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**Master of Science (MSc) by Research Thesis on**

# "Driving the Switch: Promoting the Benefits of Electric Vehicle Usage"

**By**

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## Declaration

This thesis is submitted to the Department of Entrepreneurship, Strategy, and Innovation and the Board of Examiners of Lancaster University in partial fulfilment of the requirements for the degree of Master of Science by Research in Innovation. I hereby attest that this thesis is entirely my own work (some ideas being developed through mutual discussions with my supervisors, Dr. Trivikram Dokka, Dr. Ivan Svetunkov and Prof. Stefanos Mouzas), and has not been submitted in substantially the same form for the award of a higher degree elsewhere. All sources of information have been fully referenced.

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## Abstract

Electric Vehicles have an important part to play in reducing carbon emissions.

The aim of this research is to, evaluate the adoption of electric vehicles, specifically to investigate the understanding and brand awareness of public chargepoint operators, facilities and services.. This applied study is focussed on the North West of England, in collaboration with the research's industry partner, Charge My Street. The initial objective of this research was to identify local barriers stopping individuals from making the switch to Electric Vehicles (EV), this was achieved through two online focus groups. As a result of the focus groups, two further objectives were developed: Identify changes that need to be made by public chargepoint operators to encourage prospective Electric Vehicle (EV) drivers to make the switch. And to assess the awareness of prospective and current electric vehicle (EV) drivers regarding services provided by public chargepoint operators (CPO)., these were achieved with an online survey. Each objective was then further examined in the discussion chapter using a combination of academic and contextual literature, as well as data gathered from the focus groups and the survey. Overall the data discovered achieved the objectives of this research, allowing this projects industry partner, Charge My Street, as well as chargepoint operators to understand how to promote and encourage the use of electric vehicles and public charging, to lower carbon emissions in the North West of England.

Chapter 1 introduced the thesis, Chapter 2 reviews existing theoretical literature regarding numerous topics such as Consumer Behaviour, Attitudes and Perceptions, Barriers to Entry and Adoption of Innovation in Technology, Social Network Analysis, Prospect Theory, and Brand Awareness as well as providing context regarding the electric vehicle (EV) industry.. Chapter 3 discusses the methods needed to carry out the research methods.Chapter 5 presents the findings, which are then critically analysed in Chapter 6. Finally, Chapter 7 summarises the thesis and provides recommendations for further research.

**Keywords**: Electric Vehicles, Technology Adoption, Charge Point Operator, Barriers To Adoption, Consumer Behaviour, Brand Awareness.

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# 1.0 Introduction

After several decades of incremental change, the private transport sector is seeing a step-change from the internal combustion engine (ICE) to electric powered vehicles (EV). This has created an entirely new sector of vehicle manufacturing and the charging infrastructure needed to support their expansion. The pace of change is rapid and has left major manufacturers behind and consumers ill informed as to the choices they now have. As a new sector, multiple competing lines of technology are being offered with some inconsistencies in standards, further adding to consumer confusion. From a marketing perspective, this follows pathways of technological adoption, with new opportunities emerging as brands become established. The thesis aims to understand the best practice for promotion and encouraging the use of electric vehicles and public charging stations as a contribution to lowering carbon emissions.

The shift to electric vehicles (EV) derives the recognition of anthropogenic climate changes now occurring across the globe, with sea levels rising, weather patterns shifting, and temperatures increasing. Modifications need to be made across different sectors to stop the detrimental changes to the planet (IPCC, 2021). According to the Department for Business, Energy and Industrial Strategy the transport sector emitted 28% of the total UK emissions in 2018 (Department for Business, 2019). To combat emissions from fossil-fuel-powered vehicles, a new eco-friendly mode of transportation must be used to lower these emissions. EVs are an alternative to most, if not all functions of Internal Combustion Engine (ICE) vehicles, offering financial savings and a quality driving experience, as well as $CO_2$ emission savings with every mile driven. However, there is still some hesitancy from the general public about making the switch from their current ICE vehicle to an EV.

The aim of this research is to, evaluate the adoption of electric vehicles, specifically to investigate the understanding and brand awareness of public chargepoint operators, facilities and services.. This applied study is focussed on the North West of England, in collaboration with the research's industry partner, Charge My Street.

The objectives of this research are the following.

1. Identify local barriers stopping individuals from making the switch to Electric Vehicles (EV).

2. Identify changes that need to be made by public chargepoint operators to encourage prospective Electric Vehicle (EV) drivers to make the switch.

3. Assess the awareness of prospective and current electric vehicle (EV) drivers regarding services provided by public chargepoint operators (CPO).

To deliver the objectives of this research academic literature was analysed and discussed to give critical context. The premise adopted was that established marketing models could be employed to better understand this new sector. A number of key areas of study were explored surrounding the adoption of new technologies such as consumer behaviour, attitudes and perceptions, barriers to entry and adoption of innovation in technology, social network analysis, prospect theory and brand awareness.

A number of models have been used to provide further context such as the Technology Acceptance Model (TAM) by (Davis, 1989), the theory of planned behaviour (Ajzen, 1991:182), framework of dynamics that drive technology adoption (Peng and Mu, 2011:133) and the brand knowledge pyramid (Keller, 2003). In using these established principles, it is hoped to give greater understanding of the electric vehicle sector and where it is likely to go in the next few years.This work was supported by and delivered for, an industry partner, Charge My Street, a community benefit society based in the north-west of England. Charge My Street installs community-owned fast chargers, allowing residents with no access to off-street parking the ability to charge their electric vehicles. This thesis was designed to benefit them as a business by getting a better understanding of current local barriers, how to encourage consumers to switch to electric vehicles, and assess the brand awareness of different public chargepoint operators, as well as themselves.

The research was structured based on the academic literature and data from this project's industry partner, Charge my Street. Two qualitative online focus groups were administered. The focus groups with local residents of the north west of England discovered three key themes: (1) Confusion of charging behaviour, (2) Uncertainty of public chargepoint providers, and (3) Local barriers to electric vehicle (EV) adoption.

Theme three, local barriers to electric vehicle adoption, was partitioned into three sub themes for further research: Price of electric vehicles, price of charging barriers and access to off-street parking barrier. Theme 1, is a perceived gap in the literature relating to EV, this inspired the creation of a survey. The survey tested the knowledge of current and prospective electric vehicle drivers about public chargepoint operators (CPO) and how they would prefer to receive educational information, reducing the confusion changes and increasing the chances of prospective electric vehicle drivers making the switch.

Contextual information regarding electric vehicles (EV) is provided in Chapter 2. The chapter explored several key areas of research about EV, a background to EV, take up of EV in the United Kingdom, charging infrastructure in the United Kingdom, barriers of switching to EV and Electric Vehicles lowering carbon. Chapter 5 presents all key data from the two focus groups as well as the survey. Thematic analysis was used to analyse the focus groups due to its flexible and accessible approach when analysing qualitative data (Braun and Clarke, 2006: 78). Graphs, tables, and charts were presented from the survey in Chapter 5, using cross-tabulation. Current and prospective electric vehicle drivers were analysed separately to achieve the aim and objectives of this research.

Chapter 6 analyses the results of the research and uses the theoretical and contextual literature presented to address the objectives of this research. Each theme and sub-themes discovered in the two focus groups were analysed and discussed using the literature, as well as key findings from the data collected in the survey.

The final chapter concludes the research, returning to the aim and objectives of the research. The chapter features recommendations for further research, as well as proposals for how chargepoint operators and the government can promote and encourage the use of electric vehicles and public charging, to lower carbon emissions in the North West of England.

# 2.0 Literature Review

## 2.1.1 **Literature Review Introduction**

This chapter aims to understand the theory behind the adoption of new technology, or in the case of this research, how the switch to Electric Vehicles happens. To gain a broad understanding of technology adoption, this review will analyse six areas of importance: Consumer Behaviour, Attitudes and Perceptions, Barriers to Entry and Adoption of Innovation in Technology, Social Network Analysis, Prospect Theory, and Brand Awareness. As the focus of this research is to investigate the understanding of public charging facilities in the North West of England for the benefit of the research's industry partner Charge My Street, this chapter will give context as well as analyse four main areas of importance: a background to electric vehicles, take up of electric vehicles in the United Kingdom, electric vehicle charging infrastructure, and carbon emissions savings of making the switch.

## 2.1.2 **Consumer Behaviour**

Consumer behaviour is the decision-making process a consumer makes when parting with their time, money, and/or effort (Jose, 2017). Furthermore, consumer behaviour also encompasses decision making and physical activity of the evaluation, usage and disposing of a good or service (Khan, 2006). What status your product or service holds in the mind of the consumer, depends on how much time, money, and effort they are willing to part with, for the product or service. However, consumer behaviour is not simply the consumer's views of a company, there is a multitude of factors that influence the consumer to invest their time, money, and/or effort (Kotler and Keller, 2006). This review seeks to identify these generic decision factors while recognising the context of electric vehicle adoption.

Factors such as social and cultural background, age, family cycle, attitudes, beliefs, values, motivation, personality, social class all have an impact on behaviour (Khan, 2006). Further research suggests that social and cultural background has a profound effect on consumer behaviour; also differences in geographic location contribute to success in certain domestic or international markets, requiring different marketing strategies to be developed for different regions (Ng and Lee, 2015). Consumer behaviours can also change depending on price and

technological complexity. These two variables often encourage the consumer to complete a search and evaluation process of product or service (Proctor, 2000).

Yet, as society has increasingly adopted digital technology consumer behaviour has changed; consumers are now allowed more time to make informed decisions about the brand and the product or service they provide due to increased information available via the internet (Grewal *et al.*, 2004; Rose *et al.*, 2011).

### 2.1.3 **Consumer Behaviour Process**

Consumer behaviour is a process not just the exchange of money for goods or services. It includes how a consumer has been influenced before a potential purchase, during the acquisition and finally after completing a purchase (McCracken, 1986; Solomon *et al.*, 2016). The adoption of electric vehicle technology will follow this pathway and the concept helps frame this study. Solomon *et al.*, (2016) conceptualise the consumption process into three stages: Pre-Purchase Issues, Purchase Issues, and Post-Purchase Issues. In these stages, the perspective of the consumer is analysed to understand how their behaviour assists in the purchase process.

In the pre-purchase stage, the consumer is seeking information regarding the product or service; this can be information regarding the product or alternative products (Beatty and Elizabeth Ferrell, 1998; Baumeister, 2002; Ozer and Gultekin, 2015).In this stage, the consumer forms their opinion about the product or service and the company providing it, on occasion the consumer can make a quick impulsive decision perhaps using their social network to make an informed decision. This decisive choice making is based on the consumer knowing they want that certain item without trying to discover any alternates (Yarrow, 2014). On the other hand, the consumer can learn more about similar products and services; here, the attitudes of the consumer are formed, making them to change their behaviour.

During the purchase process, the most important issue is the experience the consumer is having; if the consumer believes the process is unpleasant or stressful, they may stop their decision-making process and seek alternative products or services (Solomon *et al.*, 2016).

The post-purchase issues consumers may face are arguably the most important as the consumer makes a better-informed decision on whether their purchase suits their needs. If the post purchase process is a success the consumer may be inclined to repeat purchase or explore other services, the company provides.

The attitude the consumer forms is then passed to others in their network, influencing others and affecting their purchase decisions (Santos and Boote, 2003; Harrison and Shaw, 2004). When purchasing high value items such as electric vehicles, consumers will rely heavily on networks and peer advocacy rather than impulsive reactions.

### 2.1.4 **Consumer Behaviour towards New Technology**

New technology has an influence on the social characteristics of each generation, with digitalisation being the dominant driver of change. Consumers now take digital technology for granted, leading to higher expectations of a product's performance (Paspalakis, 2018). Consumers also demand innovation from new technology, the turnover rate of redundant technology is high, and the consumer craves new products and services more than ever (Kaczorowska-Spychalska, 2018). Yarrow (2014:16) states the desire for everything 'new' is due to the emergence of social media and review sites, allowing consumers to discover what others are thinking about new products and services encouraging them to make influenced immediate decisions and purchases. Digital technology influences our day to day lives, it determines our attitudes, preferences and decisions throughout the day, but particularly as consumers (Kaczorowska-Spychalska, 2018). It has also generated expectations for the performance of the technology and a drive to innovate. E-Commerce has allowed the consumer to control their purchase behaviour. They are able to decide when and where they acquire further information about the product or service, prior to purchase (Jose, 2017).

To understand the consumers' behaviour towards new technology, a Technological Acceptance Model (TAM), proposed by Davis (1989) can be used to understand the perceived usefulness, perceived ease of use, and attitude towards using the technology. TAM has been proven to be a useful theoretical model in understanding and explaining behaviour of consumers in different advances of technology (Legris *et al.*, 2003) and can be applied to the electric vehicle sector. Although originally designed to understand colleague attitudes towards new technology in the workplace, the measurement of experience and behaviour can be applied to today's technological advances. TAM (Davis, 1989), suggests that when individuals are presented with a new technology, they are influenced by a number of factors that influence their decisions leading to them using it or not (Figure 1). Davis (1989) originally defined perceived usefulness (PU) as the individual perceiving if it would be useful in the workplace, however, it can be used to analyse if the individual believes it will be useful for accomplishing what they want to do. Perceived ease-of-use (PEOU), Davis (1989) initially illustrated this stage would understand the individual's thoughts on how easily they could use the technology, if they felt the technology was complicated their attitudes would be negative. In the last two decades the market has broadened beyond the technological literate and the demand for a product to be instantly usable has increased. PU and PEOU form the individual's attitude toward technology, forming a behavioural intention that leads to the execution of his or her actual behaviour, whether or not he will use the technology (Davis, 1989).

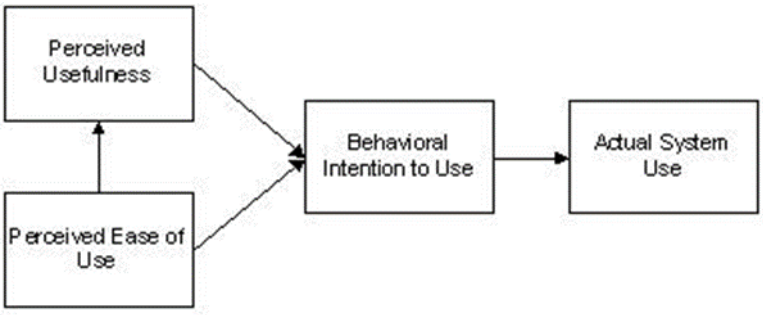



*Figure 1:The Technology Acceptance Model (TAM) Davis (1989)*

There are many positives to the model, as it helps to understand an individual's behaviour towards a technology. The TAM model can identify evidence of enjoyment that consumers may experience when using a technology (van der Heijden *et al.*, 2003).

However, due to the model is in part inadequate as it does not consider social influences or different conditions that can influence consumer's behaviour (Napitupulu, 2017; Torres and Gerhart, 2019). Further research argues that the model, due to its simplicity, is not robust enough to analyse the consumers behaviour as it does not explain the individuals buying, accepting, or rejecting a technology (Alam Kazmi, 2015).

As discussed, there is a magnitude of factors influencing consumer behaviour, this is a limitation of the TAM model as its linear style neglects any interpersonal influence such as word-of-mouth or e-word of mouth (Ajibade, 2018). For example, the influence of friends, family, or colleagues through social pressure is extremely important in newly emerging technology sectors (Ang *et al.*, 2015; Shan and King, 2015). Consideration of the very rapid transition of digital technology from early adopters to mass markets, means that the digital skill base has changed fundamentally in short time frames.

To include external influences in the TAM model, the Unified Theory of Acceptance and Use of Technology (UTAUT) model has been designed to assess the likelihood of success of the introduction of new technology and the factors influencing consumers (Venkatesh *et al.*, 2003)(Figure 2). The model is different from the original TAM, as it removes the 'attitude towards using technology', because it was discovered that there was no statistical determinant of behavioural intention (Venkatesh et al., 2003). Further alteration of the model is the addition of three determinants: performance expectancy, effort expectancy, and social influence. These factors are added to gather a further understanding of the behaviour of the individual, which is then intercepted by the mediators that affect usage of technology, gender, age, experience, and voluntariness of use. According to Chao, (2019) the effort expectancy (EE) has the most significant influence on behavioural intention (BI) in the UTAUT model in new technology, if the consumer believes they need to exert too much effort for little reward, they are less likely to pursue the behavioural intention.

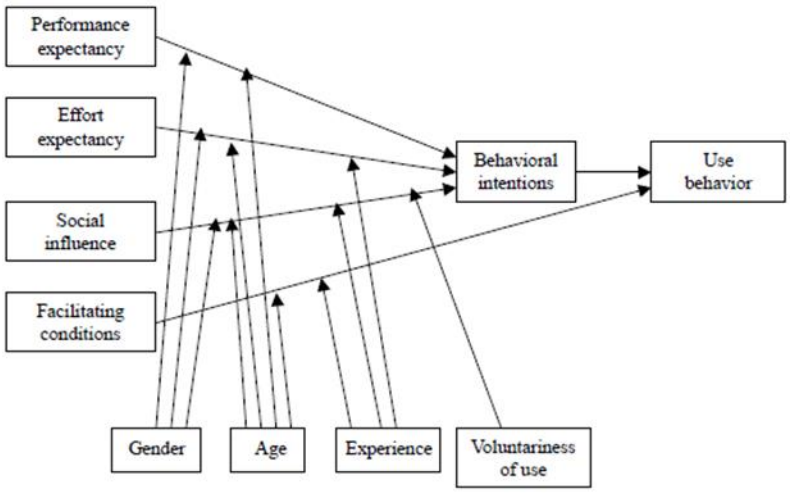



*Figure 2: The Unified Theory of Acceptance and Use of Technology (UTAUT) Venkatesh et al., (2003)*

Baron *et al.*, (2006) developed a further adaption of the UTAUT model, encompasses consumer behaviour towards the purchasing of technology products and services (Figure 3) relevant to electric vehicles. In this adaptation, 'perceived enjoyment' has been included instead of the individual using technology for work, this model encompasses the pleasure a consumer may have when purchasing a technological product or service. Voluntariness has been removed as it is not applicable to consumer technology acceptance, as the consumer actively pursues information on final purchase of the product or service. Finally, in Baron et al., (2006) model a collective of consumer traits has been added to understand what demographic factors affect the consumer. Factors such as age, gender, education, income, and personal characteristics all affect the decision-making process.

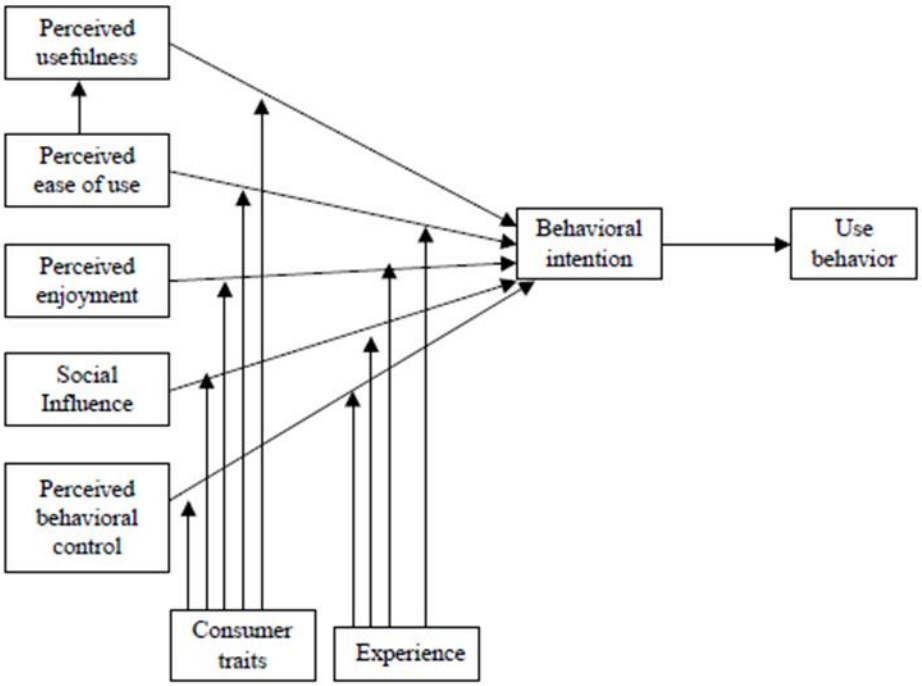



*Figure 3: Adaption of The Unified Theory of Acceptance and Use of Technology Baron et al., (2006)*

### 2.2.1 **Theory of Planned Behaviour**

To gain a better understanding of the consumers behavioural attitude and perception when making a purchase, the Theory of Planned Behaviour model can be used (Ajzen, 1991:182). According to the model, the main factors that form the consumers attitude and perception are knowledge, experience, subjective societal norms, and perceived impact of the behaviour (See Figure 4).

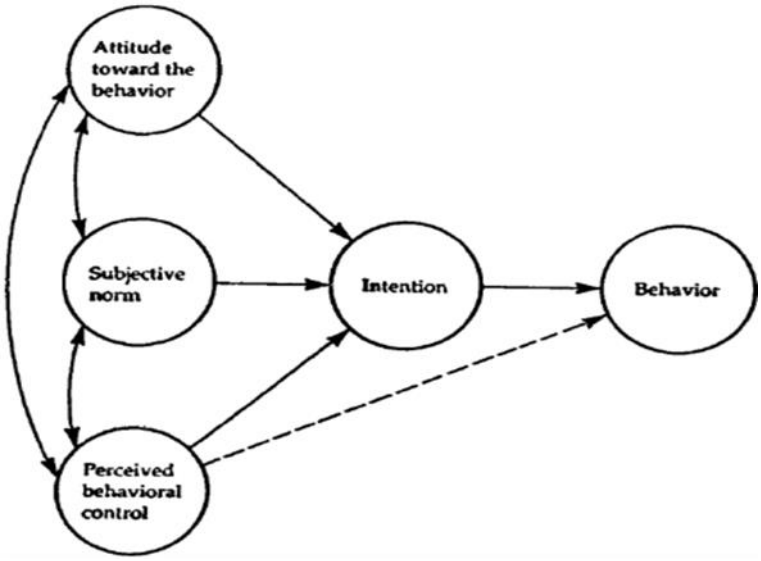



*Figure 4: The Theory of Planned Behaviour (Ajzen, 1991:182)*

The attitude consumer has towards behaviour is important. If the consumer sees the product or service as unfavourable, they will not proceed to continue with their purchase (White Baker *et al.*, 2007). As discussed in previous literature, attitudes are formed by previous experiences and knowledge of similar products and services; attitudes are also influenced by societal norms.

The subjective norm of society is integral in the theory of planned behaviour process, it shapes the perception the consumer has to them forming a final intention, (Ajzen, 1991). Norms toward electric vehicles are changing rapidly as pressure is exerted by government to encourage consumers to switch. However, according to Ajzen (1985) non-motivational factors can influence the final behavioural intention, such as time, money and cooperation of others. Modern research suggests the possible background factors that influence the consumer prior to the behaviour/purchase have greater influence than first suggested in the original model (Ajzen, 2011). Age, Gender, and exposure to media are more likely to influence the intentions and behaviour indirectly now in comparison to the original theory of 1991 (Ajzen, 2011). Due to its linear nature, the theory of planned behaviour does not consider the irrationality of human behaviour or the desire to work toward social rather than individual goals. However, Ajzen (2011) argues that it does not matter how the consumer reaches their chosen behaviour, all factors in the model all follow automatically and consistently from the consumers beliefs.

### 2.3.0 **Barriers to Entry and Adoption of Innovation in Technology**

How consumers respond to an innovation is of great interest to brands in all sectors, especially in technology (Hauser *et al.*, 2006). Rogers (2003) defines the innovation adoption process as 'the process through which an individual passes from first knowledge of an innovation, to forming an attitude toward the innovation, to a decision to adopt or reject, to implementation of the new idea, and to confirmation of this decision'.

Consumers are faced with new innovations in technology all the time which can lead to increased resistance to adopt (Lee and Colarelli O'Connor, 2003). According to Porter and Donthu (2006), there are two categories of barriers consumers face: functional barriers, and psychologic barriers.

Functional barriers are the direct consequences of the product or service deemed by the consumer, such as: usage, value, and risk. Psychological barriers are formed by prior beliefs or societal norms, such as: image of brand, social norm, social risk (Antioco and Kleijnen, 2010).

### 2.3.1 **Functional Barriers**

According to Claudy *et al.*, (2015) there are three main functional barriers consumers face when adopting a new technology: usage, value and risk barriers. Usage can be broken down into multiple sub-barriers which form the overall opinion of the consumer (Antioco and Kleijnen, 2010). These sub barriers are, complexity, compatibility and amenability, all of which are important in the adoption of electric vehicles. If a consumer perceives that a product or service is too complex to understand or use, they are less likely to adopt the technology (Rogers, 1995; Kleijnen *et al.*, 2007). In relation to technology, the consumer may have to apply high levels of cognitive effort due to the perceived complexities of the technologies, leading to a barrier of entry for the consumer (Kleijnen *et al.*, 2004p. :51). Lynch Jr and Ariely, (2000) discovered when the consumer processes easier to understand information. They will develop a positive attitude towards the product or service leading to adoption and eradication of barriers to entry.

The compatibility barrier is the consumer's belief that innovation is incompatible with their past or existing product or service and, by adopting the new innovation, it will make their previous item obsolete (Joachim *et al.*, 2018). Due to the reliance society has on technology, if a consumer perceives that the new innovation is incompatible with their lifestyle, they are less likely to adopt, especially if it takes up more time and effort to understand the new technology (Talke and Heidenreich, 2014). An example of this is the perceived range limitation of electric vehicles in relation to the consumer's lifestyle choices.

According to Ram, (1987) amenability is the most important characteristic for an innovative product or service to be successful. Joachim *et al.,* (2018) suggest that if the consumer does not believe the innovation has potential possibilities for modification to the consumer's requirements, the consumer will not adopt. Although, similar to compatibility, amenability takes into account the consumer being willing to fit the innovation into their lifestyle but only if it can be modified to do so.

If a consumer believes that the overall cost of an innovation is too high, the value barrier occurs, forming a negative connotation, leading to rejection of the product or service (Claudy *et al.*, 2015:p. 528). The value barrier also arises when the consumer compares an innovation with its predecessor or competitor, if they believe the product is not advantageous and holds high value, they will not adopt (Moore and Benbasat, 1991). In the context of this study electric vehicles will be being compared to internal combustion engine vehicles. Consumers evaluate their perceived performance-to-price ratio of an innovation, and if they perceive the value to be too high compared to the performance, they will not adopt (Molesworth and Suortti, 2002). Parasuraman and Grewal (2000) suggest, that low performance-to-price ratio is the most cited barrier when consumers adopt an innovative product or service.

### 2.3.2 **Psychological Barriers**

According to Talke and Heidenreich (2014), psychological barriers arise when a technology conflicts with social norms of a consumer and social risk, which can be detrimental to the image of the brand. There are three key psychological barriers consumers face when adopting to a new technology: Social Risk, Norm Barriers, and Image Barriers.

The social risk barrier a consumer faces is when they feel that their social group or people they aspire to be will not support their adoption of the technology (Kleijnen *et al.*, 2009). Rogers (2003) believes that peer observation is an important factor when adopting a new technology in the consumer's decision-making process. If the individual believes that there is no social support, they are less likely to adopt. This is critical in electric vehicles where benefits are shared between individuals and society at large.

Wiedmann *et al.*, (2011) state there is social stereotyping when a consumer adopts certain technologies, especially in the automotive sector. Gould and Golob, (1997) suggest that past research reveals automobiles, especially cars, project an image of their owners. Some individuals in the social group may view the adoption differently to others depending on what connotations come with the technology (Ligas, 2000). According to Bagozzi and Lee (2005) there are also social risks when adopting green technologies, consumers may refrain from adopting due to their peer group perceiving them as being too 'progressive'. However, it could be argued that since Bagozzi and Lee's (2005) research, perception has changed towards green technology due to the acceptance of a climate emergency in society (Shirsavar and Fashkhamy, 2013; Bukchin and Kerret, 2020). Overall, the higher the perceived social risk is for a consumer, the less likely they are to adopt due to strong societal pressures to conform (Wiedmann, 2011).

Norm barriers are similar but not the same as social risk. They focus on how the innovation may conflict with social groups: values, norms, and entrenched traditions. Social groups that could be affected by the innovation are family members, friends, work colleagues, etc. According to (Laukkanen, 2016) consumers have routines and habits that are significant to them, some consumers may have sentimental values towards a product or service they have used for an extended period of time, so a new technology could have a detrimental effect to the existing innovation. Norm barriers are similar to tradition barriers, such that behaviour conflicting to the tradition or norm of the social group can be detrimental to the take up of the innovation.

According to (Lian and Yen, 2013) consumers form opinions of a business or sector based on its image, if the consumer has an unfavourable impression based on factors such as country of origin, brand, or industry sector, an image-based barrier is formed against innovation. Naor *et al.*, (2015) believe that if more consumers adopt an innovation there will be an increase in word-of-mouth between consumers, lowering the psychological image barrier, and as more consumers adopt there will be fewer misconceptions and increased knowledge.

However, this is not always possible as functional barriers could take affect when adopting. Barriers such as value, complexity and amenability could occur. Furthermore, if more consumers adopt an innovation and they discuss it with their social groups, there is still no guarantee the product or service will be a success, instead poor brand image and increased negativity could develop towards the innovation.

### 2.4.0 **Social Network Analysis**

Social Network Analysis (SNA) investigates the connections and behaviour between individuals within social groups (Clifton and Webster, 2017). Chen (2009: p. 1400) states that information spreads via social networks through different communication methods, especially word of mouth. Yet, as the internet is so prevalent, the way we communicate has now changed, not least regarding technological products and developments. Evidence suggests these e-communication methods are important methods of education, for technology adoption (Godes and Mayzlin, 2004). As previously discussed by Lynch Jr and Ariely (2000), a lack of information can have a negative effect on technological adoption; however, social relationships can serve as a new information channel, allowing individuals to learn about new technology and increasing their likelihood to adopt (Beaman, 2012). Further research suggests one way of modelling diffusion (adoption) is assuming everyone in a social network has a threshold of acceptance towards technology (Domingos and Richardson, 2001).

To understand the effect that different networks have on an individual when adopting a new innovative technology, it is important to recognise the egocentric (personal) and the sociocentric (whole) network attributes (Clifton and Webster, 2017:p. 443). An egocentric network analysis requires the individual to provide a list of people across their personal network. This unlike sociocentric, can be across multiple bound networks, such as friends, family and also work colleagues (Clifton and Webster, 2017:p. 444). However, a drawback of an egocentric network is that that it is totally subjective and is based on the individual's perception, leading to a potential biased data set (Clifton *et al.*, 2007).

A sociocentric network explains a connection of relationships within a whole bounded network. It can comprise members of a family, work colleagues or community social groups (Clifton and Webster, 2017:433). However, Butts (2008) states that it can be difficult to include every relationship in certain groups such as families or communities, as they are not as definite due to the variety of different extensions leading to an incomplete whole network. It is likely that sociocentric networks will be increasingly important as environmental sustainability achieves orthodoxy in transport decisions.

Chen (2009:p. 1400) suggests that an individual is likely to become influenced by others in their network if a group of other individuals adopts a product or service, otherwise known as influence maximization. Influence maximisation is how successful a product or service will be adopted in a social network, through linear threshold (Talukder *et al.*, 2019:p. 105441). A threshold is a triggering value, or point of change, that decides a course of action, for example, the motivation to adopt to a new technology.

Talukder et al., (2019:p. 105442) suggest the threshold of social influence is a 'qualitative phenomenon' of human nature. Although social influence is qualitative, the probability of influence of others can be estimated through quantitative methods (Talukder et al., 2019:p. 105442). Peng and Mu, (2011:p. 133) discuss that there are six dynamic effects that drive technology adoption in social networks: Imitation, Similarity, Leadership, Lock-In, Recency and Size (Figure 5).

The imitation effect is where early adopters of a technology within a social network can trigger an immediate interest in a community or a social group (Peng and Mu: 2011:p. 135). Coleman *et al.*, (1966) suggest that potential adopters imitate their neighbours (someone close to them in social network e.g. friend or family) when thinking about adopting the technology, this can increase communication and interaction in the social network leading to potential adoption. Immediate interests in a social network occurs when the technology is viewed as positive in a community, leading to imitation by others (Shapiro and Varian, 1999).

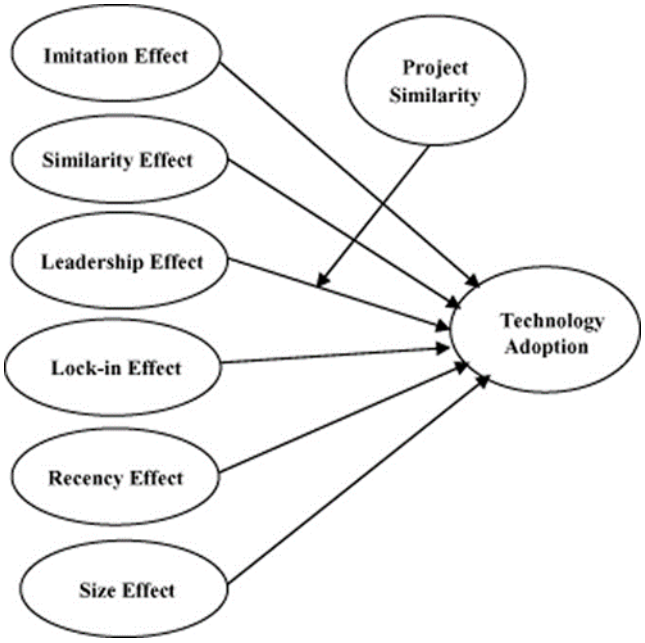



*Figure 5:Peng and Mu (2011:133) Framework of Dynamics that Drive Technology Adoption*

Peng and Mu (2011:135) believe individuals imitating others increases knowledge of a technology, lowering uncertainty and reduce the cost of decision making. Furthermore, as more information and knowledge regarding new technology is collected, it will be communicated in a social network leading to faster adoption of technology (Peng and Mu, 2011:135).

Peng and Mu (2011:135) hypothesise that the greater the similarity in an individual to its neighbour (someone who has adopted), is the faster the individual will adopt the same technology. The similarity effect is where individuals with similar personality traits or who belong to similar social groups leads to attraction, or in this case, influence another to adopt to a technology (Peng and Mu, 2011:135: Fu *et al.*, 2018). Similarity in social groups has an effect on individuals as it increases information learned, attitudes towards the technology and interactions they experience when adopting (McPherson *et al.*, 2001). Research suggests individuals prefer others who have similar attributes to them, such as demographic, attitudes, and interests, leading to further trust in the individual (Hitsch *et al.*, 2010; Martin *et al.*, 2013). Because of increased trust, an individual will receive information that will influence their behaviour; they do this by studying others who they perceive to be similar to themselves. If

they have matching ideologies, this could lead to adoption of a technology (Peng and Mu, 2011:p. 135).

### 2.5.0 **Prospect Theory**

The adoption of a new technology by an individual can be analysed using prospect theory. Prospect theory is a behavioural model that analyses how an individual decides between risk and uncertainty (Kahneman and Tversky, 1979). The model measures how individuals react on potential losses and potential gains driven by a specific situation or reference point (Levy, 1992): p.171). How risk-averse an individual is in determining how likely they are to proceed with a particular behaviour. Most individuals are risk averse to some degree when they are risking their money for a product or service (Levy, 1992: p.173) although the extent varies. According to Barberis (2013, p. 174), prospect theory has its limitations as it assumes only two non-zero outcomes. However, Kahneman and Tversky (1992) modified prospect theory, resolving this limitation and allowing analysis of risk takers, gambling on unfair odds. Personal wealth and the size of the purchase help define risk, if a consumer has a high wealth there is less of a financial risk, in comparison to a consumer with lower income. Perceived risk regarding electric vehicles will be high given the substantial purchase price relative to income levels.

Kahneman and Tversky (1992) suggested that individuals believe losses loom larger than gains, especially when an individual is adopting a new technology due to little knowledge of previous gains. (Klein and Deissenroth, 2017) advocate prospect theory that can be used to evaluate the gains and losses of green technologies such as solar photovoltaics or, in the case of this study, electric vehicles (EV). Klein and Deissenroth (2017) argue that individuals adopting a green technology are aware that initial high costs (losses) can be cancelled out by potential savings in the future (gains). Those with higher disposable wealth are more willing to take a longer perspective on the return on their investment.

### 2.6.0 **Brand Awareness**

Organisations of any sector strive to build a strong brand and this is especially so in new sectors as discussed in this study. By doing so, brands are able to receive a host of possible benefits, such as increased consumer loyalty, increased profits and possible brand-extension opportunities (Keller, 2003, p. 3). Brand awareness comprising visibility and understanding is one key component of creating a strong brand. Awareness includes whether the consumer can recall or recognize a brand and is directional, such that if exposed to the brand, the consumer will create good or bad memory nodes, which affect their behaviour towards that brand (Aaker, 2009; Keller *et al.*, 2011). According to (Macdonald and Sharp, 2000) brand awareness can affect the consumer's decision making when purchasing the brand's product or service, brands that consumers are more aware of are more likely to be included in the decision making of the consumer, otherwise known as heuristic purchasing.

### 2.6.1 **Measuring Brand Awareness**

Consumer brand awareness is measured by understanding whether or when consumers know the brand and what connotations consumers have towards a brand image (Keller, 2003). Keller (2003) depicts a consumer's awareness and knowledge of a brand using the 'Brand Knowledge Pyramid', as each layer of the pyramid is achieved by the consumer, awareness, favourability, accessibility, and loyalty increases (Figure 6).

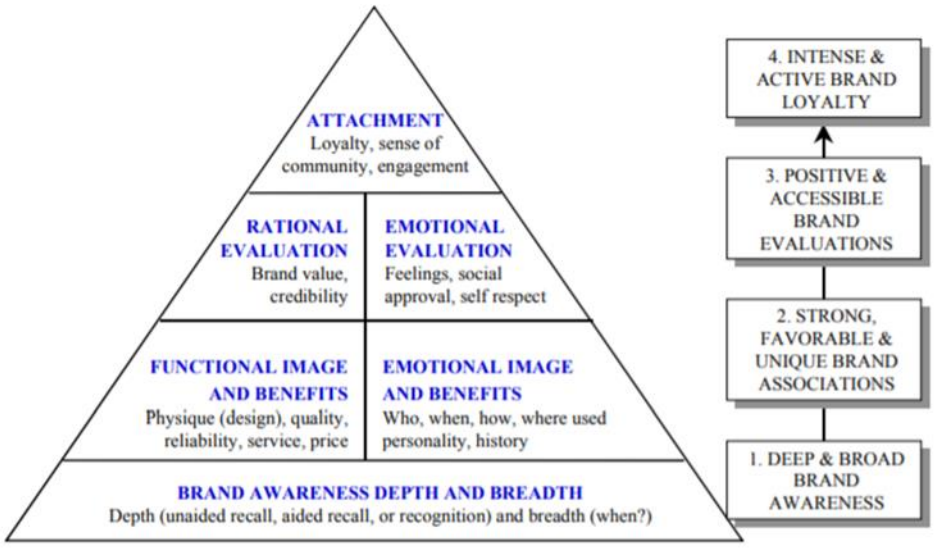



*Figure 6:The Brand Knowledge Pyramid (Keller, 2003)*

The pyramid is comprised of six different sections. Keller (2003) refers to each section as a 'building block' stating the higher up the pyramid, the stronger the relationship between a consumer and a brand.

Keller (2003) states that step one of the pyramid relates to little or no brand awareness, the consumer is asking 'Who are you?' when exposed to the brand's product or service. Brand awareness at the bottom of the pyramid can be measured using brand recall (Chandon, 2003). When given a category of the product or service, the consumer recalls a brand from memory. An example would be asking current electric vehicle (EV) driver to name a public chargepoint network provider and them recalling the first one they remember.

The second stage of the pyramid slightly narrows the broadness of the consumer awareness; they are starting to become more aware what the brand is (Keller, 2003). Although the consumer is now aware of the brand, the consumer needs to know what meaning this has to them, by understanding what the product or service a brand offers, allows them to comprehend if it will be suitable for their needs. According to Aaker (1997) consumers develop their own ideas of a brands personality, although inanimate a brand's traits include human qualities such as sincerity, excitement, competence, sophistication and ruggedness. For example, if a current electric vehicle (EV) driver thought about the public network provider Gridserve, they may class them under the 'excitement' category, as the brand is imaginative and innovative with their installations (Gridserve, 2021). Once the consumer has a comprehension of the image of the brand, they now have a better understanding of what performance they can expect from the product or service, and whether it will satisfy their needs (Chandon, 2003).

The third stage of the pyramid compromises two sections: rational evaluation (judgements) and emotional evaluation (feelings). This layer is where the consumer has a good understanding of products and services and evaluates if the product has value and credibility, as well as social approval within their social network (Chandon, 2003). Brand judgements are focused upon consumers' opinions of a brand's quality, credibility, consideration, and superiority (Keller, 2003:p.11). According to Keller (2003: p.11), the consumers' emotional

evaluation (feelings) is formed by their head and their heart as well as any positive or negative social connotations when purchasing the brands product or service. Consumers have 6 possible emotions when a brand affects their feelings: warmth, fun, excitement, security, social approval, and self-respect (Keller, 2003:p.13).

The final stage of the pyramid is consumer attachment to a brand (Keller, 2003). Keller (2003) states that once all previous stages of the pyramid have been successfully followed, the consumer will develop an attachment to the brand, and the consumer is now a loyal consumer, as they feel a sense of community, they have purchased the brands product or service (Keller, 2003). For example, a public chargepoint network provider may reward loyal consumers by giving them a small amount of free credit on their next charge, increasing loyalty and engagement with the brand.

### 2.6.3 **Logos increasing Brand Awareness**

Brands differentiate themselves from their competitors and an effective logo is one way of achieving this, logos are an opportunity for a business to present their reputation to consumers (Labrecque and Milne, 2013). According to Foroudi, (2019) brands strive to achieve a specific response from their consumers, and an effective logo used consistently is a key strategy in their communications. Careful design can achieve a chosen response, and consumers perception of a brand should be reinforced consistently in all marketing communication, built from the logo.

According to Hynes, (2009) a brands logo has several elements, such as shape, image, style, and colour(s). (Eiseman, 2000) states colour is referred to as the ‘silent salesperson’ as it can send subliminal persuasive messages, colours such as pale blues, oranges and greens are most persuasive.

Birkigt and Stadler, (1986) advocate that organisations communicate the personality of their brand in the design, behaviour, and communication of an image, otherwise known as a logo. Symbols or logos are an efficient way of composing the brands personality to the consumer, a successful logo will stay in the mind of the consumer, improving the brands awareness (van

Riel and van den Ban, 2001). Logos allow a brand to increase their recognition with consumers, logos that are cluttered or have lots of wording can create negative evaluations of the brand. If they are unrecognisable, they can damage a brands image (Henderson and Cote, 1998).

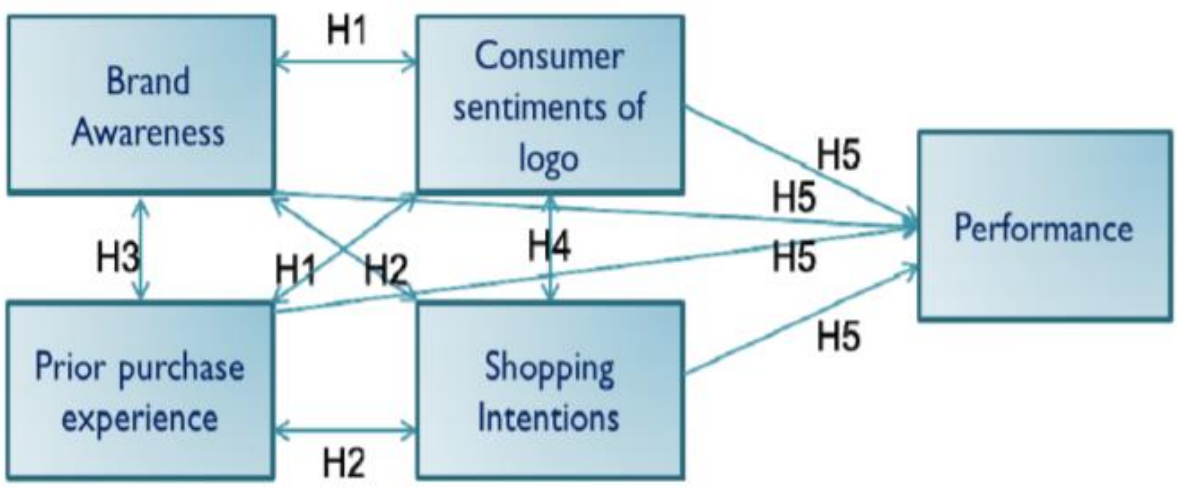



*Figure 7: Measuring Brand Awareness based on logos, conceptual model (Girard et al., (2013)*

Logos that are simple in design are easier for the consumer to remember, if a logo compromises simple elements, the consumer uses less processing capacity. As a result it can be retrieved from memory quicker than a complex logo, increasing brand awareness (Robertson, 1989; Airey, 2009).

Girard *et al.*, (2013) model allows a brand to measure its brand awareness before the consumer has purchased their product or service based on their logo (Figure 8). Girard et al. (2013) argue that if there is a combination of two of the four sections of the model, there will be a successful performance, or purchase. For example, if a consumer has a positive sentiment for a logo and a successful prior purchase experience with a brand, it will result in performance/purchase. Similarly, if a consumer is already aware of the brand and has the intention to buy a product or service in the brands sector, this will also result in a performance.

### 4.1.2.7.0 **A Background to Electric Vehicles**

Since the 1990s, the UK has attempted to contribute to international efforts to lower greenhouse gases in the atmosphere (Hausfather *et al.*, 2020). Subsequently, due to the decrease of coal usage for electricity generation, the emission levels of greenhouse gases have dropped by 43% in the UK since 1990 (Department for Business, 2019). Nevertheless, in 2018 the biggest cause of greenhouse gases in the UK is the transport sector emitting 28% of the total emissions, to combat this a new eco-friendly mode of transport must be used to lower these emissions further similar to the decrease in fuel (Department for Business, 2019).

It has been known for some that time petrol and diesel cars have been one of many factors to the emission of greenhouse gases from the transport industry (Faiz *et al.*, 1996; McCubbin and Delucchi, 1999, p. 253; Kodjak, 2019; Pal *et al.*, 2018, p. 401). It has been a constant battle for manufacturers to keep emissions low in their vehicles; some manufacturers have seen to innovate and stop the creation of 'traditional' vehicles and look to discover the solution to an ultra-low-emission vehicle (ULEV),(OLEV, 2013).

As pressure has built on car manufacturers to lower the emissions in their vehicles, they have been trying to manufacture an ULEV. The first mass produced low-emission vehicle was the Toyota Prius in 2000, the Prius is a combination of an electric and petrol motor advertising itself as the first totally emission vehicle of the time (Matulka, 2014). The aim of the Prius was to lower the entry barrier for traditional car users, the Prius allowed consumers to take steps to accept a new sector of vehicles with its hybrid technology (Enright, 2015).

Over the next few years, technology was able to advance and the creation and improvement of batteries were enhanced, in 2006 a start-up company named 'Tesla Motors' emerged with its range of luxury full electric sports cars proudly advertising 200+ mile ranges per charge (Glaister, 2006; Miller, 2010; Matulka, 2014). With this new start-up beginning to gain the attention of the common consumer, traditional car manufacturers started to mass produce their own all electric vehicles, notably the Nissan Leaf in 2010 featuring; affordable pricing and a range of 100+ miles (Nissan, 2009; Valdes-Dapena, 2010; Vaughan, 2010).

The adoption of Electric Vehicles (EVs) is on the rise, 2019 saw the sale of EV's top 2.1 million global sales (IEA, 2020). Nevertheless, these sales only accounted for 2.6% of global car sales,

showing there is still much more to be done to switch users of traditional petrol and diesel vehicles to EVs (IEA, 2020). According to (SMMT, 2020) there has been an 184% increase in electric vehicle sales since September 2019 to September 2020, compared to petrol and diesel cars having a combined 58.4% annual decrease.

The market leader in electric vehicle sales is Tesla, equal to 18% market share between January and June 2020 (Wagner, 2021). Tesla's most sold vehicle is its Model 3, which sold more than 5000 units in Q1 of 2020 (ZapMap, 2020). It is no surprise that a Tesla vehicle is leading the way in sales due to the impressive technology used including autopilot (Tesla, 2020). The Model 3 boasts large mile ranges and top speeds of 140 Mph (Tesla, 2020).

The Model 3 is currently being sold through Tesla for £40,490, a very large investment for the potential user; however, consumers do not seem to be deterred as shown in the sales figures so far in 2020 (Wagner, 2021). This shows there is a demographic of users who are willing to pay a premium for a premium electric vehicle. However, it could be argued that Tesla is alienating the common consumer with its price and overwhelming technology; if electric cars are going to become the norm on roads, all users must be able to afford the product.
Unfortunately, in 2020 there does not yet seem to be a 'Henry Ford' creating electric cars for the masses at a reasonable price, competitors of Tesla such as Nissan, VW and Renault are starting their base EV at £30,000 (Vaughan, 2019; Reuters, 2020; DeBord, 2020). There is a gap in the market for an entry EV which the common consumer can purchase; this will become more necessary in the UK due to the ban on fossil fuel vehicles in 2030 (Ambrose, 2020).

As the electric vehicle sector starts to grow, so will the second-hand market which is important as most cars purchased are pre-owned. Further barriers are present in the used EV market including range anxiety and battery degradation (Winterbourne, 2020). However, consumers are now able to find a second-hand electric car for £7000, potentially a reasonable price for a vehicle with little to no running costs compared to a traditional vehicle (PodPoint, 2021; Brignall, 2019). As new models are manufactured and more companies switch to the electric vehicle market the second-hand market will subsequently grow, allowing EV's to be readily available to the average consumer (Paton, 2021; IEA, 2020; O'Grady, 2020).

## 2.8.0 **Take Up of Electric Vehicles in the United Kingdom**

With the November 2021 announcement that the UK will phase out the production of combustion engine vehicles by 2030 to achieve Net Zero, pressure has started to build on manufacturers and consumers to purchase their electric vehicle and be prepared for the future (BBC News, 2020; Harrabin, 2020). Take up of electric vehicles In the UK has doubled since 2018, in 2018 5.96% of vehicles were EV's, now in 2020 this has grown to 10.79% (Wagner, 2020). This uptake of electric vehicles comes with a small decrease in the sales of petrol and diesel cars. The electric vehicle industry can be analysed against Porter's Industry Life Cycle (1980) (Figure 9), with four sections; Introduction, Growth, Maturity and Decline. Porter's model also evaluates the potential threats to a business, especially the government, which has a huge effect on the EV market due to legislation and financial support.

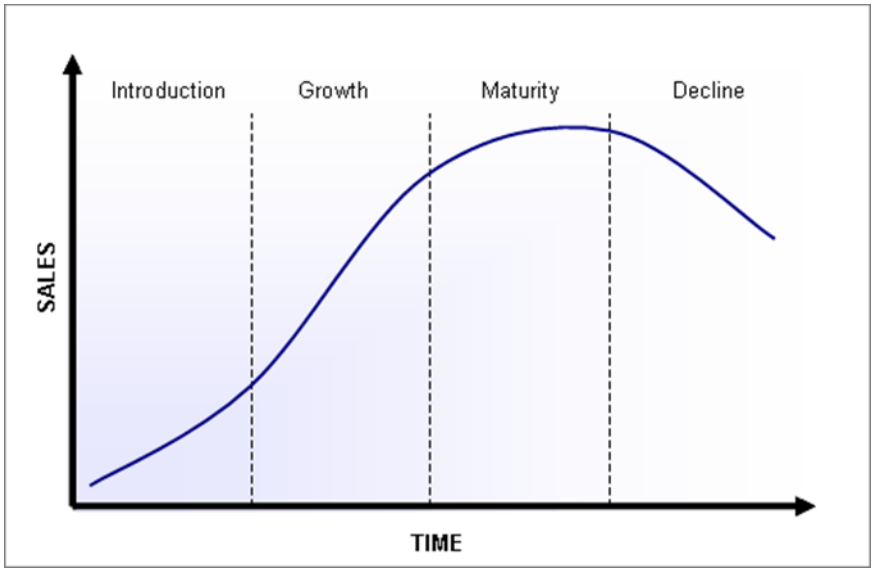



*Figure 8: Industry Life Cycle (Porter, 1980:158)*

Johnson, Whittington and Scholes Johnson *et al.*, (2014) have updated the model to analyse the competitive rivalry between sector leaders. In late 2020 it could be argued that the electric vehicle industry was between the development and growth stages of the life cycle

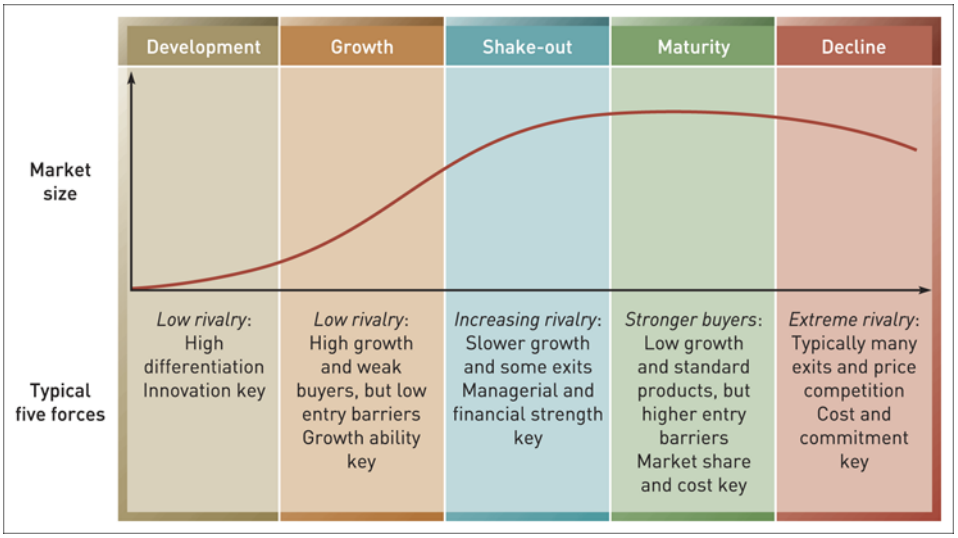



*Figure 9:Adaptation of the Industry Life Cycle (Johnson, Whittington, and Scholes, 2014)*

The development stage scrutinises differentiation of innovation, as manufacturers rethink their product line to conform with government legislation. There have been many new innovations to differentiate between rivals, such as high ranges or autopilot functions. The growth of electric vehicles in the UK is increasing exponentially and experts predict that by 2023 there will be 10 million electric vehicles in the UK, this will increase rivalry in the industry, encouraging companies to innovate further, producing a better product at a more affordable price (Woodward *et al.*, 2019).

Woodward et al. (2020) believe there are four factors driving growth of electric vehicle uptake in the United Kingdom. Firstly, consumer sentiment is always changing towards electric vehicles, as barriers of entry are being rapidly removed, consumer demand will continue fuelling the growth of electric vehicles. Woodward et al., (2020) discovered there has been a noticeable change in consumer attitudes towards switching their Internal Combustion Engine (ICE) vehicles with anxieties over range and price now being replaced by lack of charging infrastructure, a key focus of this research. This shows consumers are less worried about the financial and time constraints that were initially problems for adopters and are concerned about the longevity of owning an EV.

The second factor that influences the adoption in the United Kingdom is policy and legislation. Woodward et al., (2020) suggests that legislation encouraging EV take up has already made an

impact across Europe with Norway and the Netherlands leading the way, Norway has seen rapid growth as electric vehicles now hold 82% market share (Holland, 2020; Wagner, 2020). This shows, with financial incentives and city restrictions, that consumers are compelled to purchase an EV due to government restrictions.

Legislations has been slowly implemented in the United Kingdom, with new congestion charges introduced in London and Birmingham (TFL, 2020; GOV, 2020). and occurred after the government saw the public perception of electric vehicles change (Bunce *et al.*, 2014, p. 279). For example, the UK will start to introduce electric buses to the public transport sector with the aim of reaching net zero and coping with demand (Logan *et al.*, 2020). Further financial incentives such as the government's workplace charging scheme (WCS) and the plug-in car grant (PICG) will have a significant effect on consumers decision making when purchasing an EV, although there is currently no official data on the success of the incentives there has been a gradual uptake of EV purchases in 2020 (Roberts, 2018; EDF, 2020).

To encourage the use of electric vehicles, legislation has been passed that makes ultra-low emission vehicles (ULEV) exempt from any congestion charges in the main cities of the UK (Robbins, 2020; O'Grady, 2020). As well as restrictions being implemented on the public there has been new legislation brought on manufacturers to phase out all creation of ICE vehicles by 2030, this strong government stance will encourage manufactures to innovate and create improved electric vehicles at a better price for the consumer to increase EV market share in the UK (Pickard and Campbell, 2020; Ambrose, 2020; Paton, 2021; Frangoul, 2020).

According to Woodward et al. (2020) the third factor in Electric Vehicle growth in the United Kingdom is the strategy of the Original Equipment Manufacturer (OEM); this is to increase commitment to new models of electric vehicles to cooperate with government legislation and satisfy consumer demand. Kiser and Essery, (2017, p. 8) forecasted the success of the electric vehicle sector and how OEM's will advance the sectors high growth rate of take up and improved technologies. As predicted, OEMs have increased their production of new electric vehicles so that they can remain relevant in a growing market; Jaguar Land Rover (JLR) is an

example of this, investing £1 billion for electric vehicle production in the United Kingdom (Campbell, 2019).

OEM's have produced significantly more EV models since 2018, with a projected 214 new models available in 2021 compared to 60 models in 2018, a 112% increase in models (Bannon, 2019). According to Woodward et al., (2020) this sharp increase of new models is a combination of consumer electric vehicle adoption, government legislation and development of new technologies. Finally, according to Woodward et al., (2020) the fourth factor in United Kingdom growth is the role of large corporate company purchase plans. Woodward et al., (2020) suggest these companies see having a net zero fleet of vehicles increasing their brand image with consumers.

There has been an influx of companies striving to become 'greener', however, one sector that is leading is the express parcel sector, notably DPD who currently have 278 electric vehicles in their fleet and are looking to double this every year (DPD, 2020). DPD have been able to take advantage of the government's workplace charging scheme (WCS) by offering their drivers an electric van (Nissan E-NV200) to charge at home and charge on the go as part of their campaign to reduce their carbon footprint. Furthermore, Rogers (2003) 'diffusion of innovation' model (Figure 11 identifies five different consumer segments: Innovators, Early Adopters, Early Majority, Late Majority and Laggards. McDonald, (2017) put the model into context regarding electric vehicle adoption, can be (Figure 12). Noel *et al.*, (2019, p. 162) suggest each adopter stage follows the five main steps of innovation decision process; Knowledge, Persuasion, Decision, Implementation, and Confirmation.

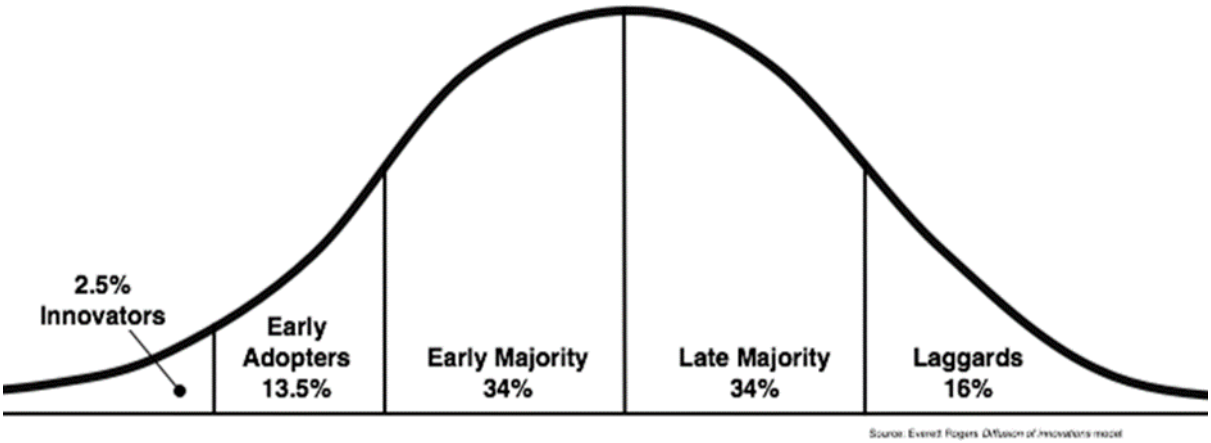



*Figure 10:Diffusion Innovation Model (Rogers, 2003)*

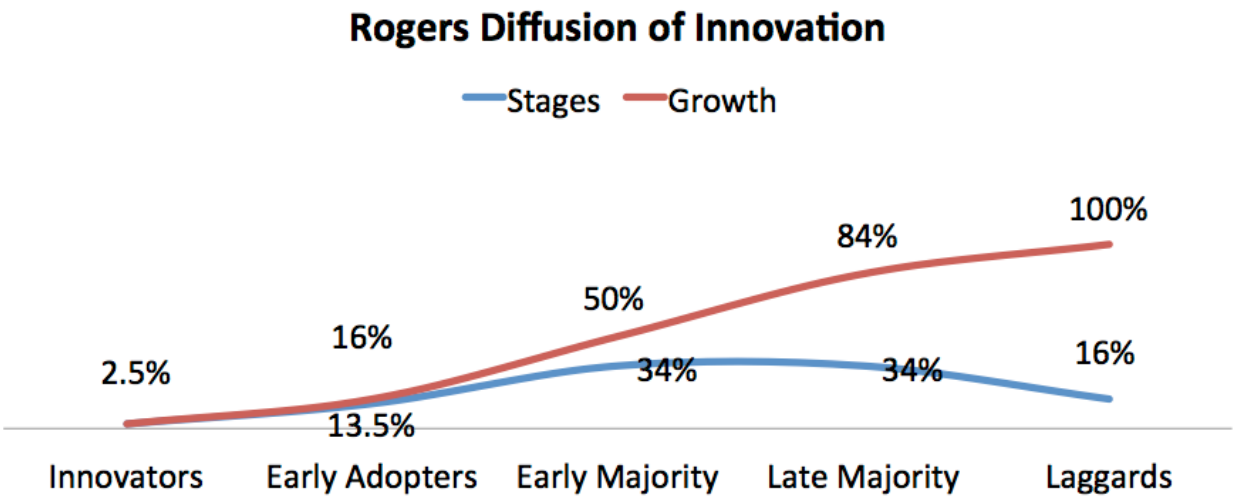



*Figure 11: Diffusion Model of Electric Vehicle Adoption (McDonald, 2017)*

However, in a diffusion process there are technological and financial developments throughout, meaning if a consumer was not an innovator or early adopter of electric vehicles there is time in the process for the consumer to revaluate and consider adopting in a later stage (Kangur *et al.*, 2017, p. 167). Additionally, according to Kangur et al., (2017:167) reasons consumers may return to the process is due to interactions on a micro-level such as social influence from peers which in turn can affect micro-behaviour, changes in buying behaviour.

The first adopters in Rogers' (2003) model are the 'innovators'; these consumers are willing to take risks to see the product or service succeed, when the model was originally developed (Rogers, 1962, p. 282) believed these consumers had; a high social status, financial liquidity, and interacted with other scientific innovators.

However, (Schaefers, 2014) has renamed these individuals as 'conspicuous innovators', these individuals consume niche products to differentiate themselves from others in society as well as bearing the original attributes of Rogers (1962:82) theory. The Office for Low Emission Vehicles (OLEV, 2015, p. 14) believe the innovators of electric vehicle consumers in the United Kingdom are young risk takers with a high education and good finances. OLEV (2015:p. 14) also believe the innovators risk tolerance allows them to trial new technologies which ultimately may fail.

The early adopters of Rogers (2003) model are similar in social status to the innovators; however, they are discreet in the adoption process and often cautious to adoption but still take the risk to maintain a central communication position (Rogers, 1962; Trigg, 2001). OLEV (2015:14) suggest that the United Kingdom's early adopters have better finances, education, and status than innovators. However, OLEV 2015:14) advise these early adopters are still young, yet, are opinion leaders. Rogers (2003) argues that once the early adopter has adopted the innovation, a social validity is formed encouraging mass society to adopt. It could be argued this is the stage electric vehicles are currently at in the United Kingdom in 2020, due to EV's slowly taking over automotive market share and encouragement from government to adopt to the new technology (OLEV, 2015; ESC, 2018; Wagner, 2020; Woodward *et al.*, 2019).

### 2.9.0 **Charging Infrastructure in the United Kingdom**

There are lots of differing public network providers in the United Kingdom installing chargepoints, offering the facility to Slow, Fast and Rapid charge an EV. ZapMap (ZapMap, 2021) lists 13 major networks across the UK.  As of May 2021, PodPoint operates most of the UK's public chargepoint network with Instavolt and BP Pulse close behind them. There are three speeds that public chargepoint network providers offer: Slow, Fast and Rapid. Slow

charging tends to be found in workplaces, this is due to the chargers providing a maximum of 6kW to the vehicle, on average this could take 6-12 hours to charge an electric vehicle (ZapMap, 2021). Fast Chargers are the most common public chargepoint charger, they include chargepoint operators such as PodPoint, BP Pulse and Charge Your Car provide fast charging. Fast chargers can charge an EV at anywhere between 7kW and 22kW; on average, this could charge an EV in 1-2 hours depending on the vehicle (ZapMap, 2021). Rapid chargers are the quickest way of charging an electric vehicle, they tend to be found on motorway services, dependent on vehicle, a rapid charger could charge an electric vehicle in as fast as 20 minutes, Instavolt and Osprey provide rapid charging across the UK (ZapMap, 2021).

The chargepoint infrastructure is increasing, as of late November 2020, there were 35,530 public charging points in the United Kingdom (ZapMap, 2021). These charge points are installed in 12,838 locations and new charge points are being installed rapidly throughout the United Kingdom (ZapMap, 2021). By May 2021, these numbers have risen to 40,963 connectors at 15,185 locations across the UK. In November 2020 in the United Kingdom, Greater London had the highest share of charging points with 26%, the disparity of charging points is large when comparing the South of England with the North, with the North (combination of the North West and North East) only holding 10.8% of the charging points in the United Kingdom (DOT, 2020; ZapMap, 2021). In late May 2021, the situation become more geographically biased, with 30.8% of chargepoints in the UK located in Greater London. However, differences are appearing in the north of England with 6.7% of chargepoints in the north-west compared to 3.4% in the north-east (ZapMap, 2021).

This increase in chargepoint installations is to cope with consumer demand, making sure electric vehicle users can use a wide range of charging stations to meet their charging needs. The distribution of chargepoints also influences adoption rates. Chargepoint operators must deal with this consumer demand to ensure that the United Kingdom has a reliable and available charging infrastructure compared to current fuel stations (Nicholas and Lutsey, 2020).

Due to electric vehicle charging being still in its infancy, planning for surges in demand in particular areas is difficult for installers. . However, due to government incentives and manufacturing legislation, suppliers of chargepoints should see consistent high demand for public charging stations (Gnann *et al.*, 2018, p. 315; Engel *et al.*, 2018; Roberts, 2019; Bowers, 2020).

Just like fuelling an internal combustion engine (ICE) vehicle, the user needs to make decisions on if they are able to reach their destination or destinations on a single fuel/charge or if they will be required to refuel/recharge throughout the day.

Hardinghaus *et al.*, (2019, p. 5925) believe electric vehicle users should plan their trip based on chargepoint locations, although infrastructure is growing there are factors that need to be considered prior to setting off including vailability, price and time. Hardinghaus, *et al.,* (2019: 5925)'s conditional range model shows the decision-making process the user faces when completing a journey (Figure 13). The first stage of the model requires the user to consider if there is enough charge in their vehicle to reach the destination, if yes, the journey can be completed, if not the vehicle must be charged. With free to use apps and services such as ZapMap and PodPoint, the user can pre-plan the journey based on final location and what chargepoints are available to use mid-journey or at the destination.

As public infrastructure grows across the United Kingdom and time to charge is increased the decision-making process of the EV user will become more similar to the decision-making process of a current ICE vehicle owner.

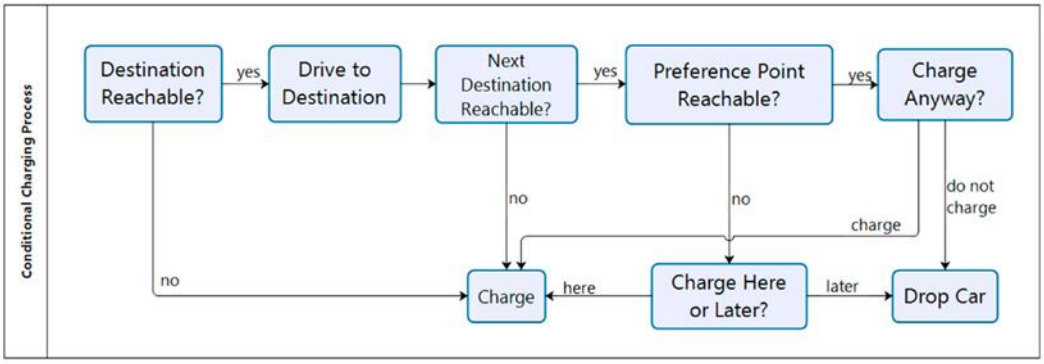



*Figure 12:Conditional Charge Model (Hardinghaus, Seidel and Anderson, 2019:p. 5925)*

## 2.10.0 **Barriers of Switching to Electric Vehicles**

Although the adoption of electric vehicles are on the rise, there are a number of factors that consumer's perceive as barriers to their adoption in making the switch to an electric vehicle. The literature suggests that there are four main barriers: price of vehicle, range of vehicle, education regarding electric vehicles and access to public chargepoints.

### 2.6.6 **Purchase Price**

Electric vehicles have much cheaper running costs than internal combustion engine vehicles, due to reduced charging/fuelling costs, free UK road tax and occasionally free parking, however, the initial buying cost of an electric vehicle has been a barrier for some consumers (Proff and Kilian, 2012; Vassileva and Campillo, 2017, p. 634). (Larson *et al.*, 2014, p. 302) study discovered consumers were not willing to pay high costs for an electric vehicle, it is argued that EVs tend to be more expensive new due to the high cost of battery manufacturing. As previously discussed, price tends to be a main barrier to new technology, the innovators or early adopters are more likely to risk adopting the new expensive technology. However, financial incentives are available when purchasing a new electric vehicle, such as a UK government grant allowing the consumer to install a chargepoint at their home. Due to decreased run costs, electric vehicle drivers are taking advantage of low monthly payments of the vehicle, through hire purchase (HP) or personal contract purchase (PCP) (Hardman *et al.*, 2015; Berkeley *et al.*, 2018, p. 468).

As more electric vehicles are produced, the more second-hand vehicles are available for consumers, these reduced prices for good quality vehicles will allow electric vehicles to become more affordable to consumers (Paton, 2021). Despite economic benefits and potential incentives, recent literature suggests that the purchase price of an electric vehicle is still one of the main barriers to adoption (Noel et al., 2020).

### 2.11.0 **Range Anxiety**

One of the other common perceived barriers to making the switch to an electric vehicle are the range limitations of the vehicles, otherwise known as 'range anxiety' (Naor *et al.*, 2015). According to (Noel *et al.*, 2019, p. 96) 'range anxiety' is defined as the 'psychological anxiety a consumer experiences in response to the limited range of an electric vehicle'. As public chargepoints are not as quick or efficient as filling up a ICE vehicle with petrol, some

consumers are fearful of their battery depleting in the middle of a journey (Neubauer and Wood, 2014, p. 12).

Internal combustion engine vehicles (ICE) can comfortably complete day to day journeys on one tank of fuel, however, this comes at a premium price. Although the range of electric vehicles is improving all the time, they do need to be charged/fuelled more frequently than most internal combustion engine vehicles. According to Zapmap (2021) the UK now has more charging locations than petrol stations, yet more need to be installed to accommodate EV take up.

According to a study by the (Department for Transport, 2020) (DOT), discovered the most common trip length for a driver in the North West of England is under 10 miles, with very few drivers driving 50 to 100 miles per trip (Figure 14). All these trip lengths can be completed in a modern EV and multiple short trips would be easily completed on one single charge. Most common trips in the North West were commuting (15%), school run (6%) or shopping (20%).

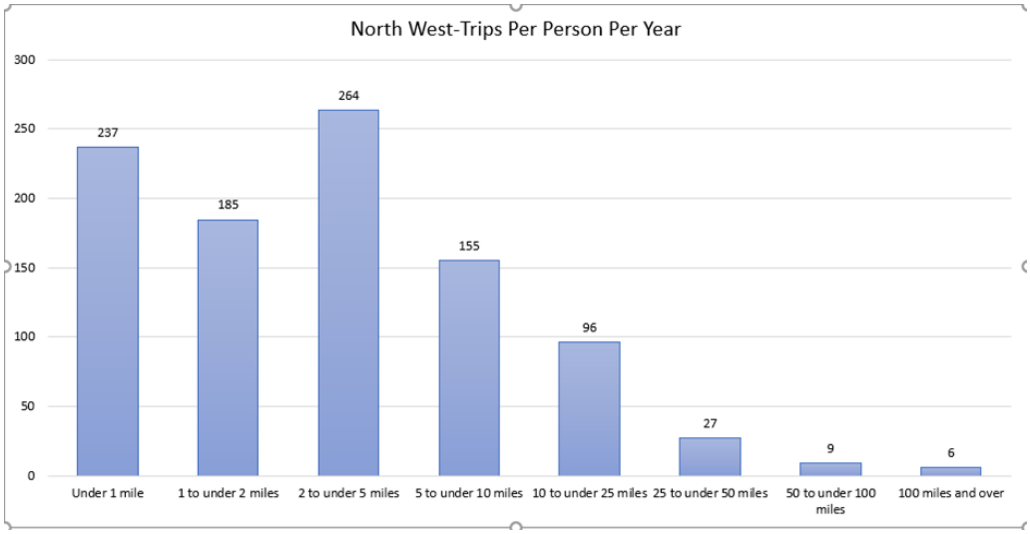



*Figure 13: North West Trips Per Person Per Year (DOT, 2019)*

These statistics have been drastically affected by the COVID-19 pandemic and UK restrictions, as there was a 85% decrease in traffic on roads from 29th of March 2020 (LexisNexis, 2020). With restrictions lifted on 15th June 2020, trips were still low with a reduction in traffic by a third compared to 2019, distances of journeys also decreased by 60% (LexisNexis, 2020). These

drastic changes in travel behaviour may change again, with passengers now less likely than ever to use public transport due to added risks and resorting to cars (IEA, 2020).

### 2.12.0 **Consumer Education of Electric Vehicles**

Another perceived barrier consumers face when making the switch to an electric vehicle (EV) is a lack of easy-to-understand information that can cause confusion or lead to believing incorrect information (JDPower, 2019). It is vital for the widespread adoption of electric vehicles (EVs) that consumers have a good understanding and awareness of how electric vehicles can benefit them and their day to day lives (Axsen *et al.*, 2017, p. 171). There is very little literature studying the understanding of electric vehicles in the United Kingdom; however, Axsen et al. (2017:171) Canadian study shows there is a lack of knowledge on key aspects including range, charging, operational costs and environmental impacts.

Axsen *et al.,* (2017: 171) suggest that more can be done to educate consumers with informative marketing campaigns, from governments and the industry themselves. However, Axsen *et al.,* (2017: 171) recommends that information is not passed on solely through the industry as it could be seen as biased. Schuitema *et al.*, (2013, p. 40) suggests unbiased information regarding electric vehicles (EV) from current EV drivers, this community-led approach will allow perspective EV drivers to understand what it is like to own an electric vehicle. A further recommendation from Axsen *et al.* (2017) is a government lead approach by normalising the use of EVs in their own fleets; this could quell any 'strangeness' or trustworthiness' surrounding EVs, this clear support of EVs could convert consumers, in 2021 there is currently no government initiative to educate the consumer.

### 2.13.0 **Access to Public Chargepoints**

If consumers want to make the switch to an electric vehicle but do not have access to off-street parking, they will rely solely on the public chargepoint network. Although the number of public chargepoints is growing rapidly, a common barrier consumers face when switching to an electric vehicle is the lack of reliable public chargepoints (Krishna, 2021, p. 5). Krishna (2015: p.5) states that there are more public chargepoints located in major cities, compared to

rural areas, making it harder for those living in rural towns and villages to make the switch due to range anxiety. Hardman *et al.*, (2018, p. 509) argues that developing an easily usable dedicated charging infrastructure will encourage more consumers to switch their internal combustion engine vehicles for an electric one.

However, Hardman et al. (2018:509) recommends charging infrastructure must be installed in locations that benefit the user, such as by installing chargepoints in locations the user already visits including workplaces, shopping centres, and public car parks. Van der Kam *et al.*, (2020, p. 3) believes due to current low levels of electric vehicle adoption, 'chargepoint hogging' is not a current issue, however, as EVs become popular this will be a regular occurrence if chargepoint operators do not increase the infrastructure.

### 2.14.0 **Electric Vehicles Lowering Carbon Emissions**

In 2020, carbon dioxide emissions from the transport sector decreased by 10.7%, primarily due to national coronavirus (COVID-19) lockdowns lowering the amount of road transport (BEIS, 2019). However, the transport sector still remains the highest sector of carbon emissions in the United Kingdom, 30% of carbon emissions come from this sector and electrifying the sector will reduce these substantially (BEIS, 2019). Electric vehicles are considered the direct replacement for petrol and diesel vehicles, due to their zero carbon emissions and low fuel price compared to other fuel options (Wassan *et al.*, 2019). Although in the early days of electric vehicles (rumours circulated that electric vehicles were not as green as advertised, however, a study by (Knobloch *et al.*, 2020, p. 438) debunked such ideas confirming EV's do produce less carbon emissions than their petrol or diesel competitors.

For context, if 50 vehicles (25 petrol and 25 diesel) were replaced by electric vehicles in one year, there would be a saving of 104.3 tCO2e per year. This calculation is based on average mileages of 6300 petrol and 9300 diesel = 15700 total miles, and an average of 7850 per vehicle.As discussed electric vehicle adoption is on the rise, if more people switch their petrol or diesel vehicle to electric, the transport sector carbon emissions will continue to fall.

Reducing carbon emissions will benefit the planet, but it will also have a positive affect on the quality of air humans breathe. According to HEI (2018), road transportation is a source of outdoor air pollution, which has contributed to 4.1 million deaths with exposure to particulate matter (PM). Exposure to particulate matter can contribute to deaths from heart disease, strokes and various lung diseases. Although electric vehicles do produce particulates from brakes like other vehicles, they do not add to particulates through combustion.

### 2.15.0 **Conclusion**

In summary, this chapter has reviewed academic literature and literature relating to electric vehicles. The academic literature investigated consumer behaviour, attitudes and perceptions, barriers to entry, and adoption of innovation in technology, social network analysis, prospect theory, and brand awareness. Then, literature relating to electric vehicles was summarised to give context to the research as well as the academic models.

By using traditional models and updated variations of them, such as the theory of acceptance model (Davis, 1989) and the unified theory of acceptance and use of technology, Venkatesh et al. (2003) have given context to the broader subject of adoption of new technology (UTAUT), which is especially relevant to electric vehicles. Venkatesh et al., (2003) model brought a new angle to research by explaining the importance of social influence when adopting new technology. With this new angle of research, models such as The Theory of Planned Behaviour (Ajzen, 1991:182) were explored, allowing the research to gain further information regarding the social influence on others when adopting new technology, or in this case electric vehicles (EV), which is something that is echoed in electric vehicle academic literature.

Through these generic models, it is possible to draw together specific approaches than can be used in the objectives of this thesis. Although every product has its own characteristics, the principles can readily be applied to the provision of electric vehicles and public chargepoints. Models that engage with technological developments are most applicable to communication through social media platforms is most relevant to this digital-era product. These models serve to inform the methodological approach to be followed and analysis of the data to be used.

# 3.0 Methodology

## 3.1.0 **Methodology Introduction**

This chapter explains and justifies the reasoning behind the methods used in this research, as well as providing a critique of the approaches chosen and discusses the use of mixed methods to achieve the aim of this research.

## 3.2.0 **Focus Groups**

Focus group discussions are frequently used as a qualitative approach to gain an in-depth understanding of social issues, aiming to acquire data from a purposely selected group of participants rather than 'typical' or 'average' opinions from broader views of a large population (O.Nyumba *et al.*, 2018). Focus groups involve understanding the opinions and approaches of key agents using interpretivism and qualitative research methodologies. Due to Government pandemic restrictions  dyadic interviews with individual participants were considered, however, as the principal research intends to understand multiple opinions and encourage discussion amongst participants it was decided two small focus groups would be best (Guest *et al.*, 2017).. Asynchronous Focus Groups were considered, as these are held over a few hours or even days on online chat-based platforms; there are little to no time pressures when answering, allowing the participant to think and plan their answer (Poynter, 2010; Sintjago and Link, 2012).

Instead, a synchronous focus group will be most applicable for this study, it is the nearest in style to traditional face-to-face focus groups and involves real-time discussions led by one or more moderators and usually up to eight participants (Poynter 2010; Sintjago and Link 2012). Due to restrictions on groups meeting in the COVID-19 pandemic in the United Kingdom in February 2021, online focus groups were the best collection method to satisfy the preliminary data needs for this project. This research methodology differs from a typical in-person focus group, where normally 10 to 12 participants would attend a one-off event to gather data that perhaps represents a sample of the broader population (Nyumba et al., 2018). Nevertheless, the online format can work well with small adaptations to make the best of the medium.

There are many positives to the focus groups being hosted online, such as the minimal cost and participants are able to be in their own environment, hopefully leading to richer data collection (Wilkerson *et al.*, 2014; Kite and Phongsavan, 2017). Research by Lobe and Morgan (2020) discovered that participants in online focus groups with a maximum participant list of 4 were more comfortable answering questions rather than large online groups.

However, there are negatives to online focus groups. For some participants there could be a digital gap, some maybe alienated from the research as their digital skills may stop them from attending. However, it can be argued that since the start of the COVID-19 pandemic, society has become accustomed to video conferencing software for work and pleasure purposes (Gupta, 2020).

Due to the focus groups being administered in an online format, it has been decided to have a maximum participant level of 5. In part, this is a practical solution enabling multiple participants to appear on screen and interact, but also to make it easier to moderate. Furthermore, in previous focus group studies conducted by this project's industry partner, Charge My Street, it was found that some participants contributed more than others, perhaps due to confidence in the format, leading to a poor set of data. With this in mind, two online focus groups were conducted to decrease the levels of randomness in the studies, with the hope of gathering rich local data which can lead to further avenues of study in this research.

A key reason for using focus groups is that it can provide detailed local knowledge. This research with its focus on charging points has some specific local considerations that can best be addressed by using participants from a similar area. Broader research related to electric vehicles has been conducted in Norway to understand the perceptions of none electric vehicle drivers(Kester *et al.*, 2019). However, Kester et al.'s (2019) research was nationally based, leading to a broad set of data with the potential for regional disparities. This research aims to target participants from a specific area of England, the North West which will overcome large regionl differences. In addition to minimising socioeconomic variation, this regional approach recognises the geographic factors inherent in transport decisions and be valuable to the industry partner, Charge My Street who are based in the North West.

To understand the local up to date barriers Lancashire and Cumbria individuals face when making the switch to an Electric Vehicle, participants needed to be residents of the North West and have a desire to own an electric vehicle (See Table 1).

| Participant | Location | Current EV Driver | Residency Status |
|---|---|---|---|
| P1 | Barrow-In-Furness, Cumbria | Yes | Yes Driveway |
| P2 | Kendal, Cumbria. | No | No Driveway |
| P3 | Lancaster, Lancashire. | No | No Driveway |
| P4 | Whitehaven, Cumbria. | Yes | Yes Driveway |
| P5 | Lancaster, Lancashire. | No | No Driveway |
| P6 | Lancaster, Lancashire. | No | No Driveway |

*Table 1: Participant Profiles*

Data was used from this project's industry partner to identify potential participants for the focus group. The industry partner had previously designed a survey which was distributed around the North West using targeted ads, specifically in areas where potential new chargepoints could be installed. These survey ran between 2017 and 2019, participants were encouraged to answer questions regarding current and future ownership of an EV, reasons for owning an EV and usage of public charging infrastructure (See Table 2).

Data from these studies was then imported into Google Maps; using the participants post code, the maps would show their location, allowing this research's industry partner to see what locations individuals had an electric vehicle or were planning on buying one, so chargepoints could be installed. These data were further analysed and participants were chosen based on; location, desire to own an electric vehicle in the next three years or less, no access to a driveway and willingness to use and invest in a public community charging point. These variables are based on this project industry partner's aim of installing public community funded chargepoints no further than a 5-minute walk from housing with no access to a driveway. These variables also matched the aim of this project of encouraging the switch to an Electric Vehicle.

| Question | Answer |
|---|---|
| Do you have access to a driveway? | Yes or No |
| When might you consider buying an electric car? | Already have one, Next 12 Months, Next 2 Years, Next 3 Years, Next 4 Years. |
| What are the reasons holding you back from owning an EV today? | Price, Price of Charging, Infrastructure, Range, Lack of Information, Other. |
| What are the reasons you would buy an electric vehicle? | Save Money on Fuel, Reduce CO2, Improve Air Quality, Lower Maintenance. |
| How long would you be willing to walk from your home to the nearest vehicle chargepoint? | Less than a minute, 1-5 Minutes, 5-10 Minutes, Over 10 Minutes. |
| What is the maximum you would you be willing to invest for a locally owned, shared chargepoint near your house? | Type your answer. |
| Name | Participant Name |
| Email Address | Participant Email Address |
| Postcode | Participant Postcode |

*Table 2:Industry Partner's Survey Questions*

Being a new technology, it was decided that each focus group should have its own 'Champion' who would be an existing Electric Vehicle owner in the region. Their attendance would allow the other participants to understand what it is like to own an electric vehicle in their locality and answer any technical questions participants had. Both champions were chosen due to their ongoing relationship with Charge My Street as well as their location and ownership of an electric vehicle. Although this adds a degree of bias to the group, it also gives the potential for a deeper conversation between participants rather than a question and answer session with the moderator. A dual-moderation style of focus groups allows the groups principle participant to receive further expertise on a topic (Billups, 2020:p. 100).

Once the champions were chosen, 15 potential participants were carefully selected who matched the required criteria. Although the focus groups were designed to be small in attendance, it was important to invite more participants that fitted the criteria to increase the chances of good attendance numbers leading to quality data capture. Participants received emails to the email address they provided using Charge My Street's email account to give

participants peace of mind that this was an authentic email invitation. Participants were equally distributed between the two focus groups dependant on location so there was a better chance of gathering data from as many locations as possible.

In the email, participants were asked to complete an online consent form on Google Docs, and attached was the participant information sheet, as well as all Zoom Meetings joining instructions and further information regarding the project for educational and transparency reasons. Normally participants of a focus group would sign the consent form in person, due to them being hosted online creating the consent form online was needed, this streamlined the process, allowing the researcher to keep a log of who had signed the form as well as making it easy for the participants.

These groups focused on two main discussion topics, the switch to an electric vehicle and specific location criteria that were of interest to them. Open ended discussion topics were designed to allow participants to have a group discussion, in the hope of discovering rich data. The first topic, switching to an electric vehicle, was split into two scenarios, (i) the participant has made the switch since answering the survey or (ii) is yet to make the switch to an electric vehicle. If the participant had made the switch to an electric vehicle, questions would be asked regarding, what electric vehicle they purchased, how did they purchase, what was the experience they had and did the recent government announcement encourage them in making the switch. However, if the participant had not made the switch to an electric vehicle, questions would be asked regarding local barriers stopping them making the switch and what would make the individual make the switch. The second section discussed residential factors, this section was designed to understand if the participant lives at a property with or without access to a driveway and if this has changed since they answered the survey. The three questions in the second section of discussion were closed as each participant's status may be different, however, the last four were open ended and are designed for debate and for participants to discuss the charging infrastructure in their local area.

Finally, the last two discussion topics were designed to get the participant thinking about site suggestions in their local area, as well as their awareness of Charge My Street installs and marketing material.

Gibbs, (1997) discusses the responsibilities of a moderator in a focus group. It is imperative that the moderator provides a clear purpose of the focus group to the participants at the outset (Gibbs, 1997). As well as understanding purpose, the participants should be informed on the discussion topics and be informed of any rules of the focus group. As this focus group had one extra participant, the champion, participants were made aware of them in the invitation email and at the beginning of the focus group by the moderator and the champion themselves. As the focus groups were hosted online, participants were required to mute their microphones when not speaking; this lowered any background noise allowing them to be understood by others in the call and allowed the recording to be clear for transcription purposes. The moderator also needed to keep the group focused on the discussion topics, allow all participants to contribute, and in the case of these focus groups, encourage participants to deliberate discussion topics between themselves (Morgan, 2018; Barbour and Barbour, 2018). According to Gibbs (1997) traditionally moderators would need to take notes, but due to the focus groups being hosted digitally, this process was not required as the meetings were automatically recorded and uploaded to an encrypted cloud.

### 3.2.1 **Ethics of a Focus Group**

This research is ethically low risk as all participants had a prior knowledge of the topic field and had stated previously that in the future, they would like to purchase an electric vehicle. According to (Sim and Waterfield, 2019) focus groups generate unique ethical challenges in comparison to one-to-one interviews, such as consent, confidentiality, and anonymity. In this study, consent was obtained by an online consent form created on Google Forms in the style of a survey (Appendix 1). For ease of use the participant would simply read each statement and decide if they consent, their name and date were required at the bottom allowing the researcher to see which participants have completed the form and gave their consent to participate in the study.

A consent form allows the participant to communicate their 'performative' consent towards the research (Schaber and Müller, 2018). Participants were also sent the participant information sheet along with their invitation (Appendix 2), this allowed them to understand what the focus groups are about, how the data will be used and stored and where to get further information if necessary.

Confidentiality and anonymity must be assured to participants, in this research, participants were guaranteed their identity such as name or specific location would be kept anonymous and confidential (Hennink, 2007, p. 41; Lincoln, 2009). Prior to the focus group, all emails were sent individually so that participants did not have access to other participants' information. In the invitation email participants were asked to only use their first names on the Zoom call and were advised to blur their backgrounds so they did not share anything confidential, to other participants on the call. Participants were informed in the participant information sheet that they could leave or not contribute when discussing a topic, they felt uncomfortable with, or they perceived to be upsetting. However, 'Champion' participants were asked to be as transparent as they felt necessary to share their name, location, and job role so other participants had a better understanding of their status. When transcribing the data, participants names were changed to keep their answers anonymous.

### 3.2.2 **Data Analysis of Focus Groups**

The qualitative audio data gathered from the two focus groups were later uploaded to Otter.AI, an artificial information system which transcribes the audio files. Once the transcription was complete, it was important to use data cleaning, this corrected any grammatical or verbal errors in the transcription process (Saunders *et al.*, 2019, p. 572). When both focus groups were transcribed, it created a total of 31 pages of transcribed data.

Thematic analysis is a flexible and accessible approach when analysing qualitative data (Braun and Clarke, 2006, p. 78) and was chosen to analyse the data collected from the focus groups. Thematic analysis identifies key themes and patterns in the transcribed data, and it can be used to understand factors behind human attitudes and actions of a certain topic (Saunders et

al., 2016:p. 579). The transcribed data from the focus groups was analysed using Nvivo 12, a data analytical software, allowing the researcher to create themes and sub-themes to gain a better understanding of the data. Themes were generated deductively, and theory and prior research was used to form the main theme, which was not chosen by quantifiable measures, rather as it captured something important and relevant to the research (Braun and Clarke, 2006; DeSantis and Ugarriza, 2000). Three key themes were identified from the focus groups: Confusion of Charging Behaviour, Misinterpretation of Public Chargepoint Providers and Local Barriers to Electric Vehicle Adoption, these are analysed further in chapter 6.

### 3.3.0 **Survey**

### 3.3.1 **Introduction to the survey**

Following completion of the focus groups, it was apparent that an important theme that emerged was the lack of easy-to-digest information regarding electric vehicles, leading to misunderstanding information. Participants agreed that there is too much new information to process, and it can be overwhelming when making the switch. To better understand this important finding and the awareness of current and prospective electric vehicle drivers regarding public charging networks, a survey was chosen to reach a wider audience.
The aim of this research survey was to:

*Measure the brand awareness of chargepoint networks in the North of England of current and prospective electric vehicle drivers.*

To achieve the aims and objectives of the study, it is necessary to carefully select the most appropriate style, design, and reach of survey within the constraints of the project. Saunders *et al.,* (2016:p. 436) state that the term survey has an array of definitions. The term is most commonly used for self-completed survey, where an individual records his own answers from a select set of questions; this differs from surveys that are asked by an interviewer, face-to-face or via telephone. Surveys allow the research to obtain relevant and reliable information on a wider scale (Taherdoost, 2016). To gather a rich set of data from the survey, a self-completed online survey would be best suited to this research. Self-completed or self-administered survey is when the participant completes the study individually rather than being

asked the questions by an interviewer (Bell *et al.*, 2018). Due to the successes of the pilot focus groups in gaining rich data, consideration was given to a second series involving a bigger group of prospective and current EV drivers to understand their awareness of different public charging networks.

### 3.3.2 **Why a Survey?**

Gillham, (2008:p. 6) states there are many benefits of using a survey as part of a research project, some key benefits are: Low cost in time and money, participants can complete the research when it suits them and respondent anonymity. Since Gilham (2008:p.6)'s research, the cost of creating a survey has decreased, and there are many different software packages that allow creation of very sophisticated survey. Time was also a key reason survey was selected, the focus groups in this research took over a month of researching and planning yet reached only a small number of people. In comparison, the survey has the ability to reach much further with similar preparation times. It was critical that this survey was completed efficiently to fit within the funding constraints. Allowing time for multiple drafts and pilots was key for the success of the survey. The survey went through four iterations and was piloted by sample participants who were asked to complete the survey and provide constructive feedback on the survey experience. Williams (2003, p. 121) suggests piloting a survey in the draft stage is vital to the success of the research, by gathering feedback in the early stages of development will correct any errors, allowing better data collection once live.

Self-completed surveys have the ability to keep the participants responses anonymous and give confidence in this respect. Gillham (2008:p.7) states that respondents will feel undoubtedly more comfortable when answering a self-completed survey, as there is no pressure to give potential sensitive answers. In some situations, less relevant to this research, a self-completed survey should always be chosen, for example if the respondent is asked to answer potentially harmful questions or personal (Ong and Weiss, 2000).

However, according to Bryman and Bell (2011:p. 233), there are also some disadvantages of self-completed surveys that should be assessed prior to choosing the research method.

Bryman and Bell (2011:p.233) believe that one main disadvantage of self-completed surveys is there is no way of prompting or probing the participants if they are struggling to answer a question.

As this research wanted to understand the brand awareness of public chargepoint networks in England of both prospective and current electric vehicle drivers, it was essential to use quota sampling (Rooney and Evans, 2019, p. 132). According to Acharya *et al.*, (2013, p. 332) quota sampling is the procedure where a sample of participants are chosen based on a certain characteristic. Quotas can be decided on many variables, such as demographical attributes or the ownership of the same or similar products (Yang and Banamah, 2014). This allows the researcher to gather data representing a select representative sample to understand a larger population.

### 3.3.3 **Methods of distribution and reach**

To ensure that the survey was answered by participants covering both quotas, namely prospective and current electric vehicle owners, it was distributed through numerous relevant different channels. The most used channel was social media to enable some targeting instead of distributing to the general population. Electric vehicle Facebook groups were researched so that the survey could be completed by prospective and current electric vehicle owners in the UK. Two key Facebook groups were identified, the 'UK Electric Vehicle Owners Club' with more than 10,000 members and a vehicle specific group, the 'MG Electric Vehicle Owners Group' with more than 6000 members. As well as specific groups, the survey was distributed via this project's industry partner's social media accounts, as those who follow the account will have a strong interest in owning or already owning an electric vehicle. To collect data from selected parts of the UK, the survey used Facebook advertising, which allowed the survey to be distributed to specific post codes of those people who had an interest in owning an electric vehicle by using search engine cookies. Other modes of distribution were the newsletter of this project's industry partner, which has a subscribed audience of over 300 people, and Google ads. Google ads allowed the survey to be advertised to prospective participants who searched for this projects industry partner on Google. This approach to distribution will create some biases, for example against those who do not use social networks, although studies have

suggested that social networks us is high among early adopters of new technologies (Aldahdouh *et al.*, 2020).

The survey was created and distributed through Qualtrics, an online survey software. Google Forms and Survey Monkey were considered prior to designing the survey. However, since this survey aimed to be as interactive as possible with multiple styles of questions, Qualtrics was decided to be the best way to achieve the aim of this research. To gain the understanding of as many current or prospective electric vehicle drivers, the survey was distributed over a 6-week period, between April 2021 and June 2021. Due to an initial high completion numbers in the initial launch of the survey, it was decided 200 responses would be a realistic goal in the time period. Overall, the survey achieved 207 responses, this would achieve a good understanding of the brand awareness of current and prospective electric vehicle drivers. Of those 207 full responses, 12 participants responses were removed as in question Q1.3 those participants answered ‘Never’ to when they would purchase an electric vehicle, as this survey was to be answered by current and prospective EV drivers. A further two participants' responses were removed as there was missing information for Q6.1 on 'What is your age?’. This left 193 full responses to analyse.

Similar to the focus groups, the survey was ethically low risk, as they all had knowledge of the topic field prior to the survey, and it was their decision to participate. According to (Fox *et al.*, 2003) there are three ethical considerations when hosting a web-based research: anonymity, protection from harm and data security. Making sure the participants identity was kept unidentifiable was essential, the survey did not collect any personal contact information from the participants, other than demographical information which participants could provide if they wished to do so. Second, it was essential to ensure that participants were protected from any potential harm, as the survey did not ask any potentially harmful or intrusive questions, and the study was considered low risk. Prior to completing the survey, participants were asked to read the participant information sheet (Appendix 3), here they could learn more about the study and make an informed decision on participating, participants were not able to proceed with the survey until they selected ‘Click here to consent to the above’.

Security of the data from the survey was very important, Qualtrics keeps the data encrypted, when the survey was complete, all data retrieved was stored in an encrypted cloud storage system.

### 3.3.4 **Survey construction and design**

The survey was broken down into six sections: about you, chargepoint network installations, chargepoint network logos, chargepoint network services, information preferences and demographical information. A mixture of questions was asked in the survey, a mixture of closed and contingency questions (Siniscalco and Auriat, 2005).

According to (Roopa and Rani, 2012, p. 274) a closed question in a survey is where the answers are limited to a fixed response, closed questions can come in many forms, such as: Yes/No questions, Multiple Choice questions and scaled questions. Closed questions retrieve short precoded answers from the survey, closed questions are easier to process and analyse after the survey is complete (Brace, 2018, p. 60).

A contingency question is limited to a subgroup of respondents; this means the participant only answers questions that are relevant to them (Lavrakas, 2008). Relevancy can be determined based on demographical information, for example, gender or location, or particular responses to a previous question (Roopa and Rani, 2012: p.273). An advantage of contingency questions is the participant does not answer questions that do not apply to them, increasing the richness of the data as quota of participants will be met. The literature suggests that, in order to increase participants' comprehension of the questions, each question was designed to be short, no more than 20 words per question (Fink, 2003; Holbrook *et al.*, 2006). For full participant comprehension, this survey did not have a question longer than 15 words per question. As this survey aimed to understand the awareness of the participant, it was essential to offer a no-opinion option to some questions, otherwise known as a filter question (Converse and Presser, 1986). By offering a ‘Don’t Know’ or ‘Not sure’ option, the participant can choose whether it is acceptable to not offer information (Converse and Presser, 1986, p. 282). Further research suggests that participants may not want to appear uninformed and give an untruthful answer, to prevent this ‘Don’t Know’ or ‘Not sure’ options from being added (Converse and Presser, 1986; Vaillancourt, 1973).

The first section of the survey was designed to understand more about the current or prospective electric vehicle driver, and the section compromised five questions. This section allows the research to achieve its quota of participants who are prospective or current electric vehicle drivers. Section one is short, making sure the participant is not overwhelmed by the beginning of the survey; if they are overwhelmed, they may not commit to the full study effecting the data (See Appendix 6). The following section briefly explains the rationale behind these questions.

Section two consists of six closed questions. This section was designed to understand the participant awareness of different UK public chargepoint network provider installations, the provider logos were distorted. Participants were presented with a photo of a public chargepoint and were asked to name the network provider; since the chargepoints have logos on, these were blurred or removed to understand the awareness of the participant. The six questions were multiple choice, they offered three random network providers as well as the correct one, not to pressure the participant a filter question of 'I don't know' option was available. Section two collected data on whether prospective or current electric vehicle drivers could name public network chargepoint providers, even with their installations distorted.

Section 3 consists of six questions. This section was designed to understand the awareness of different UK public chargepoint network providers logos, the logos of the network provider were distorted. Participants were presented with the same short question: Which one of these public chargepoint networks is, with the network providers name changed. Participants were asked to answer the multiple choice question by selecting which of the distorted logos they believed was the network provider. Section 3 gathered data on whether prospective or current electric vehicle drivers could name public network charging point providers, even with their logos distorted.

Section 4 compromised 6 questions. This section was designed to understand the participants awareness of the services of different UK public network chargepoint providers. Participants were asked a series of the same multiple-choice question, What charging services does *X*

provide? (Select as many answers as possible that apply), with a range of major public network chargepoint providers being tested. However, as Section four aimed to understand the service the public network chargepoint provider provides, its full logo was shown. So participants could fully comprehend each possible answer, a short description of each answer was provided, and these statements were taken from ZapMap to limit any misunderstanding. Kosnick and Presser (2010:243) believe it is best practice in a survey not to use technical terminology, by adding the description allowed the participant to be as informed as possible when answering.

Participants were allowed to select as many options as possible that they deemed to be correct, this was due to some public network chargepoint providers having multiple services to charge an electric vehicle

Section five consists of 7 questions. This section was designed to understand the preferred methods of receiving information from participants regarding public chargepoint networks. Participants were asked a range of different closed questions as well as a contingency question at the end of the section.

The first question in this section asked Q5.1 Are you interested in receiving information regarding new and existing chargepoints in your area?, this question was designed to understand if prospective and current electric vehicle drivers were interested in receiving this information. Question Q5.1 is a multiple-choice question, allowing the participant to select only one answer, a filter don't question was added 'Not Sure' to make sure the participant answered appropriately, increasing the richness in data.

Question 5.2 was a closed multiple choice question, Q5.2 What is your preferred method of receiving online information? (Select all that apply,) allowing the participant to choose as many options as appropriate. A filter question was added of 'None of the above' and 'Other', this allowed the participant to either not answer or add their preferred method of receiving online information if it was not listed.

Question 5.3 was a closed question, Rank, using drag and drop, what forms of social media do you use most frequently, this required the participant to rank each social media platform in into three different boxes: I use most frequently (Daily), I don't use very often (Once a week) and I don't use at all (Once a month or never). Using the ranking feature increased the interaction of the participant in the survey, other question methods such as sliders or multiple-choice tick boxes could have been used, however, drag and drop ranking was chosen due to its interactive abilities.

The headings on the frequency of the social media usage was decided as it would have been difficult to suit all participants usage, by narrowing it down to Daily, Weekly, Monthly/Never, allowed to gain an overall understanding of the usage. Other used a filter option, allowing participants to add other social media that was not listed, as well as allowing participants to leave out those they never use or are not applicable to them.

Question 5.4 was a closed question, Rank, using drag and drop, what type of social media content you would like to see more of, similar to Q5.3 participants were required to rank, using drag and drop, what electric vehicle content they would like to see more of. They were required to add the types of content into three boxes: Interested,, Might Be Interested and Not Interested. Other used a filter option, allowing participants to add another type of content that was not listed, as well as allowing participants to leave out those they never use or are not applicable to them.

Question 5.5 was a multiple-choice closed question, What are your preferred methods of receiving offline information? (Select all that apply), allowing the participant to choose as many options as appropriate. A filter question was added of 'None of the above' and 'Other', this allowed the participant to either not answer or add their preferred method of receiving online information if it was not listed. Question 5.5 was designed to mirror Q5.2, as it aimed to compare the preferred methods of receiving information of public electric vehicle chargepoints.

Question 5.6 was a multiple-choice question, Are you aware of Charge My Street and their services?. Participants could only select one option of Yes, No, and a filter question of Not

Sure. This question was a contingency question, if the participant answered Yes, they would be automatically sent to Q5.7, if they answered No or Not Sure, they would be sent to Section 6.

Question 5.7 was a multiple choice question, Choose what platforms do you follow Charge My Street on. (Select as many answers that apply). This questioned allowed participants who answered Yes to Q5.6 to choose what forms they follow Charge My Street on with a filter option of either I do not currently follow Charge My Street on Social Media or Other.

Section 6 consists of three demographical questions. This section collected participant demographic data, which allows the research to gain a better understanding of the participants, providing context to the participants responses (Allen, 2017).

It is essential to only collect appropriate demographical data in research, as asking sensitive personal questions that are not essential could risk participants not completing the survey (Tourangeau and Yan, 2007; Hughes *et al.*, 2016, p. 139). The three questions in section 6 asked; Age, Gender and Location of participants, it was discussed to ask further demographical questions such as ethnicity, education, marital status and income, it was decided as these were not relevant to the research they would not be asked.

### 3.3.5 **Methods of Analysis**

Once the survey reached its goal of 200 responses in 6 weeks, the data was cleaned and responses that were not relevant to the aim of the survey were removed. The quantitative data was then imported into SPSS, a data analysis software allowing the data to be examined for relationships, differences, and trends in the data. A mixture of graphs, tables, and charts was created to present the findings of the survey, to support the findings, To explore whether similar values between two binary variables could be considered statistically different in a cross-tabulation table, Phi is used (Akoglu, 2018). According to Liebetrau (1983) Cramer's V is the most popular chi-square-based measures of association as it is a good measure of relation between variables. It varies from 0 to 1 regardless of table size. Alternatively, the data could have been analysed using Chi-Squared. Chi-Squared is typically used for hypothesis testing, this test would not show the strength of relation in the data, meaning, Cramer's V is the most

appropriate measure. Due the survey data having variables in nominal and ordinal scales, typically where there are more than two levels. Cohen (1988) suggests when analysing the relation, 0.1 is a small effect, 0.3 is medium and 0.5 is a high effect size. Using Cramer's V, the association between participants wanting to receive information regarding new and existing chargepoints in their area is .16, a low effect overall. However, as the bar chart shows, there is demand from both current and prospective electric vehicle drivers for more information.

# 4.0 Empirical Findings

## 5.1.0 **Introduction**

This chapter will present the key data captured from the two methods of research, focus groups and the survey. Firstly, data will be presented from the focus groups; after analysing the data, three key themes appeared: confusion of charging behaviour, misinterpretation of public chargepoint providers and local barriers to electric vehicle Adoption. Theme 3 has been divided into three subthemes: price of electric vehicles, price of charging barriers and access to off-street parking.

## 5.2.1 **Theme 1: Confusion of Charging Behaviour**

**Participant 4**: "Which means you then, like **P5** said, you need the extra costs, you're going to need a charger at home, because you'll be charging maybe every night or once every other night, you know, so you can't, you can't go and charge it up somewhere else."

**Participant 6**: "So it's like, that's another thing about sort of leaving maybe your car, I know, two, three hours however long it is."

**Participant 4**: "And so charging them fuelling them using them, is exactly the same as the internal combustion engine models that we've got, you would do it once or twice a week."

**Participant 1**: "If you go and do your shopping, you've charged a car for free. Yeah. Yeah, my neighbour and another neighbour with an EV on the street. He uses it and he say 20 minutes will just top it up nicely. And he just takes a bit longer to go around the shop."

**Participant 3**: "Tripping out in your work. See, I don't want to walk a mile in my work. Work suit to go to come pick up my car in the morning."

**Participant 3**: "Pop in the office and plug the car in for an hour while I'm while I'm popping in the into works and that's win-win isn't it"

## 5.2.2 **Theme 2: Uncertainty of Public Chargepoint Providers**

**Participant 5: "**If I'm driving up and down motorways plugging the thing in, I'm probably getting fossil fuel fired electricity, which I don't. That's what I want to know. I would want to know that the charging networks were on renewables, otherwise it's not actually a clean option."

**Participant 6: "**Yeah, I just I what also concerns me about the you know, plugging in a supermarket or motorway services, or whatever it is, it's probably about twice the price of plugging in at home."

**Participant 1**: "I don't know about the big fast chargers in booths."

**Participant 1: "**Just go to booths, if you need to fast charge just plug in there."

**Participant 1**: "Old Tesla's charging points are free. And they're extremely fast. So, you think it's about 25 to 30 minutes to charge for Tesla. And the booths, one's think are about 30 kilowatts. So you are, you're only going to be charged for about an hour."

**Participant 3:** "I live in South Lancaster and the nearest one would be either booths which is about a mile and a half away."

**Participant 1**: "Sainsbury's have a free EV, charger."

### 5.2.3 **Theme 3: Local Barriers to Electric Vehicle (EV) Adoption**

*Sub Theme 3.1: Price of Electric Vehicle (EV) Barrier*

**Participant 5:** "There's, what was the other thing, all this stuff about leasing batteries, and all that kind of palaver. It's not just buying the thing, you know, there's a lot of extra costs in it even second-hand, and that's an obstacle."

**Participant 5: "**I haven't actually checked the insurance for it. I mean, it does seem it's higher than what I have at the minute."

**Participant 6: "**And certainly, you know, my, my budget for a new second-hand car is 3000 pounds. So, I'm not going to be getting an EV anytime soon."

**Participant 1:** "I understand that getting a nice new EV or an EV will be a sort of like a bit of a cost benefit analysis really, you've got to make sure it's worth it."

**Participant 3:** "But yeah, the other problems are also price, but there's some really competitive like by what's it called loan, loans to buy or whatever?"

**Participant 3: "**So, you know, which is comparable to the loan that I've just about paid off my car anyway. So, and the car that I've got I bought, I almost, I've almost finished paying for. So, it will be comparable to that to get a new one on the on the loan thing?"

**Participant 2**: "I feel a bit hypocritical really, because I have a big, gas guzzling diesel guzzling camper van as well. And I have a Mercedes and I am looking at getting an electric Merc or electric VW. And I'm not worried about the money.

*Sub Theme 3.2: Price of Charging Barrier*

**Participant 6**: "Yeah, I just I what also concerns me about the you know, plugging in a supermarket or motorway services, or whatever it is, it's probably about twice the price of plugging in at home. So, my electricity costs, what 15 pence a unit."
**Participant 6**: "We are we are stuck with council charging points, so maximum cost."

*Sub Theme 3.3: Access to Off-Street parking Barrier*

**Participant 5**: "I do not have access to a driveway".

**Participant 6**: “I can't charge at home because I live in a terrace street”.

**Participant 2**: “I live in a terraced house. And there's no parking”.

**Participant 3**: “I live on terrace Street.”

**Participant 3**: “You can’t park right outside my house and although I would consider if there was somewhere safe, sort of within 10 minutes’ walk.”

### 5.3.0 **Survey Findings Introduction**

This section of the empirical findings section will present key data gathered from the survey. The graphs, charts, and tables exhibited were carefully chosen from the data collected from the survey to achieve the aim and objectives of this research.

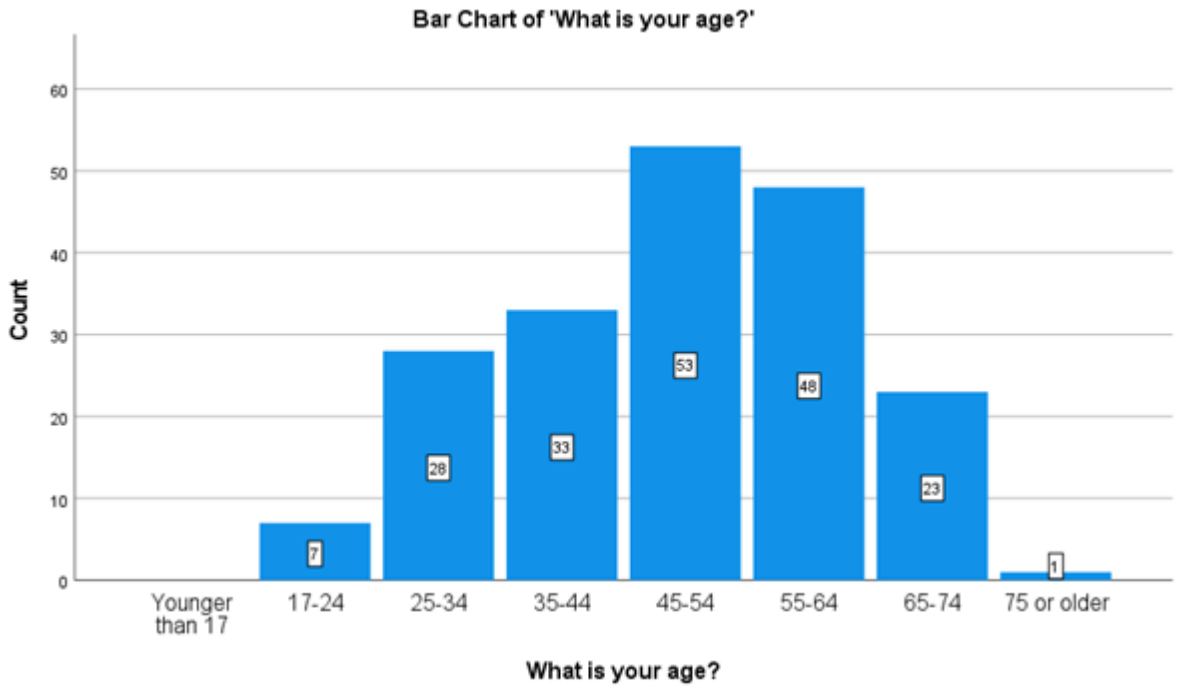



*Figure 14:Bar Chart of 'What is your age?'*

Participants were commonly aged either 45-54 or 55-64. Electric vehicles are a new technology, using Rogers’ (2003) model, those who have already bought electric vehicles are innovators or early adopters. These individuals are willing to take financial risks to see a product succeed. Rogers (1962) suggests, these consumers have a high social status, financial liquidity, typical with the most common age ranges of participants.

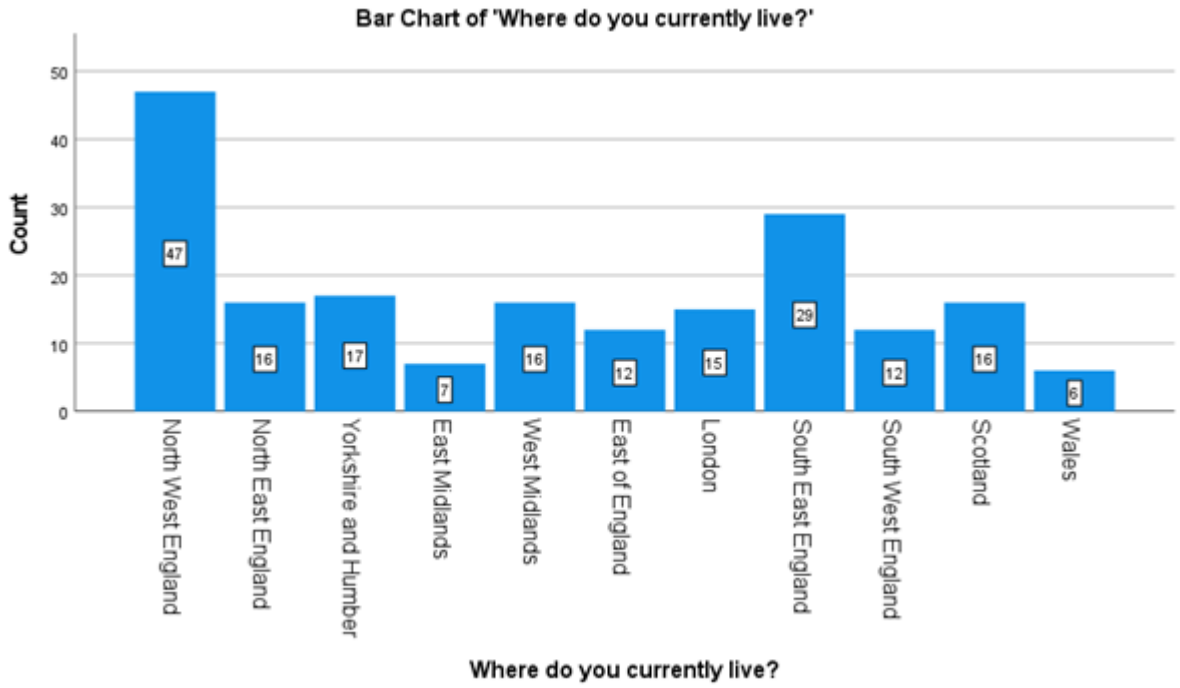



*Figure 15:Bar Chart of 'Where do you currently live?'*

Due to the survey being advertised on multiple online channels, it was completed by participants from a range of locations across the UK. However, the most common area participants resided was the North West of England.

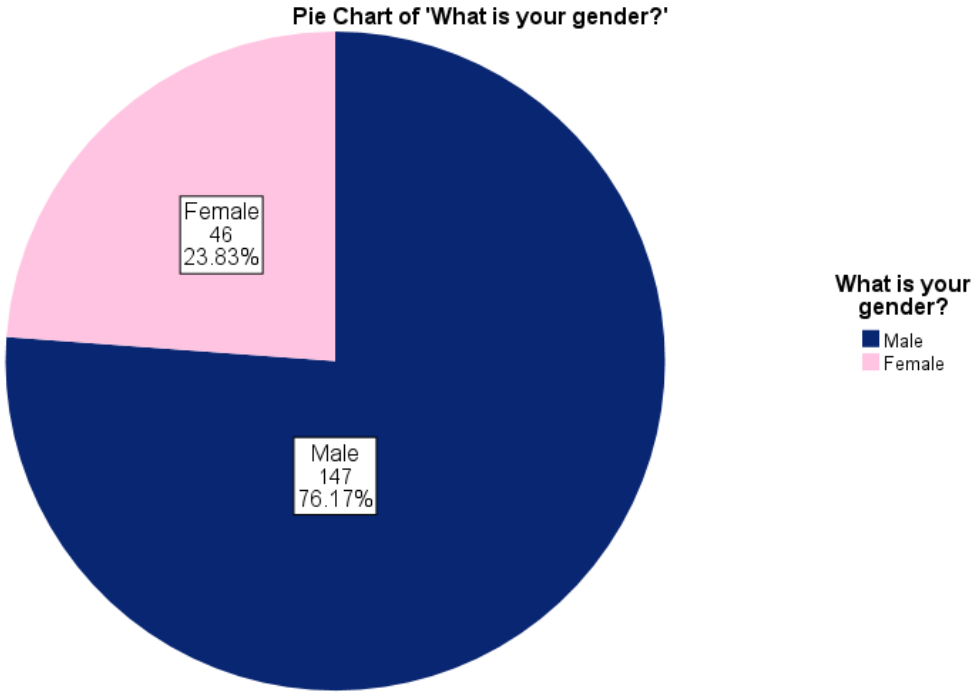



*Figure 16:Pie Chart of 'What is your gender?'*

Similarly to figure 15, the gender of participants that completed the study correlate with the adoption stage of electric vehicles.

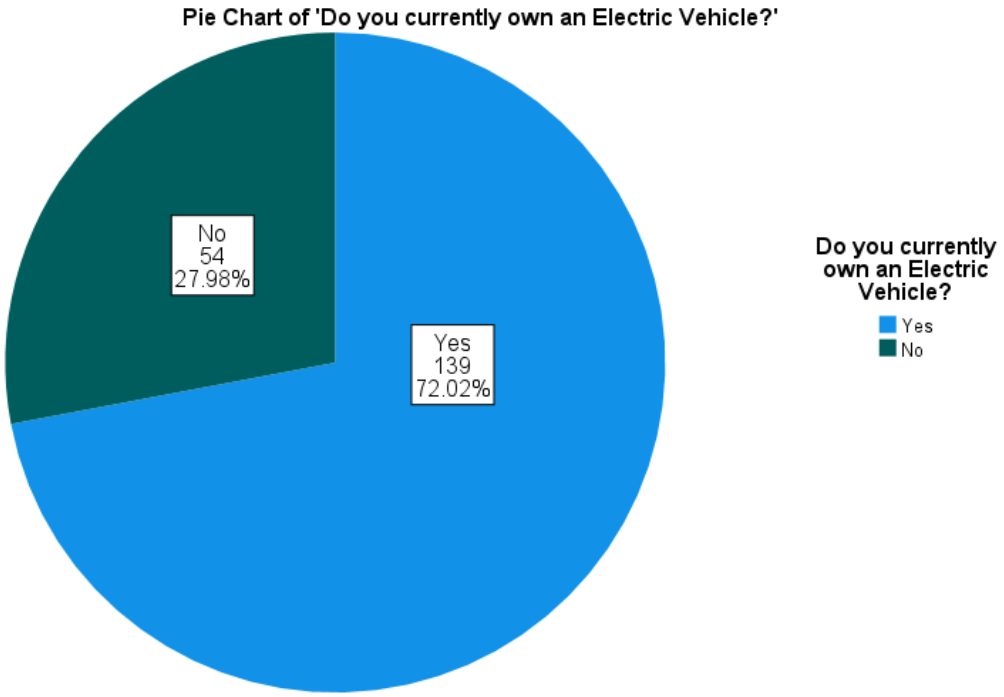



*Figure 17:Pie Chart of 'Do you currently own an Electric Vehicle? (EV)'*

*Table 3: 'Do you currently own an Electric Vehicle?' versus 'Do you have access to a driveway?'*

| | | Do you have access to a driveway? | | | |
|---|---|---|---|---|---|
| | | Yes | Sometimes | No | Total |
| Do you currently own an Electric Vehicle? | Yes | 118 | 2 | 19 | 139 |
| | No | 25 | 7 | 22 | 54 |
| Total | | 143 | 9 | 41 | 193 |

**Symmetric Measures**

| | | Value | Approximate Significance |
|---|---|---|---|
| Nominal by Nominal | Phi | .409 | .000 |
| | Cramer's V | .409 | .000 |
| N of Valid Cases | | 193 | |

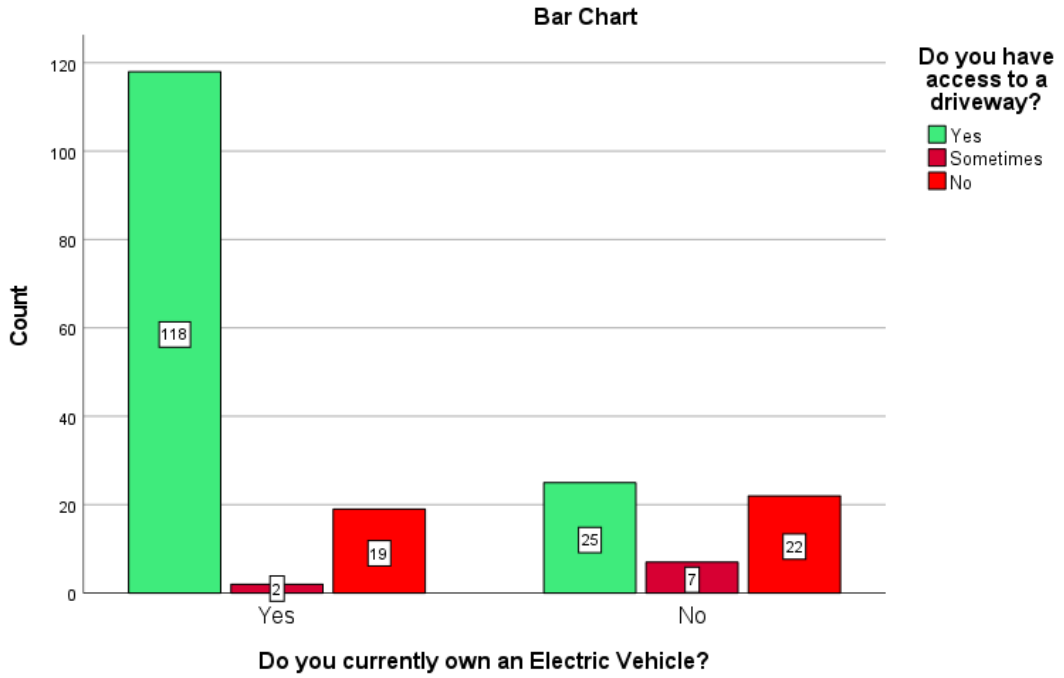



*Figure 18: Bar Chart of: 'Do you currently own an Electric Vehicle?' versus 'Do you have access to a driveway?'*

The majority of participants who currently own an electric vehicle have access to off-street parking. This is a common barrier to entry for those who do not have access to off-street parking when making the switch to an electric vehicle.

*Table 4: 'Do you currently own an Electric Vehicle (EV)?' Versus 'Where do you currently live?'*

| | | Do you currently own an Electric Vehicle? | |
|---|---|---|---|
| | | Yes Count | No Count |
| Where do you currently live? - Selected Choice | North West England | 26 | 21 |
| | North East England | 8 | 8 |
| | Yorkshire and Humber | 15 | 2 |
| | East Midlands | 6 | 1 |
| | West Midlands | 14 | 2 |
| | East of England | 10 | 2 |
| | London | 8 | 7 |
| | South East England | 24 | 5 |
| | South West England | 8 | 4 |
| | Scotland | 15 | 1 |
| | Wales | 5 | 1 |
| | Northern Ireland | 0 | 0 |
| | Ireland | 0 | 0 |
| | Outside of UK (Specify if you would like to) | 0 | 0 |

**Symmetric Measures**

| | | Value | Approximate Significance |
|---|---|---|---|
| Nominal by Nominal | Phi | .356 | .006 |
| | Cramer's V | .356 | .006 |
| N of Valid Cases | | 193 | |

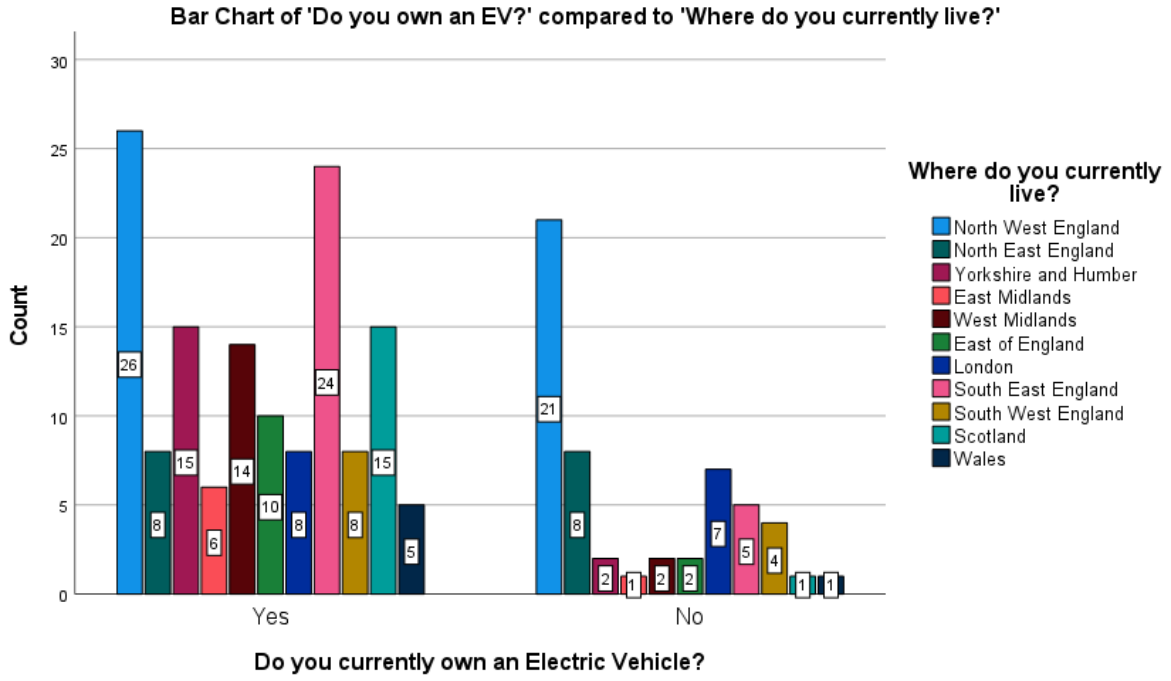



*Figure 19: Bar Chart of: 'Do you currently own an Electric Vehicle (EV)?' Versus 'Where do you currently live?'*

Interestingly, participants who lived in the South West of England, were more likely to own an electric vehicle than not. This could be potentially due to higher wealth in that area leading to adoption and access to off-street parking.

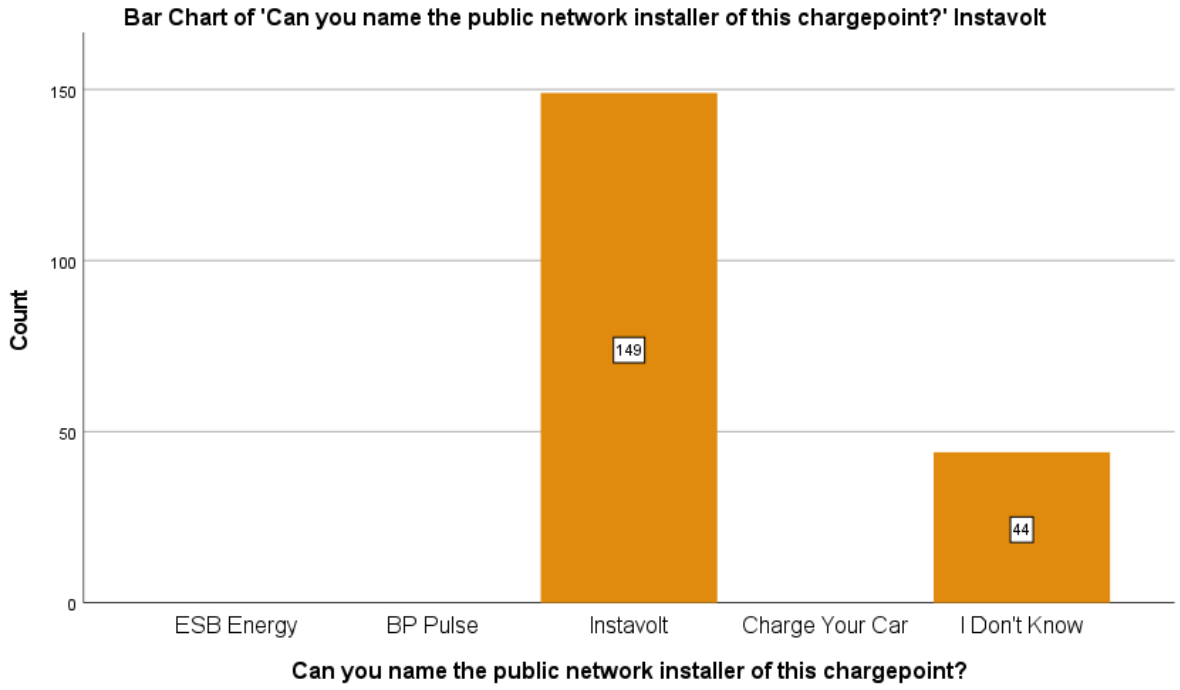



*Figure 20: Bar chart of Can you name the public network installation of this chargepoint?' (Instavolt)*

The survey discovered that 149 participants could name Instavolt when shown a distorted image of their chargepoint. Participants did not select another operator if they were unsure, meaning Instavolt's installation that is not similar to their competitors.

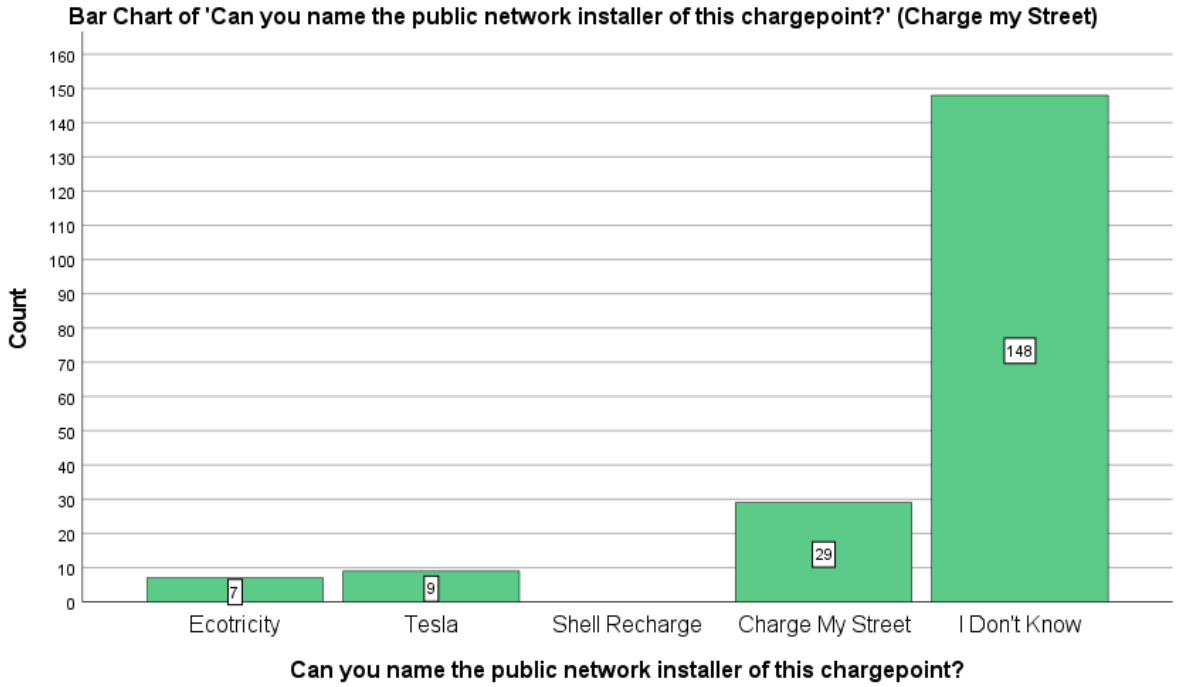



*Figure 21: Bar chart of: 'Can you name the public network installation of this chargepoint?' (Charge My Street)*

Only 29 participants could name Charge My Street's installation. 148 participants were unable to name the installation or chose Ecoticity or Tesla as the installer. Meaning Charge My Street need to make their installations recognisable.

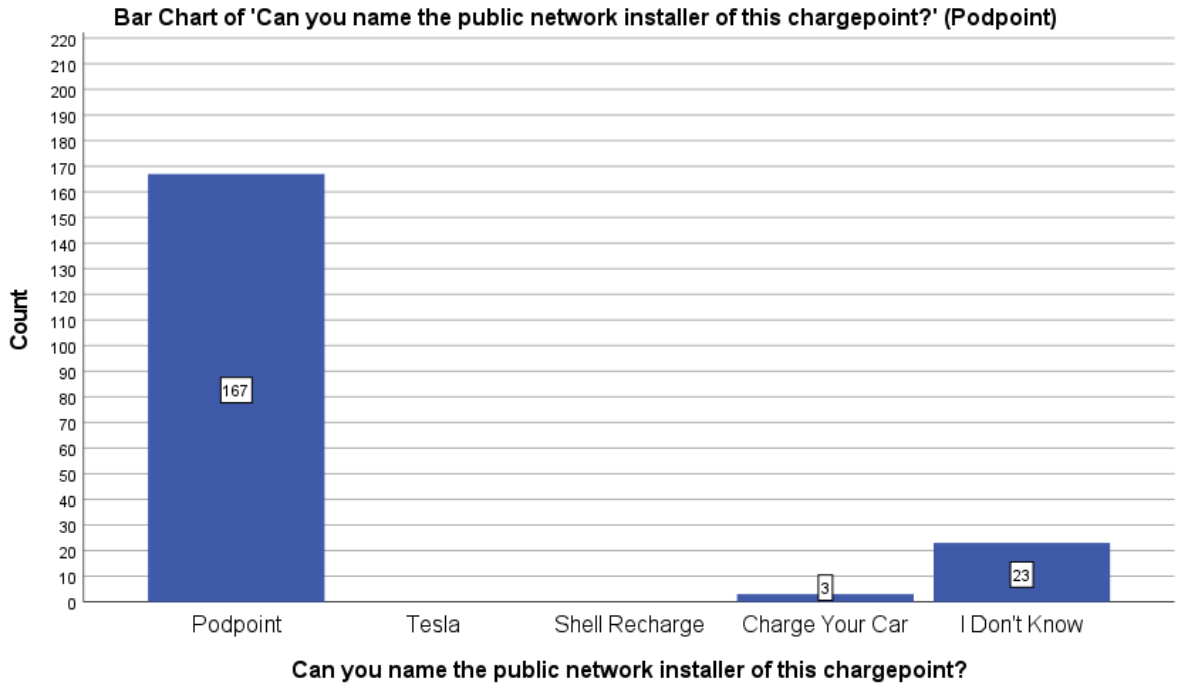



*Figure 22: Bar Chart of: 'Can you name the public network installation of this chargepoint?' (Podpoint)*

167 participants successfully named podpoint as the chargepoint operator. A few participants believed 'Charge Your Car' were the operator, yet, Podpoints installations are very recognisable.

*Table 5: 'Do you currently own an Electric Vehicle (EV) versus 'Can you name the public network installer of this chargepoint?' (Podpoint)*

| | | Can you name the public network installer of this chargepoint? | | | |
|---|---|---|---|---|---|
| | | Podpoint | Charge Your Car | I Don't Know | Total |
| Do you currently own an Electric Vehicle? | Yes | 129 | 2 | 8 | 139 |
| | No | 38 | 1 | 15 | 54 |
| Total | | 167 | 3 | 23 | 193 |

**Symmetric Measures**

| | | Value | Approximate Significance |
|---|---|---|---|
| Nominal by Nominal | Phi | .307 | .000 |
| | Cramer's V | .307 | .000 |
| N of Valid Cases | | 193 | |

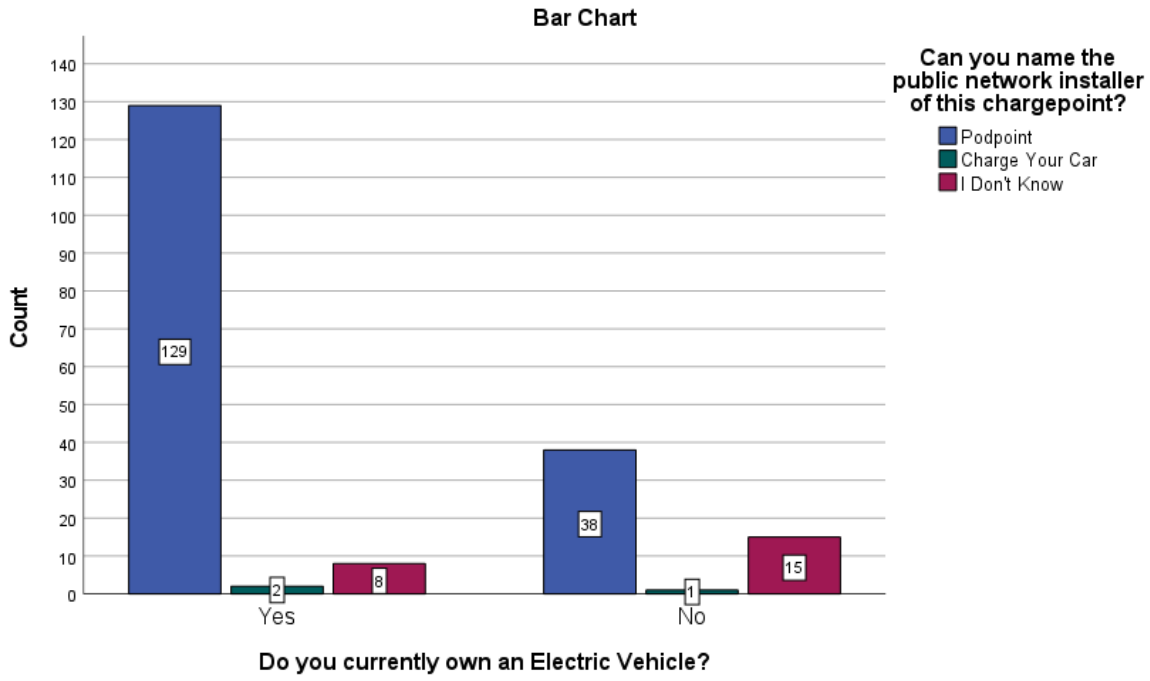



*Figure 23: Bar Chart of: 'Do you currently own an Electric Vehicle (EV) versus 'Can you name the public network installer of this chargepoint?' (Podpoint)*

Podpoint is recognisable to those who are current and prospective EV drivers. Only 10 EV drivers were incorrect. The installation was successfully named by 38 prospective EV drivers, meaning the installations are recognisable, even if you do not own an EV.

*Table 6: 'Do you currently own an Electric Vehicle?' versus 'Which one of these public chargepoint networks is Podpoint?'*

| | | Which one of these public chargepoint networks is Podpoint? | | | |
|---|---|---|---|---|---|
| | | Instavolt | PodPoint | I Don't Know | Total |
| Do you currently own an Electric Vehicle? | Yes | 0 | 134 | 5 | 139 |
| | No | 1 | 42 | 11 | 54 |
| Total | | 1 | 176 | 16 | 193 |

**Symmetric Measures**

| | | Value | Approximate Significance |
|---|---|---|---|
| Nominal by Nominal | Phi | .299 | .000 |
| | Cramer's V | .299 | .000 |
| N of Valid Cases | | 193 | |

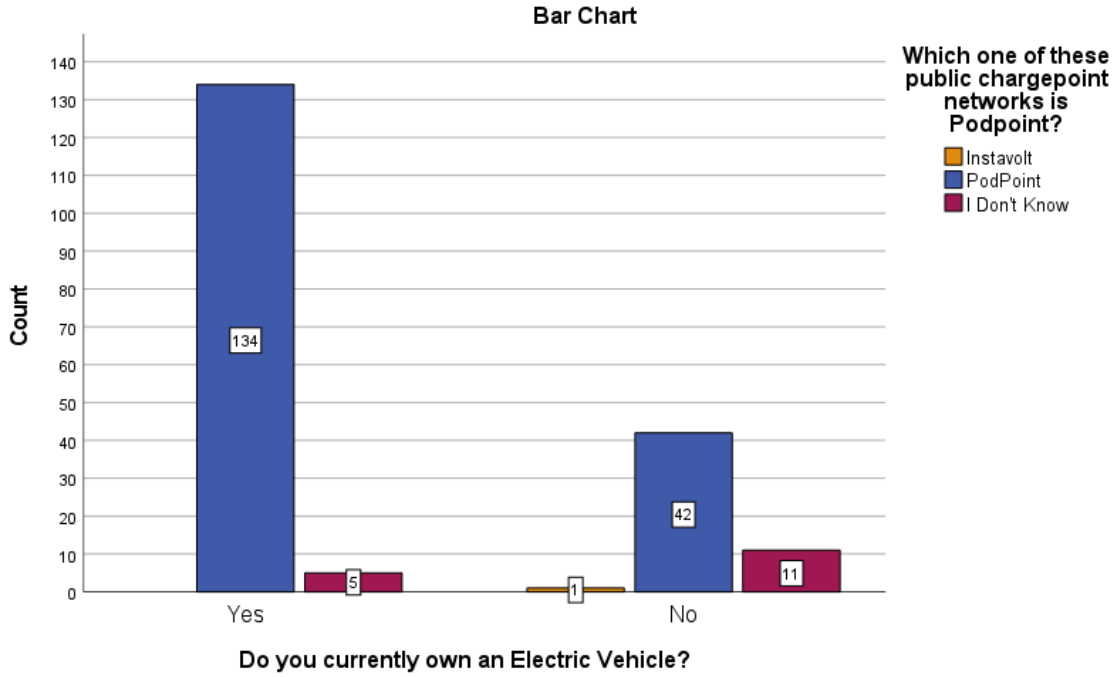



*Figure 24: Bar chart of: 'Do you currently own an Electric Vehicle?' versus 'Which one of these public chargepoint networks is Podpoint?'*

Instavolt is recognisable to those who are current and prospective EV drivers. Only 5 EV drivers were incorrect. The installation was successfully named by 42 prospective EV drivers, meaning the installations are recognisable, slightly higher than Podpoint's recognition.

*Table 7:'Do you own an Electric Vehicle (EV)?' versus 'What charging services does Podpoint provide?'*

Rapid Charging

| | | Do you currently own an Electric Vehicle? | | |
|---|---|---|---|---|
| | | Yes | No | Total |
| What charging services does Podpoint provide? | Rapid Charging | 60 | 11 | 71 |
| Total | | 60 | 11 | 71 |

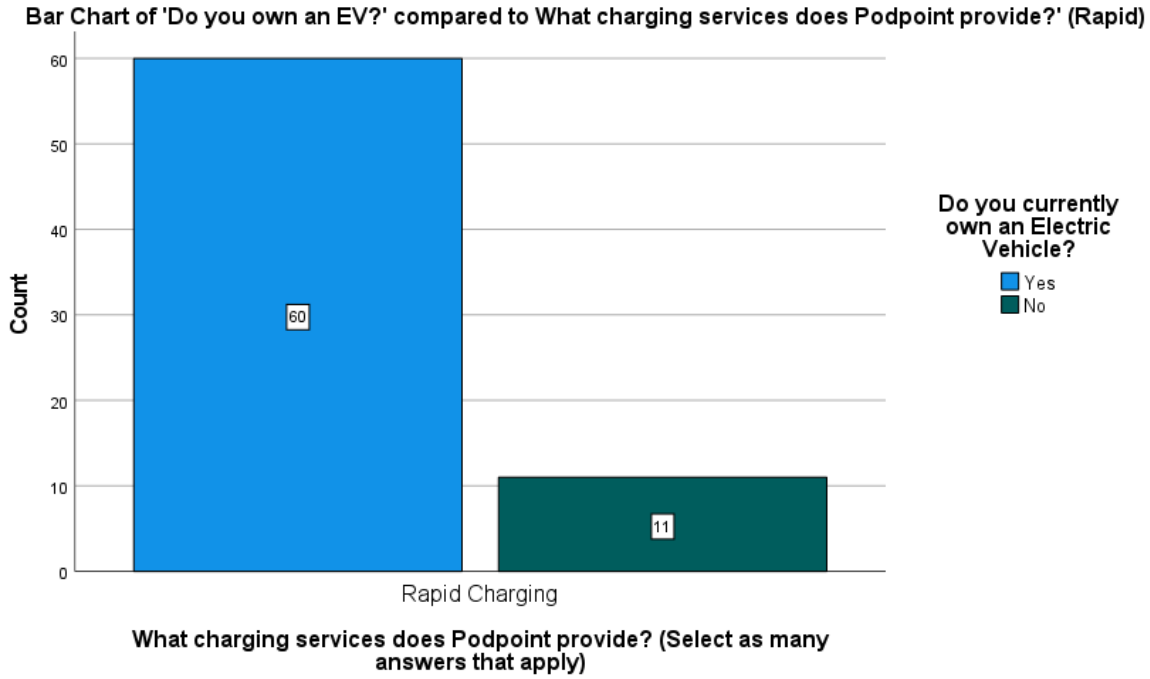



*Figure 25: Bar Chart of: 'Do you own an Electric Vehicle (EV)?' versus 'What charging services does Podpoint provide?' (Rapid)*

Podpoint provides a fast charging service, however, 60 current EV drivers believed they provided rapid charging, which is incorrect.

*Table 8: 'Do you own an Electric Vehicle (EV)?' versus 'What charging services does Podpoint provide?'*

Fast Charging- Correct Answer

| | | Do you currently own an Electric Vehicle? | | |
|---|---|---|---|---|
| | | Yes | No | Total |
| What charging services does Podpoint provide? | Fast Charging | 115 | 23 | 138 |
| Total | | 115 | 23 | 138 |

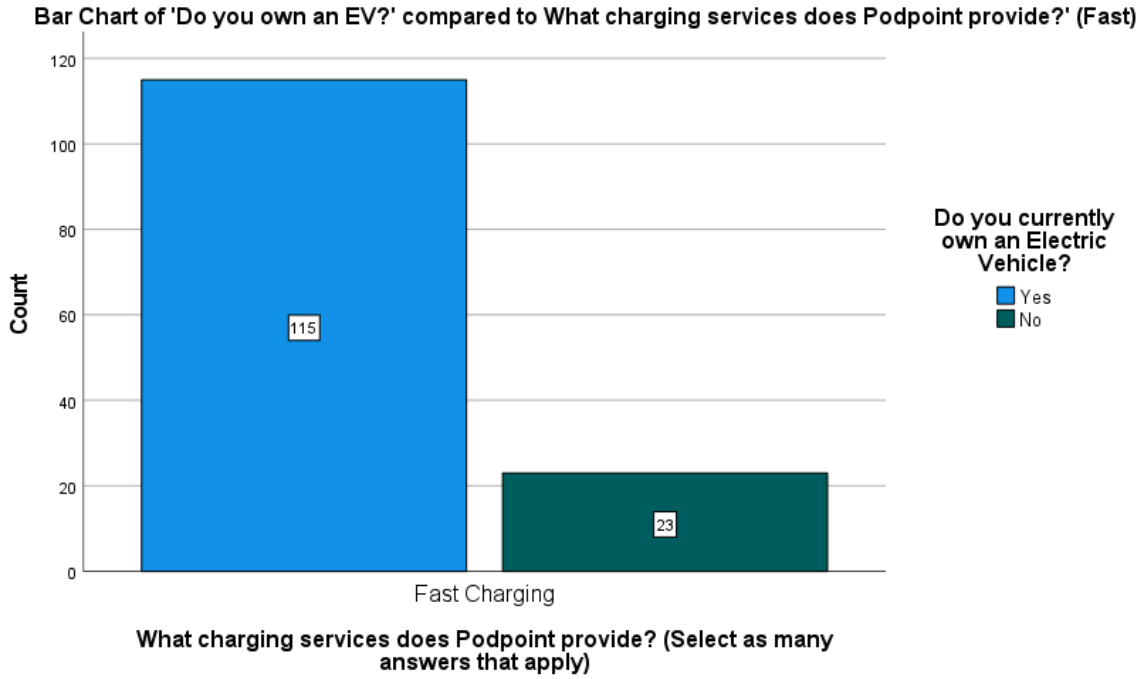



*Figure 26: Bar Chart of: 'Do you own an Electric Vehicle (EV)?' versus 'What charging services does Podpoint provide?' (Fast Charging)*

The majority of current EV drivers were correct, stating Podpoint provides a fast charging solution. There were 23 prospective EV drivers who were also correct naming their charging service.

*Table 9: 'Do you own an Electric Vehicle (EV)?' versus 'What charging services does Podpoint provide?'*

Slow Charging

| | | Do you currently own an Electric Vehicle? | | |
|---|---|---|---|---|
| | | Yes | No | Total |
| What charging services does Podpoint provide? | Slow Charging | 70 | 16 | 86 |
| Total | | 70 | 16 | 86 |

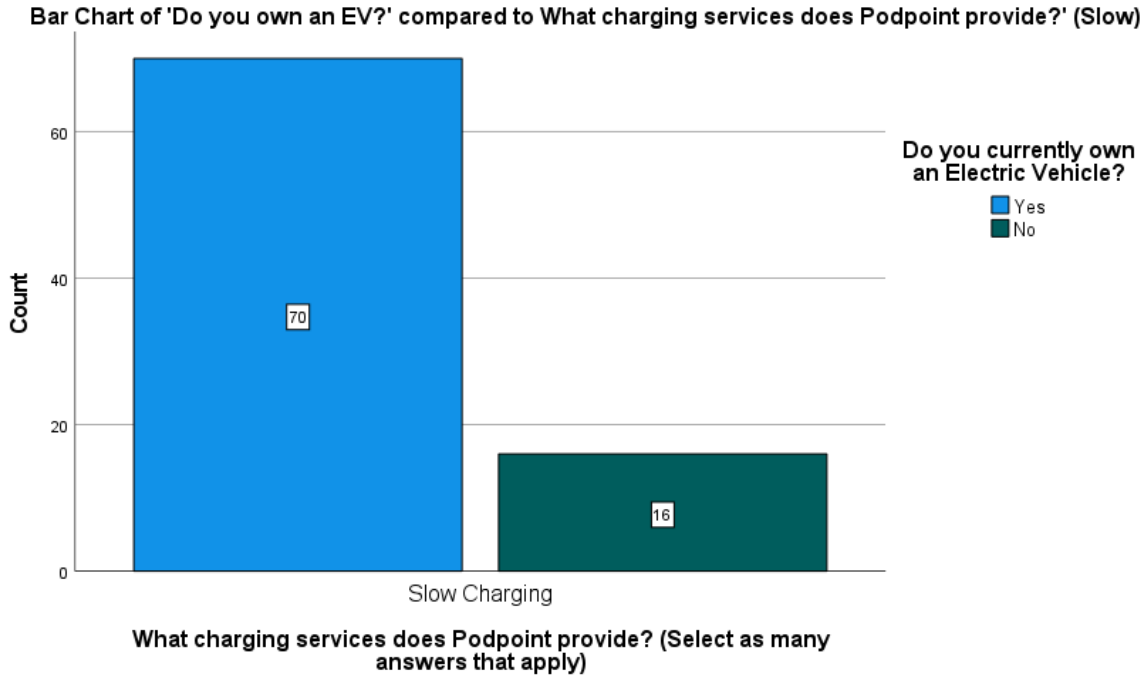



*Figure 27: Bar Chart of: 'Do you own an Electric Vehicle (EV)?' versus 'What charging services does Podpoint provide?' (Slow Charging)*

Podpoint provides a fast charging service, however, 70 current EV drivers believed they provided slow charging, which is incorrect. There seems to be a confusion between the terminology Fast and Slow charging, further research could explore this confusion.

*Table 10: 'Do you own an Electric Vehicle (EV)?' versus 'What charging services does Podpoint provide?'*

I Don't Know

| | | Do you currently own an Electric Vehicle? | | |
|---|---|---|---|---|
| | | Yes | No | Total |
| What charging services does Podpoint provide? | I Don't Know | 12 | 25 | 37 |
| Total | | 12 | 25 | 37 |

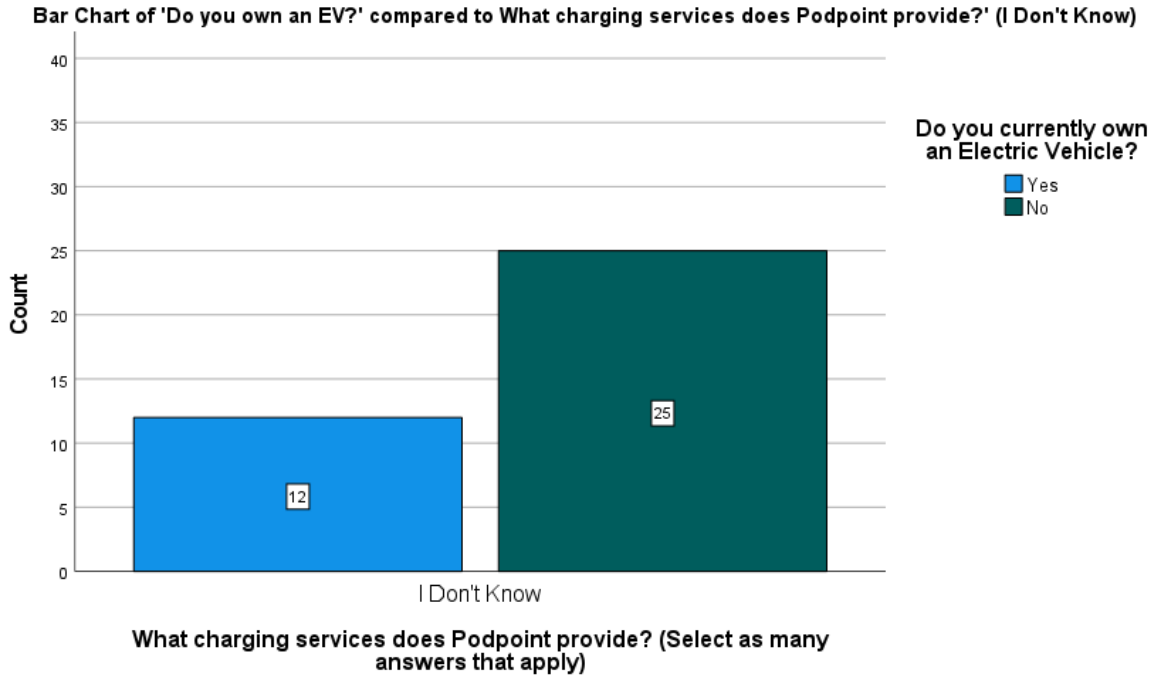



*Figure 28: Bar Chart of: 'Do you own an Electric Vehicle (EV)?' versus 'What charging services does Podpoint provide?' (I don't know)*

Podpoint provides a fast charging service, however, 12 current EV drivers could not name their charging service. Similarly, 25 prospective EV drivers were unable to name their service.

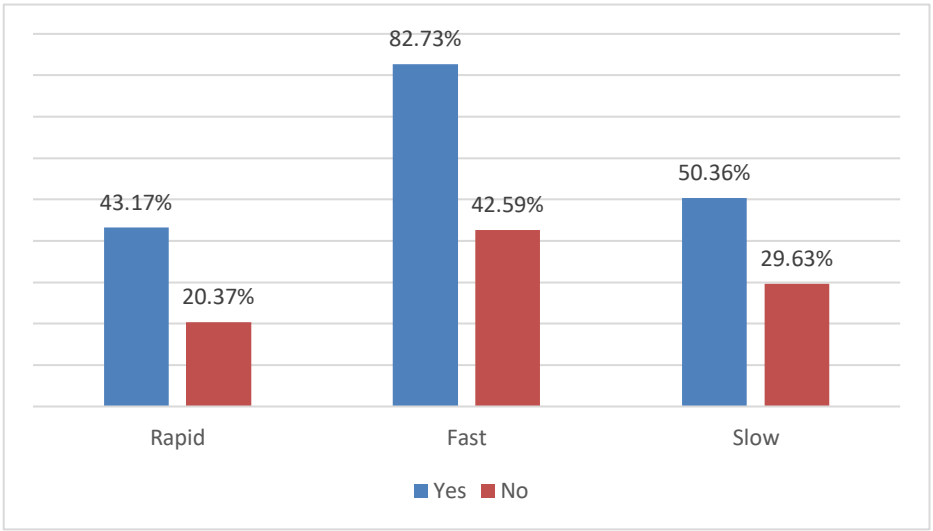



*Figure 29: Bar Chart of 'Do you own an electric vehicle?' versus 'What charging services does Podpoint provide?' (Percentage of correct answers)*

Although a lot of participants were correct in naming Podpoints charging service, there seems to be a confusion between Fast and Slow charging. If both current and prospective EV drivers were better informed, improving their charging behaviour.

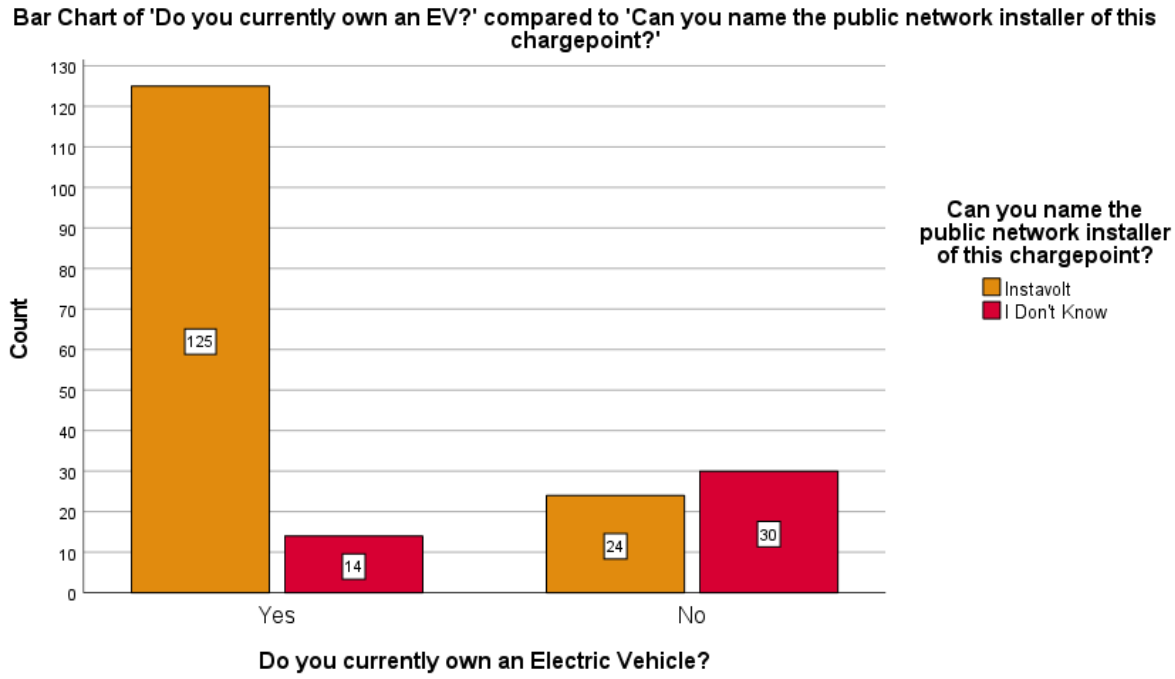



*Figure 30: Bar Chart: 'Do you currently own an Electric Vehicle (EV) versus 'Can you name the public network installer of this chargepoint?'*

Instavolt is recognisable to those who are current and prospective EV drivers. Only 14 EV drivers were incorrect. The installation was successfully named by 24 prospective EV drivers, meaning the installations are recognisable, even if you do not own an EV.

*Table 11: 'Do you currently own an Electric Vehicle?' versus 'Which one of these public chargepoint networks is Instavolt?'*

| | | Which one of these public chargepoint networks is Instavolt? | | | |
|---|---|---|---|---|---|
| | | Instavolt | PodPoint | BP Pulse | I Don't Know |
| Do you currently own an Electric Vehicle? | Yes | 121 | 0 | 3 | 15 |
| | No | 28 | 1 | 1 | 24 |
| Total | | 149 | 1 | 4 | 39 |

**Symmetric Measures**

| | | Value | Approximate Significance |
|---|---|---|---|
| Nominal by Nominal | Phi | .398 | .000 |
| | Cramer's V | .398 | .000 |
| N of Valid Cases | | 193 | |

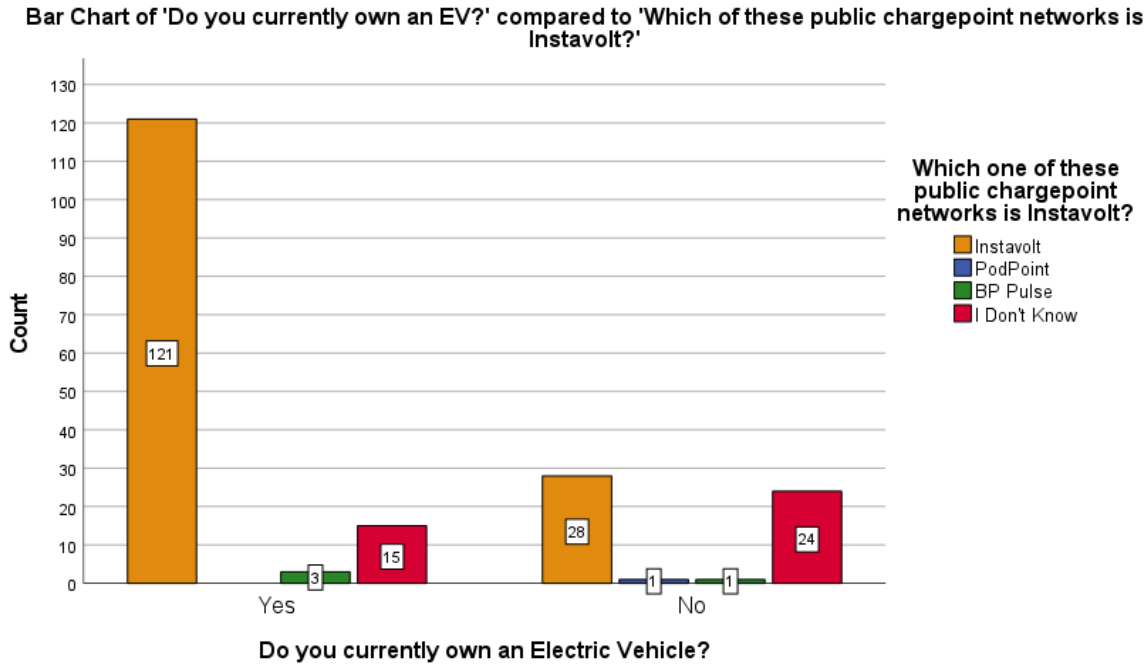



*Figure 31: Bar Chart of: 'Do you currently own an Electric Vehicle?' versus 'Which one of these public chargepoint networks is Instavolt?'*

*Table 12: 'Do you own an Electric Vehicle (EV)?' versus 'What charging services does Instavolt provide?'*

Rapid Charging- Correct Answer

Count

| | | Do you currently own an Electric Vehicle? | | |
|---|---|---|---|---|
| | | Yes | No | Total |
| What charging services does Instavolt provide? | Rapid Charging | 119 | 21 | 140 |
| Total | | 119 | 21 | 140 |

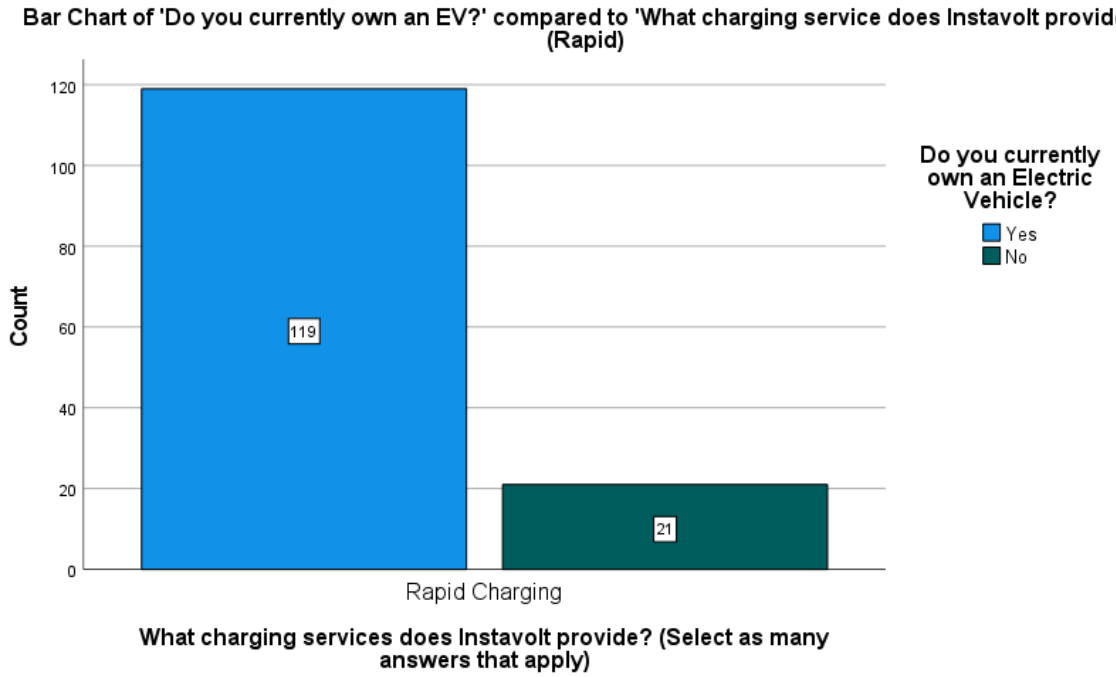



*Figure 32: Bar Chart of: 'Do you currently own an Electric Vehicle?' versus 'Which one of these public chargepoint networks is Instavolt?'*

The majority of current EV drivers were correct, stating Instavolt provides a rapid charging solution. There were 21 prospective EV drivers who were also correct naming their charging service.

*Table 13: 'Do you own an Electric Vehicle (EV)?' versus 'What charging services does Instavolt provide?'*

Fast Charging

| | | Do you currently own an Electric Vehicle? | | |
|---|---|---|---|---|
| | | Yes | No | Total |
| What charging services does Instavolt provide? | Fast Charging | 20 | 8 | 28 |
| Total | | 20 | 8 | 28 |

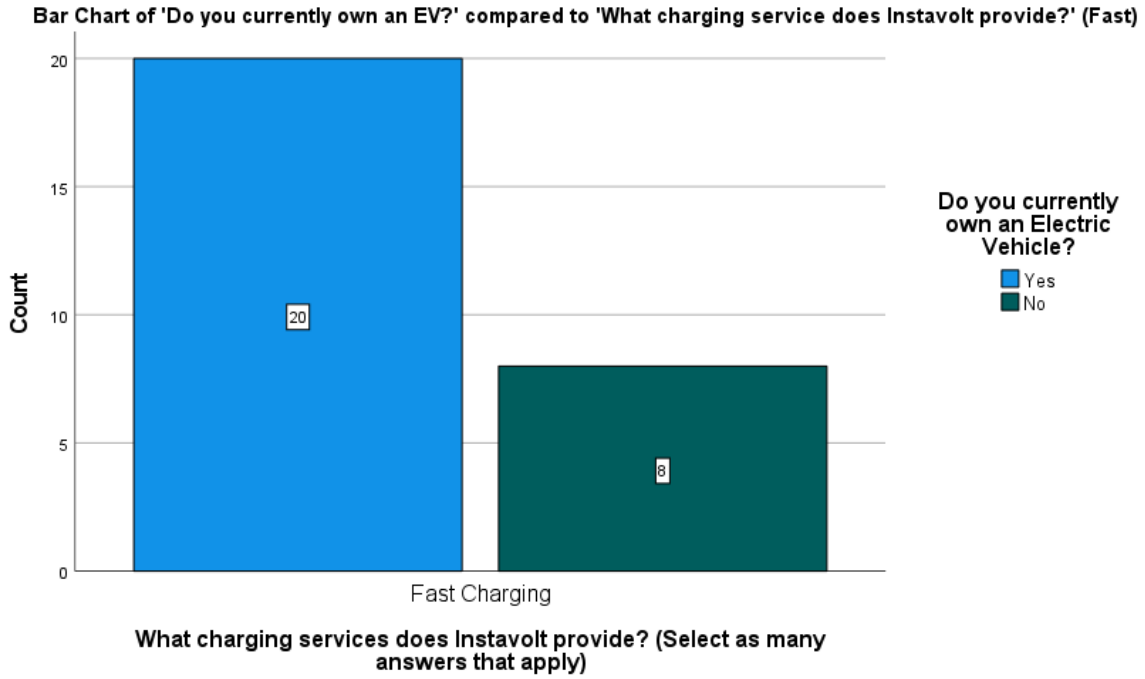



*Figure 33: 'Do you own an Electric Vehicle (EV)?' versus 'What charging services does Instavolt provide?' (Fast Charging)*

Instavolt provides a rapid charging service, however, 20 current EV drivers believed they provided fast charging, which is incorrect.

*Table 14: 'Do you own an Electric Vehicle (EV)?' versus 'What charging services does Instavolt provide?'*

Slow Charging

| | | Do you currently own an Electric Vehicle? | | |
|---|---|---|---|---|
| | | Yes | No | Total |
| What charging services does Instavolt provide? | Slow Charging | 2 | 3 | 5 |
| Total | | 2 | 3 | 5 |

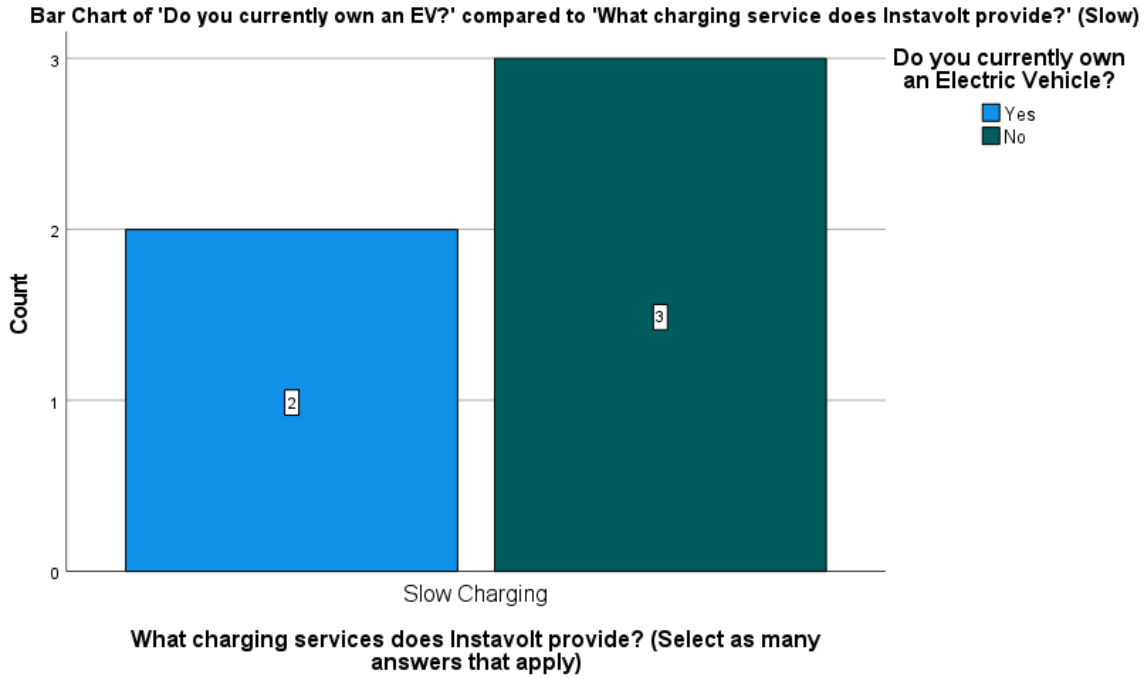



*Figure 34: 'Do you own an Electric Vehicle (EV)?' versus 'What charging services does Instavolt provide?' (Slow Charging)*

Instavolt provides a rapid charging service, however, 60 current EV drivers believed they provided rapid charging, which is incorrect.

*Table 15: 'Do you own an Electric Vehicle (EV)?' versus 'What charging services does Instavolt provide?'*

I don't know

| | | Do you currently own an Electric Vehicle? | | |
|---|---|---|---|---|
| | | Yes | No | Total |
| What charging services does Instavolt provide? (Select as many answers that apply) | I Don't Know | 19 | 30 | 49 |
| Total | | 19 | 30 | 49 |

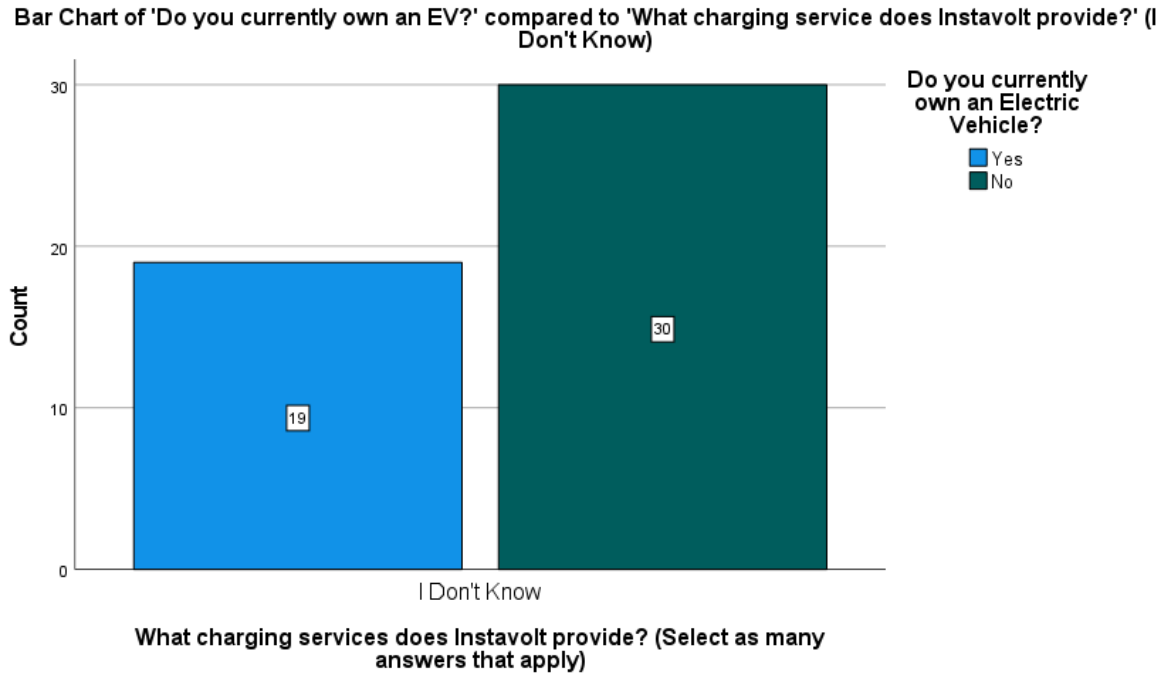



*Figure 35: 'Do you own an Electric Vehicle (EV)?' versus 'What charging services does Instavolt provide?' (I don't know)*

Interestingly, 30 prospective EV drivers were unable to choose what service Instavolt provides.

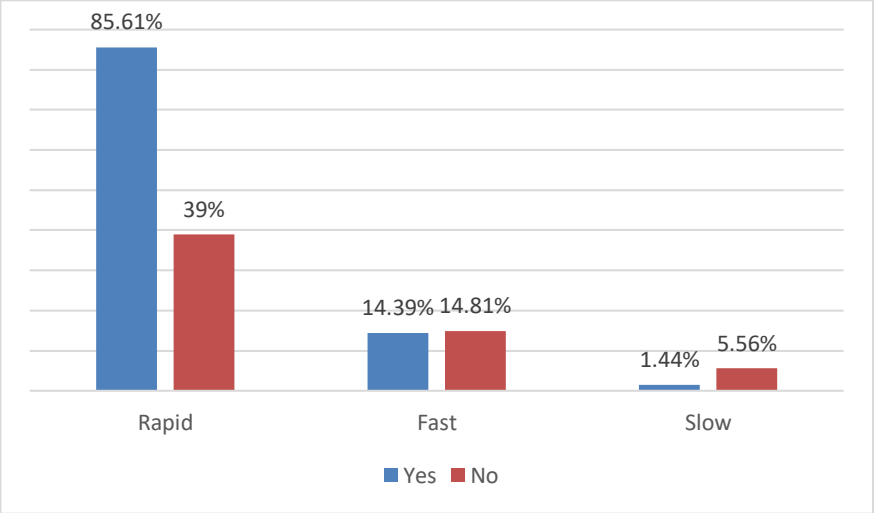
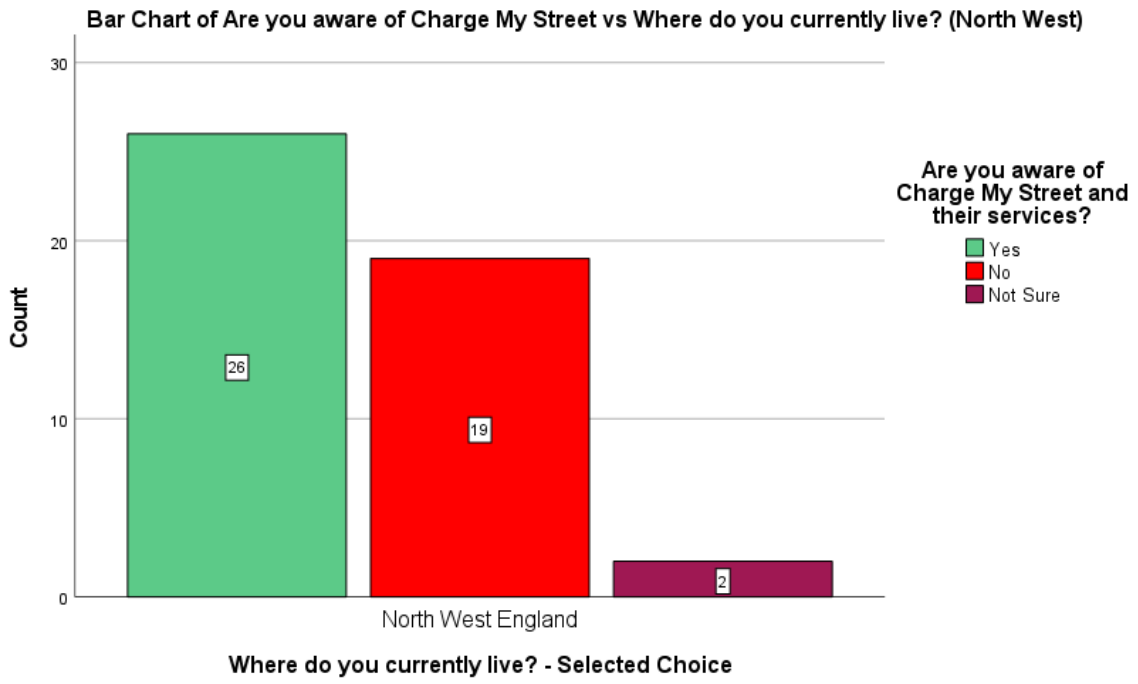



*Figure 36: Bar Chart of 'Do you own an electric vehicle?' versus 'What charging services does Instavolt provide?' (Percentage of correct answers)*

A lot of participants were correct in naming Instavolt's charging service, there seems to be a confusion between Fast and Slow charging. If both current and prospective EV drivers were better informed, improving their charging behaviour.

*Figure 37: Bar Chart of: Are you aware of Charge My Street vs Where do you currently live? (NW)*




Although Charge My Street is the second biggest chargepoint operator in Cumbria, there are still a lot of residents who are unaware of their services.

*Figure 38: Bar Chart of 'Do you own an electric vehicle?' versus 'What charging services does CMS provide?' (Percentage of correct answers)*

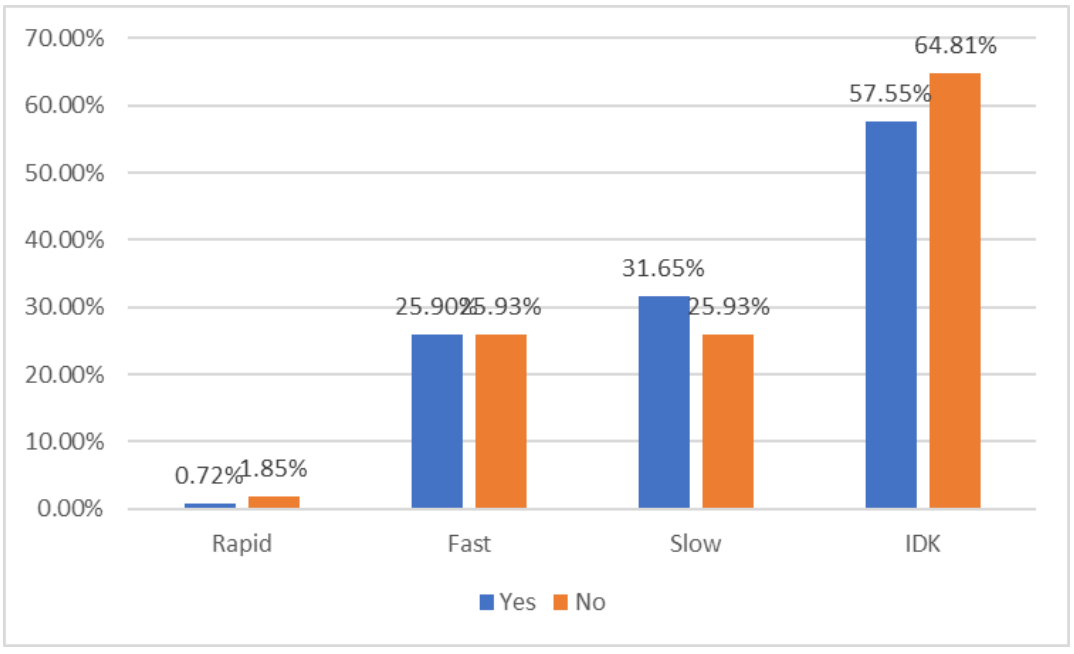


*Table 16: 'Do you own an Electric Vehicle (EV)?' versus 'What charging services does Charge My Street provide?'*

Rapid Charging

**Rapid Charging**

Count

| | | Do you currently own an Electric Vehicle? Yes | No | Total |
|---|---|---|---|---|
| What charging services does Charge My Street provide? Rapid Charging | Rapid Charging | 1 | 1 | 2 |
| Total | | 1 | 1 | 2 |

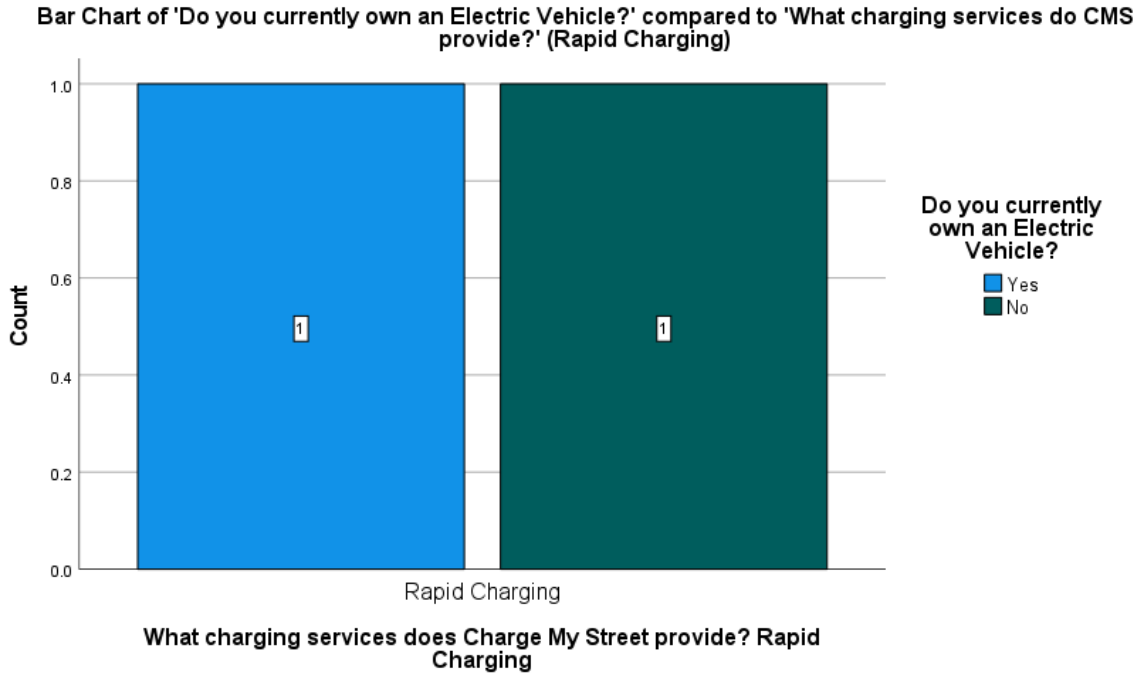



*Figure 39: 'Do you own an Electric Vehicle (EV)?' versus 'What charging services does Charge My Street provide?' (Rapid)*

Charge My Street provides a fast charging service, however, only 1 current and 1 prospective EV drivers believed they provided rapid charging, which is incorrect.

*Table 17: 'Do you own an Electric Vehicle (EV)?' versus 'What charging services does Charge My Street provide?'*

Fast Charging- Correct Answer

| | | Do you currently own an Electric Vehicle? | | |
|---|---|---|---|---|
| | | Yes | No | Total |
| What charging services does Charge My Street provide? | Fast Charging | 36 | 14 | 50 |
| Total | | 36 | 14 | 50 |

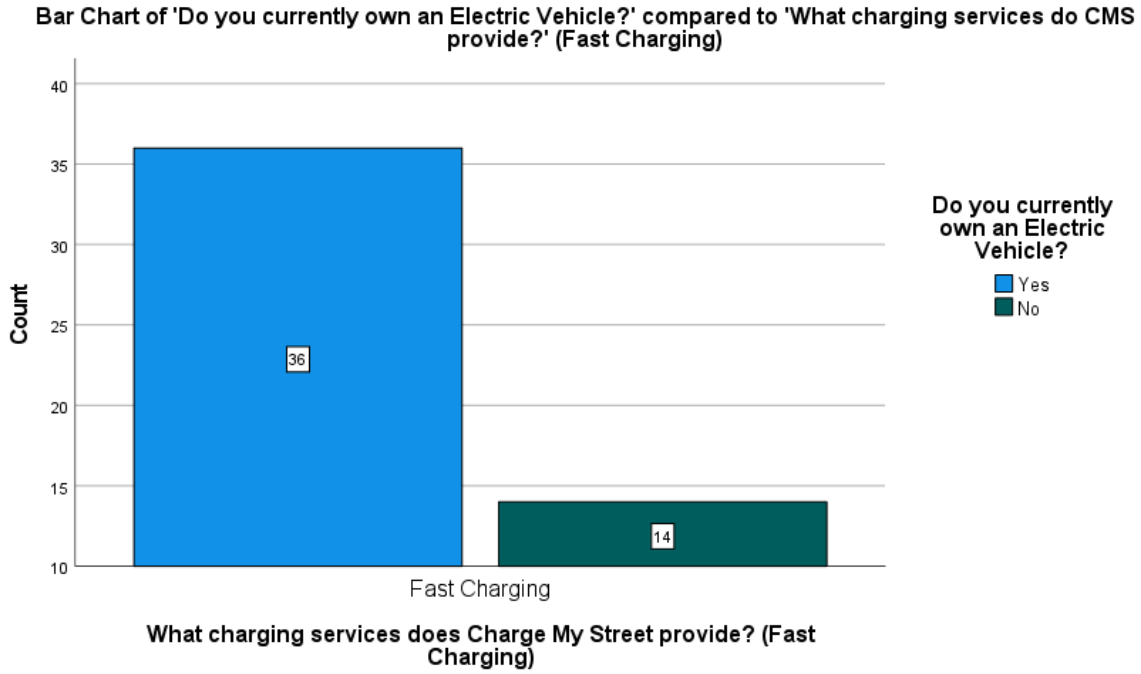



*Figure 40: 'Do you own an Electric Vehicle (EV)?' versus 'What charging services does Charge My Street provide?' (Fast)*

Charge My Street provides a fast charging service, 36 current EV drivers were correct, as well as 14 prospective EV drivers.

*Table 18: 'Do you own an Electric Vehicle (EV)?' versus 'What charging services does Charge My Street provide?'*

Slow Charging

| | | Do you currently own an Electric Vehicle? | | |
|---|---|---|---|---|
| | | Yes | No | Total |
| What charging services does Charge My Street provide? Slow Charging | Slow Charging | 44 | 14 | 58 |
| Total | | 44 | 14 | 58 |

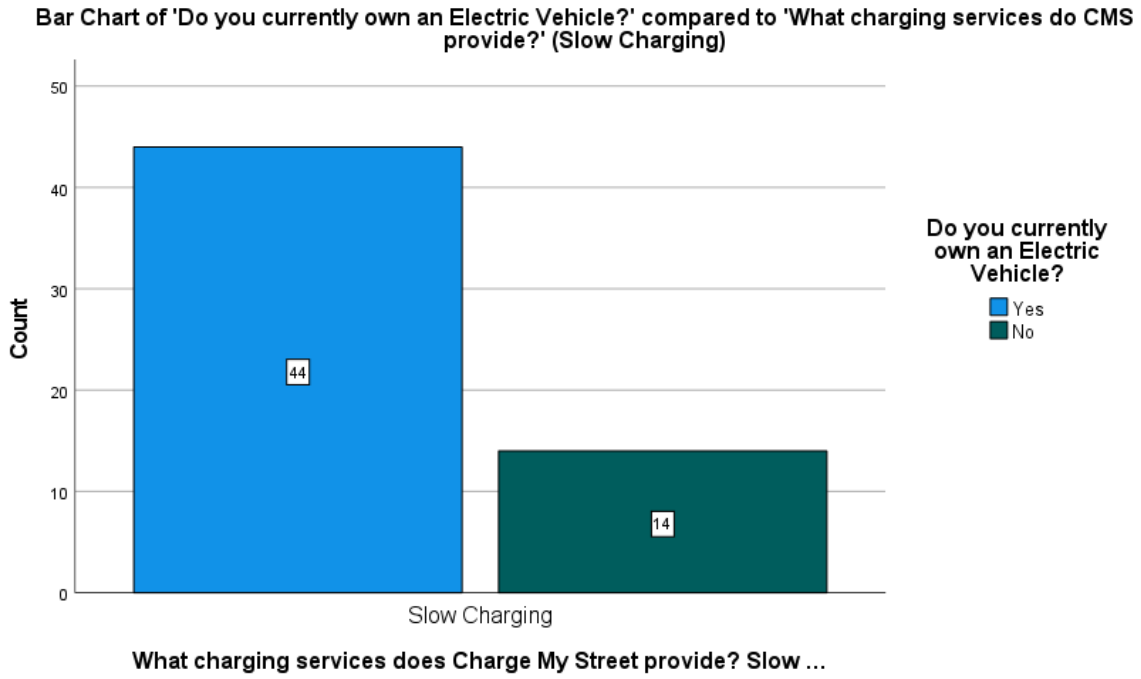



*Figure 41: 'Do you own an Electric Vehicle (EV)?' versus 'What charging services does Charge My Street provide?' (Slow)*

Although a lot of participants were correct in naming Charge My Street's charging service, there seems to be a confusion between the terminology of Fast and Slow charging. If both current and prospective EV drivers were better informed, improving their charging behaviour.

*Table 19: 'Do you own an Electric Vehicle (EV)?' versus 'What charging services does Charge My Street provide?'*

I Don't Know

| | | Do you currently own an Electric Vehicle? | | |
|---|---|---|---|---|
| | | Yes | No | Total |
| What charging services does Charge My Street provide? I Don't Know | I Don't Know | 80 | 35 | 115 |
| Total | | 80 | 35 | 115 |

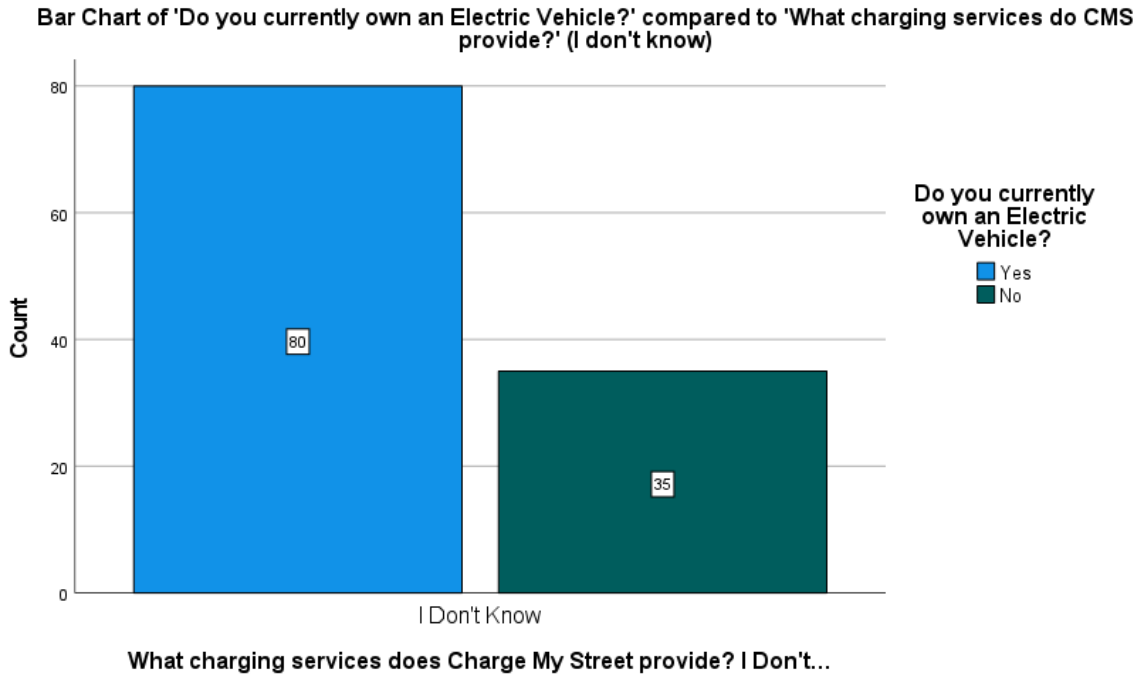



*Figure 42: 'Do you own an Electric Vehicle (EV)?' versus 'What charging services does Charge My Street provide?' (IDK)*

115 participants were unaware of Charge My Street's services.

*Table 20: 'Do you currently own an Electric Vehicle?' versus 'Are you interested in receiving information regarding new and existing chargepoints in your area?'*

| | | Are you interested in receiving information regarding new and existing chargepoints in your area? | | | |
|---|---|---|---|---|---|
| | | Yes | No | Not Sure | Total |
| Do you currently own an Electric Vehicle? | Yes | 99 | 34 | 6 | 139 |
| | No | 37 | 10 | 7 | 54 |
| Total | | 136 | 44 | 13 | 193 |

**Symmetric Measures**

| | | Value | Approximate Significance |
|---|---|---|---|
| Nominal by Nominal | Phi | .160 | .084 |
| | Cramer's V | .160 | .084 |
| N of Valid Cases | | 193 | |

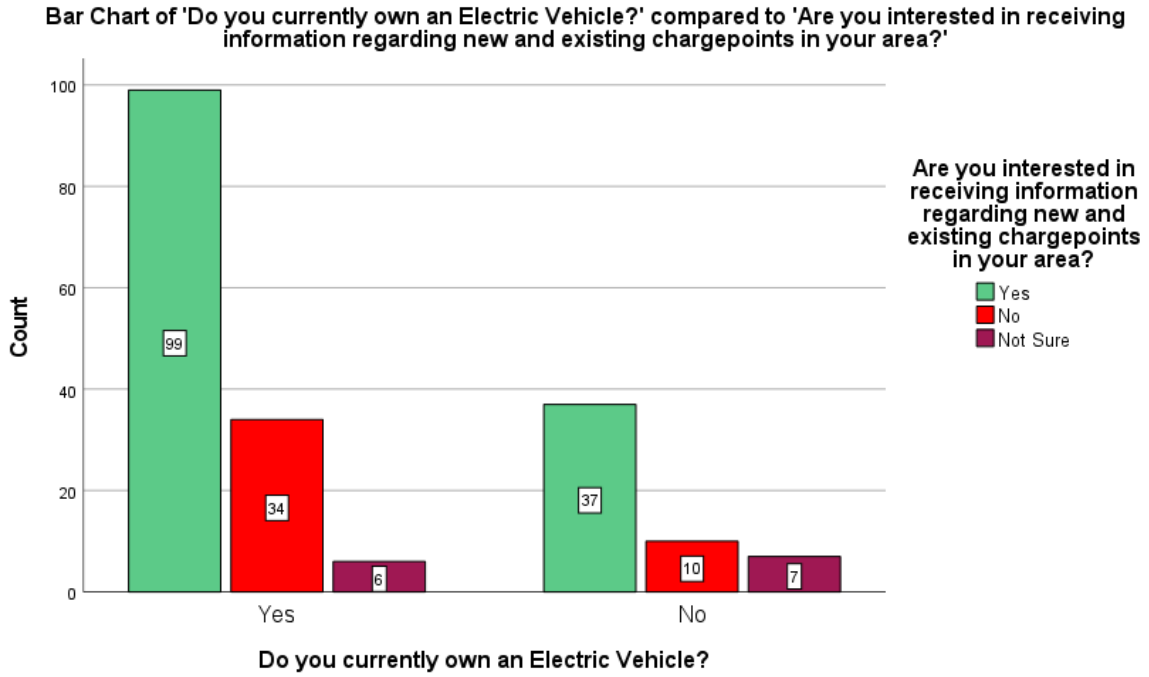
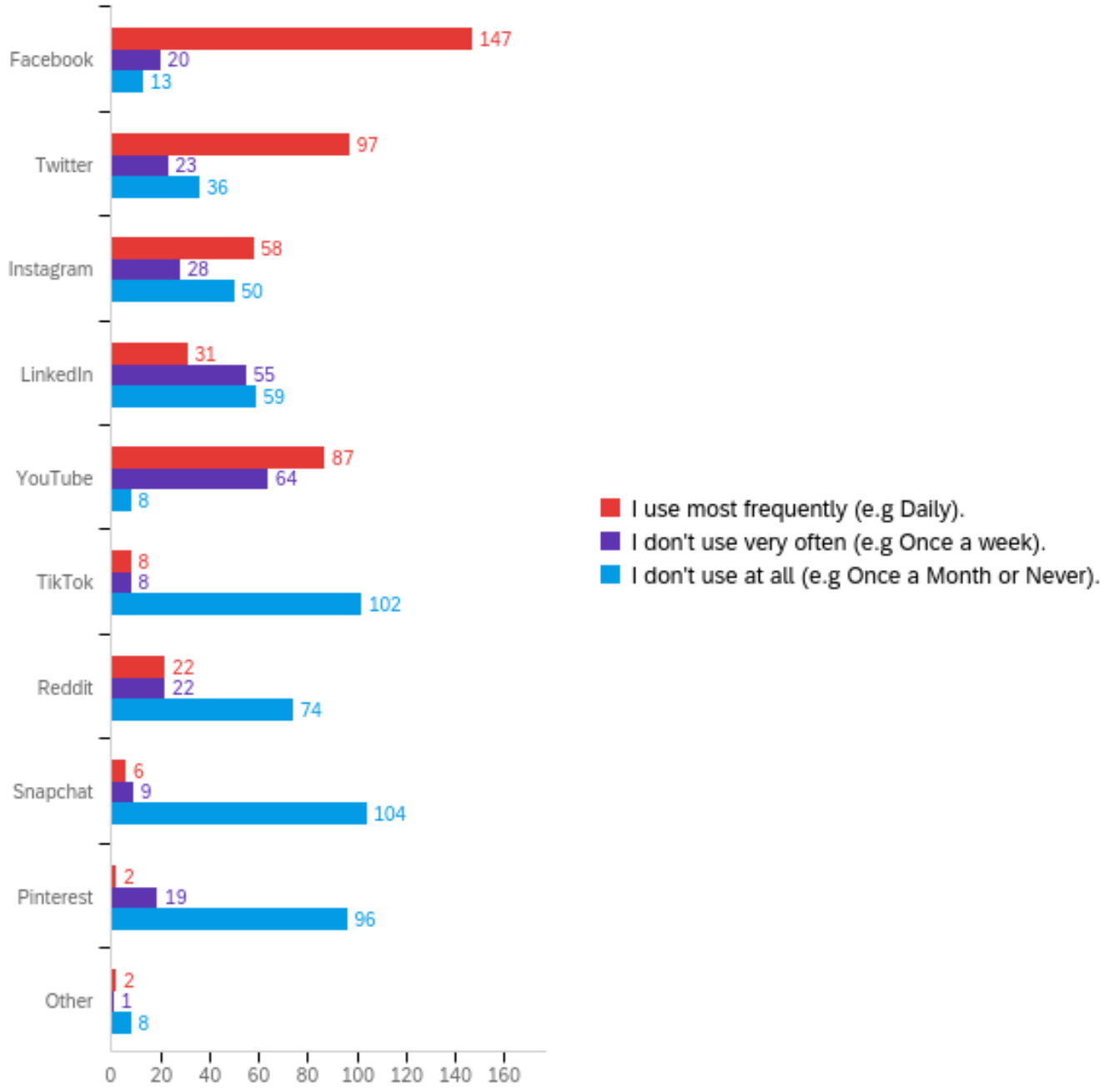



*Figure 43: Bar Chart of: Do you currently own an electric vehicle? Compared to 'Are you interested in receiving information regarding new and existing chargepoints in your area?'*

Both current and prospective EV drivers were interested in receiving information regarding new and existing chargepoints in their area. The majority of current EV drivers were very interested, this will allow them to know where to charge their EV in more locations.

*Table 21:Table of '- Rank, using drag and drop, what forms of social media do you use most frequently'*




This table shows what forms of social media participants of the survey use most. Facebook and Twitter were used the most with Snapchat and Pinterest used the least.

*Table 22: Table of 'Do you currently own an Electric Vehicle (EV) versus 'What is your preferred method of receiving online information?'*

| | | Do you currently own an Electric Vehicle? | |
|---|---|---|---|
| | | Yes Count | No Count |
| What is your preferred method of receiving online information? | Social Media | 85 | 28 |
| What is your preferred method of receiving online information? | Search Engine Promotion | 10 | 4 |
| What is your preferred method of receiving online information? | Email | 82 | 25 |
| What is your preferred method of receiving online information? | E-Newsletter | 40 | 14 |
| What is your preferred method of receiving online information? | Website Promotion | 18 | 9 |
| What is your preferred method of receiving online information? | None of the above | 11 | 3 |
| What is your preferred method of receiving online information? | Other | 15 | 8 |

This table shows what forms of online methods of receiving information was depending if the participant drove an electric vehicle or not. Of the 15 participants that selected 'Other' they stated, 12 Apps such as ZapMap, Plugshare and WattsUp were their preferred method of receiving online information, as well as 3 participants selecting podcasts.

*Table 23: Table of 'Do you currently own an Electric Vehicle (EV) versus 'What is your preferred method of receiving offline information?'*

| | | Do you currently own an Electric Vehicle? | |
|---|---|---|---|
| | | Yes | No |
| What are your preferred methods of receiving offline information? | Posters | 20 | 12 |
| What are your preferred methods of receiving offline information? | Leaflets | 17 | 6 |
| What are your preferred methods of receiving offline information? | Mail (Post) | 27 | 7 |
| What are your preferred methods of receiving offline information? | Newsletters | 22 | 11 |
| What are your preferred methods of receiving offline information? | Billboards | 12 | 10 |
| What are your preferred methods of receiving offline information? | Events | 23 | 14 |
| What are your preferred methods of receiving offline information? | Television | 50 | 21 |
| What are your preferred methods of receiving offline information? | Radio | 33 | 19 |
| What are your preferred methods of receiving offline information? | None of the above | 38 | 10 |
| What are your preferred methods of receiving offline information? | Other | 3 | 3 |

This table shows what forms of offline methods of receiving information was depending if the participant drove an electric vehicle or not.

*Table 24: Table of 'What is your age?' versus 'What is your preferred method of receiving online information?'*

| | What is your age? | | | | |
|---|---|---|---|---|---|
| | 17-24 Count | 25-34 Count | 35-44 Count | 45-54 Count | 55-64 Count |
| Social Media | 7 | 20 | 22 | 27 | 27 |
| Search Engine Promotion | 1 | 1 | 2 | 3 | 4 |
| Email | 5 | 12 | 16 | 31 | 31 |
| E-Newsletter | 3 | 5 | 14 | 10 | 14 |
| Website Promotion | 1 | 3 | 3 | 8 | 8 |
| None of the above | 0 | 2 | 3 | 5 | 1 |
| Other | 0 | 5 | 4 | 9 | 4 |

| | What is your age? | |
|---|---|---|
| | 65-74 Count | 75 or older Count |
| Social Media | 10 | 0 |
| Search Engine Promotion | 3 | 0 |
| Email | 11 | 1 |
| E-Newsletter | 8 | 0 |
| Website Promotion | 4 | 0 |
| None of the above | 3 | 0 |
| Other | 1 | 0 |

### 5.4.0 **Findings Chapter Conclusion**

This chapter has presented key data gathered from the two methods of research used. Firstly, the three themes of the focus groups were presented; Theme 1: confusion of charging behaviour, Theme 2: uncertainty of public chargepoint providers and Theme 3: local barriers to electric vehicle adoption, as well as the three sub themes of Theme 3; price of electric vehicles, price of charging barrier and access to off-street parking barrier. These themes will be analysed further in the discussion chapter, using theoretical literature as well as contextual electric vehicle literature to support the findings. Similarly, this chapter has displayed key data collected from the survey.. The next chapter will provide a theoretical and contextual background to the data gathered in this research, the chapter will analyse and discuss the data in greater detail.

# 5.0 Analysis and Discussion

### 6.1.0 Discussion Chapter Introduction

Drawing on data from both the two focus groups and the survey it is possible to evaluate the objectives of this research as specified in the chapter 1. This discussion chapter will also engage with the academic literature to challenge the data and the conclusions drawn. To critique each sub theme, of theme 3, relevant theoretical concepts have been used (See Table 29).

| Theme | Relevant Theoretical Concept |
|---|---|
| 3.1 | • Consumer Behaviour (Proctor, 2000),<br>• Prospect Theory (Kaheman & Tversky (1992) |
| 3.2 | • Consumer Behaviour (Jose, 2017)<br>• Technology Acceptance (Baron et al., 2006) |
| 3.3 | • Active innovation resistance (Joachim et al., 2018)<br>• Pro-Change Bias (Talke & Heidenreich, 2014)<br>• Threshold Estimation Model (Taukder et al., 2019)<br>• Social Network Analysis (Clifton & Webster, 2017)<br>• Approximability of Influence in Social Networks (Chen, 2009)<br>• Technology Adoption (Peng & Mu, 2011) |

*Table 25: Relevant Theoretical Concepts Used*

### 6.2.0 Objective 1: Identify local barriers stopping individuals making the switch to Electric Vehicles.

The focus groups identified three local barriers to electric vehicle adoption, namely: price of electric vehicles, price of charging and access to off-street parking. These barriers were anticipated and have been identified in previous academic studies. However, the findings do suggest regional relevance and the importance of understanding the local context.

### 6.2.1 **Sub Theme 3.1: Price of Electric Vehicle (EV) Barrier**

Due to the high levels of technology integrated into electric vehicles, the initial purchase cost of buying an electric vehicle can be much greater than its internal-combustion-engine (ICE) counterpart (Vassileva and Campillo, 2017:p. 634). In relatively low-income areas such as the North-West of England this can constrain the market and be a barrier to entry for many. Literature suggests that adopters of electric vehicles are not willing to pay high initial purchase costs, even though the running costs of owning an electric vehicle are significantly less than ICE vehicles (Larson et al., 2014: 302: Noel et al., 2020). However, the focus groups also indicate that consumers are willing to think beyond purchase price and consider the whole financial costs of ownership as well as environmental benefits.

Data obtained from the focus groups mirror the findings in the literature, three of the six participants were worried they would not be able to afford an electric vehicle, this one barrier to them adopting (See Table 30).

| Focus Group | Participant | Quote |
|---|---|---|
| 2 | 6 | "And certainly, you know, my, my budget for a new second-hand car is 3000 pounds. So, I'm not going to be getting an EV anytime soon." |
| 2 | 5 | "There's, what was the other thing, all this stuff about leasing batteries, and all that kind of palaver. It's not just buying the thing, you know, there's a lot of extra costs in it even second-hand, and that's an obstacle." |
| 1 | 3 | "But yeah, the other problems are also price, but there's some really competitive like by what's it called loan, loans to buy or whatever?" |

*Table 26: Table of Participant Quotes*

However, for participant 2, price was not a barrier, due to them disclosing they already drove a top of the range ICE vehicle, they would be able to sell their current vehicle to pay for the electric vehicle (See Table 31).

| Focus Group | Participant | Quote |
|---|---|---|
| 1 | 2 | "And I'm not worried about the money. That's not the problem." |

*Table 27: Table of Participant Quotes*

Although participant 3 initially believed price would be a barrier to them adopting an electric vehicle. However, they realised that monthly payment rates through personal contract purchase (PCP) or hire purchase (HP) were comparable between ICE and electric vehicle (See

| Focus Group | Participant | Quote |
|---|---|---|
| 1 | 3 | "So, you know, which is comparable to the loan that I've just about paid off my car anyway. So, and the car that I've got I bought, I almost, I've almost finished paying for. So, it will be comparable to that to get a new one on the on the loan thing?" |

Table 32).

*Table 28: Table of Participant Quotes*

Hardman *et al.,* (2015) and Berkeley *et al.,* (2018:p. 468) suggest electric vehicle drivers are taking advantage of low monthly payments of the vehicle, through HP or PCP due to the high initial prices when purchasing the vehicle outright.

According to Molesworth and Suortti (2002:p. 161) consumers evaluate their perceived performance-to-price ratio of an innovation. If the consumer believes the value of the technology to be too high compared to the perceived performance, they will not adopt. Similarly, Proctor (2000) suggests that consumers behaviour changes dependant on the price of the technology, this encourages the consumer to complete a search and evaluation process of the technology. Respectively, Parasuraman and Grewal (2000:p. 169) suggest that low performance-to-price ratio is the most cited barrier when consumers adopt to an innovative technology.

Kaheman and Tversky (1992) suggested prospect theory can be used when assessing high purchase price as a barrier to adoption. Due to the high price, the consumer may not take the risk on the EV despite the low costs of owning one in the future, this was raised by Participant 1 in the focus groups. Klein and Deissenroth (2017) suggest prospect theory can be used to evaluate the gains and losses of green technologies, they propose that individuals adopting to

a green technology are aware initial high costs (losses) can be cancelled out by potential savings in the future (gains).

However, it can be argued that even though price maybe a barrier to some consumers, early adopters, are ready to take financial risks to make the switch to an electric vehicle for environmental reasons for example participant 2 (See Table 33).

| Focus Group | Participant | Quote |
|---|---|---|
| 1 | 2 | "I feel a bit hypocritical really, because I have a big, gas guzzling diesel guzzling camper van as well. And I have a Mercedes and I am looking at getting an electric Merc or electric VW. |

*Table 29: Table of Participant Quotes*

### 6.2.2 **Sub Theme 3.2: Price of Charging Barrier**

Another local barrier that was discussed in the focus group was the price of charging their prospective electric vehicle. Some conflated this with a lack of access to their own charging facilities on their driveway. The perception is that it could make them vulnerable to limited external provision and high charging costs. Participant 6, who would need to rely on public charging due to no access of a driveway, stated they were concerned with high prices of public charging (See Table 34).

| Focus Group | Participant | Quote |
|---|---|---|
| 2 | 6 | "Yeah, I just I what also concerns me about the you know, plugging in a supermarket or motorway services, or whatever it is, it's probably about twice the price of plugging in at home. So, my electricity costs, what 15 pence a unit." |
| 2 | 6 | "We are we are stuck with council charging points, so maximum cost." |

*Table 30: Table of Participant Quotes*

Although the price of the vehicle itself is widely discussed in literature as a barrier to electric vehicle adoption, the price of charging is rarely mentioned. Yet the focus groups do demonstrate a fear of unknown costs and further education in marketing materials would be needed to help reassure the costs are likely to be manageable. For those without access to off-street parking, the prospect of having to pay a premium for charging as well as the hassle of having to drive somewhere to charge, tests the consumer's behaviour decision making process when adopting to an electric vehicle. Jose (2017) states the consumer makes decisions when adopting by evaluating the prospective time, money and effort. Therefore, when an individual is assessing whether to switch to an electric vehicle, they will assess what time money and effort they will need to part with. So if there is limited public charging infrastructure as well as

the price being high, they are much less likely to adopt. It is also necessary to add a fear of the unknown to, Jose (2017) statements when a consumer moves from the hypothetical to the specific context of their locality.

When assessing a consumer's behaviour to adopting to a new technology, the Unified Theory of Acceptance and Use of Technology (UTAUT) can be used (Figure 2). In the case of prospective electric vehicle driver's behaviour, the perceived ease of use (use of public charging) and perceived usefulness (cost of charging) can be assessed using the model.

Yet, Baron et al., (2006) argues that consumer traits and experience can affect these factors. The focus groups suggest that each participant was at a different point in the adoption process, for example participant 3 had thought about switching their current ICE vehicle using PCP, in comparison to participant 6 who was stuck with price being their main barrier and not considering leasing options. Baron *et al.,* (2006) suggest consumer traits are not just age and gender like in Venkatesh *et al.,* (2003), they can be traits such as income, education and personal characteristics. According to OLEV (2015:14) electric vehicle early adopters have relatively high incomes and high levels of education and status. Due to their high incomes and education this will affect their chances of adopting to the technology, although not specified in the focus groups, participant 2 stated money was not a barrier for them adopting to an electric vehicle. One way of breaking the barrier of price of public charging would be to allow prospective electric vehicle drivers to rent a car for a few days, allowing them the ability to test their concerns in a real-life experiment. Participant 1, the champion of the first focus group stated she had test drove a few different electric vehicles such as a Tesla and a Renault Zoe before making a decision of buying their Hyundai Kona (See Table 35).

| Focus Group | Participant | Quote |
|---|---|---|
| 1 | 1 | "We test drove a Tesla and up until driving a Tesla, it was absolutely amazing. It was one with the DeLorean doors. I don't know what model that is. It was brilliant." |
| 1 | 1 | "But when we were looking, and I looked at a Renault ZOE, my husband, he was six foot three couldn't actually fit in it. So, we didn't get that." |

*Table 31: Table of Participant Quotes*

### 6.2.3 **Sub Theme 3.3: Access to Off-Street parking Barrier**

According to Krishna (2015:5) a common barrier to electric vehicle adoption is the lack of reliable public chargepoints, especially for those adopters that do not have access to off-street parking. This barrier to adoption was echoed by those who attended the focus groups (See Table 36).

| Focus Group | Participant | Quote |
|---|---|---|
| 2 | 5 | "I do not have access to a driveway". |
| 2 | 6 | "I can't charge at home because I live in a terrace street". |
| 1 | 2 | "I live in a terraced house. And there's no parking". |
| 1 | 3 | "I live on terrace Street." |
| 1 | 3 | "You can't park right outside my house and although I would consider if there was somewhere safe, sort of within 10 minutes' walk." |

*Table 32: Table of Participant Quotes*

Daina *et al.,* (2018) states that increasing charging infrastructure in the UK will encourage consumers to make the switch to an electric vehicle. Nevertheless, Daina *et al.,* (2018:p. 509) believes public chargepoints must be installed in locations where the consumer already frequents, such as workplaces shopping centres and public car parks. As well as accessibility this also helps security concerns for the owners and the high-value vehicles.

If a consumer does not have access to off-street parking to charge their prospective electric vehicle, they will rely on the public chargepoint network, potentially leading to the consumer believing in EV is not compatible with their lifestyle. This could be a particular issue in the UK where public services are often thought to be underfunded and therefore less reliable. On an individual basis, consumers form a compatibility barrier when they believe the technology, an electric vehicle, is incompatible with their past or existing product or service, internal combustion engine vehicle (Joachim et al., 2018). Talke and Heidenreich (2014) state that if the consumer perceives the technology is incompatible with their lifestyle, they are less likely to adopt, especially if it takes more time and effort compared to their current product or service.

However, if the consumer is aware of a current electric vehicle driver in their social network, such as a neighbour who also does not have access to off-street parking, they maybe more likely to adopt. Talukder et al., (2019:105442) states social influence is a qualitative phenomenon, those influenced by multiple networks such as their friends, family and

neighbours are apart of an egocentric social network (Clifton and Webster, 2017:444). Individuals become influenced by others in their social network to adopt to a new product or service, otherwise known as influence maximisation (Chen, 2009: 1400).

According to Peng and Mu (2011:135), when an individual is influenced by someone close to them in their social network, this is referred to as the imitation effect. The closer someone is in the individual's social network the more chance there is of increased communication and interaction, leading to potential adoption of the, product or service, or in this case an electric vehicle (Coleman *et al.,* 1966). Additionally, if an individual deems the adopter to have similar demographic attributes or has similar attitudes and interest to themselves this increases trust between the two individuals (Hitsch *et al.,* 2010 and Martin *et al.,* 2013). Peng and Mu (2011:135) suggest that with this trustworthy information the prospective adopter will be influenced and more likely to adopt to the new technology.

Overall, the focus groups contributed important information to objective one of this research. They revealed key barriers to electric vehicle adoption in the North West of England including the initial purchase costs which had been anticipated. Interestingly, new barriers were uncovered, such as concerns about the price of charging, and it can be suggested that this information is important for the broader adoption of electric vehicles.

### 6.3.0 **Objective 2: Identify changes that need to be made to encourage prospective Electric Vehicle drivers to make the switch.**

As well as barriers to adoption, the focus groups used in this research were successful in discovering two key themes that should be considered in the marketing of electric vehicles: confusion of charging behaviour and uncertainty about public chargepoint providers.
Some participants were confused or uncertain about when or how they would use a public electric vehicle chargepoint.

According to Axsen et al., (2017:171) it is essential that potential adopters to electric vehicles have a good understanding and awareness of the benefits of owning an electric vehicle, increasing widespread electric vehicle adoption. In the United Kingdom, there is not any published academic literature regarding education of adopters towards charging electric

vehicles. However, Axsen et al., (2017:171) advises that there is very little done by public chargepoint providers to educate consumers in their marketing campaigns, this was apparent in the focus groups as participants were confused about how they would charge their prospective electric vehicle and how long they would need to charge the electric vehicle for.

### 6.3.1 **Theme 1: Confusion of Charging Behaviour**

Firstly, a few participants were confused regarding charging behaviour, participants believed that for the number of miles that they drive in a day they would need to charge their electric vehicle regularly, even overnight or for long periods of time (See Table 38).

| Focus Group | Participant | Quote |
|---|---|---|
| 2 | 4 | "Which means you then, like P5 said, you need the extra costs, you're going to need a charger at home, because you'll be charging maybe every night or once every other night, you know, so you can't, you can't go and charge it up somewhere else." |
| 2 | 6 | "So it's like, that's another thing about sort of leaving maybe your car, I know, two, three hours however long it is." |

*Table 33: Table of Participant Quotes*

However, the Department of Transport (DOT) (2020) revealed that in the North West of England, the average trip in a car is under 10 miles, with very few individuals driving 50 to 100 miles per trip. Of these short journeys in the North West of England, the most common trips were commuting, school run and shopping, where it is common for public electric vehicle chargepoints to be located. Unless any of the participants had long commutes or consistently travelled long distances, they would be able to complete their most common trips with an electric vehicle (See table 39).

| Focus Group | Participant | Quote |
|---|---|---|
| 1 | 3 | "Tripping out in your work. See, I don't want to walk a mile in my work suit to go to come pick up my car in the morning." |

*Table 34: Table of Participant Quotes*

### 6.3.2 **Theme 2: Uncertainty of Public Chargepoint Providers**

Secondly, another theme that appeared in the focus groups was the uncertainty of different public chargepoint providers, specifically who they were and what they offered. Rather than describing the public chargepoint by its network name, participants named the location or the public chargepoint such as a service or more commonly, a supermarket. There was no understanding that there are different providers of chargepoints, instead the chargepoints were associated with specific shops or locations (See Table 40).

| Focus Group | Participant | Quote |
|---|---|---|
| 1 | 3 | "I live in South Lancaster and the nearest one would be either Booths (supermarket) which is about a mile and a half away." |
| 1 | 1 | "Sainsburys (supermarket) have a free EV, charger." |

*Table 35: Table of Participant Quotes*

There is little academic literature that suggests adopters need further educating about electric vehicles, although this was discussed by Axsen et al, (2017: 171). The survey developed in this study aims to address this gap and test brand awareness and preferences of how information about electric vehicles (EV) by current or prospective EV drivers is best delivered. With this information, public chargepoint providers would be able to inform more potential EV adopters, encouraging them to make the switch to an EV as well as channelling the information through their preferred methods of advertising.

Prospective and current electric vehicle drivers are a distinct demographic and user group who need to be approached with information through specific means. The second part of the survey explored whether they preferred to receive electric vehicle content through online and offline methods. Firstly, participants were asked if they did want to receive information about new and existing public chargepoints in their area.

Figure 49 shows the comparison between current and prospective EV drivers and their preference to receiving information on public chargepoints in their area. Interestingly, current electric vehicle drivers were more likely to be interested, with 71% answering Yes. Comparably, 68% of those not currently owning an electric vehicle were still interested in receiving information about public chargepoints in their area.

To ascertain how current and prospective electric vehicle drivers would like to receive this information, they were asked their preferred online and offline methods of receiving information. When asked about receiving information online, participants who owned an electric vehicle preferred method was Social Media (n=85, 65%), Email (n=82, 58%) and E-Newsletters (n=40, 28%), this was very similar for prospective electric vehicle drivers, as Social media (n=28, 51%) Email (n=25, 46%) and E-Newsletter (n=14, 25%). Interestingly, 15 (10%) current electric vehicle drivers selected 'Other' and stated they liked EV Apps such as ZapMap, Plugshare and WattsUp as well as EV related Podcasts.

Due to its popularity, social media needed to be dissected into individual platforms to give a further understanding of which forms are frequently used by current and prospective electric vehicle drivers. Participants were asked to drag and drop their most frequently used social media forms, Facebook, Twitter and YouTube were interestingly the most frequently used, with; TikTok, Snapchat and Reddit being the least commonly used (See Table 24).

Using cross-tabulation, age was compared to preferred method of receiving online information. The data suggests that those aged between 45-54 were more likely to prefer email communications in comparison to those aged 25-34 preferring social media. Interestingly, there was very little difference between email and social media preference of those aged 45-75. If inciteful educational information about current and new chargepoints was advertised using Email and Social Media, especially; Facebook, Twitter and YouTube, more current and prospective electric vehicle drivers would be less likely to be confused or uncertain about them.

Prospective and current electric vehicle drivers were asked which offline (traditional media and hard copy sources) methods they prefer when receiving information. The most common methods of offline advertising were Television, Radio and Events. However, the data shows that those currently owning an electric vehicle were more likely to prefer receiving offline information through mail, newsletters and leaflets in comparison to those yet to make the switch. Participants who were older than 45 were more likely to prefer television and radio in comparison to younger participants who expressed a preference for promotional events and

mail. Nevertheless, the data also showed a lot of participants were not interested in receiving offline information, as a combined 48 participants selected 'None of the above'. The above suggests that all platforms have some merit in the promotion of materials relevant to electric vehicles. Both prospective and current electric vehicle drivers are preferring receiving information about electric vehicle chargepoints through online methods such as social media, emails and newsletters, however, some offline methods such as television, radio and events could still be effective to reach the full demographic of potential purchasers.

The data gathered from the focus groups as well as the questionnaire survey address's objective two of this research: Identify changes that need to be made to encourage prospective electric vehicle drivers to make the switch. In summary more easily understood information and education is needed by chargepoint operators as well as government to understand more about EVs and especially chargepoints through specific preferred online and potentially offline methods.

### 6.4.0 **Objective 3: To assess the awareness of prospective and current electric vehicle (EV) drivers regarding services provided by public chargepoint operators.**

According to Keller (2011) it is important to understand consumer's existing brand awareness, whether or not consumers know about a brand and what connotations the brand conveys. To further understand the brand awareness of prospective and current electric vehicle drivers of different public chargepoint operators, the knowledge of the participant was tested in the survey. Using obscured photos of public chargepoints and their logos, participants were required to name the provider as well as what service each operator provided.

Participants were asked to name the electric vehicle chargepoint operator based on a photo of an installation, all logos and branding was blurred. Participants were presented with installations from; Instavolt, Charge My Street, BP Polar, PodPoint, Gridserve and Osprey. According to ZapMap (2021), as of May 2021, Podpoint operate the most chargepoints across the UK, with Instavolt with the least installations of the major networks, for the purpose of this research, they will be compared against each other, as well as this project's industry partner, Charge My Street.

Firstly, 167 (86%) participants were able to name the PodPoint installation, of those participants, 129 (77%) of them currently owned an electric vehicle and 38 (22%) did not (Figure 50). Nevertheless, only 8 current electric vehicle drivers could not name the chargepoint, yet 15 prospective electric vehicle drivers could not name the chargepoint, with 3 participants selecting 'Charge Your Car'. According to Cramer's V, the relation of participants selecting PodPoint as the chargepoint installation was .307, a medium to high association, meaning participants were more likely to choose the correct chargepoint installation.


*Figure 44: PodPoint Installtion*


*Figure 45: Instavolt Installation*

However, when analysing the awareness of prospective and current electric vehicle drivers, Instavolt's installation (Figure 51) was one of the most recognisable, although, according to ZapMap (2021) they have the least installations of the major public chargepoint operators. 149 participants were able to name Instavolt, of those participants 121 (81%) were current electric vehicle drivers and 28 (18%) prospective electric vehicle drivers. Nonetheless, 1 participant believed it was installed by PodPoint and 4 BP Pulse, interestingly, 39 participants were not able to name the chargepoint split between 15 current electric vehicle drivers and 24 prospective electric vehicle drivers. Cramer's V shows there is a high association of participants being able to name Instavolt as the chargepoint installer with .398.

Charge My Street, this projects industry partner, installation was analysed to understand the awareness of current and prospective electric vehicle drivers. 29 were able to name Charge My Street, of those, 18 were current EV drivers and 11 were prospective, much less than the major networks, PodPoint and Instavolt (Figure 52). 7 participants believed the installation was Ecotricity and 9 believed it was Tesla. However, 76% could not name the installation, 109

participants were current electric vehicle drivers and 39 were prospective electric vehicle drivers. The Cramer's V calculation of relation was a very high .493 of participants not knowing the Charge My Street Installation, this could be due to their limited national infrastructure.


*Figure 46: Charge My Street Installation*

When measuring the brand awareness of a brand on image alone, Keller's (2003) brand pyramid can be used (Figure 6). Those participants that were unable to name the chargepoint operators' installation are at the bottom of the pyramid, Keller (2003) suggests they are in the 'Who are you?' stage, as they are unable to recall the brand without aid. On the other hand, those participants able to name the chargepoint operators' installation are at minimum the second stage of the pyramid (Figure 6). This result is not surprising in a new business sector and supports the need for more education and targeted information. Keller (2001) suggests if the consumer knows what the product or service is, the consumer can understand if it will be suitable for their needs.

The survey also tested the participants brand awareness of public chargepoint operators based on their logo. According to Labrecque and Milne (2013), brands can differentiate themselves from their competitors by using logos. An effective logo if used consistently is a

key strategy in a brands communication, careful design can achieve a chosen response and the consumers perception can be influenced (Faroudi, 2019).

Participants were faced with multiple distorted logos and asked to choose which one they believe was either PodPoint or Instavolt (Figure 53 & 54). Firstly, 176 (91%) participants were successfully able to decipher PodPoint from the selection of logos, of those, 134 (76%) participants were current electric vehicle drivers and 42 (23%) were prospective electric vehicle drivers. Only 16 (9%) participants could not name PodPoint, they compromised of 5 current electric vehicle drivers and 11 who are prospective.

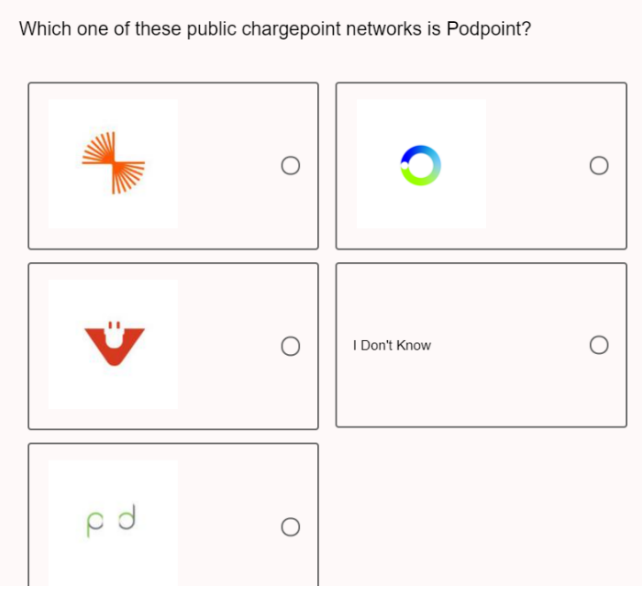



*Figure 47: PodPoint Logo*

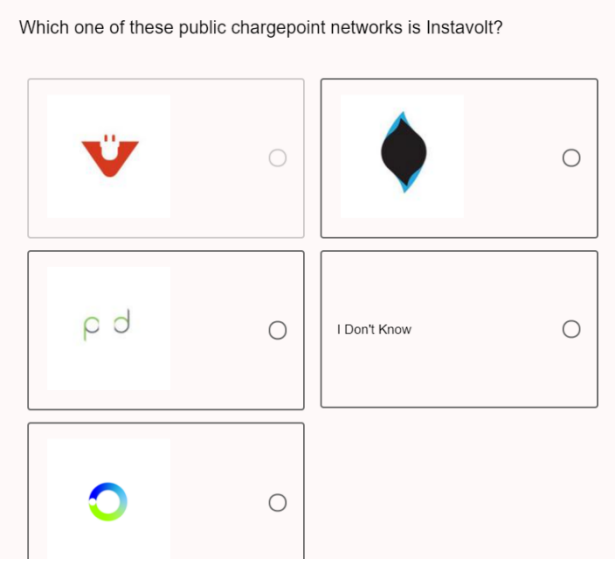



*Figure 48: Instavolt Logo*

When participants were required to select which logo, they believed was Instavolt, 149 (77%) participants were successful (Figure 54). Of those participants, 121 (81%) current EV drivers and 28 (18%) prospective electric vehicle drivers were successful. However, 39 (26%) participants were not able to decipher which logo was Instavolt, of those 15 were current electric vehicle drivers and 24 prospective EV drivers. The Cramer's V measure is equal to 0.398, which means that the EV drivers on average tend to identify Instavolt's logo from the rest.

In part, recognition draws from logo design as well as familiarity due to distribution. Henderson and Cote (1998) state that logos that are cluttered or have lots of text can discourage consumers to purchase their product or service. Respectively, PodPoint and Instavolt both have very clean logos, with very little text, similarly they use one solid colour.

According to Eiseman (2000), colours such as oranges and pale blues are most persuasive, PodPoint and Instavolt use either a mixture of pale blue and green (PodPoint) or orange (Instavolt). These colours are consistent throughout their advertising, increasing the brand awareness as well as conveying the personalities of the brands (Van Reil and Van den Ban, 2001). Simply designed logos increase the chances of them being recognised and remembered quickly by consumers (Robertson, 1989 and Airey, 2009). The success of PodPoint and Instavolt's brand awareness through colour and simple logo design can be seen in the results of the survey, as participants were effectively able to name them even when the logos were distorted.

According to ZapMap (2021), there are three speeds public chargepoint network providers offer: Rapid(>22KW), Fast(<22KW) and Slow(<7KW). Different public chargepoint operators offer different speeds, without knowledge of what each operator provides could cause electric vehicle drivers to potentially not charge at the speed they expect or overpaying for speeds they do not need. One key finding from the focus groups was the confusion of charging behaviour, some participants were confused by how long it would take to charge their prospective electric vehicle at different public chargepoint providers, this was tested further in the survey.

Both current and prospective electric vehicle drivers were presented with a public chargepoint operators' full logo and were asked to select as many services they believed to be provided; Rapid, Fast or Slow. PodPoint, Instavolt and Charge My Street will be analysed to gain an overall understanding of knowledge of participants.

According to ZapMap (2021) PodPoint provide Fast Charging, 138 participants were successfully able to name the service PodPoint provides. Of those 138, 115 were current electric vehicle drivers and 23 were prospective, 82% of current EV drivers could name the correct service which PodPoint provide, however, 43% selected Rapid and 50% selected Slow. Interestingly the majority of prospective EV drivers were correct in selecting Fast Charging

(42%), however, some were still confused as 20% selected Rapid and 29% selected Slow. What is apparent is both current and prospective EV drivers were unable to differentiate the difference between Fast and Slow charging when asked what service PodPoint provides.

ZapMap (2021) states that Instavolt provides Rapid charging. Comparably, when testing participants knowledge of charging services of Instavolt, Cramer's V shows there was a .487, a high, association of participants correctly selecting Rapid Charging. 85% (119) of current EV drivers were successfully able to name Rapid charging as Instavolt's service despite them having the least number of installations of the major public chargepoint networks. Interestingly, Instavolt's presence is very prominent between prospective electric vehicle drivers, despite them not using the service, 39% (21) selected Rapid charging.ZapMap (2021) suggest this project's industry partner, Charge My Street, is a minor public chargepoint operator due to the size of their network. 25.9% (36) current electric vehicle drivers were successfully able to name Fast charging as Charge My Street's service, comparably, 26% (14) prospective EV drivers were able to select the correct service provided. However, 57% (80) of current EV drivers and 64% (35) were unable to name the service provided by Charge My Street, selecting 'I don't know'. Although Charge My Street's services are not known by a large majority of the participants. Using cross-tabulation, the data showed that those participants living in the North-West (26) of England were most aware of their services, due to the relatively large number of installations in that area. As Charge My Street grows their infrastructure across the United Kingdom will increase awareness of current and prospective electric vehicle (EV) drivers.

### 6.5.0 **Conclusions**

This chapter has analysed the data gathered from the two focus groups and the survey. Previous academic research discovered in the literature review was then used to support the data gathered and complete each objective of this research. The results typify a new business sector where consumers have imperfect knowledge and products are not well defined. This presents an opportunity for carefully targeted marketing to both existing and new users to help grow the sector. Above all, the message from both the focus groups and the survey was that consumers need education through the provision of clear trusted information.

# **7.0** Conclusions and Implications

## 7.1.0 **Introduction**

Few studies have addressed consumer attitudes and perceptions of electric vehicle charging points and especially within demographics typically found in the North West of England. Greater understanding of local needs and concerns is needed to help adoption of electric vehicles and to better frame marketing strategies from charge point providers. This research has evaluated how to promote and encourage the use of electric vehicle and public charging using theoretical and contextual literature as well as conducting focus groups and a survey.

Using academic literature, several themes were identified that became the basis for this research. These themes encompassed an investigation into consumer behaviour and the adoption of new technologies, as well as an understanding of the behaviour of prospective electric vehicle drivers when they are making the switch. With this theoretical background, two focus groups were instigated with residents of the North West of England, three themes and three subthemes were discovered as a result of the focus groups.

1. Confusion of Charging Behaviour
2. Uncertainty of public chargepoint providers
3. Local Barriers to Electric Vehicle (EV) Adoption.
   - 3.1 Price of Electric Vehicle (EV) Barrier
   - 3.2 Price of Charging Barrier
   - 3.3 Access to Off-Street parking Barrier

Using contextual academic literature regarding electric vehicles, as well as the data gathered from the focus groups, a survey was designed. The survey was created to measure the brand awareness and understanding of chargepoint networks, from the perspective of current and prospective EV drivers.

## 7.2.0 **Theoretical Contributions**

The focus groups were designed to achieve objective one, *Identify local barriers stopping individuals making the switch to Electric Vehicles,* three new barriers to electric vehicle adoption that do not appear in electric vehicle academic literature are the *price of charging, confusion of charging behaviour* and *uncertainty about public chargepoint providers.*

Barriers that are featured in contextual electric vehicle academia such as: purchase price and access to off-street parking were discussed by participants of the focus groups. Price is a commonly discussed barrier to electric vehicle adoption, literature by Vassileva and Campillo, (2017), Larson *et al.,* (2014) and Noel *et al.,* (2020), state consumers are not adopting an electric vehicle due to the high cost of the vehicle. This also featured in the responses given by the focus group participants. Nevertheless, one participant stated price was not a barrier to them as they would part-exchange their current vehicle, similarly another participant had already seen an electric vehicle would have similar monthly payments to their current internal-combustion-engine vehicle (ICE). Parasuraman and Grewal (2000:p. 169) state that low performance-to-price ratio is the most cited barrier when consumers adopt to a new technology. Consumers evaluate their perceived performance-to-price ratio of a technology, if the consumer believes the value of the technology to be too high compared to the perceived performance, they will not adopt. These focus groups demonstrate that modes of purchase such as repayment schemes could help overcome this specific barrier to entry.

There is currently little literature surrounding the *price and nature of charging*. Those consumers with no access to off-street parking will have to rely on the public charging infrastructure and for them, this is a major concern. Consumers make decisions when adopting a new technology based on how much time, money and effort they will spend (Jose, 2017). Meaning, if a consumer has to pay a premium to charge their electric vehicle, they are less likely to adopt, a new barrier of adoption to electric vehicle. Cost can also be measured in terms of time and for those without the option of home charging, this also emerged as a concern.

The two further barriers discovered, *confusion of charging behaviour* and *uncertainty of public chargepoint providers,* inspired the creation of the survey. It was important to measure the brand awareness of different public chargepoint providers as the data gathered will give those encouraging prospective electric vehicle drivers' methods of how to stop them from being 'confused' or 'uncertain'. It is unsurprising that charging behaviour is a major concern since this is not analogous to filling a vehicle with petrol or diesel. It needs more forethought and

planning as well as knowledge of the charging networks and providers. Again, these are a new concept to most people. In contrast purchasing an electric vehicle rather than an ICE vehicle is a familiar process of substitution.

### 7.3.0 **Business and Policy Implications**

As well as giving new academic considerations, this thesis aimed to discover information to help and support an industry partner, Charge My Street. This provided real-world relevance for the work and immediate deployment of the findings to business. The survey was designed to understand what business or policy implications needed to be addressed in the electric vehicle sector to stop prospective electric vehicle drivers from being 'confused' or 'uncertain', encouraging them to make the switch. Participants were asked if they were interested in receiving information regarding new and existing chargepoints in their area. Both current and prospective EV drivers were interested, with 71% of current and 68% of prospective EV drivers (See Figure 49).

Respondents also expressed interest in receiving information regarding new and existing chargepoints in their area, with further questions establishing the communication modes preferred. With this information, chargepoint operators (CPO) such as Charge My Street should now target current and prospective electric vehicle drivers with easy-to-understand information regarding chargepoints in their area through their preferred online methods. Such as Social Media, Email and E-Newsletters. Interestingly, current electric vehicle users also preferred receiving information through mobile apps such as Plugshare or ZapMap, as well as EV related podcasts. If prospective electric vehicle drivers were made aware of such apps or podcasts, they too will be better informed of new and existing chargepoints in their area, so they are not 'confused' or 'uncertain'. Furthermore, due to participants of both current (65%) and prospective (28%) electric vehicle drivers preferring social media communication, participants were asked to rank through drag and drop their most frequently used modes of social media. Participants selected, Facebook, Twitter and YouTube as their preferred modes of social media, with TikTok, Pinterest and Snapchat being the least frequently used. Chargepoint operators, such as Charge My Street, should now tailor organic social media content to suit the target audience, paid social media content could also be used, reaching a

wider demographic. Further research could discover what type of social media content participants preferred to be as effective as possible.

To achieve objective three, *To assess the awareness of prospective and current electric vehicle (EV) drivers regarding services provided by public chargepoint operators*. A key finding from the focus groups was the uncertainty about public chargepoint providers, this encompassed who they are as well as what services they provide. Participants of the survey were asked to name the electric vehicle chargepoint operator (CPO) based on a photo of an installation, all logos and what service they provide. This information will be critical for a CPO, as they can change their branding, or work further their promotion through advertising, to increase awareness of their services. When comparing installations of Podpoint and Instavolt, there were significant similarities in the data based on Cramer's V measure of association. Podpoint, that has the most installations of the major CPO's, was most recognisable, with 86% of participants successfully able to name their installation (ZapMap, 2021). However, 15 (9%) prospective electric vehicle drivers could not, instead selecting Charge Your Car or stating they did not know. Likewise, Instavolt, that has the least installations of a major CPO, was recognisable by 81% of participants (ZapMap, 2021). Interestingly, 39 (20%) participants were not able to name the chargepoint, split between 15 current EV drivers and 24 prospective EV drivers. Although Instavolt's network of installations is growing, they could do more to increase awareness of their installations through preferred modes of advertising for prospective electric vehicle drivers. This is characteristic of a new market where knowledge is imperfect and brand loyalty has not become established, potentially creating opportunities for businesses able to invest in providing the information customers are looking for.

The awareness of Podpoint and Instavolt's brands were also analysed in the survey, both with high awareness of current and prospective electric vehicle drivers. Of the two, Podpoint was the most well recognised, with 91% of participants compared to 77% Instavolt. Neither PodPoint nor Instavolt have cluttered logos and using as little text as possible which would be consistent with recommendations made by Henderson and Cote (1998). Overall, the data from the survey shows that although the logos were distorted, the majority of participants, both current and prospective electric vehicle drivers were are able to name Podpoint and Instavolt.

Participants were asked to name the service provided by a range of chargepoint operators (CPO). Results suggest that participants were successfully able to identify Fast Charging as a service Podpoint provides. However, it was apparent that both current and prospective electric vehicle (EV) drivers were unable to differentiate between Fast and Slow charging when asked what service PodPoint provides. It appears these that terms are used casually and need to be explained in information distributed through trusted sources. Similarly, 85% of participants were able to name the service Instavolt provides, Rapid charging and very few participants were incorrect. Interestingly, Instavolt's services were also known by prospective EV drivers, despite them not using the service, 39% (21) were correct by selecting Rapid charging. This could be due to Instavolt consistently advertising their service across all their online and offline patforms. Meaning that when a current or prospective electric vehicle driver comes to use their service, they know what service they expect, easing 'confusion'.

Podpoint could ease 'uncertainty' of prospective electric vehicle drivers by advertising their charging services through different preferred advertising methods such as social media or electric vehicle mobile apps such as ZapMap or Plugshare. The electric vehicle industry with new brands, chargepoint operators, are offering unfamiliar services in different ways, prospective electric vehicle drivers are not able to easily distinguish good and bad products which fuels anxiety, creating a new barrier to entry for consumers.

### 7.4.0 **Academic Implications**

When researching key contextual literature regarding barriers to adoption of EV, it was apparent that literature focused on: Range, Price of Vehicle and Access to Public Charging (Krishna, 2021:5, Vassileva and Campillo, 2017; Berkeley et al., 2018:p. 468; Daina et al., 2018:p. 509; Noel et al., 2020). However, there is very little research on consumer education about owning an electric vehicle, especially regarding the confusion and uncertainty that exists about charging behaviour. The broad range of public chargepoint providers and the types of service offered emerged as barriers to entry for participants in this research's focus groups. A Canadian study states it is vital for the widespread adoption of EV that consumers have a good understanding and awareness of how electric vehicles can benefit them and their day to day

lives (Axsen et al., 2017:p. 171). Axsen et al., (2017) show there is a lack of knowledge of prospective EV owners on: Range, Charging, Operational Costs and Environmental impacts. There is very little UK related literature regarding the consumer education of EV, or how people perceive living with an EV. Further research regarding up-to-date barriers to adoption would be beneficial so misconceived perceptions can be debunked, with an aim of increasing adoption of electric vehicle.

### 7.5.0 **Limitations of Study**

The project could have been improved by increasing the sample size of participants in the two online focus groups and potentially running additional groups. Although it was essential that the participants of the focus groups were locals of the North West, a larger sample size could have identified further local barriers stopping individuals making the switch to electric vehicles. This limitation relates to difficulties of engaging groups during the period of COVID regulations. Furthermore, this research had to rely on online methods of research, if the focus groups were held in person, they could have created a different dynamic or attracted a broader range of people, ultimately leading to a different set of data. The survey could have enquired participants preferred social media content, proving further data for CPO. Field research talking to users about the charging experience would also have been useful, especially in tourist destinations such as the Lake District and would have captured more information relevant to the region.

### 7.6.0 **Further research suggestions.**

This thesis could benefit from potential further research. There is scope for this research to be mirrored in a different location, that has a different demographic of its population, this could discover new barriers to adoption. Furthermore, this study could be extended by completing face-to-face interviews with individuals that promote the use of electric vehicles using online advertising methods such as social media, youtube and podcasts. Interestingly, there is a large group of individuals who promote their own experience of driving an electric vehicle online to encourage more prospective electric vehicle drivers to make the switch. These individuals from around the UK could be interviewed to discover their opinions on what could be done by chargepoint operators (CPO), manufacturers and the Government to overcome barriers to

adoption. Although data regarding preferred online and offline methods was gathered, further research regarding what types of content participants prefer could lead to further education about electric vehicle and chargepoints in particular. It would also be interesting to understand how quickly understanding of chargepoints changes, as more people take up electric vehicles and person to person networks emerge to help users. It is also likely that CPO will face greater regulations, perhaps enhancing the consumer experience, follow-up work could measure this change.

Overall, this research has been successful in its aim of this research is to, evaluate the adoption of electric vehicles, specifically to investigate the understanding and brand awareness of public chargepoint operators, facilities and services.. The first objective was successfully achieved through the empirical research. This research successfully identified changes that need to be made to encourage prospective electric vehicle drivers to make the switch by discovering how to advertise easy to understand educational content via different preferred online and offline methods. Objective three was to assess the awareness of prospective and current electric vehicle drivers of the services provided by public chargepoint operators (CPO). The data gathered here could be used by major CPO to change their design of their installations and logo to increase their brand awareness leading to further adoption of electric vehicles.

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# 9.0 Appendices

**Appendix 1**: Focus Group Ethics Form

Name of student, Department, e-mail address:

Tom Barker, Entrepreneurship, Strategy and Innovation, t.barker2@lancaster.ac.uk

Module this application is related to:

MSc by Research Innovation Thesis.

Name of dissertation supervisors:

Dr Trivikram Dokka Venkata Satyanarayana, Dr Ivan Svetunkov and Prof. Stefanos Mouzas.
Project title:

Driving The Switch: Promoting the Benefits of Electric Vehicle Usage.

**Overall aim of the project and research questions:**

I will be hosting two small online focus groups with up to 5 participants each. My research aims to understand the barriers individuals have in the North West of England to making the transition to an electric vehicle. The focus groups will allow participants to discuss their current situations: if they have switched and if not why is this the case. One member of the focus group will be an existing user, someone who has made the switch and actively uses a charge point in their area. This person will be identified to the group prior to the session, will not receive payment and is there to answer any questions that the participants may have regarding the practicalities of owning an Electric Vehicle at a very local level.

**What will be the research methods?**

Two Focus Groups.

**Who are the intended participants and how will you recruit them?**

The participants have been chosen as they have previously answered questionnaires from my industry partner Charge My Street. These individuals expressed they were interested to switching to an Electric Car in the next few years. There has been 10 participants identified from previous surveys by Charge My Street. These participants willingly included their names and email addresses in the data so they could be contacted again. Participants are all adults and are a mix of genders located in the North West of England, notably, Lancaster, Kendal, Barrow-in-Furness and Carlisle.

**Where will the research be carried out and do you have permission from the organisation(s) concerned (e.g. the school you want to work in)?:**

The focus groups will be hosted on a secure encrypted Zoom Conference Call.

**Do any of the aspects of the study pose any risks to the participants' physical or emotional well-being (e.g. might they find taking part embarrassing or may they be asked to discuss topics which are emotionally upsetting)?**
There will be no physical, psychological or sensitive topics discussed in the focus groups. However, if a participant decides they do not want to answer a question or participate in a topic they feel uncomfortable with they can leave the call. As discussed in the Participant Information Sheet, participants are welcome to withdraw from the study at any time before the focus group begins. Participants will be advised their background location will be visible if they use their camera and do not blur their screen.

**Does your project involve people or groups who may be vulnerable, in particular in the context of the planned research (e.g. children in schools who may be vulnerable to feeling under pressure to consent to taking part in the study)?:**
No.

**Does your project involve covert methods or any form of deception or limited disclosure (this may be necessary in some forms of experimental research)?**
No.

**How will you ensure that data participants share with you will only be used in such a way that they cannot be identified? How will you ensure that participants' personal data will be kept confidential?**

In the Focus Group, participants can choose what name they want to show in the Zoom call. Once they have been accepted and signed the consent form they will be notified via email to only use their first name on the call. As the focus groups will be recorded, the participant can choose whether they want to have their camera on or blur their background. The video recording of the focus group will not be shared, once the meeting has been transcribed the video footage will be deleted. An audio file of the conversation will be kept in an encrypted file on an encrypted cloud storage system (OneDrive). All data gathered will be stored securely in an encrypted cloud storage file. The video recording of the focus groups will be converted immediately into an MP3. Audio format and all video will be deleted. The transcripts of the focus groups will be stored and kept on the encrypted cloud storage file for the longevity of my studies at Lancaster University and will be deleted once my course is complete on the 30th September 2021. I (the student) will be responsible for the deletion of all transcripts and documentation.

**Will participants be given accessible information explaining: the general aim of the study; what they will be expected to do; how their data will be stored and how you will use their data in the essay/dissertation?**
Prior to accepting the invitation all participants will be able to access the participant information sheet. This includes information explaining the aim of the study, what will be

expected from them and how their data will be stored and used in this Master's by Research thesis.

Student signature Date

Tom Barker 09.02.2021

**Approval**

Dissertation Supervisor Date

Trivikram Dokka Feb 10, 2021

Trivikram Dokka (Feb 10, 2021 13:42 GMT)

Dissertation Supervisor Date

Ivan Svetunkov Feb 10, 2021

Ivan Svetunkov (Feb 10, 2021 14:02 GMT)

Dissertation Supervisor Date

Stefanos Mouzas

Stefanos Mouzas (Feb 11, 2021 10:55 GMT)

Feb 10, 2021

**Appendix 2**: Focus Group Participant Information Sheet

# Participant information sheet

For further information about how Lancaster University processes personal data for research purposes and your data rights please visit our webpage: www.lancaster.ac.uk/research/data-protection

My name is Tom Barker and I am a Masters by research student at Lancaster University working alongside Charge My Street and I would like to invite you to take part in a research study about the switch from petrol and diesel vehicles to electric vehicles in the North West of England to improve carbon emissions.

**Please take time to read the following information carefully before you decide whether you wish to take part.**

**What is the study about?**
**This study aims to** understand what marketing techniques are most effective to encourage petrol and diesel car owners to switch to an electric vehicle, and to help reduce carbon emissions in the transport sector. Firstly, local barriers need to be identified so that could get a better understanding of what is stopping locals making the switch to electric vehicles. This information will help produce marketing techniques to help the take-up of chargepoints across the North West. By gathering this information, we hope to understand how to reach a wider audience, including tourists and visitors, making them aware of the existing infrastructure.

**Why have I been invited?**
We have approached you because you completed a Charge My Street questionnaire in the last three years, and you expressed your interest in owning an Electric Vehicle in the next few years. It would be very beneficial for us to hear your own experience of purchasing an electric vehicle or to hear about the barriers you still face which are stopping you from making the switch. This invitation will not focus on your specific purchase decisions; rather we want to better understand the considerations you are making.

**What will I be asked to do if I take part?**
If you decided to take part, this would involve taking part in one short group meeting hosted online via Zoom, which with your consent will be recorded for transcription purposes, leading to the footage being deleted immediately once transcribed. The meeting will be administered by Tom Barker and you will be with 5 others from areas such as Lancaster, Kendal, Carlisle and Barrow-In-Furness who have also participated in previous studies by Charge My Street.

**What are the possible benefits from taking part?**
**Taking part in this study will allow you to learn what it is like to own an electric vehicle in your local area as we know that all regions are different. You will also be able to gain an insight into buying experience of an electric vehicle at a local level from someone who has already taken that step. Furthermore, all participants who attend the focus group will receive a £10 Booths Supermarket voucher.**

**Do I have to take part?**
No. It's completely up to you to decide whether or not you take part. Your participation is voluntary and if you decide not to take part in the study this will not affect your relationship with Charge My Street.

**What if I change my mind?**

**If you change your mind, you are free to withdraw at any time during your participation in this study. If you want to withdraw, please let me know, and I will extract any ideas or information (=data) you contributed to the study and destroy them. However, it is difficult and often impossible to take out data from one specific participant when this has already been anonymised or pooled together with other people's data. Therefore, you can only withdraw up to 6 weeks after taking part in the study.**

**What are the possible disadvantages and risks of taking part?**
It is unlikely that there will be any major disadvantages to taking part, the meeting should not last more than 1 hour.

**Will my data be identifiable?**
After the focus group, only myself and employees of Charge My Street, will have access to the ideas you share with us.

We will keep all personal information about you (e.g. your name and other information about you that can identify you) confidential, that is we will not share it with third parties. We will remove any personal information from the written record of your contribution. All reasonable steps will be taken to protect the anonymity of the participants involved in this project. Participants in the meeting will be asked not to disclose information outside of the group without the relevant person's permission.

**How will we use the information you have shared with us and what will happen to the results of the research study?**
**We will use the information you have shared with us for research purposes only. This will include Master's thesis and possible academic publications. The data will be anonymised and it will not be possible to trace it back to the participants of this survey.**

**When writing up the findings from this study, we would like to reproduce some of the views and ideas you shared with us. We will only use anonymised quotes (e.g. from my interview with you), so that although we will use your exact words,** all reasonable steps will be taken to protect your anonymity in **our publications.**

**How my data will be stored**
Your data will be stored in encrypted files (that is no-one other than the researcher will be able to access them) and on password-protected computers. We will store hard copies of any data securely in locked cabinets in my office. We will keep data that can identify you separately from non-personal information (e.g. your views on a specific topic). In accordance with University guidelines, we will keep the data securely for a minimum of ten years.

**This study is funded by the European Regional Development Fund through the Centre for Global Eco-Innovation at Lancaster University. The funder expects Tom to make data available for future use by other researchers. Tom will exclude all personal data from archiving. Data will be deposited in Lancaster University's institutional data repository and made freely available with an appropriate data license.**

**What if I have a question or concern?**

**If you have any queries or if you are unhappy with anything that happens concerning your participation in the study, please contact Tom Barker (t.barker2@lancaster.ac.uk) or one of his supervisors:**

- **Dr Trivikram Dokka Venkata Satyanarayana, t.dokka@lancaster.ac.uk, Lancaster University Management School.**
- **Dr Ivan Svetunkov, i.svetunkov@lancaster.ac.uk, Lancaster University Management School.**
- **Professor Stefanos Mouzas, s.mouzas@lancaster.ac.uk, Lancaster University Management School.**

**If you have any concerns or complaints that you wish to discuss with a person who is not directly involved in the research, you can also contact:**

Professor Gillian Hopkinson, g.hopkinson@lancaster.ac.uk, **Lancaster University Management School.**

**Sources of support**
Further information is available from Dr Andy Pickard, Manager, Centre for Global Ecoinnovation, Lancaster University.

This study has been reviewed and approved by the Faculty of Arts and Social Sciences and Lancaster Management School's Research Ethics Committee.

**Thank you for considering your participation in this project.**

**Appendix 3**: Focus Group Discussion Topics

## **Section One**: Switching.

- Since you answered the initial questionnaire have you made the switch to an EV?

- If so, what model have you purchased? What has your overall experience been?
- If so, did you use a leasing or hire purchase method for the purchase?
- If so, has the Government announcement of phasing out the sale of petrol and diesel cars in 2030, encourage you to make the switch?
- If not, what local barriers are stopping you from making the switch?
- If not, since you answered the initial questionnaire are there any other reasons to switching?
- If not, what would make you make the switch to an EV?

**Section Two**: Residency.

- Since you answered the initial questionnaire has your residential status changed?
- Are you still in a property with/without a driveway?
- Since the survey are you now a 5-minute walk of a Charge My Street chargepoint?
- If your property does not have access to a driveway are you willing to use a community chargepoint?
- If your property does not have access to a driveway are you willing to invest in a community chargepoint?
- Are you aware of any other chargepoints in your area?
- Are you aware of any Charge My Street chargepoints in your area?

Approval Form for UG and taught PG students

Name of student, Department, e-mail address

Tom Barker, Entrepreneurship, Strategy and Innovation, t.barker2@lancaster.ac.uk

Module this application is related to:

MSc by Research Innovation Thesis

Name of dissertation supervisors:

Dr Trivikram Dokka Venkata Satyanarayana, Dr Ivan Svetunkov and Prof. Stefanos Mouzas.

Project Title:

Driving The Switch: Promoting the Benefits of Electric Vehicle Usage.

**Overall aim of the project and research questions:**

The second part of research I will be conducting in my thesis is an online questionnaire. The questionnaire will aim to understand current and prospective Electric Vehicle drivers awareness of different chargepoint network installation companies as well as understanding what marketing and advertising techniques are most efficient.

**What will be the research methods?**

Questionnaire

**Who are the intended participants and how will you recruit them?**

The questionnaire will be sent to current and prospective electric vehicle drivers through social media, e-newsletter and Google Ads.

**Where will the research be carried out and do you have permission from the organisation(s) concerned (e.g. the school you want to work in)?**

The questionnaire will be created using Qualtrics.

**Do any of the aspects of the study pose any risks to the participants' physical or emotional well-being (e.g. might they find taking part embarrassing or may they be asked to discuss topics which are emotionally upsetting)?**

No.

**Does your project involve people or groups who may be vulnerable, in particular in the context of the planned research (e.g. children in schools who may be vulnerable to feeling under pressure to consent to taking part in the study)?**

No.

**Does your project involve covert methods or any form of deception or limited disclosure (this may be necessary in some forms of experimental research)?**

No.

**How will you ensure that data participants share with you will only be used in such a way that they cannot be identified? How will you ensure that participants' personal data will be kept confidential?**

This research does not require any personal information from the participant as it is only their opinion that is most important in this study. However, all data gathered will be stored securely in an encrypted cloud storage file. This data will be kept for the longevity of my studies at Lancaster University and will be deleted once my course is completed on the 30th September 2021. I (the student) will be responsible for the deletion of all data gathered.

**Will participants be given accessible information explaining: the general aim of the study; what they will be expected to do; how their data will be stored and how you will use their data in the essay/dissertation?**

Prior to answering the questionnaire all participants will be able to read the participant information sheet. This includes information explaining the aim of the study, what will be expected from them and how their data will be stored and used in this Master's by Research thesis.

Student signature Date

Tom Barker

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16.04.2021

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Approval

Dissertation Supervisor Date

*stefanos Mouzas* Apr 21, 2021

stefanos Mouzas (Apr 21, 2021 17:36 GMT+1)

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Dissertation Supervisor Date

*Ivan Svetunkov* Apr 21, 2021

Dissertation Supervisor Date

*Trivikram Dokka* Apr 22, 2021

rivikram Dokka (Apr 22, 2021 15:32 GMT+1)

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**Appendix 5**: Questionnaire Participant Information Sheet

## Participant information sheet

For further information about how Lancaster University processes personal data for research purposes and your data rights please visit our webpage: www.lancaster.ac.uk/research/data-protection

My name is Tom Barker and I am a Masters by research student at Lancaster University working alongside Charge My Street. I would like to invite you to take part in a research study about the switch from petrol and diesel vehicles to electric vehicles in the North West of England, to improve carbon emissions.

**Please take time to read the following information carefully before you decide whether you wish to take part.**

### What is the study about?

This study aims to promote the use of electric vehicles, to help reduce carbon emissions in the transport sector. This questionnaire will aim to understand brand awareness of different public chargepoints as well as Charge My Street. By gathering this information, we hope to understand how to educate prospective Electric Vehicle drivers, so they do not feel overwhelmed by the gulf of information when making the switch to an Electric Vehicle. We also hope to improve our marketing allowing us to reach a wider audience, including tourists and visitors, making them aware of Charge My Streets existing infrastructure.

### Why have I been invited?

I would like to understand your awareness of electric vehicle chargepoint networks as well as learning what you find most effective in chargepoint advertising.

### What will I be asked to do if I take part?

If you decide to take part, this will involve taking part in one questionnaire. The questionnaire is designed to understand your opinions so the majority of questions are multiple choice, however, some questions may ask you to add an extra comment to support your answer.

### What are the possible benefits from taking part?

Your opinions will contribute to understanding of what the brand awareness is of public network chargepoints as well as marketing and advertising techniques that are best for advertising.

### Do I have to take part?

No. It is completely up to you to decide whether or not you take part. Your participation is voluntary and if you decide not to take part in the study, this will not affect your relationship with Charge My Street.

**What if I change my mind?**

If you change your mind, you are free to withdraw at any time during your participation in this study. If you want to withdraw after submitting, withdrawal may not be possible as the questionnaire is anonymous.

**What are the possible disadvantages and risks of taking part?**

It is unlikely that there will be any major disadvantages to taking part, the questionnaire shouldn't take more than 10 minutes.

**Will my data be identifiable?**

No, this questionnaire is anonymous and does not require any personal information.

After the questionnaire, only myself and employees of Charge My Street, will have access to the data. We will keep all personal information about you (e.g. Age and Location) confidential. All reasonable steps will be taken to protect the anonymity of the participants involved in this project.

**How will we use the information you have shared with us and what will happen to the results of the research study?**

We will use the information you have shared with us for research purposes only. This will include Master's thesis and possible academic publications. The data will be anonymised, and it will not be possible to trace it back to the participants of this survey.

**How my data will be stored**

Your data will be stored in encrypted files (that is no-one other than me, the researcher will be able to access them) and on password-protected computers. In accordance with University guidelines, I will keep the data securely for a minimum of ten years.

This study is funded by the European Regional Development Fund through the Centre for Global Eco-Innovation at Lancaster University. The funder expects Tom to make data available for future use by other researchers. Tom will exclude all personal data from archiving. Data will be deposited in Lancaster University's institutional data repository and made freely available with an appropriate data license.

**What if I have a question or concern?**

If you have any queries or if you are unhappy with anything that happens concerning your participation in the study, please contact Tom Barker (t.barker2@lancaster.ac.uk) or one of his supervisors:

- **Dr Trivikram Dokka Venkata Satyanarayana**, t.dokka@lancaster.ac.uk, Lancaster University Management School.

- **Dr Ivan Svetunkov,** i.svetunkov@lancaster.ac.uk, Lancaster University Management School.

- **Professor Stefanos Mouzas,** s.mouzas@lancaster.ac.uk, Lancaster University Management School.

If you have any concerns or complaints that you wish to discuss with a person who is not directly involved in the research, you can also contact:

Professor Magnus George, m.george@lancaster.ac.uk, Lancaster University Management School.

**Sources of support**

Further information is available from Dr Andy Pickard, Manager, Centre for Global Eco-Innovation, Lancaster University.

**Appendix 6**: Complete Survey

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# Participant Information Sheet

## Participant Information Sheet

My name is Tom Barker and I am a Masters by research student at Lancaster University working alongside Charge My Street. I would like to invite you to take part in a research study about the switch from petrol and diesel vehicles to electric vehicles in the North West of England, to improve carbon emissions.

**Please take time to read the following information carefully before you decide whether you wish to take part.**

**What is the study about?**
This study aims to promote the use of electric vehicles, to help reduce carbon emissions in the transport sector. This questionnaire will aim to understand brand awareness of different public chargepoints as well as Charge My Street. By gathering this information, we hope to understand how to educate prospective Electric Vehicle drivers, so they do not feel overwhelmed by the gulf of information when making the switch to an Electric Vehicle. We also hope to improve our marketing allowing us to reach a wider audience, including tourists and visitors, making them aware of Charge My Streets existing infrastructure.

**Why have I been invited?**
I would like to understand your awareness of electric vehicle chargepoint networks as well as learning what you find most effective in chargepoint advertising.

**What will I be asked to do if I take part?**
If you decide to take part, this will involve taking part in one questionnaire. The questionnaire is designed to understand your opinions so the majority of questions are multiple choice, however, some questions may ask you to add an extra comment to support your answer.

**What are the possible benefits from taking part?**
Your opinions will contribute to understanding of what the brand awareness is of public network chargepoints as well as marketing and advertising techniques that are best for advertising.

**Do I have to take part?**
No. It is completely up to you to decide whether or not you take part. Your participation is voluntary and if you decide not to take part in the study, this will not affect your relationship with Charge My Street.

**What if I change my mind?**
If you change your mind, you are free to withdraw at any time during your participation in this study. If you want to withdraw after submitting, withdrawal may not be possible as the questionnaire is anonymous.

**What are the possible disadvantages and risks of taking part?**
It is unlikely that there will be any major disadvantages to taking part, the questionnaire shouldn't take more than 10 minutes.

**Will my data be identifiable?**
No, this questionnaire is anonymous and does not require any personal information.
After the questionnaire, only myself and employees of Charge My Street, will have access to the data. We will keep all personal information about you (e.g. Age and Location) confidential. All reasonable steps will be taken to protect the anonymity of the participants involved in this project.

**How will we use the information you have shared with us and what will happen to the results of the research study?**
We will use the information you have shared with us for research purposes only. This will include Master's thesis and possible academic publications. The data will be anonymised, and it will not be possible to trace it back to the participants of this survey.

**How my data will be stored**

Your data will be stored in encrypted files (that is no-one other than me, the researcher will be able to access them) and on password-protected computers. In accordance with University guidelines, I will keep the data securely for a minimum of ten years.

This study is funded by the European Regional Development Fund through the Centre for Global Eco-Innovation at Lancaster University. The funder expects Tom to make data available for future use by other researchers. Tom will exclude all personal data from archiving. Data will be deposited in Lancaster University's institutional data repository and made freely available with an appropriate data license.

**What if I have a question or concern?**
If you have any queries or if you are unhappy with anything that happens concerning your participation in the study, please contact Tom Barker (t.barker2@lancaster.ac.uk) or one of his supervisors:

- **Dr Trivikram Dokka Venkata Satyanarayana**, t.dokka@lancaster.ac.uk, Lancaster University Management School.
- **Dr Ivan Svetunkov,** i.svetunkov@lancaster.ac.uk, Lancaster University Management School.

- **Professor Stefanos Mouzas,** s.mouzas@lancaster.ac.uk, Lancaster University Management School.

If you have any concerns or complaints that you wish to discuss with a person who is not directly involved in the research, you can also contact:
Professor Magnus George, m.george@lancaster.ac.uk, Lancaster University Management School.

**Sources of support**
Further information is available from Dr Andy Pickard, Manager, Centre for Global Eco-Innovation, Lancaster University.

Click here to consent to the above and start the questionnaire.

## Section One: About You

This section is designed to learn more about you as a current or prospective Electric Vehicle driver.

Do you currently own an Electric Vehicle?

Yes
No

How do you currently charge your Electric Vehicle? (Select all that apply)

Home Charging
Work Charging
Public Charging

When are you planning on buying an Electric Vehicle?

This year

In the next year

In the next two years

In the next three years or more

Never

## Do you have access to a driveway?

Yes

Sometimes

No

Section Two: Chargepoint Network Installations

This section is designed to understand your awareness of different UK public chargepoint network provider installations, the logos have been removed from their installations. There are 6 questions in this section.

Can you name the public network installer of this chargepoint?

ESB Energy

BP Pulse

Instavolt

Charge Your Car

I Don't Know

Can you name the public network installer of this chargepoint?


Ecotricity

Tesla

Shell Recharge

Charge My Street

I Don't Know

Can you name the public network installer of this chargepoint?


Ecotricity

BP Polar

GeniePoint

Charge My Street

I Don't Know

Can you name the public network installer of this chargepoint?

Podpoint

Tesla

Shell Recharge

Charge Your Car

I Don't Know

Can you name the public network installer of this chargepoint?


Osprey

Gridserve

Charge My Street

BP Pulse

I Don't Know

Can you name the public network installer of this chargepoint?

Osprey

Ubitricity

GeniePoint

Ecotricity

I Don't Know

Section Three: Chargepoint Network Logos

This section is designed to understand your awareness of different UK public chargepoint network providers logos, the wording has been removed from their logos.
There are 6 questions in this section.

Which one of these public chargepoint networks is BP Pulse?

I Don't Know

Which one of these public chargepoint networks is Osprey?

I Don't Know

Which one of these public chargepoint networks is Instavolt?

I Don't Know

Which one of these public chargepoint networks is Geniepoint?

I Don't Know

Which one of these public chargepoint networks is Podpoint?

I Don't Know

Which one of these public chargepoint networks is Gridserve?

I Don't Know

## Section Four: Chargepoint Network Services

This section is designed to understand your awareness of the services of different UK public chargepoint network providers.
There are 6 questions in this section.

What charging services does Gridserve provide? (Select as many answers that apply)


FYI

-Rapid Charging: Often rated at around 50 kW, typically takes less than half an hour.

-Fast Charging: (7-22kW), a full charge is typically 3 to 4 hours.

-Slow Charging: (up to 3kW) typically taking 6 to 8 hours.

- [ ] Rapid Charging
- [ ] Fast Charging
- [ ] Slow Charging
- [ ] I Don't Know

What charging services does Podpoint provide? (Select as many answers that apply)


FYI

-Rapid Charging: Often rated at around 50 kW, typically takes less than half an hour.

-Fast Charging: (7-22kW), a full charge is typically 3 to 4 hours.

-Slow Charging: (up to 3kW) typically taking 6 to 8 hours.

- [ ] Rapid Charging
- [ ] Fast Charging
- [ ] Slow Charging
- [ ] I Don't Know

What charging services does Osprey provide? (Select as many answers that apply)


FYI

-Rapid Charging: Often rated at around 50 kW, typically takes less than half an hour.

-Fast Charging: (7-22kW), a full charge is typically 3 to 4 hours.

-Slow Charging: (up to 3kW) typically taking 6 to 8 hours.

- [ ] Rapid Charging
- [ ] Fast Charging
- [ ] Slow Charging
- [ ] I Don't Know

What charging services does BP Pulse provide? (Select as many answers that apply)

FYI

-Rapid Charging: Often rated at around 50 kW, typically takes less than half an hour.

-Fast Charging: (7-22kW), a full charge is typically 3 to 4 hours.

-Slow Charging: (up to 3kW) typically taking 6 to 8 hours.

- [ ] Rapid Charging
- [ ] Fast Charging
- [ ] Slow Charging
- [ ] I Don't Know

What charging services does Instavolt provide? (Select as many answers that apply)

FYI

-Rapid Charging: Often rated at around 50 kW, typically takes less than half an hour.

-Fast Charging: (7-22kW), a full charge is typically 3 to 4 hours.

-Slow Charging: (up to 3kW) typically taking 6 to 8 hours.

- [ ] Rapid Charging
- [ ] Fast Charging
- [ ] Slow Charging
- [ ] I Don't Know

What charging services does Charge My Street provide? (Select as many answers that apply)


FYI

-Rapid Charging: Often rated at around 50 kW, typically takes less than half an hour.

-Fast Charging: (7-22kW), a full charge is typically 3 to 4 hours.

-Slow Charging: (up to 3kW) typically taking 6 to 8 hours.

- [ ] Rapid Charging
- [ ] Fast Charging
- [ ] Slow Charging
- [ ] I Don't Know

Section Five: Information Preferences

This section is designed to understand your preferred methods of receiving information regarding public chargepoint networks.

There are 7 questions in this section.

Are you interested in receiving information regarding new and existing chargepoints in your area?

- ○ Yes
- ○ No
- ○ Not Sure

What is your preferred method of receiving **online** information? (Select all that apply)

- [ ] Social Media
- [ ] Website Promotion
- [ ] Search Engine Promotion
- [ ] None of the above
- [ ] Email
- [ ] Other
- [ ] E-Newsletter

Rank, using drag and drop, what forms of social media do you use most frequently. (You can leave the ones you don't use at all)

| Items | I use most frequently (e.g Daily). | I don't use very often (e.g Once a week). |
|---|---|---|
| Facebook | | |
| Twitter | | |
| Instagram | | |
| LinkedIn | | |
| YouTube | | |
| TikTok | | |
| Reddit | | |
| Snapchat | | |
| Pinterest | | |
| Other | | |

I don't use at all (e.g Once a Month or Never).

Rank, using drag and drop, what type of social media content you would like to see more of. (You can leave the ones you don't like at all)

Items

Electric Vehicle Facts

Electric Vehicle News

New Public Chargepoint Installations

Current Public Chargepoint Installations

User Experiences

Polls

Live Streams

Question and Answer Sessions

Other

Interested

Might Be Interested

Not Interested

What are your preferred methods of receiving **offline** information? (Select all that apply)

- [ ] Posters
- [ ] Events
- [ ] Leaflets
- [ ]

Television

Mail (Post)

Radio

Newsletters

None of the above

Billboards

Other

Are you aware of Charge My Street and their services?

Yes

No

Not Sure

Choose what platforms do you follow Charge My Street on. (Select as many answers that apply)

Facebook

E-Newsletter

Twitter

I do not currently follow Charge My Street on Social Media

LinkedIn

Other

YouTube

Section Six: Demographical Information

Finally, please tells us a little bit about yourself.

What is your age?

Younger than 17

55-64

17-24

65-74

25-34

75 or older

35-44

Prefer not to say.

45-54

What is your gender?

Male

Female

Other (Specify if you would like to)

Prefer not to say.

Where do you currently live?

North West England

South East England

North East England

South West England

Yorkshire and Humber

Scotland (Specify if you would like to)

East Midlands

Wales (Specify if you would like to)

West Midlands

Northern Ireland (Specify if you would like to)

East of England

Ireland (Specify if you would like to)

London

Outside of UK (Specify if you would like to)

Please click the green arrow to proceed.

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