Satisfaction and preferences for Electric Vehicle Charging Infrastructure in Ireland *

Do you agree to take part in this study?

- ◯ I am happy to take part in this study
- ◯ I do not want to take part in this study

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* Indicates required question

This section contains questions related to your general demographic information:

Where do you live in? *

- Dublin
- Cork
- Limerick
- Galway
- Waterford
- Kilkenny
- Other: ____

This question is voluntary.

What gender do you identify as?

- Male
- Female
- Gay or Lesbian
- Bisexual
- Other sexual orientationn 5
- Prefer not to say

How old are you? *

- 18–30
- 31–40
- 41–50
- 51–60
- Over 60

What is the highest degree or level of education you have completed? *

- Secondary school and below
- Bachelor's degree
- Master's degree
- Ph.D. degree and above

What is your current employment status? *

- Employed Full-Time
- Employed Part-Time
- Seeking opportunities
- Self employed
- Retired
- Prefer not to say
- Other: ____

What is your annual personal income? *

- 20,000 Euro and below
- 20,000–40,000 Euro
- 40,000-60,000 Euro
- 60,000–80,000 Euro
- 80,000–120,000 Euro
- 120,000 Euro and above

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* Indicates required question

This section contains questions related to electric vehicle ownership and usage, if you own an electric vehicle then please choose the options according to your car usage.

Have you or your family bought an electric vehicle? *

- ◯ Yes
- ◯ No

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This next question is to analyze your travel attributes

What is the annual driven mileage of electric vehicles for you or your family if you are not an electric vehicle user now then how much do you estimate to drive as per your requirement after you purchase an electric vehicle? *

- ◯ 10,000 km and below
- ◯ 10,000–15,000 km
- ◯ 15,000–20,000 km
- ◯ 20,000–25,000 km
- ◯ 25,000–30,000 km
- ◯ 30,000–35,000 km

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* Indicates required question

This section contains questions regarding your preferences for electric vehicle charging infrastructure.

Do you prefer to choose public or private charging infrastructure? *

- ○ Public charging infrastructure
- ○ Private charging infrastructure
- ○ Both charging infrastructure

Which public service provider do you frequently use or plan to use to charge your electric vehicle? *

- ☐ ESB ecars
- ☐ EasyGo
- ☐ Circle K
- ☐ Applegreen
- ☐ Ionity
- ☐ Tesla
- ☐ Other: ______

What are the key determinants to choose the preferred charging infrastructure? kindly rank them on a scale of 1-5 where 1 is the most important and 5 is the least important to you. *

	Most Important 1	2	3	4	Least Important 5
Location of charging station	○	○	○	○	○
Charging cost	○	○	○	○	○
Wait line	○	○	○	○	○
Charging speed	○	○	○	○	○
Service quality	○	○	○	○	○
Compatible charging technology	○	○	○	○	○

When do you prefer to charge your electric vehicle at home or other private charging infrastructure? *

- ○ Daytime (6:01–18:00)
- ○ Night-time (18:01–6:00)

When do you prefer to charge your electric vehicle at public charging infrastructure? *

- ○ Daytime (6:01–18:00)
- ○ Night-time (18:01–6:00)

How long can you generally wait each time you charge the electric vehicle at public charging units such as workplaces, grocery places, shopping centers, or motorway stations? *

- ○ 1 hour and below
- ○ 1–2 hour
- ○ 2–3 hour
- ○ 3 hour and above
- ○ It varies

What is your attitude toward waiting in line while charging? *

- ○ Totally unacceptable
- ○ Occasionally acceptable
- ○ Not sure
- ○ Occasionally unacceptable
- ○ Totally acceptable

How far do you wish the nearest charging infrastructure to be from your home? *

- ○ 1 km and below
- ○ 1–2 km
- ○ 2–3 km
- ○ 3 km and above

Please rank the following charging infrastructure locations where you want to charge your electric vehicle in order of 1 being the most preferred location and 5 being the least preferred location to you. *

	Most Important 1	2	3	4	Least Important 5
Residential area	○	○	○	○	○
Park	○	○	○	○	○
Shopping center	○	○	○	○	○
Street	○	○	○	○	○
Grocery place	○	○	○	○	○
School	○	○	○	○	○
Workplace area	○	○	○	○	○

If the property management company or power operator supports it, do you want to install private charging facilities? *

- ○ I extremely don't want to do that
- ○ I don't want to do that
- ○ I don't care about that
- ○ I want to do that
- ○ I extremely want to do that
- ○ I have already installed

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* Indicates required question

This section concentrates on sensitivity to price changes for charging your electric vehicles.

How much of your electric vehicle usage will be reduced when the charging prices are increased by 10%? *

- 2%
- 5%
- 10%
- 20%
- 30%
- 40%
- 50%
- > 50%

How much of your electric vehicle usage will be reduced when the charging prices are increased by 25%? *

- 2%
- 5%
- 10%
- 20%
- 30%
- 40%
- 50%
- > 50%

How much of your electric vehicle usage will be reduced when the charging prices are increased by 50%? *

- 2%
- 5%
- 10%
- 20%
- 30%
- 40%
- 50%
- > 50%

How much of your electric vehicle usage will be reduced when the charging prices are increased by 100%? *

- 2%
- 5%
- 10%
- 20%
- 30%
- 40%
- 50%
- > 50%

Does an increase in electricity tariff during peak hours shift your electric vehicle charging to non-peak hours at home? *

- Yes
- No

Does an increase in overall charging cost affect your decision of purchasing an electric vehicle? *

- Extremely affected
- Little affected
- Not sure
- Not affected
- Do not care

What do you think is a more reasonable charging fee for private charging facilities? *

- Significantly lower than the charging fee of public charging infrastructure
- Slightly lower than the charging fee of public charging infrastructure
- Equal to the charging fee of public charging infrastructure
- Slightly higher than the charging fee of public charging infrastructure
- Significantly higher than the charging fee of public charging infrastructure

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Survey: Consumer Satisfaction for Electric Vehicle Charging Infrastructure in Ireland

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* Indicates required question

This section contains questions regarding your satisfaction with electric vehicle charging infrastructure

Are you satisfied with the current charging infrastructure, based on your experience and feedback from your family and friends? *

	Very dissatisfied	Dissatisfied	Not sure	Satisfied	Very satisfied
Satisfaction	○	○	○	○	○

What are the key factors for your satisfaction with the current charging infrastructure? Please rank them on a scale of 1-5 where 1 is the most important and 5 is the least important to you. *

	Most Important 1	2	3	4	Least Important 5
Good service	○	○	○	○	○
Well known service provider	○	○	○	○	○
Up-to-date technology	○	○	○	○	○
Convinient operating hours	○	○	○	○	○
Close proximity	○	○	○	○	○
Needs are fulfilled	○	○	○	○	○
Queue waiting time	○	○	○	○	○

What are the key factors for your dissatisfaction with the current charging infrastructure? kindly rank them on a scale of 1-5 where 1 is the most important and 5 is the least important to you. *

	Most Important 1	2	3	4	Least Important 5
Charging cost	○	○	○	○	○
Unavalibility of infrastructure to install home charging unit	○	○	○	○	○
limited public charging infrastructure	○	○	○	○	○
Range anxiety	○	○	○	○	○
Charging time	○	○	○	○	○
Congestion at charging station	○	○	○	○	○
Location of charging station	○	○	○	○	○

Are you satisfied with your current preferred charging infrastructure options? *

	Very dissatisfied	Dissatisfied	Not sure	Satisfied	Very satisfied
Satisfaction	○	○	○	○	○

Are you satisfied with the total number of available charging station points in your area or your most frequently used route? *

	Very dissatisfied	Dissatisfied	Not sure	Satisfied	Very satisfied
Satisfaction	○	○	○	○	○

Are you satisfied with the current grants and incentives provided by the Ireland government for charging infrastructure? *

	Very dissatisfied	Dissatisfied	Not sure	Satisfied	Very satisfied
Satisfaction	○	○	○	○	○

Do you think the overall state of your city's charging infrastructure will affect your willingness to buy an electric vehicle? *

	Not affected	Little Affected	Not sure	Affected	Greatly affected
Willingness to Buy	○	○	○	○	○

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