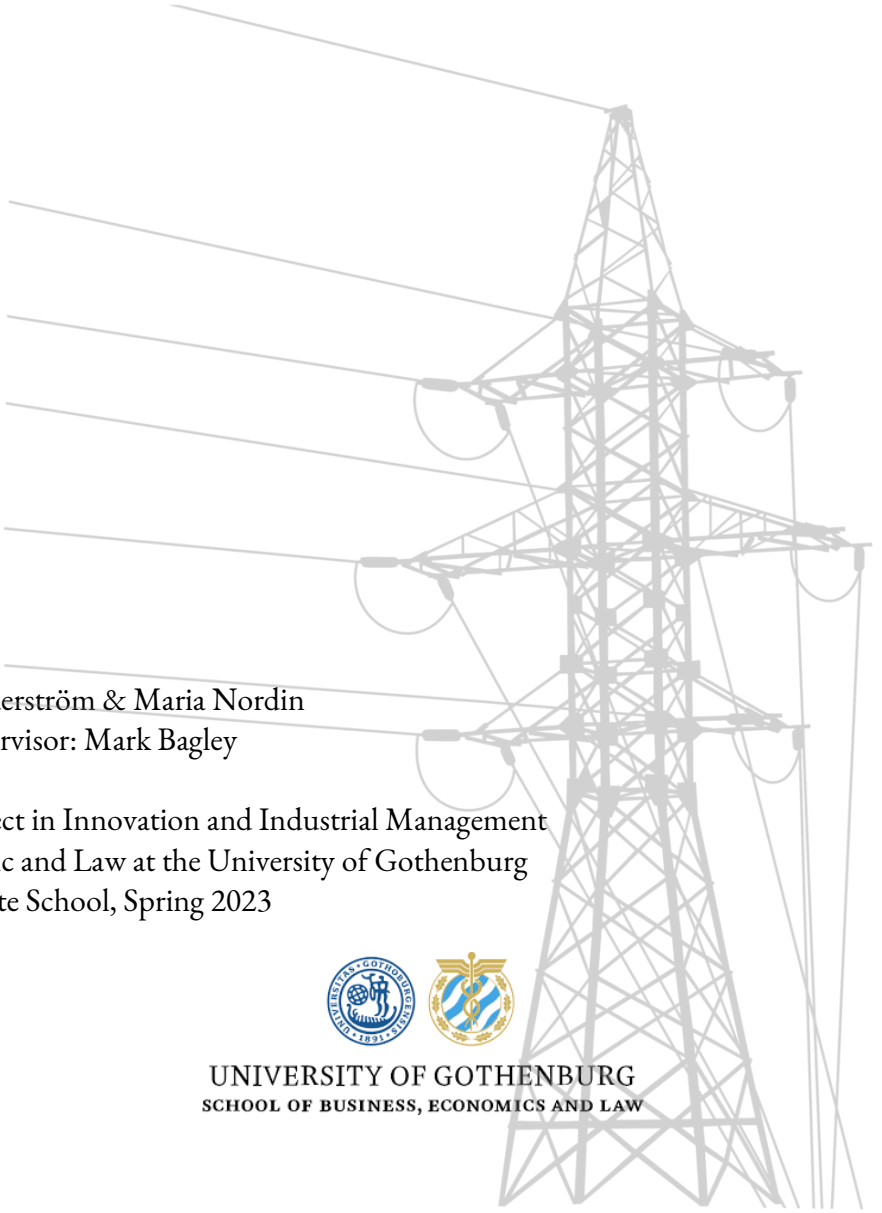
The new era of Electric Vehicles:

Rolling out the Energy Storage Solution of Tomorrow

A single case study investigating fleet customers' opportunities and challenges with adopting Vehicle-to-Grid technology, to identify complexities and important considerations when accelerating the implementation.



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UNIVERSITY OF GOTHENBURG
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The new era of Electrical Vehicles: Rolling out the Energy Storage Solution of Tomorrow.

An exploratory case study investigating the barriers and challenges of adopting the Vehicle-to-Grid technology among B2B customers.

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Abstract

The following thesis investigates the complexities of implementing the Vehicle-to-Grid (V2G) technology. It explores the perceived benefits and challenges that fleet customers within an automotive company have towards the technology. The electricity grid is under pressure when EV adoption increases, and V2G capable vehicles have the potential (with bidirectional charging) to allow the EV battery to work as an energy storage solution. Understanding the benefits that fleet customers can see with V2G and the challenges or barriers that need to be overcome can allow the case company to accelerate the implementation and achieve widespread adoption. Interviews with fleet customers and experts within the field have been conducted through an abductive research approach. In addition, a literature review of the theory of technology adoption as well as current literature on V2G benefits and barriers perceived by retail customers is carried out. The results from this study show that fleet customers see V2G as an opportunity to (1) benefit society, (2) a possibility to sell more EVs and (3) create new business opportunities where the fleet customer could fill an aggregator role. On the other hand, important considerations when facing the challenges expressed by customers are to (1) create value for all stakeholders, (2) find early adopters, (3) show transparency for everyone involved, (4) enable actual usage and, (5) to create an easy user experience. Since previous literature only captures the retail side of the customers to automotive companies, this study adds a dimension of the fleet perspectives to current research and brings insights into how they need to be a part of the value chain of V2G. The implications this creates for the case company is that fleet customers need to be carefully considered when creating the business model to ensure that widespread adoption of the technology can take place.

Keywords:

Innovation; Sustainability; Technology Adoption; Electrical Distribution; Power Grid; Electric Vehicles; Energy Storage Solutions; Renewable Energy; V2X; Vehicle-to-Grid; V2G

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We would also like to extend our gratitude towards all customers and expert respondents who chose to participate and took their time for an interview, giving their perceptions of V2G and providing the case company with essential considerations for future implementation.

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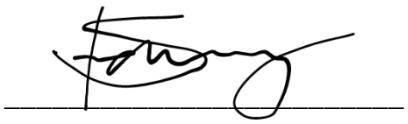

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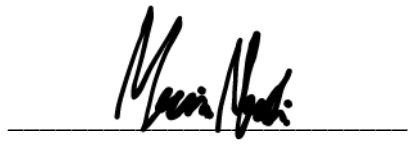

Maria Nordin

Abbreviations

B2B - Business-to-Business

B2C - Business-to-Customer

CSR - Corporate Social Responsibility

EV - Electric Vehicle

ESS - Energy Storage Solution

G2V - Grid-to-Vehicle

ICE - Internal Combustion Engine

OEM - Original Equipment Manufacturer

V2G - Vehicle-to-Grid

V2H - Vehicle-to-Home

V2V - Vehicle-to-Vehicle

V2X - Vehicle-to-Everything

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1. INTRODUCTION

The following thesis aims to understand how an automotive company can accelerate the implementation of Vehicle-to-Grid (V2G) technology among their fleet customers. According to the Global EV Outlook of 2022, the global CO2 emissions in the transportation sector stood for approximately 37% of the total emission globally (IEA, 2022). Unlike traditional internal combustion engine (ICE) vehicles, electric vehicles (EVs) can feature zero carbon emissions when being used (Lopes & Soares, 2010). However, EVs' substantial increase and technological advancement put further pressure on the charging infrastructure (Huda et al., 2020). A study from Kasten et al. (2016) projected that the electricity demand from EV charging in 2050 could account for 9.5% of the total energy demand in the European Union. When it comes to the distribution of the grid, it is designed with low safety margins and overloading capacity. Hence, the electrical distribution network will be affected when charging of a larger scale of EVs is uncoordinated and the load peaks increase (Huda et al., 2020). Beyond that, it increases the risk of power lines and transformer overload, resulting in energy losses and power quality degradation (Clement-Nyns et al., 2010).

One sustainable solution to address this risk could be the reinforcement of excess energy from the EV battery back to the distribution network using V2G technology (Yu et al., 2022). According to Virta (2023), "Electric vehicle batteries are by far the most cost-efficient form of energy storage." Kaluza (2022) further claims that a battery in an EV can store up to 40 kWh, which is feasible for two days of power consumption for an average modern home. Distinctly, an EV has the potential to provide a significant flexible energy resource and help the energy system to utilise more renewable energy, reduce the risk of power outages, and support in balancing the supply and demand in electric power systems (Aktar et al., 2023). Moreover, technological innovation is widely recognised as crucial in tackling climate change and achieving energy policy objectives, including increasing energy access, and reducing air pollution (IEA, 2020). Seeing this, the V2G technology can be an essential step towards a more sustainable automotive industry and efficient usage of EV batteries.

Due to the vast and rapid transformation the automotive industry is experiencing today, taking advantage of new and sustainable technology will be crucial for survival. V2G can be an essential puzzle piece to enable a completely renewable energy system. The case company further describes the technology as a step towards a world where coal and nuclear power plants are no longer needed, which is one part of the unprecedented challenge of creating sustainable mobility. To create this way towards zero emissions, automotive companies need to address and overcome barriers that new technology innovations bring. Compared to research on the technical aspects of V2G, previous

research on customer acceptance has been relatively low (Sovacool et al., 2017; Park Lee, 2019). It has also been found that it is crucial to build customer confidence and create ease and simplicity around the technology (Kaluza, 2022). Consequently, in the implementation process for V2G, automotive companies need to understand how to gain customer acceptance. The study focuses on the fleet customers within the case company since they play a crucial role as an intermediate between the automotive company and the end driver. Fleet customers stand for the majority of sales; hence building customer confidence about V2G among these customers will help secure the usage of the V2G technology among the majority of driver.

To accelerate the widespread adoption of V2G, the case company needs to know how these customers think they could benefit from adopting V2G and understand what challenges they experience that need to be overcome. The study is operationalised with a case company and will combine previous research with new empirical material. Therefore, the studied research question is: *How can the implementation of Vehicle-to-Grid technology be accelerated toward the company's fleet customers?* This research question examines (1) The fleet customers' perceptions of how they can benefit from participating in V2G and (2) The challenges among fleet customers today that could limit the adoption of V2G. These sub-questions will create considerations in the implementation process based on the fleet customers' perceived benefits and challenges.

The study is conducted through qualitative interviews with the case company's fleet customers to understand their perception of the benefits and potential challenges of adopting V2G. Leasing companies are the central perspective investigated since these are the majority of fleet customers within the case company. Additional interviews with experts within electricity infrastructure, technology innovation, and charging complement the first-mentioned interviews to gain in-depth knowledge about the topic and add valuable insights to the analysis of the customer's perceptions. Additionally, previous research on V2G and technology adoption in the literature review is included to complement the results. Previous literature on challenges and barriers with V2G technology exists (Tan et al., 2015; Sovacool et al., 2018; Yilmaz & Krein, 2012; Habib et al., 2014). However, the research on customer barriers is limited and only explored within the retail side of the business, which leaves the fleet customer perspective unexplored.

The disposition of the thesis is as follows; Section 2 contains a literature review explaining V2G in-depth, existing research on benefits and challenges, and presents the theory of technology diffusion. This section works as a theoretical framework for the analysis part, which will be compared and used to analyse and interpret the results from customer and expert interviews. Section 3 presents the methodology of the research and the processes behind the data collection, sampling, and analysis. Section 4 presents the empirical results from the interviews, which Section 5 analyses. This analysis

creates themes and patterns from the customers' perceptions and will be compared to the initial literature review and expert comments. Section 6 concludes and summaries the findings and presents the final considerations and suggestions to the case company.

Figure 1: Thesis disposition.

2. LITERATURE REVIEW

The following section consists of a literature review that will lay a background for the topic and a theoretical framework for the subsequent analysis. The chapter contains two sections, where 2.1 will describe the phenomenon of technology diffusion and the barriers to adopting new renewable energy technologies. 2.2 will describe essential aspects of the technology and how it works, the benefits of V2G, already known barriers to V2G adoption, and challenges perceived by retail customers.

2.1 Technology Adoption

2.1.1. Diffusion of innovation theory and early adopters

The *diffusion of technology* can be defined as "the process in which (1) innovation is (2) communicated through certain channels (3) over time (4) among members of a social system" (Rogers, 2003, p.5). The diffusion process will follow an S-shaped curve (Figure 2) in which the natural growth of many new technologies is cumulatively adopted over time (Rogers, 2003). Diffusion is, according to Rogers (2003), a five-stage process of awareness, interest, evaluation, trial, and adoption, which in turn corresponds to different stages of consumer adoption during the deployment of the technology, classified as innovators, early adopters, early and late majority and laggards (Figure 2). The adoption of a new idea will not happen simultaneously in the social system; instead, it is a process where people will be adequate to adapt to innovation in an earlier stage and others in a later stage (Rogers, 2003). Researchers (Rogers, 2003; Tornatzky, 1982; Ogawa, 2013) have found that innovators have different characteristics compared to people who adopt an innovation in a later stage. Therefore, it is crucial to investigate and understand the features of the social system which will help or hinder the adoption of the innovation.

Innovators, for instance, have different characteristics, whereas Roger (1963) claimed five different aspects: (1) innovators are often young, (2) they have high education, and (3) they use impersonal sources for new ideas, which make them (4) deviants to most of the peers, and lastly (5) they use opinion leadership to influence the adoption decisions to the new ideas. When it comes to early adopters, they have similarities in their characteristics as innovators, although being a more integrated part of the social system. Further, early adopters have the highest degree of opinion leadership among all adopter categories. Roger (2003) explains the early adopter type as someone to check with before adopting new technologies. This is strengthened by research on how early adopters use word-of-mouth; hence, imitation effects will bolster (Arthur & Lane, 1993; Di Maggio & Powell, 1983). As early adopters are a more integrated part of the social system, they are not too far ahead of other individuals' average innovativeness, hence they serve as role models for other

individuals in the social system. This adoption category can also be sought by change agents to speed up the diffusion process (Rogers, 2003). Other literature indicates that finding early adopters to encourage subsequent purchases are well-established practice. Hence, early adopters are important individuals to trigger the critical mass when adopting new technologies (Brierty et al., 1998; Kotler, 2003).

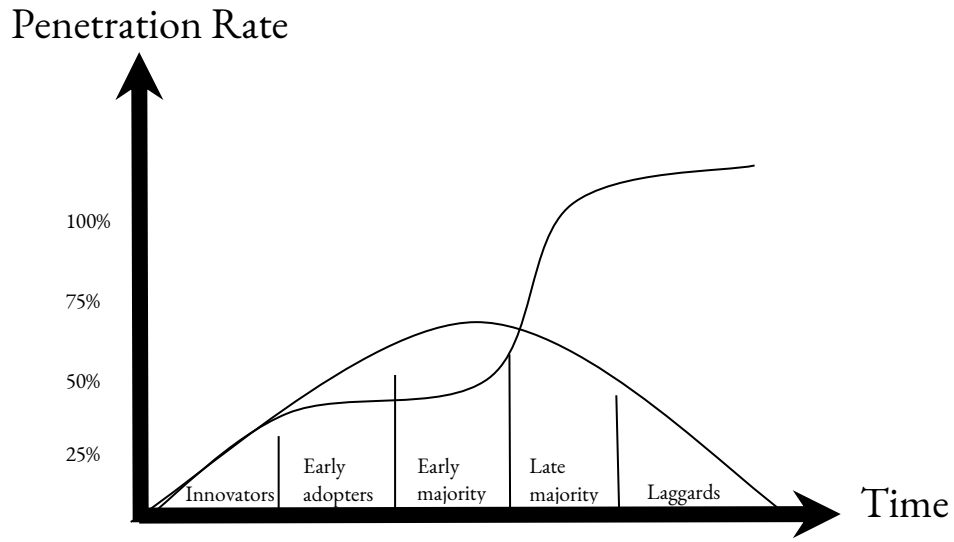

Figure 2: S-shaped curve - The diffusion process (Rogers, 2003).

Moreover, Rogers (2003) offered a time-tested framework to examine some of the factors that contributed to an innovation's success or failure and found that innovations that have (1) high relative advantage, (2) trialability, (3) observability, (4) comparability, and (5) low complexity are likely to succeed. The factors were tested in multiple studies, and it resulted in a strong relationship between these factors and successful diffusion of an innovation (Rogers, 2003). Regarding relative advantage, the innovation is examined to which degree it appears to be better than other options for the potential adopter. This is measured in terms of economic, convenience, satisfaction, and social prestige. On the other hand, trialability is to which degree the innovation can be experienced firsthand on a limited basis. Meaning to which extent the innovation can be tested or verified in the first stage. Observability is the degree in which the innovation or its results can be seen as likely to be adopted by others. Potential adopters need to be aware of the innovation and see their peers adopt them to adopt it themselves. Hence, observability is an essential factor for the adoption spread. Compatibility is the degree to which the innovation is seen as consistent with existing values, previous experience, and needs of the user. Innovations exist among other innovations, and therefore, potential adopters may judge the innovation within the context of the group rather than individually. Lastly, complexity is the degree to which the innovation is considered difficult to understand or use. If the innovation is too complex, people are less likely to adopt it.

2.1.2 Development of the diffusion of innovation theory and the integrated role of early adopters

Recently published studies have used Roger's theory as a framework to test the diffusion of a specific innovation (Desiraju et al., 2004; Bass, 2004; Bewley & Griffiths, 2003). The theory has further been studied from many complementary perspectives, including sociological, economic, business strategy, and marketing. These have led to several interpretative and predictive models assuming different natures of the diffusion process (Hall, 2004). Innovations might experience desirable or undesirable outcomes, which leaves the innovation with direct or indirect consequences as well as expected or unexpected benefits due to the social factors that apply. This uncertainty has been studied and is why users will reject or accept innovation (El-Helaly et al., 2020; Elmghaamez et al., 2020; Oliviera & Santos, 2019). Another approach in the diffusion literature is the factors considered to have the most significant influence on diffusion, where Parry and Kawakami (2015) researched how word-of-mouth shapes the usefulness and credibility of the innovation. Furthermore, Chiesa and Frattini (2011) discuss how word-of-mouth from early adopters will catch the later buyers and hence the majority of the market.

Moreover, the importance of commercialisation and the precursors to a successful launch have also been studied (Calantone & Di Benedetto, 2007). The authors stated that a poorly executed launch could result in a failed innovation even if the product development process has been executed well. The relationship between launching an innovation and its adopters have created a new area called user innovation research, suggesting that firms should be increasingly interactive with their customers during the development of the innovation (Von Hippel, 2010). Other studies in user innovation research have suggested that the users involved in developing an innovation are often early adopters (Droge et al., 2010). However, these early adopters' role in the later diffusion process is not investigated in detail. Bianchi et al. (2017) argue that commercialising an industrial innovation is not only descriptive, meaning that the firm identifies the early adopters, targets them at launch, and then passively waits for the results of the market launch. Instead, the researchers mean that it has an essential constructive dimension that is often neglected in the diffusion of innovation research. Consequently, targeting and involvement are important tools to gain clarification concerning the process of early adopters. If early adopters are selected proactively, the product innovation will have a greater chance of providing a better fit in the selected early adopters category (Bianchi et al., 2017).

2.1.3 Diffusion of innovation theory and its applicability to renewable energy and energy storage technologies

In adopting new technology, the diffusion of innovation theory developed by Rogers (2003) is essential to identify the diffusion rates dependent on socioeconomic, technological, and institutional factors, seeing that these factors facilitate or hinder the diffusion of the new technology. Earlier

studies have been made on various diffusion processes, including consumer goods, cars, computers, etc. (Desiraju et al., 2004; Bass, 2004; Bewley & Griffiths, 2003). However, regarding new renewable energy technologies, including energy storage technologies, Jacobsson and Johnson (2000) state that the incentives for developing new technologies differ from earlier studies. Mainly because it comes from environmental and energy security considerations arising from the fact that fossil-based energy sources are not endless (Jacobsson & Johnsson, 2000). Hence, these technologies receive significant financial or fiscal incentives from government or public agencies for promotion and adoption (Jacobsson & Johnson, 2000). Rao and Kishore (2010) elaborated on this and discussed that renewable energy technologies might follow a different diffusion theory rather than the classic theory applied to consumer products. According to Rao and Kishore (2010), a high investment cost and significant impact of policies in renewable energy diffusion are the main reasons why the new renewable energy technologies will not apply to the classic diffusion models. However, although direct policy efforts and socioeconomic advantages of renewable energy sources, the adoption spread of new renewable energy technologies has been low (Rao & Kishore, 2010).

Jacobsson and Johnson (2000) further concluded that the renewable energy transformation processes include three different components: (1) Actors on the market, specifically prime movers who are leading the change, (2) networks and different organisations, and lastly (3) institutions including capital market, legalisation, or educational systems. These three components are related to the social system that is included in Roger's (2003) theory of diffusion of innovation. The social system is a set of interrelated units engaged in joint problem-solving to achieve a common goal. Furthermore, the social system has a structure that reflects the arrangements of the units in the system and gives stability and regularity to the individual's behavior within the system (Rogers, 2003). Jacobsson and Johnson (2000) further claim how important it is to have prime movers in the diffusion of the innovation process as they act as important promoters for the technology and raise awareness at the beginning of the diffusion process. Most individuals will not evaluate the innovation on scientific research by experts, instead through evaluation by near equal individuals who act as prime movers and have already adopted the innovation. Later their innovative behavior is imitated by others in their social system (Rogers, 2003).

2.1.4 Barriers for commercialisation of energy storage technologies

Jacobsson and Johnson (2000) focused on the different actors, networks, and institutions, while Reddy and Painuly (2004) studied the diffusion barriers by interviewing stakeholders in renewable energy projects to identify the most outstanding barriers to market penetration. The authors found financing, taxation, and regulation as the three main barriers of the study and pointed out that government intervention will be an essential tool to remove the obstacles to renewable energy

technology diffusion. Furthermore, Gissey et al. (2018) studied the regulatory barriers in energy storage. They found that the current classification of storage as a generation asset is one of the main barriers, as its value is not defined, which creates uncertainties in the regulation. Ruz and Pollit (2016) claim in a comparative study how the energy storage systems deployment is proceeding at a different rate worldwide. North America, specifically California, is progressing quickly compared to Europe. This is mainly because the energy storage legislation lacks jurisdiction, and the current market design benefits traditional European technologies (Ruz & Pollit, 2016). Zhang and Yang (2021) studied the barriers to energy storage in China and found significant industrial effort in creating a robust and world-leading energy storage industry. However, new regulatory considerations raise concerns about the plan's viability (Zhang & Yang, 2021).

Besides regulatory concerns, Meijer et al. (2019) researched barriers to technology commercialisation in the Dutch sustainable energy sector and found finance, risk aversion, and technical complexity as the main barriers. Beyond, Juszczyk et al. (2022) studied new renewable energy technologies barriers and found the shortage of financing options and poor social awareness as significant barriers to diffusion. Painuly (2001) also claims that the financing option is a primary barrier as it includes the high cost of capital. Juszczyk et al. (2022) discussed the lack of consumer acceptance and state that it can be hard to penetrate the market if the product is new and unknown and therefore lacks appeal to its customers. Painuly (2001) discusses the lack of social acceptance and states that it can be because customers have preferences for traditional energy or do not understand the usage of the new technology (Painuly, 2001). Social awareness and acceptance of V2G will be further discussed in the next chapter.

2.2 Vehicle-to-Grid

2.2.1 A smart grid concept

Integrating the transport sector into the power grid through the introduction of EVs creates new challenges to the power system (Tan et al., 2015). For example, EVs' fast expansion and usage puts more pressure on the power system load during charging (Tan et al., 2015). Therefore, the power system has recently been introduced to new modern communications features, which is the introduction of smart grid concepts. This enables EVs to be a part of the power grid services, and the technology concept of when an EV battery is integrated with the electricity services is known as Vehicle-to-Everything (V2X) (Khezri et al., 2022). V2X is any service that can be provided by the EV other than mobility and is made possible by bidirectional charging, which controls the power flows in and out from the battery. V2X aims to make EV energy usage more efficient and flexible

and enable the energy and power from EV batteries to be used in homes, buildings, workplaces, other vehicles, and the main grid (Khezri et al., 2022).

Three of these smart grid technologies within V2X are Vehicle-to-Vehicle (V2V), Vehicle-to-Home (V2H), and Vehicle-to-Grid (V2G). Figure 3 shows a simple overview of these three systems. These can all be used when the EV is plugged in with a charger and connected to the grid (Liu et al., 2013). V2V involves several EVs and enables an EV to transfer the energy through a local grid to EVs by an aggregator, creating interactions between the grid and other EVs (Liu et al., 2013). V2H, on the other hand, is the possibility for the EV to charge energy from a home and transfer power back to the house from the EV battery according to a control scheme (Liu et al., 2013). This generally involves one single EV in a single household. Lastly, V2G is the ability to allow a direct flow of power between an EV and the power grid and involves a large group of EVs (Liu et al, 2013; Habib et al., 2014).

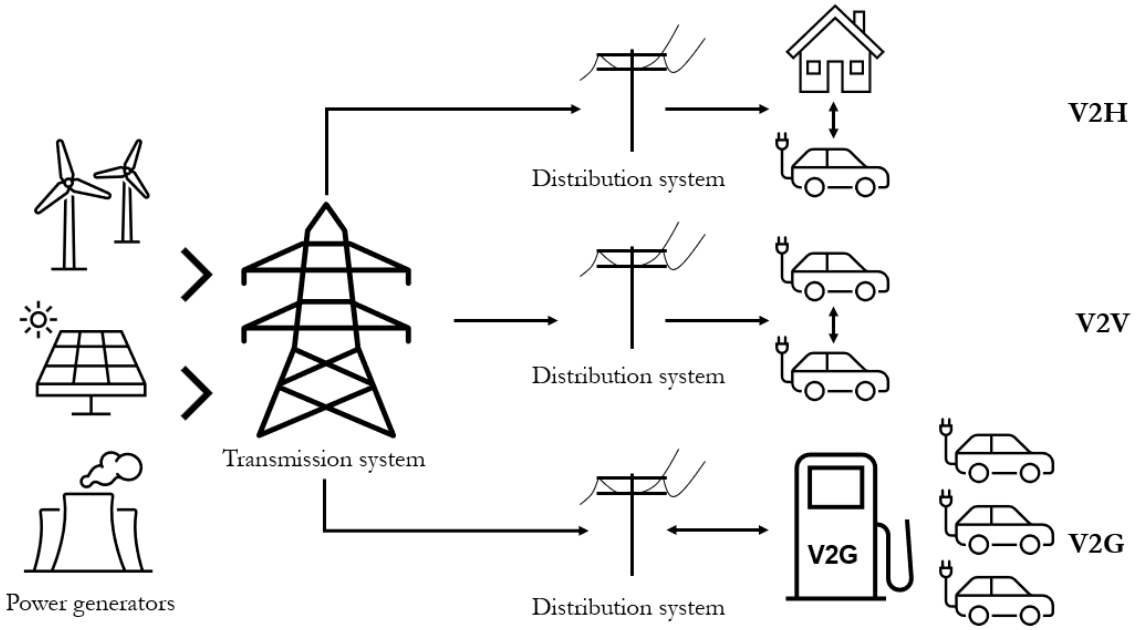

Figure 3: V2V, V2H and V2G relationships.

2.2.2 The Vehicle-to-Grid Technology

EVs have the potential to offer this unique opportunity known as V2G (Habib et al., 2014). V2G creates a power flow from the EV battery to and from the electrical distribution network, also known as the power grid, when the EV is in parking mode (Habib et al., 2014). This interaction can be seen as a communication system between the vehicle and the power grid. The power grid operator can use this communication facility to manage the flow to and from the EV battery to distribute power

more efficiently (Tan et al., 2015). This is enabled by the possibility of the EV battery being used as an Energy Storage System (ESS) when the car stands still for several hours at work or home (Salvatti et al., 2020). An EV that is connected to a power outlet can be in either charging mode, called Grid-to-Vehicle (G2V), or in discharging mode, called V2G (Habib et al., 2014). The possibility for the EV to be used as an ESS means that EVs can act as distributed storage devices and, when attached to the distribution network, deliver power back to the grid during peak hours (Habib et al., 2014; Tan et al., 2015). This is an opportunity for EVs to not only act as vehicles, but also as mobile energy storage sources on wheels when connected to the power grid (Sovacool et al., 2020). The exchange of energy from the EV and the power grid, also known as a bidirectional flow, can improve the power system operations and provide several advantages to the grid (Tan et al., 2015). Among these advantages are maximising profit, reducing emissions, and improving the grid's power quality (Ahn et al., 2011; Tan et al., 2015).

V2G charging provides both unidirectional and bidirectional flows. Unidirectional flow is a single power flow from the grid to the EV, and this technology can control the charging rate of the EV by providing ancillary services to the power grid (Tan et al., 2015). EV owners can benefit from participating in regulated charging processes and creating revenue by charging during off-peak hours. This means that the EV owner avoids peak grid hours and that power utilities can avoid overloading during these hours (Habib et al., 2014). However, using unidirectional V2G services requires that ancillary services can be provided to the power grid, and many of these services will also require a bidirectional flow (Tan et al., 2015). The bidirectional flow, compared to the unidirectional one, is a dual-direction power flow between the grid and the EV, which enables the charging of the EV during off-peak hours as well as transferring EV battery energy back to the grid during peak hours (Tan et al., 2015). The benefits of the bidirectional flow are the active and reactive power support the EV will supply and the possibility to integrate and store renewable energy (Tan et al., 2015). The bidirectional flow is more difficult to control than the unidirectional flow due to the two-way power connection and the need for smart sensors (Habib et al., 2014). This comes with higher costs and investment requirements but with additional benefits to the power grid and the climate, described in more detail in section 2.2.3.

There are two requirements to implement bidirectional V2G, which are: (1) a power connection used to transmit energy to and from the EV, and (2) logic and control connections that give signals and communicate when power is needed and what direction to send the power (Habib et al., 2014). These logic and control connections require an intelligent connection to the grid, which is the concept of smart grid that needs to be integrated into the electrical grid system (Habib et al., 2014). The control and communication mechanism are essential for services requiring dynamic adjustments, such as tracking power prices, power regulation, and spinning reserves (Yilmaz &

Krein, 2013). According to the V2G company Nuvve, the possible customers of the V2G technology across different stakeholder types are car manufacturers, vehicle owners or fleet managers, transmission system operators, distribution service or network operators, and policymakers (Sovacool et al., 2020).

2.2.3 Advantages with the V2G technology

2.2.3.1 Power grid efficiency and economic effects

V2G can, through the bidirectional two-way communication between EVs and the electricity grid, generate improved efficiency, stability, and reliability to the grid (Yilmaz & Krein, 2012; Habib et al., 2014). Additionally, it can enhance the profitability of electricity grids by empowering EV owners to sell power back to the grid (Tomic & Kempton, 2007; Sovacool & Hirsh, 2009). Previous research has shown that simple smart charging, such as unidirectional flow, helps avoid peaks and shift load. However, coordinated smart charging, which refers to the bidirectional flow, is most beneficial for grid operators and EV owners as it minimises the impact of EV charging on the power grid (Yilmaz & Krein, 2013). The advantages that V2G can provide to the grid operators include reactive power support, active power regulation, load balancing, and peak load shaving (Yilmaz & Krein, 2013).

These advantages enable higher-quality ancillary services such as quick frequency and voltage control, peak power management, and effective spinning reserves, reducing operating costs and generating revenues (Yilmaz & Krein, 2013; Habib et al., 2014; Liu et al., 2013). Spinning reserves create storage of unused capacity in online energy assets and reduce the need for the system to rely on conventional generators (Sioshansi & Denholm, 2010). Frequency regulation is a service that balances supply and demand for active power (Yilmaz & Krein, 2013), which can be utilised with a unidirectional flow (Tan et al., 2015). This enables an alternative to the regular and costly process of cycling large generators (Yilmaz & Krein, 2013). A European frequency regulation study found a profit range of 0 to 9 600 euros per year and per vehicle (Yilmaz & Krein, 2013). The other type of regulation, voltage regulation, is used to balance supply and demand for reactive power. The EV bidirectional chargers can include voltage control, and charging can start when the voltage is high in the power grid and stop when the voltage is low (Yilmaz & Krein, 2013).

Peak power management, or active power support (Tan et al., 2015), is only offered by bidirectional V2G charging when utilising the discharging possibility during daily grid peaks and charging during off-peak low demand hours, usually overnight (Yilmaz & Krein, 2013). The goal of the power support service is to flatten the load profile, meaning the grid power curve, by load leveling (Tan et al., 2015). Hence, load leveling for the grid often means charging the EV during nights when demand

is down and consequently reducing peak loads (Yilmaz & Krein, 2013), also known as peak shaving (Tan et al., 2015). This reduces the pressure on the power system and pays the EV owners back a premium energy rate (Tan et al., 2015). During off-peak hours, EV owners consequently charge their cars to a lower energy rate.

A study made in the UK showed that a 20% EV penetration rate would increase the peak load on the power grid by 35,8% if only uncoordinated charging were used (Qian et al., 2011). Uncoordinated charging is when the EV starts charging when automatically plugged in or after a user-adjustable delay and is charged until the EV has been fully charged or unplugged (Yilmaz & Krein, 2013). This is considered traditional charging, in contrast to smart charging. When the utility operators do not have the required power capacity in these power peaks, they need to increase power generation, which will be mirrored in the electricity prices of the EV owners (Yilmaz & Krein, 2013). For the EV owners who are instead charging and discharging their cars with the intelligent V2G technology, Yilmaz and Krein (2013) estimated that potential revenue generation can range between 90 and 4000 dollars per year and vehicle. A study made in the US showed similar results, where the yearly return ranged from 3268 dollars to 7942 dollars, and the initial investments required were around 2800 dollars for the home power connection and utility infrastructure (Quinn et al., 2009). This means that the technology paid for itself in less than a year. Another recent study from Kaluza (2022), surveying customers' perceptions of the technology and its potential benefits, showed that the average customer could save 466 dollars annually. The more active and engaged participants could, according to Kaluza (2022), eliminate their household energy costs by instead earning up to 960 dollars per year.

2.2.3.2 Environmental effects

V2G offers the possibility to use and store more localised renewable energy (Uddin et al., 2018; Clement-Nyns et al., 2010), consequently avoiding wasting renewable energy (Yilmaz & Krein, 2013). Bringing more renewable energy into the system lays the foundation for a more sustainable and greener power grid. This is one of the most significant environmental achievements of the smart grid concept (Habib et al., 2014; Kaluza, 2022). Using renewable energy when charging the EV with smart V2G charging and discharging has been reported to have the best potential for utilising renewable sources while reducing cost and emissions (Yilmaz & Krein, 2013). Hence, the EV battery can now offer the ability to store generated wind and solar energy (Birnie, 2008; Kempton & Tomic, 2007), and the charging and discharging of the battery can help to match the generation and consumption of renewable energy (Clement-Nyns et al., 2010). New types of renewable energy resources, in the form of fleets of EVs acting as energy storage, can supply power when the generation of renewable energy is insufficient (Tan et al., 2015).

Moreover, Kaluza, UK's largest energy service provider OVO, and the Automotive company Nissan published the results from the world's largest V2G trial in December 2022 (Kaluza, 2022). The trial, deploying 300-400 V2G chargers with OVO customers, showed that 46.8 tons of CO2 could be saved and that over 3 million "free" miles were driven over 12 months. The results showed that a fleet of 330 managed vehicles could save 192 kg of CO2 emissions per day. This is 45% less than the CO2 emissions from unmanaged EV charging, and the reduction is equivalent to the daily CO2 offset from 7 000 trees (Kaluza, 2022). When comparing one-way smart charging (G2V) to bidirectional charging (V2G), the carbon intensity of consumed electricity was reduced three times more with the bidirectional charging (Kaluza, 2022).

2.2.4 Barriers to the V2G technology

Previous studies on potential barriers to adopting V2G technology include battery degradation, intensive communication requirements, resistance from automotive and oil sectors, necessary infrastructure changes, and social, political, cultural, and technical obstacles (Yilmaz & Krein, 2013). Due to the new and unmatured technology, economic, technological, and social challenges still need to be overcome for the full adoption of V2G to take place (Tan et al., 2015). Khezri et al. (2022) classified the barriers to V2G into four categories, which are technical, economic, regulatory, and social. The technical category is described as containing the leading group of barriers.

2.2.4.1 Technological, economic, and regulatory barriers

By using both charging and discharging techniques, there is a risk of reducing the life cycle of the battery as well as the storage capability (Yilmaz & Krein, 2013). The impact of V2G on the battery degradation of EV batteries is a crucial concern regarding the implementation (Uddin et al., 2018; Khezri et al., 2022). However, the research on potential degradation by V2X technologies is limited (Khezri et al., 2022). An experimental study from Dubarry et al. (2017) showed that discharging the battery back to the grid can harm the battery's performance. However, a second study the same year by Uddin et al. (2017) presented the opposite result and showed that V2G usage could instead extend the life of the batteries. Uddin et al. (2016) explain that EV batteries age and are hence exposed to degradation, but the degradation depends on so-called aging stress factors, meaning how the battery is used. The physical degradation is usually divided into either capacity fade, which is the effect on the EV range, and power fade, which is the effect on the power capacity and EV efficiency (Uddin et al., 2018). Furthermore, a study by Peterson et al. (2010) found that rapid battery charging and discharging cycles, as with the usage of V2G, are more likely to cause more battery degradation. Therefore, battery health needs to be considered when implementing V2G technology (Tan et al., 2015).

Another potential barrier to the V2G implementation is the initial required investment to update the power system and the needed hardware and software infrastructures (Tan et al., 2015). These investments are required to serve the increased number of EVs connected to the grid (Yilmaz & Krein, 2013). In addition, each EV owner will need their own bidirectional battery charger (Tan et al., 2015), and this additional cost is also stated as a barrier by Khezri et al. (2022). Bidirectional converters come with an extra cost, and there will also be a need to guarantee that the EV is charged with enough energy when the driver wishes to use the car (Yilmaz & Krein, 2013).

Yilmaz and Krein (2013) conclude that the economic benefits for vehicle owners or grid operators of V2G technology outweigh the downsides of a potentially reduced battery lifetime. However, the success and economic benefits will depend on standardised requirements, infrastructure, and EV aggregators as a source of stored energy (Yilmaz & Krein, 2013). Khezri et al. (2022) mentioned that to have an efficient V2G strategy, the role of aggregators is important. The batteries must also support a long-life cycle and the V2G concept (Yilmaz & Krein, 2013).

Another issue is the risk of V2G increasing energy losses because charging and discharging cycles involve increasing energy conversions (Dehaghani & Williamson, 2012). These energy conversions could lead to energy losses to the power system when charging and discharging a large fleet of EVs (Dehaghani & Williamson, 2012). Lastly, the regulatory barriers found are mainly from the network operator and industry sides (Khezri et al., 2022). One example of these challenges is integrating service providers with small capacity into the electricity network. In these matters where the providers cannot provide enough energy to integrate, there is a need to define new regulatory roles. Another example Khezri et al. (2022) mentioned is the challenge of lacking standards and grid codes to integrate V2X services into the power grid.

2.2.4.2 Social barriers

Before a procedure of adoption and commercialisation of V2G can be achieved, it is essential to analyse the acceptance of EV drivers to use the technology (Sovacool et al., 2017). Despite its importance, studies connected to consumer acceptance of V2G have been relatively low compared to the studies on the technical aspect of V2G (Sovacool et al., 2017; Park Lee, 2019). More specifically, there are gaps related to the perceptions of V2G connected to EV drivers, whereas the underlying motivation behind their attitudes and certain factors influencing their acceptance of the V2G technology are understudied. Heuveln et al. (2021) made a comprehensive literature review of existing studies of consumer acceptance of V2G and found that previous studies focused more on choice experiments (Geske & Schuman, 2018; Kubli et al., 2018; Zonneveld, 2019; Meijissen, 2019; Noel et al., 2019b) rather than interviews with experts in the field (Kester et al., 2018; Noel et al., 2019b; Sovacool et al., 2019a; Sovacool et al., 2019b). Other studies related to V2G acceptance have

been made on the willingness to participate in a V2G contract (Huang et al., 2021; Geske & Schuman, 2018; Kubli et al., 2018; Zonnevald, 2019). The contract includes to which extent the aggregators are allowed to manage the EV's battery and how much remuneration the EV owner gets for the inconvenience of having the EV plugged in for some specific hours a day (Huang et al., 2021).

Kalzua (2022) discovered that the V2G concept is still unknown to most EV drivers, which amplifies that these stakeholders need to understand the technological, environmental, and economic advantages of V2G. Furthermore, it was found that the three most prominent reasons for participating in V2G among end drivers would be (1) saving money, (2) being an early adopter, or (3) reducing their carbon footprint (Kalzua, 2022). Moreover, Noel et al. (2019a) researched five Nordic countries on diverging attitudes of willingness to pay for an EV that is V2G compatible. They concluded that two of the five countries had customers who today would be willing to pay more for a vehicle with V2G compatibility (Noel et al., 2019a).

Moreover, the technical performance of the EV has shown to be an influential aspect of EV owners' willingness to participate in V2G. Technical restrictions, such as long recharging time, range anxiety, and minimum range, are important factors, according to EV owners (Geske & Shuman, 2018; Tan et al., 2015). Results from a study by Huang et al. (2021) showed that the preferences of Dutch EV drivers considered guaranteed minimum battery level and fully discharged cycles as two of the most important aspects of adopting V2G. Most drivers were also concerned about the inconvenience of long plug-in times due to a fear of not having the required energy stored in the EV when unpredicted journeys are necessary (Huang et al., 2021). This was earlier stated by Geske and Shuman (2018) and Zonnevalds (2019) studies on the willingness to participate in a V2G contract in the Netherlands. However, Huang et al. (2021) showed that acceptance of V2G increased in the context of fast recharging rather than current recharging time. The interaction between recharging time and guaranteed minimum battery level was highly significant, which means that the development of EV battery technology can erase the barrier of guaranteed minimum battery in the widespread adoption of V2G (Huang et al., 2021).

3. METHODOLOGY

The following section consists of an explanation and motivation for the research methodology. This section will provide the overall strategy of the thesis and provide clarity and trustworthiness to the study. The section starts with explaining the research's overall strategy and motivates the choice of research design. Thereafter, the process of data collection and the following data analysis is explained. Lastly, research quality and limitations are discussed to strengthen the validity and reliability of the data provided and the consequent research results and conclusions.

3.1 Research Strategy

3.1.1 Philosophical Assumptions

The first thing that needs to be understood when defining the research strategy is the assumptions about the nature of reality and how this reality should be studied (Bell et al., 2019). In addition to the theoretical orientation and how we understand and use theory, as will be defined in the next section, assumptions need to be made about understanding and conducting research effectively. These assumptions should be understood to choose the appropriate research method. This is the philosophy of social science and refers to making assumptions and understanding the spheres of ontology and epistemology (Bell et al., 2019). Ontology is the assumption about the nature of reality, and researchers aim to understand reality. How we understand reality is, therefore, crucial in how we choose to research this reality. Additionally, this assumption is divided into two different positions, namely objectivism and constructionism (Bell et al., 2019).

Objectivism implies that the researched phenomena are confronted with external facts and hence have an objective reality independent from the observer's role. Conversely, constructionism challenge objective phenomena and emphasises that the researched phenomena are affected by socially constructed entities, constantly revised, created, and influenced by humans. This is, in contrast to objectivism, a subjective position. Since the research aims at capturing the subjective perceptions of B2B customers, the ontological position taken in the study is constructionism. This assumption acknowledges that social actors, such as fleet customers, influence the V2G environment and the possibility of adoption and implementation.

The second sphere, epistemology, is the theory of knowledge, meaning how we can gain knowledge of the reality understood from the ontological position. Since the constructionist ontology position is taken, knowledge needs to be gathered through observations or interviews to understand how

participants understand the world (Bell et al., 2019). This assumption generally leads to a particular methodological assumption, namely a qualitative research method.

3.1.2 Research Assumptions

In addition to the assumptions about reality, research assumptions should be made about the relation between theory and research (Bell et al., 2019). Historically, there have been two different assumptions: the deductive and inductive approaches (Bell et al., 2019). The choice of research approach is whether theories drive the research process or are a product of the research process, where a deductive approach represents the first mentioned and an inductive one the latter. This study aims at building up to new general findings from the data collection rather than testing existing theory. However, it is sometimes challenging to ensure that qualitative research always generates new theories and that theories can be used as a background to qualitative research. A relatively new approach called an abductive process has arisen to overcome the limitation of choosing either a deductive or inductive approach. According to Bell et al. (2019), this approach is neither deductive nor inductive and is used to make logical inferences and create theories about the world.

The logic behind abductive research is to choose the best explanation or interpretation of the data and acknowledge the importance of cognitive reasoning in theory building (Mantere & Ketokivi, 2013). Hence, this research follows an abductive approach since no current theories or frameworks can explain how to accelerate the implementation of new technology or what customer challenges are essential to overcome. Further, the current study might not build up to a new theory but rather conclude recommendations to achieve customer adoption of V2G. According to Bell et al. (2019), the abductive approach aims at finding the best possible solutions for current challenges by moving back and forth between data and theory. Mantere and Ketokivi (2013) also describe that abduction starts with a puzzle, some empirical phenomena that existing theory cannot account for, where abductive reasoning should make a phenomenon less puzzling and translate unknown facts into an understandable matter of course. This applies to the study, aiming to find out the matter of course for what generalisable challenges and barriers that need to be overcome.

3.1.3 Research Method

The two general methods to distinguish between are the qualitative and quantitative approaches, which have different epistemological foundations and hence different research strategies (Bell et al. 2019). Therefore, the philosophical assumptions, together with the research assumptions, build up to the appropriate research method or strategy. Following the two earlier sections, the appropriate choice for this study is a qualitative research strategy. Qualitative strategy can be generalised by an inductive approach and the view on reality from individuals' constantly changing and subjective

creations. In contrast, quantitative strategy can be generalised by a deductive approach between theory and research, as well as it sees reality from the external and objective point of view. Another common distinction between quantitative and qualitative methods concerns that quantitative research attempts to measure or quantify social phenomena. In contrast, qualitative research emphasises words rather than numbers in data collection (Bell et al., 2019). Due to the yet unexplored nature of the V2G technology, subjective opinions from participants need to be understood to plan for future implementation. There is also a need to go back and forth between theory and research to find the "best" explanation mentioned in the previous section. Therefore, a qualitative research method with an abductive approach will be used in the study to collect customer data and understand what customers require to accelerate the implementation of V2G.

3.2 Research Design

A single case study is chosen as the research design for the study. According to Bell et al. (2019), the research design is the framework used to collect and analyse data concerning the chosen research method. Further, research design can also be described as the criteria that are used to assess the quality of the business research. As this study focuses on contributing to a detailed analysis within a specific case to a single organisation and is qualitative in nature, a single case study framework is suitable. A single case study allows one to study the company and its specific adoption of V2G in-depth and to understand the "complexity and particular nature of the case in question" (Bell et al., 2019, p.109). Since V2G and electric vehicles are a relatively new phenomenon, applying any time-dependent research designs or relying on best practices from other large automotive companies is hence not considered appropriate.

Although the specific case that is being studied is seen as a unique case, which according to Eisenhardt (2021), is in favor of a single-case study, other researchers (Eisenhardt & Gabner, 2007; Bell et al., 2019) discusses that a single case study can lack quality when comparing it to a multiple case study. According to Bell et al. (2019), considering the quality criteria in business research is highly important, especially regarding external validity or generalisability in a single case study. To address this concern, the participants in the research are carefully selected and active within different markets and positions. The study also includes interviews with leasing companies, a corporate company, and experts within the field to grasp a broader perspective of the perceptions of V2G within fleet businesses. This will compensate for a low generalisation of a single case study and creates a more substantial validity to the study.

3.3 Data collection

The data collected in this research includes both primary and secondary data. Primary data was gathered from several in-depth semi-structured interviews with several of the case company's fleet customers. The primary data collected is aligned with the chosen research design, and the conducted interviews enabled a detailed investigation of the researched problem. To be consistent with the abductive reasoning approach of this research, secondary data was used in conjunction with the primary data to form a complete overview of the subject. The secondary data include a collection of academic articles, previously made studies within the subjects, and other reports and empirical relevant material building a theoretical framework.

3.3.1 Primary Data

The thesis aims to gather new perspectives, perceptions, and experiences connected to the researched problem. Therefore, in-depth interviews were considered suitable for grasping an in-depth understanding of the chosen issue. Interviews allow us to receive detailed information from different perspectives, which were later compared to create a nuanced reflection of the challenges the case company faces in accelerating the V2G implementation. Furthermore, semi-structured interviews were chosen because it eases the compilation and comparison of the data (Bell et al., 2019). Thus, finding similarities or dissimilarities in the data collection can be facilitated by detecting patterns between the respondents. Semi-structured interviews further enabled a combination of flexibility with a structured interview guide, allowing the respondent to have latitude in responding but still offering a structured approach (Bell et al., 2019). The predetermined interview guide functioned as a base for the discussed topic, which mitigated the risk of getting off-topic during the interview. Nevertheless, semi-structured interviews can adapt every interview to different respondents and hence ask follow-up questions or exclude questions if they were already answered or excessive. This provided detailed answers, which could be more challenging to get with unstructured interviews. Furthermore, the interview guide only contained open questions excluding leading questions. This allowed the respondent to speak freely about the informed topic, which according to Bell et al. (2019), is crucial to understand the respondent's perspective and perception better.

3.3.1.1 Interview Process

To conform the semi-structured interview approach, an interview guide was created to serve as a base for the interviews. The guide was sent to the respondent beforehand so the respondent could prepare their answers before the interview. As previously mentioned, the respondents had different relationships with the case company. Hence, different interview guides were created and adjusted depending on the respondent. The interview guides varied substantially between the interviews since

the respondent's businesses had different missions. Therefore, the questions had to be changed based on the respondent's expertise.

Although the questions varied between the different interview guides, the interviews followed a similar structure. Firstly, an introduction of the researchers, subject, purpose, and the role of the respondents were presented. This eliminated confusion regarding how the data would be collected and used and how the respondent contributed to the research. After the introduction, the questions for the fleet customers were divided into five different categories: (1) Sales and understanding of the business, (2) Sustainability, (3) Introduction to V2G, (4) Benefits with V2G, and (5) Challenges with V2G. When finishing the interview, the respondents were asked if they wanted to add anything they thought could be valuable for the study.

Since the researchers and the respondents were geographically dispersed, all interviews were held digitally. Beyond the flexibility a digital interview brings, Bell et al. (2019) also argue that this can attract a more extensive selection of respondents, which can bring a more objective view of the research. However, a downside of digital interviews is the difficulty of observing the respondents' physical behavior, as it might be hard to recognise facial expressions and body language (Bell et al., 2019). To mitigate this problem, all interviews were held with cameras on the platform Teams. Furthermore, most of the interviews were held in English due to the preference of speaking in the case company's business language. Naturally, this created challenges as expressions or words risk being lost when not conducting it in the respondent's native tongue. However, tools were provided to ensure accurate translation.

Permission to record the interview was asked for at the beginning of the interview to construct detailed transcribed material, which all respondents accepted. This enabled the possibility to go through the interviews afterward and ensure that the interviews were interpreted correctly. Hence, the focus was on understanding and asking follow-up questions rather than taking notes during the interviews. According to Bell et al. (2019), this efficient method can lead to more valuable insights during the interview. Additionally, the customers were informed about their anonymity in the research before the interview started. This could arguably make them more comfortable sharing details about their business and strategy (Bell et al., 2019). Moreover, all respondents were offered to get a copy of the study afterward, which can increase their willingness to contribute to the study in the best possible way.

3.3.1.2 Sampling

The chosen sampling approach was purposive sampling. According to Bell et al. (2019), purposive sampling is conducted with alignment to the study's goal, meaning that the sampling is chosen to

answer the research question. Teddlie and Yu (2007) bring up two approaches to purposive sampling: sequential sampling and fixed sampling. Sequential sampling starts from an initial sample but then evolves as the researchers add to the sample to benefit the research. Fixed sampling is formed at the outset of the research, whereas there is little adding to the sample during the research process (Teddlie & Yu, 2007). This research applied a sequential sampling strategy since the sample expanded as the research proceeded. The researchers had a vision of the sample at the beginning of the research. However, this changed due to new insights and the rejection of some proposed interviews. Glaser and Strauss (1967) elaborate on purposive sampling in the context of grounded theory with a theoretical sampling approach. The approach can be described as a data collection process that generates a theory by collecting, coding, and analysing the collected data to understand what type of data should be collected next to evolve and emerge the theory which was the case in this research (Glaser & Strauss, 1967).

Moreover, Bell et al. (2019) describes the importance of being transparent about what criteria were chosen when including and excluding respondents. Therefore, the criteria were already formed when contacting the respondents. The sample used in this research was divided into two sections: interviews with experts and interviews with the case company's fleet customers. Respondents in the expert category were interviewed to grasp an overall understanding of the subject and complement the literature review. These people were highly involved in the topic or essential partners for the case company. The aim of these interviews was not to create a comparison between the experts but rather to establish a better knowledge of the technology and later also be compared with the answers from the customers. Hence, the research was conducted with a more holistic view, as several perspectives were included. The experts were crucial in exploring specific knowledge and new insights contributing to broader research. The complete list of the participants in the first section can be found in Table 1 below.

Table 1: Expert respondents

ORGANISATION	NAME	ROLE	DATE	LENGTH
Göteborg Energi	Henrik Forsgren, E1	Senior Project Manager - Mobility and Energy Consumption	3/4	46 min
Case Company	E2	Project Leader for V2G	12/4	41 min
Case Company	E3	Manager Charging & Energy	12/4	55 min
Gothenburg University	Jon Williamsson, E4	Senior Lecturer and Researcher within Sustainable Businesses	13/4	52 min
Chalmers University of Technology	David Steen, E5	Researcher at Electric Power Engineering	17/4	51 min
GodEnergi	Jan Darville, E6 & Kasper Hjort, E7	CEO and Founder & Area Manager for EVs	18/4	50 min

The second section of the sample included interviews with fleet customers of the case company. Aligning with the purposive sampling approach, the inclusion and exclusion criteria were also applied to this section to ensure the sample was relevant to answer the research questions. The selected sample combined two parts of the business side, namely leasing companies, and corporate companies, which are customers to the leasing companies. The research grasped a broader perspective of the case company's fleet customers' attitude towards the V2G technology by conducting interviews within these two customer segments. To ensure that the sample was relevant for the subject, it was important to have respondents who were knowledgeable about the technology and had, to some extent, earlier discussed V2G within their company. Therefore, the companies were asked to bring the most suitable person to contribute with nuanced answers. Referring to Table 2, the respondents' roles were hence divergent.

Other than the previously described criteria, no other criteria were applied as the researcher thought too many criteria could prevent people from participating in an interview. According to Bell et al. (2019), this aligned with the grounded theory approach, as the interview transcripts were analysed continuously throughout the process, which provided flexibility in evaluating the proposed sample of respondents. The sample also depended on the amount of information each respondent stated since the goal was to fulfill theoretical saturation. Theoretical saturation is one of the key elements in the grounded theory approach and entails that the researchers collect data until a category has been saturated with data (Bell et al., 2019). Therefore, the finalising result was nine interviews with

customers from the company's fleet side. A complete list of all participants in the second section can be found below in Table 2.

Table 2: Customer respondents

CUSTOMER	NAME	ROLE	DATE	LENGTH	MARKET
Leasing Company	C1 & C2	Global Procurement Manager & International Business Owner e-Mobility	9/3	62 min	Global
Leasing Company	C3 & C4	Head of OEMS Relationship & Head of Mobility Partnership	13/3	60 min	Global
Leasing Company	C5	Consultant Project Manager	13/3	35 min	Sweden
Leasing Company	C6	Managing Director	21/3	37 min	Finland
Leasing Company	C7 & C8	Key Account Manager & Country Manager	27/3	57 min	Sweden
Corporate Company	C9	Global Category Manager - HR, Travel Services, Fleet and Mobility	11/4	45 min	Global
Leasing Company	C10	E-mobility and Fleet specialist	14/4	30 min	Denmark
Leasing Company	C11 & C12	EV expert & Product Manager for Value Added Services	17/4	38 min	Denmark
Leasing Company	C13 & C14	Business Developer - Sustainability & International Sourcing Manager	20/4	28 min	Global

3.3.2 Secondary Data

The empirical findings from the primary data were combined with secondary data forming the literature review of this research. Hence, the combination of sources was created to make an overall understanding of the research phenomenon and enable a comparative element to be incorporated into the research design. The secondary data used in this research were compiled into a theoretical framework to grasp the current literature of already published studies within V2G. Furthermore, studies about barriers to renewable technology and the theory of diffusion of innovation were covered. The literature review consisted primarily of articles and journals found via GU super search or Google Scholar. Besides academic articles and journals, the literature review includes reports from

the case company's partners. Once the relevant literature was found, it was later categorised and compiled into different blocks depending on its topic.

3.3.2.1 Literature Review

The literature review takes a narrative approach, meaning that the purpose is to create an understanding and gain initial impressions of the topic area. According to Bell et al. (2019), this process is more suitable for quantitative research since it requires greater flexibility and can be modified as the research proceeds. It is further suitable for the abductive approach since an iterative process between observations and theory takes place, which also requires flexibility as the new phenomenon occurs. The initial research area when collecting most of the literature was earlier research and findings about V2G. This was considered an appropriate starting point for the literature review since it enabled the researchers to understand the technical parts of V2G better and gain an initial understanding of advantages and barriers.

Although taking a narrative approach to the literature review, the systematic review structure that adopts quantitative procedures was used as a starting point when collecting the articles. This approach was used to ensure that all relevant articles were looked through when grasping an understanding of previously researched advantages and challenges with the V2G technology. This creates a more replicable, scientific, and transparent literature review process (Bell et al., 2019). All abstracts from the articles found on respective keywords were read through to understand if the article would be interesting to read in detail. After the initial screening, the number of articles chosen for review was read through in detail and added to the literature review if the articles were found interesting and valuable for the study.

Several aspects were considered when determining which literature to include as secondary data. As V2G is a new technology constantly developing, one preference was to find as recently written articles as possible. However, the articles were significantly older when describing the diffusion of technology and its applicability to renewable energy technologies. In fact, prominent studies on these subjects were sometimes more than two decades old. However, these studies still have relevance in technology adoption today. Hence, the thesis did not implement a strict limit on publication year but instead carefully considered their relevance to the research area. Lastly, almost all articles used in this thesis were peer-reviewed, besides conference papers that were also allowed as an exception.

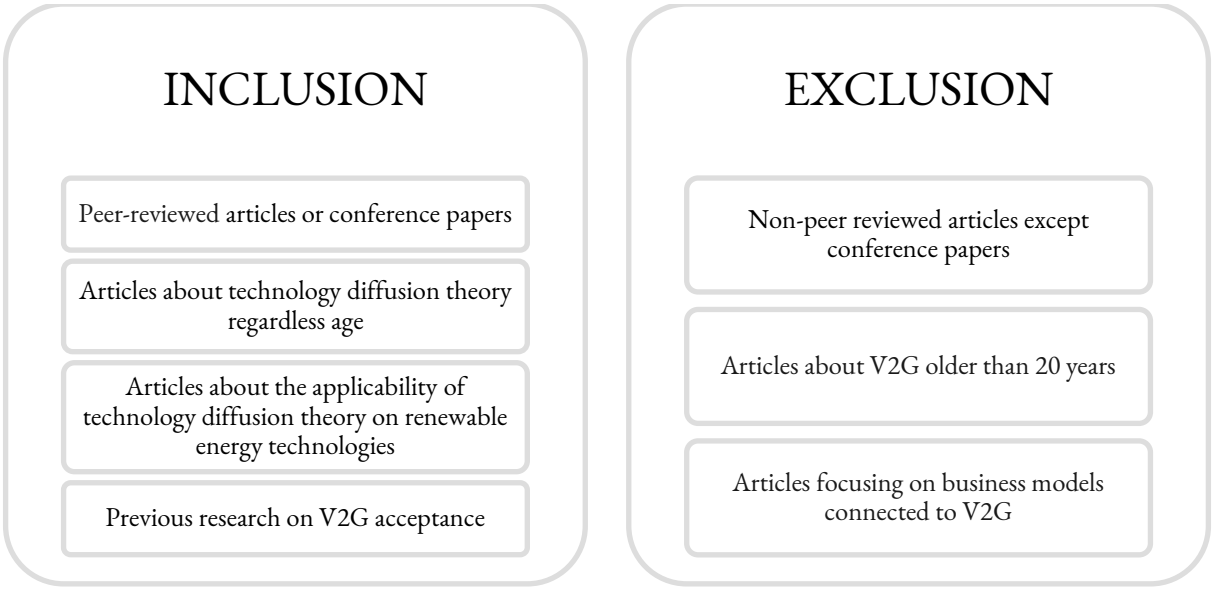

Figure 4: Inclusion and Exclusion criteria for the literature review.

3.4 Data Analysis

When analysing the data that the research generates, elements from both grounded theory and thematic analysis were used. Qualitative research generates large and complex datasets in the form of interview transcripts, and according to Bell et al. (2019), there are no clear and set rules about how this qualitative data should be analysed. However, thematic analysis and grounded theory are the two most frequently used strategies. Grounded theory was used to achieve theoretical saturation in the study. This is an iterative approach which, according to Bell et al. (2019), is an approach where the data collected is analysed along the way, and interviews are added until theoretical saturation is achieved. Furthermore, looking for codes within each interview is an additional tool within the grounded theory approach used in the study. These codes are grouped into concepts that are identified to find themes from the respondents, as shown in Figure 5. The tools of grounded theory give different outcomes which build up to a theory (Bell et al., 2019). According to grounded theory, these outcomes are concepts, categories, properties, hypotheses, and theories. However, since the study aims to understand how to accelerate the future implementation of V2G, rather than building up to a new theory, the tools from the grounded theory approach are combined with the thematic analysis approach. This approach marks the last step in Figure 5 below, where the theme found from the example is “Creating value for all stakeholders”.

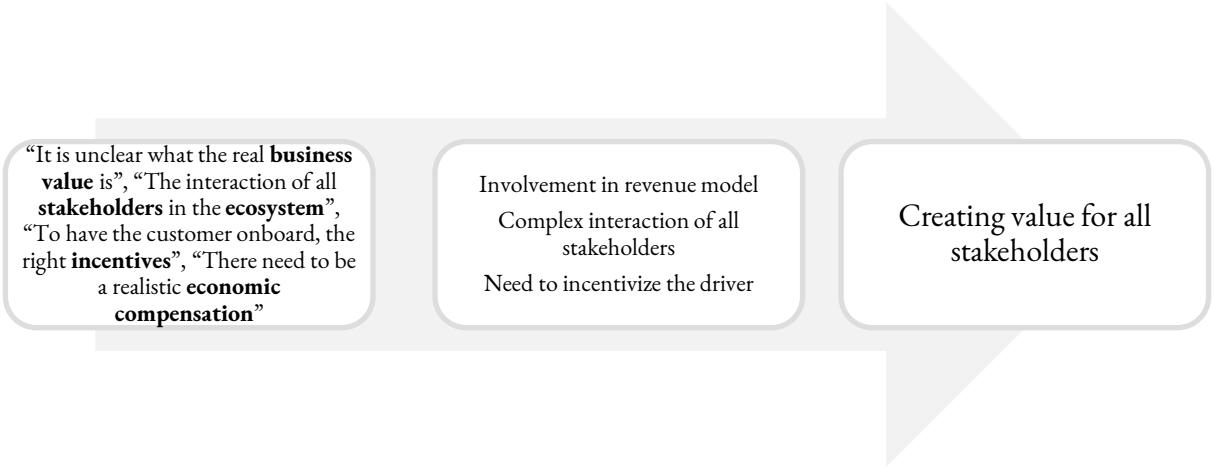

Figure 5. Process of finding codes, concepts, and themes in the interviews.

The thematic analysis looks for themes and patterns in the collected data, such as repetition of topics, metaphors, and analogies represented by participants or similarities and differences in how interviewees discuss topics differently (Bell et al., 2019). Repetition is one of the most common criteria for finding a theme in the research if it is relevant to the studied research questions. The purpose of the thematic analysis was to structure the qualitative data findings and to find themes from respondents which could then be connected and compared to the literature review. Hence, once the codes and concepts were created from the grounded theory approach, these concepts were translated into different themes, which represent the main findings and answers to the research questions. All different parts of the study were together critical steps when analysing the data and finding the appropriate recommendations for the case company going forward to accelerate its implementation of V2G technology.

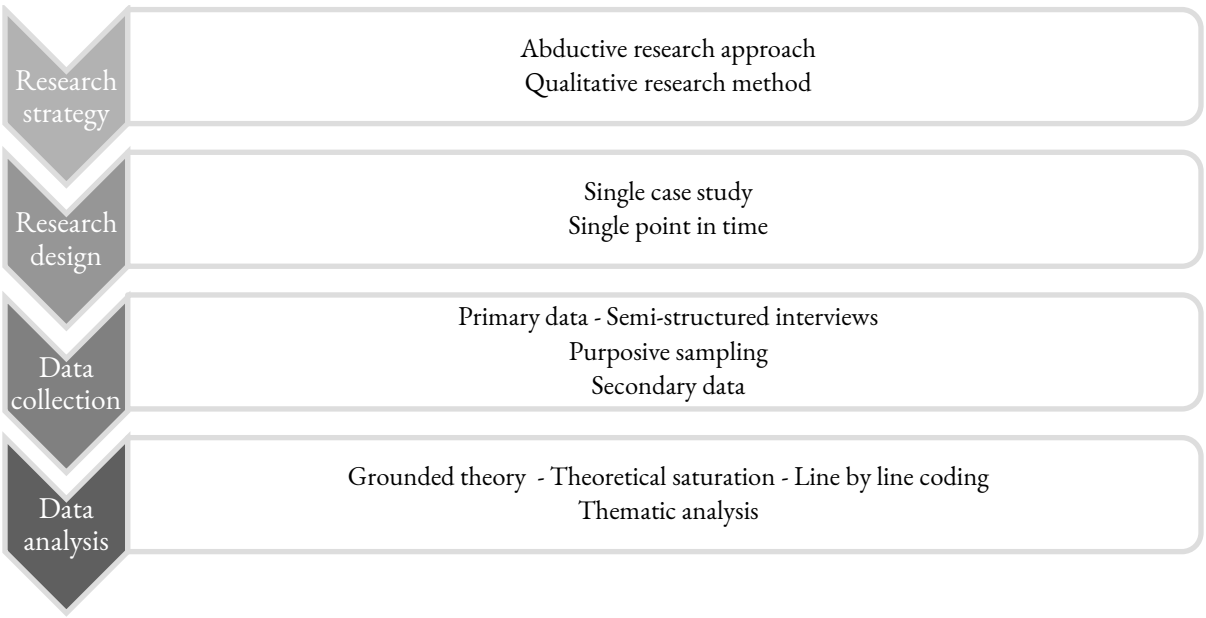

Figure 6: Relationships of methodology steps.

3.5 Research Quality

Reliability, replicability, and validity are the most common criteria for evaluating business and management research (Bell et al., 2019). In qualitative business research, however, these criteria have limited application due to these criteria being focused on measurement. Lincoln and Guba (1985) and Guba and Lincoln (1994), therefore, suggest two other quality criteria that are required to evaluate qualitative business research, namely trustworthiness, and authenticity (Bell et al., 2019). Trustworthiness is divided into four criteria, which are credibility, transferability, dependability, and confirmability. These five different criteria are suggested to be used because of the belief that there is not a single view of the social setting available (Bell et al., 2019).

3.5.1 Trustworthiness

3.5.1.1 Credibility

The credibility criterion ensures that the research is carried out in good practice and that the investigators have correctly understood the research findings (Bell et al., 2019). Thereby ensuring that the investigators have understood the social world correctly. This technique is commonly referred to as respondent validation and is vital to correctly reflect the respondents' viewpoint. To ensure credibility in the research, each customer and expert interview was transcribed before the analysis process began. Before publishing the thesis, any quotes taken directly from an expert participant, who is not anonymous in the thesis, were sent out to that specific respondent to receive consent. During the interview, each respondent was also asked whether it was okay to ask complementary questions via email if a question arose after the interview. This ensured that potential questions or gaps could be solved and create a more trustworthy analysis.

3.5.1.2 Transferability

According to Lincoln and Cuba (1985), a second criterion is the transferability criterion, which accounts for how well the research can be applied to another context or in the same context but at another time. Providing the study with a thick description, meaning detailed information about the setting and data collection process, lays a good foundation for others to judge whether the findings are transferable to other situations. Transferability is achieved by ensuring that the data collection and analysis process is described in detail and offering as much information about the customers as possible while keeping their anonymity. Because other automotive companies are likely to face the same challenge with implementing V2G and have similar or the same fleet customers, the study achieve transferability to companies within the same industry as the case company.

3.5.1.3 Dependability

Lincoln and Guba (1985) suggested an alternative to the reliability criterion, which is the dependability criterion for qualitative research. This criterion ensures that records of all processes within each research phase exist and are described in detail. This further requires that there exist peers who review the process as it goes and is assuring that procedures are being followed. To achieve dependability in the study, all steps, such as the problem formulation, interview process, and analysis, have been described in detail and should be easy to replicate. During the research period, the thesis was peer-reviewed by the thesis supervisor as well as other master colleagues to make sure that no step was lacking important information or details and to ensure that everything was understood correctly.

3.5.1.4 Confirmability

The fourth criterion stated by Lincoln and Guba (1985) is the confirmability criterion, to certify that the researchers have acted in "good faith" and not used any subjective or personal values to influence the research. Achieve confirmability is also one of the objectives for the auditors; hence this has been achieved through peer reviews during the research period. This is important since the research within qualitative research is highly involved in the analysis process, compared to quantitative research, where objectivity can be achieved much more manageably with help from different statistical programs. However, achieving complete objectivity in business research is impossible (Bell et al., 2019), and realising and reflecting on one's bias is a crucial step to increase confirmability by constantly ensuring that subjective reflections are kept out of the analysis.

3.5.2 Authenticity

The fifth criterion Lincoln and Guba (1985) suggested is authenticity, which raises issues about the research's social and political impact. This criterion highlights the researcher's responsibility to represent multiple viewpoints and perspectives of a social setting and to encourage change across participants. To add authenticity to the study, the chosen respondents come from different markets and countries, representing different economic and environmental perspectives. Additionally, the respondents are active within two out of three of the case company's business fields: leasing and corporate companies. The interview guide is being adapted depending on what customer is being interviewed, which creates a better perception of their reality and how V2G will affect them differently.

3.6 Research Ethics

In addition to the research's quality, ethical considerations must be accounted for continuously. According to Bell et al. (2019), there are four ethical principles in business research, where avoidance of harm and informed consent have been especially addressed in the study. The code of ethics states that it is the response of the researcher to minimise the risk of harm (Bell et al., 2019). The thesis treats the customer participants with anonymity to avoid harm to these participants and the case company's customers. This is also not to expose the case companies' customers and is not considered to harm the quality of the information received from the participants. Instead, it is an action to ensure that participants can share their beliefs honestly without risking someone questioning their responses. The customer's positions within the company are displayed to add to the chosen respondents' legitimacy and the contribution they can make. However, their name and the company at which they are working remain anonymous. The expert respondents' names are not treated with anonymity in the thesis, after consent from all expert respondents, because knowing who they are is considered to add legitimacy to the study.

Informed consent also ensures that the research participants are given sufficient information beforehand to decide whether they wish to participate (Bell et al., 2019). To ensure this, information about V2G was added to the interview requests to give a background to the topic. This way, the respondents were asked to find the most appropriate person within the company to interview that felt they could contribute significantly to the study. Informed consent also refers to informing about whether any observation or recording equipment would be used (Bell et al., 2019). Therefore, each interview started with a question of whether the recording was okay, to which all respondents consented.

3.7 Case Company and its fleet customers

The case company is an electric automotive company determined to improve society by using design and innovation to accelerate the shift toward sustainable mobility. Their cars are available in several markets globally across North America, Europe, and Asia Pacific.

The case company's fleet side of the business is the sale of EVs to leasing companies, rental companies, or corporate companies doing direct purchasing from the case company. See Figure 7 for this relationship. For direct purchase, the car is opposed to a private individual within the organisation or company. Rental companies own the car and rent out the car for shorter periods to individual customers. On the other hand, leasing companies act as intermediaries and financiers for a corporate company. This means that the leasing company buys and owns the vehicle, while

employees at the corporate company are the driver and end users. Corporate companies can either be a customer doing direct purchases or a customer of the leasing company, then referred to as corporate customers. When referring to the user of the V2G technology, it is referred to as 'the leasing company's customer,' 'end user,' or 'end driver'.

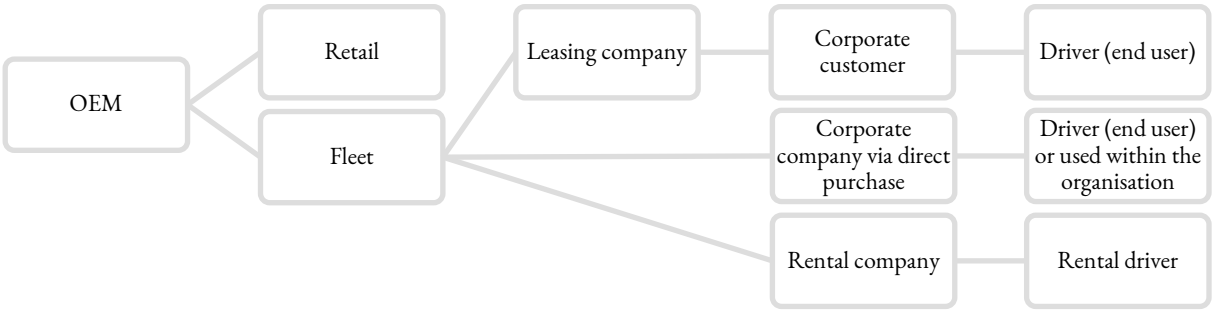

Figure 7: Relationships within the case company's fleet side of the business.

3.8 Research Delimitations

Several delimitations follow to narrow the scope of the research. First, the thesis foremost focuses on a managerial perspective. Hence, the technical perspective will not be in focus. Furthermore, no specific strategy for implementing V2G will be given. Instead, the study will focus on what to consider in accelerating the implementation process and adoption of V2G. Because of the chosen single case study design, the results are influenced by the backgrounds of the case companies' customers and their relationship with the case company. Although the generalisability to other companies in the same industry is limited due to this, several customers are prominent actors that work with different OEMs all over the world. To align the research with the needs of the case company, only the fleet customers are being researched. This is because the case company already got better insights into the challenges experienced on the retail side of the business. This implies that the end driver will not be researched, which is the person who will drive the vehicle.

Lastly, since V2G is a new technology, the general understanding and technological knowledge on this topic is limited. Although most of the conducted interviews were completed with the most experienced person within that company, V2G was not always at the top of their agenda. Thus, an in-depth understanding was sometimes hard to grasp from the customers. Additionally, several customers declined the request to participate in an interview because they had limited insights and were not ready to talk about it yet. This was why the thesis could not include a rental company's perspective.

4. EMPIRICAL FINDINGS

This chapter presents the empirical results from the interviews with customers and experts, where the expert interviews work to complement or add perspectives to the customers' perceptions. The first section provides a background to the customers' sustainability focus, creating an understanding of how actively they are working to reduce CO2 emissions and their current knowledge about V2G. The following sections present the opportunities and challenges with V2G mentioned in the interviews, laying the ground for the following analysis in Chapter 5.

4.1 Importance of Environmental Sustainability

4.1.1 Environmental guidelines

All customer interviews mention that they have ambitious targets to reduce CO2 emissions. According to C4, they are fortunate to work in an organisation concentrating on sustainability topics for several years. C4 explains that their company started looking into electric vehicles in the mid-90s and was one of the first leasing companies to sign the UN Global Compact Agreement. Furthermore, C4 explains that they can help their customers in their energy transition and that they have an objective of reducing the average CO2 emissions of their fleet by 35% until the end of 2025. Therefore, electric vehicles are an essential part of achieving this goal. C6 also mentions that they have goals for reducing CO2 emissions and helping customers transition energy. According to C6, these objectives are their whole purpose for existing. Hence, reducing carbon emissions from their car fleet is at the core of their strategy. C6 adds that they need to attract people to become sustainable by giving their customers a good customer experience. Hence, the leasing company aims to be both sustainable and hassle-free.

C10 points out their project EV100 as the base of the company's sustainability strategy, where they commit to being CO2 neutral by 2030, and C11 also communicates a goal of removing most of their CO2 emissions until 2030. C2, C5, C8, and C13 mention that their sustainability strategy is concentrated on a global or top management level, and C5 mentions that they want ⅓ of their global fleet to be electrified in 2025. Both C8 and C13 have overall high ambitions and set high goals for how their organisation should be controlled when it comes to reducing carbon emissions. For example, C8 says they work hard to enable all employees to drive to and from work emission-free. C8 also mentions an international partnership where consultants and experts discuss how they can increase EVs in their portfolio and reduce emissions. C4, C8, C9, and C13 also mention that their company has a travel policy and is working on switching their employee fleet to a fully electric one.

4.1.2 Push or pull strategies for EVs

C1, C4, C5, C7, C10, C11, and C13 say that they focus on serving their customers based on their demand. C7 and C13 elaborate on how they are not pushing their customers in any direction but instead informing and consulting them to see the opportunities for electrification. C2, C4, and C10 agree on this and explain that they analyse what is necessary for each customer and try to align their recommendation with the customer's CSR strategy to support the customers in their energy transition. C2 thinks that, although more customers have sustainability guidelines and requirements they must meet, it will come down to economic incentives at the end of the day. However, although not pushing customers in a particular direction, C2 adds that they rather see a pull situation from customers that needs to apply to their sustainability standards. C4 confirms the pull from customers by saying how many of their customers today ask what they can offer them regarding sustainability rather than only being concerned about cost savings. C4 discusses that their company sometimes needs to be very proactive on some topics that will impact their customers, for example, the taxonomy 2025, where most customers need to report specific KPI-related factors from their fleet. Therefore, the customers need C4's expertise to align with external requirements. C4 further states that they try to encourage their customers as much as they can to drive electric vehicles and that:

"Recommendations based on customers objectives such as cost savings, CSR aspects or employee satisfaction will in most cases lead to a recommendation towards electrification." - C4

However, in the end, all customer cases are built upon the objectives of their willingness to electrify their fleet. C7 mentions that their customers have developed at different paces when it comes to electrifying their fleet. Nevertheless, C7 says that few customers are ordering a fleet with only combustion engine vehicles today. C5 and C11 mention how most of their large company customers have CO2 policies that only allow for EVs, and C11 adds that many other customers give out benefits if the employee chooses an EV as a company car. C8 and C10 elaborate on this and say that pressure for companies to report their carbon emissions in the future will be a reality, and hence it will also be more natural to choose EVs. C9, representing a corporate customer to one of the leasing companies, confirms that they have very ambitious and strict targets for their zero-emission company transformation. All delivery services and company or benefit cars shall transform to zero emissions by 2025. This is where C2 means leasing companies can step in and support their customers in their green transition and on what solutions exist.

Furthermore, C10 explains how beneficial it has become to drive an EV in Denmark because of tax benefits, and therefore it has naturally become more popular. C2, C3, and C4 state that some markets are more mature than others, but we also have seen unexpected markets that are stepping forward and picking up the electrification. C4 mentions that today, in countries like Norway, the

UK, or the Netherlands, the economic benefits of driving an electric vehicle have also become a more common incentive. In these countries and some situations, it is either cheaper for the company or the employee to use an electric vehicle. C8 confirms this by saying that their portfolio has been naturally created since driving an EV has been an economic advantage compared to an ICE vehicle.

According to C1, although they do not have a specific target for the share of EVs sold, EVs are taking up an incredible amount of space to achieve their 70% CO2 reduction target. Hence, they indirectly aim to sell more EVs even if they usually say that they offer what the customer wants. C2 explains that, although they are interested in ensuring their EV fleet is growing, they cannot aim for a particular share of EVs sold because they are a global leasing company active in many markets. The markets are entirely different when it comes to the development of electrification.

Looking into the environmental awareness of customers, C6 thinks that there is only a tiny difference between customers buying an ICE vehicle and an EV. Although they can see that green awareness is driving companies, the total ownership cost still underwrites EV sales. Additionally, C6 believes that environmental and economic costs are essential and must fit together. C6 explains that they have decided to deliver the last fossil fuel car from their fleet in 2028. However, C6 also mentions that it is crucial to be pragmatic against new technology, vehicle models and producers, and customer preferences, and how it is not their thing to say what is right and wrong or drive out ICE vehicles in one go. Despite this, C6 explains that they are pushing for EVs because they know that this is the best technology, has the best total cost of ownership, and is the best alternative for the environment. C6 explains that they want to be the contact to which customers can outsource their green transition.

4.1.3 Previous knowledge about V2G

C2 and C10 both say that V2G is something that is and needs to be on top of mind for them. However, it is still relatively unknown to their customers or end users. C6 and C13 follow this line and mention that their company is well involved in the topic and believes this technology could boost their EV sales. C13 elaborates on this and mentions that they cooperate with an OEM in the industry to grasp more knowledge about the technology. C4 follow by showing a solid understanding of V2G, where they started to investigate the topic of V2G a couple of years ago:

"In fact, we installed our first V2G charge point back in 2018 in the Netherlands and we started to test it with the compatible model on the market. We are also about to launch and offer a service starting with France in 2023, for customers to be able to subscribe to the service of Vehicle-to-Grid." - C4

C2 sees how this topic is where they need to position themselves and understand the impact and value stream. Based on the maturity of the Netherlands market, where many of their employees are

positioned, C2 thinks they will experience the first move on V2G. Regarding the rest of the markets, C2 believes they need to prepare them for what V2G is and educate colleagues to answer customer questions. At present, they are trying to communicate what they know about the future from their own experiences and what this will mean in a few years. For example, they know that V2G will require new types of charges, an investment cost that they might already need to consider before making new investments today with charges that are not V2G capable. Additionally, C2 thinks that making it very concrete how things are working is what is most important to get a discussion going today and to have a starting point:

"You need to spread the word, show people what it means, give them a test drive, and this is the same as how it was with the electrification itself and the introduction of EVs." - C2

On the contrary, C11 explains that their knowledge about V2G is relatively limited. However, they had some conversations with their charging solutions partner about the implication of V2G to charging boxes. Additionally, C11 mentions that they expect most new EVs to be prepared for V2G. C5 explains that V2G is something they started to investigate recently but currently focuses on the business model and strategic solution rather than the technical. C7 and C8 explain how V2G is something they have yet to investigate in their market. Hence, they had a small amount of knowledge before the interview. C9, working at a large corporate company, mentions that the concept is familiar, and they are involved with V2G during discussions about their charging infrastructure. However, they are too early in the discussion to know what a potential business model would need to look like.

4.2 Potential benefits and opportunities with V2G

4.2.1 Opportunities to stabilise the energy grid

C8, C10, and C13 highlight the benefit for the overall society because of how V2G can balance the power grid during peak hours and overload in the electric distribution network. C8 further mentioned this as an advantage considering the strained power grid in Sweden during winter. Hence, C8 claims this has a bigger purpose than only generating benefits for the end driver. C4 further states that energy production can be avoided because of an intelligent way of reinjecting energy back to the grid. According to C4, avoiding overproducing energy during peak times is an important part of the environmental impact. E2 and E3 agree and point out the opportunity to use V2G as a stabiliser during peak hours when the grid is strained, and E2 elaborates and states that investments to expand the electric distribution system can then be avoided. C9 mentions that they are already experiencing a problem connected to the maximum capacity of the grid and describes that this maximum capacity

needs to be managed somehow to avoid the system from collapsing. If V2G can help solve this issue, C9 thinks investigating it is very interesting. Adding to this, C2 mentions that in the Netherlands, they are already seeing quite some issues with the grid that need to be solved, and how:

"I'm really positive that this is the future, that this will not go away, that this is really a big need we need to provide." - C2

E1 elaborates on the fact that electricity production needs to double until 2040-2045, where about 25% of this increase will come from EVs. The law of physics, E1 explains, states that the sum of consumption and production must be balanced every second, or the energy system will collapse. E1 adds that the increase in energy demand will almost solely come from renewable sources, which needs to be balanced by different types of flexible storage solutions. This is due to the uncertain access to renewable sources, for example, sun and wind. Therefore, V2G creates a possibility to use the batteries in EVs to balance the electricity system and store these renewable sources. E5 points out that Sweden has a strong electrical grid since the country uses electric heating. However, his studies on how the power grids are affected by the increased charging of EVs show that the power grid can be affected if the charging is not controlled significantly, as the uncontrolled wind and solar energy sources have increased in importance in Sweden. Furthermore, E5 states that countries using gas networks or natural gas for heating, such as Portugal, Spain, and Germany, will face other challenges and probably need to invest in and expand their energy system.

C2 can see how V2G could create an opportunity for them in the remarketing of their vehicles. The number of vehicles they are remarketing per year in the Netherlands is about 20 000, which is cars getting in every week and staying at their parking lot for 2-3 weeks. Currently, these are only ICE vehicles, so it has no value. However, if these vehicles were fully electric and V2G capable, C2 meant that they could keep them connected, which would create a big battery standing in front of their door. This energy capacity could create an offer to the energy companies and be sold to balance the grid. C5 elaborates and claims they are highly competitive since they own a fleet of 1,8 million cars and can negotiate as a potential aggregator. Thinking about this at a larger scale, C2 believes that they could extend this offer to their customers and make sure that customers are connected to a good energy company and negotiate prices based on scale.

Both E1 and E5 confirm these opportunities that C2 and C5 see about how fleet customers could be able to connect vehicles, create an aggregator function and sell electricity to grid providers. E1 and E5 mention how this creates benefits for the network owners. Instead of spending money on expanding the electricity network and cables and changing transformers, they can spend it on paying for or buying these services from aggregators. Energy providers could use bids from corporate customers who connect their vehicles to the V2G system with their fleets of vehicles and work as an

aggregator. E1 explains that this aggregator function is some trader or intermediary between the flexible energy resource and the one who would like to use it. With this aggregator function, the company can bid on markets that the energy providers have:

"It is a whole new world to trade these types of flexible solutions for the electricity system." – Henrik Forsgren

E5 can see the aggregator function as more flexible regarding ownership, where OEMs, third-party companies, and energy suppliers can be potential aggregators. E4 also mentions that the aggregator function and who will take this role is still to be defined. However, E5 sees potential in leasing companies taking on the role of aggregators since they own the car and therefore control how it should be used.

Furthermore, C4 brings up different use cases that could benefit a more extensive adoption of V2G. For example, station-based car sharing means that car sharing is offered within the company, where the company has all information about how to anticipate the timings when a vehicle can be plugged in or not. C4 claims that this is something they do at their headquarters now and that could be performed by other companies in the future. In line with C4, E5 mentions a current project looking at different use cases with V2G and highlights car sharing as a massive potential for V2G since these cars stand still during longer time slots. On the other hand, these cars need to have a high availability, which can potentially create a problem with having their cars connected to a V2G system.

4.2.2 Support the green transition

C6 believes that V2G can create huge opportunities and that the small steps we can do each day will create our green transition. C7 states that the strongest argument to push this technology on to their customers is because it adds another parameter to their own and their customers' sustainability work and thus accelerates the reduction of carbon emissions. E4 and E5 confirm that, from what it looks like right now, V2G will be an essential component of a more sustainable energy system. E5 highlighted how it could help in enabling the green transition, and E6 states that V2G is part of the story of getting 100% green power in our hands. This is further aligned with both E2 and E3's discussion of how V2G enables the storage of renewable energy in the battery, which can lead to total trust in renewable energy sources in the future. They state the importance of accelerating the green transition in society, which aligns with the case company's sustainability goals.

Furthermore, both C4 and C6 see the implementation of V2G as an opportunity for users to become more energy self-sufficient. C4 mentions the benefits for the end users when installing this in their home and combining it with solar panels. Hence, the best-case scenario could lead to not having to buy a specific storage unit for the household but rather using the vehicle as the energy producer to

produce and consume household electricity. C6 believes that it will become more common for customers to require to know where their energy comes from and that it is locally produced, green, and cheap. Hence, this will make customers interested in V2G. C6 sees an opportunity to partner with, for example, solar panel companies and create a network of complete energy solutions for customers. This is similar to what they do today when they recommend different vehicles to different customers depending on their location and discuss how they should purchase green energy. This is further aligned with one of the benefits E5 brings up, called "micro-network thinking," where the customer can potentially be self-sufficient and create a local micro-electrical network using V2G.

C9 also elaborates on how V2G creates a possibility for them as a company to have more renewable resources in place by using batteries as storage devices. Using solar panels, for example, on top of their buildings' roofs, will enable them to better utilise the energy they produce. According to C9, this will work as a built ecosystem. What they are currently discussing, however, is whether they should own their sharing structure or if they would like to have a shared revenue model with any of the energy companies. Hence, they are in the middle of their charging infrastructure discussions.

4.2.3 Cost savings

According to C2, financial earnings are an aspect that will be important for them. However, C2 also mentions that they are unsure about how this will take place practically. Although the financial rewards or the value of having a battery on wheels connected to a charging station needs to be clarified, C2 can see a possibility in the remarketing of their vehicles, as mentioned above. These services create a possibility for them to earn money. C13 also sees potential for their company, especially since they own up to 700 000 cars and can give colossal electricity storage if managed correctly. E4 elaborates on how V2G also allows the OEM to create and capture value connected to the batteries and make money on either arbitrage or support services. However, C2 believes that the most significant opportunity exists among fleet owners since they have many vehicles available to track exactly where they are, when they are connected, and how they are being used. E4 adds that:

"When creating the business model, I would say that it is easiest to focus on the fleet owners first. Make sure that you create an attractive model together with them. When this model exists and it creates value, it should be possible to make sure that value can be created for the individual driver or owner too, and that it is attractive for them too." - Jon Williamsson

C4 states that V2G can be an extra selling point for EVs for customers; hence it is important to mention the benefits V2G can bring to the end driver. Regarding the different incentives for their customers or the end driver, C2 thinks that both environmental and economic incentives would be essential benefits. According to C2, the environmental aspect is always top of the minds of their

customers, but both C2 and C7 state that if looking towards the end driver, they are often more financially oriented. This is further aligned with E1's, E3's, and E4's reasoning about economic incentives for increasing the adoption of V2G. In the beginning, E3 thinks V2G needs to create a financial benefit, especially for the user. C6 adds that the advantages should go straight to the end customer. C10 agrees and highlights that V2G will be an advantage for the driver in terms of cost savings. E5 describes this relationship:

"The user can buy electricity when it is cheaper, participate in various service markets such as frequency regulation, voltage regulation markets and local flexibility markets and hence make an income from it." - David Steen

However, C6 can see advantages for them and OEMs regarding an extra usage area for the same product. You get more functionalities for the same price, which both C6 and C7 think will boost fleet sales. This is aligned with E3's discussion about advantages for the OEMs since the car is issued with more value to the customer. C6 makes a comparison to a person who owns an EV, has solar panels installed on the roof, and has 40-kilowatt hours of battery. This battery is expensive, but if the customer could use V2G, charge the car when cheaper, and discharge it during high-demand periods, this person could save all the money spent on investments. Then this would be as if this person owns a "free" battery which you can bring to additionally charge your car, C6 explains.

According to C2, you need to be able to show results from the effect, especially if it is about money. If you can show this to the driver, it will work. C9 also mentions that the cost aspect is essential when it comes to the reasons for implementing V2G. C9 would like to lower the costs, which is an important implementation aspect. However, when it comes to the mentioned opportunities to stabilise the grid, C9 adds that this could be a vital incentive even without real economic wins or incentive.

4.3 Potential challenges with implementing V2G

4.3.1 The complexity of the ecosystem

According to C2, C4, C9, C13, E1, E2, E3, E4, and E5, it is challenging to think about who and how each party should be involved in the V2G ecosystem. C13 highlights stakeholder management as one of the challenges with implementing V2G, meaning that several actors have their own targets and goals that need to be aligned. E2 agrees and discusses the complexity of the ecosystem and the interaction between the different stakeholders as one of the top challenges they have today. E3 elaborates on the complex ecosystem and a challenge that the case company is facing:

"It is important to find the interfaces and areas of responsibility that the various stakeholders can agree upon." - E3

E4 also brings up the connection between different actors as a challenge since the roles are unclear. E4 mentions that it is not stipulated who will be the aggregator in the system, whose responsibility this will be, or what this role might imply. C13 agrees and brings up the leasing company, their customers, the driver, and different charge operators as part of the complex system. Here, C13 further discusses the ownership of the car as a challenge. It will be hard to navigate how the ownership should be utilised, so all stakeholders get value from V2G. Because of this, C13 sees the V2G technology as more compatible with private customers than business customers.

According to C2, the first thing they need to know is the realistic outcome, meaning what the business model will look like. C2 thinks a discussion between them, the case company, and an energy supplier or grid operator is necessary to understand how and if this would affect the car's value. C5 adds the challenge of the facilitation of the technology, especially contracting how much the end driver can use V2G to ensure the leasing company calculates the correct residual value at the end of the leasing period. Similarly, C2 expresses concerns about how the V2G product should be offered to their customers, especially since they need to take the corporate company, which is their customer, and the end driver into account. Hence, C2 states that further discussions need to elaborate on how much the driver needs to be incentivised to plug in the vehicle and what kinds of risk they need to account for. Hence, an open discussion about what it means for everyone involved. E1 confirms that the business model is one of the two primary challenges E1 can see right now, and how to make it attractive to be a part of V2G.

E4 brings up an additional challenge connected with the system's complexity, which is that each market looks different and that only some markets offer payments for the earlier-mentioned support services to the grid. As a first mover this might imply that you need to create these markets. Because of this, E4 explains that it is sometimes easier to be a first follower. E6 further states that it is uncertain how this will go since there are so many possibilities, rules, and big interests in the market. E6 elaborates and says that the case company should use the time now, until regulations are implemented, to do something to be ready when the regulations are changed. Regarding this, E6 thinks it sounds easier to do tryouts with companies rather than retail customers since fleet customers have many vehicles available that could be used in the trials. Additionally, many companies would probably be eager to help due to their strict targets and objectives of reducing their carbon footprints.

4.3.2 Battery degradation

C5 and C8 mention that they must know they can sell a car with good battery conditions when the leasing period ends, especially since it will be harder for a leasing company to calculate its value. C3 highlights how leasing companies' business is built on knowing how to calculate the risk, and their expertise is to know what the car will be worth in 4 or 5 years, which makes this a significant challenge. Currently, C4 is skeptical of existing studies that state how V2G will affect the battery since there are not many pilots done yet. However, C4 is still positive:

"In the end, it is an interesting topic enough to take the risks that are implied with the implementation." - C4

Regarding the effect that V2G might have on the battery, C6 is not worried that it will harm the battery to a high degree. Additionally, both C6 and C11 add that fast charging would harm the battery more than slowly discharging the battery. However, C5 and C6 mention the need for an open dialog between the OEMs, themselves as the owners of the car, the driver, and the corporate company. There must be an open platform with a discussion about how it works and where data on the usage of V2G is being shared. C11 also elaborates on how much data is being created for the OEM and expresses the wish to take part of this data. Adding to this, C6 would want to see an "open sanity check" in place, by which C6 refers to a standard of how to validate the quality of the battery.

The difficulties in the V2G relationship, according to C2, is that the relationship is between the end user and the power company, but that it is, in fact, their battery. Since the leasing company owns the car and hence the battery, the driver could earn money on something which belongs to the leasing company. C2 thinks the problem lies in if something were to happen with the battery, which might steam from an increased V2G usage, and the end driver would claim that it needs to be repaired and fixed. Therefore, C2 says that they would want to have some kind of assurance if something is happening with the battery. Here, C2 explains that they are investigating how this could work in the future, the real business value of V2G, and the amount of money involved. However, C2 thinks they would be comfortable with the technical solution if there is still a battery warranty. C10 also expresses insecurity regarding the effect on the battery, but how it is up to the OEM to guarantee a warranty that reflects the condition of the battery. According to C2, if the warranty exists, the only question would be if and how much the state of charge would drop in the end. Let's say that the state of charge after all years would be at 60%; then, probably no one would be interested in buying a car with a battery size that is reduced that much. C2 summarizes this by saying that:

"I think based on that; I think the technology is fine. I think it is about the earning model and how it will work in the end." - C2

E5 confirms the potential of battery degradation as a challenge, and we need to guarantee that the battery will be in good condition before implementing V2G. Therefore, models and calculation methods need to be in place to prove the actual state of the battery. According to C11, they feel optimistic about having V2G in place if the OEM could show documented trials of how the technology does not tear down the battery. Additionally, since they cannot know the charging or discharging patterns of the customer, they would want to be assured that customers charge properly. E2 explains that many factors affect how the battery wears out, including both natural and cyclic aging. Cyclic aging depends on how often the driver charges and discharges, how much the person drive, the weather, and other factors. Therefore, E2 also mentions the importance of controlling how V2G is used since the goal is to maximise the benefit of the battery during the period of use. For this matter, C4 discusses the importance of testing and having a lot of data to see how V2G will affect the car's battery before making it accessible to all customers. C4 further states that, in the beginning, they are positive about having a structure where it is only possible to operate a small percentage of the battery. Thus, not discharging the battery fully and only using 10-20% of the battery capacity. However, C4 still wants more insights on the impact of the battery and is willing to enter new partnerships to exchange data and observations to accelerate the implementation of V2G.

According to C6, it can become a problem when the battery reaches 5-8 years old since we have yet to determine how it will function due to the recent introduction of EVs. C11 also points out how EVs are relatively new and how we, in a few years, need to see a report showing the state of charge and the battery condition. C6 continues by saying that there might be a discussion about how much the battery has suffered from someone optimising their energy consumption through their company car. Here, C6 refers to the fact that there should be some standards and recommendations on how to use V2G and what is okay or not okay to do. E5 agrees with C6 and how V2G needs to be managed by controlling the battery's quality. According to E5, it is not too advance to create models of how to use V2G to meet the demand of balancing the peaks.

4.3.3 The revenue model

C2 sees a challenge in that no one knows the real business value, what money that is going to be involved, and how much money that is going to be earned by the driver or themself:

"We would definitely want to be part of the revenue model that V2G could bring. But that is more connected to assuring a proper working vehicle." - C2

C4 states that they will play an essential role in the implementation and therefore want to be part of the value chain. However, they still do not know how the best setup will be demonstrated. E5 discusses the potential challenge in the uncertainty of which actors should be involved and share the

revenues that will be created. E5 further highlights that the end user will be a vital actor to incentivise so that she or he feels it is worth being part of the system. Otherwise, the users will not plug in their EVs:

"We need to create business models that ensure that the user plugging in their car after he or she has used it." - David Steen

C2 then mentions that an additional question is what percentage they need to gain from the earnings, which is where they need to estimate with a comparison of consumption and value of the returned vehicle, and based on that, make a prediction. C2 can see a challenge in communicating a potential revenue earning to the driver and then making sure that the driver is plugging in the vehicle and earns the money that has been communicated or promised. C2 and C8 connect this to an additional challenge of managing everything, such as the invoice stream. Currently, all costs connected to the vehicle, including the charging, are addressed, and invoiced by them. Hence, the process for deducting the earnings from V2G and who should participate in these will need to be set. E4 also mentioned challenges connected to the payment streams and things like VAT that will work differently depending on the customer.

According to C5, having a clear business model and creating a contract between the user and the owner of the vehicle will be important. Furthermore, C5 wants to earn money on V2G, especially since they own the car. C5 describes a double interest in V2G, both the opportunity for them to earn money and help their customers save money when using V2G. E1 mentions that one opportunity for fleet customers to benefit from V2G is to calculate and establish these potential aggregator functions, where they can sell energy capacity to energy providers. However, in that case, some contracted behavior would be needed to know that the driver is plugging in the vehicle and making the batteries accessible. E6 mentioned the issue of being sure about how many available cars can be plugged in simultaneously. When creating an offer or a bid on the auction to grid operators with the vehicles at hand, they will need to know how many megawatts of power you can offer to know that you have enough capacity to balance the power. E1 adds that companies can create technical routines to check usage patterns. According to E1 and E6, one solution for drivers could then be that they receive a lower leasing price if they choose to participate in V2G.

On the contrary, C6, C7, C10, C11, and C13 do not think that V2G is something they should earn money from or be involved in. What is important for C6 is to talk with their customers about green energy. According to C6, the economic benefit of V2G is that they will sell more EVs, especially to fleet customers. According to C7, C10, and C11, it is unnecessary to be a part of the revenue model because they think it will be hard to achieve this administration. Since electricity from the company goes into the user's private consumption, C11 explains that they have a hands-off approach and

probably would not want to be involved. Although, C11 highlights the importance of everyone agreeing that the solution and V2G offer is good enough.

4.3.4 Customer incentives

C2 states the importance of ensuring that the driver uses V2G as often as possible, so it is crucial to create incentives for the customer to use it. C2 thinks that their customers and the driver are more financially oriented than driven by other incentives. Therefore, if you can show the driver that it can be financially beneficial to use V2G, C2 thinks that it will work. This is aligned with C4 and C5's discussion about the potential advantages of V2G, whereas both C4 and C5 highlight the importance of pushing for the financial benefits to incentivise the user. E1 agrees upon the importance of making it simple and incentivising the driver to keep the EV plugged in when not needing to charge their vehicle and that it needs to be a realistic compensation for it:

"Doing good for society can also be a motivation, but not if it is too expensive to do it." - Henrik Forsgren

Although some customers could be interested in V2G for the purpose of being able to use it in their sustainability reporting, E4 explains that one needs to point out the values for each different customer segment. C4 further states that V2G will not be attractive in all countries since the production energy patterns differ, and how beneficial it will be will depend on how energy is produced in that specific country. C4 thinks that the countries that have a lot of solar and wind energy sources will be the ones that are attractive and interesting in V2G. E4 explains that economic, instrumental, and symbolic values can incentivise customers to use V2G. One thing that can provide safety for the customer is knowing that, if the electricity shuts down, they still have 1 or 2 days of electricity usage in their battery as a power bank. Other symbolic values are that we can use more solar or wind energy and contribute to not using as much fossil energy. This way, E4 means customers know they are greener than by not using V2G.

C6 thinks that V2G will be a part of their green energy discussion with their customers. One requirement from C6 to start using V2G would be that the technology will allow it to discharge more energy than possible in V2 G-capable cars today. These cars only allow for very little energy to be taken out of the battery, which according to C6, would not be enough to provide energy for a house. C6 explains that there are likely to be two different types of users, where there will be the ones that optimise their energy consumption, and there will be the ones who use it as a self-sufficient storage solution. C6 thinks that most customers will be the latter and that a minority will optimise their energy purchasing during the day. C4 confirms and discusses the importance of packaging everything easy for the customers to create an incentive to plug in the car. Both E2 and E3 state the importance for the case company of having a seamless customer experience, whereas it should be

readily available and easy to understand the technology. E3 thinks a potential barrier could arise if the driver thinks the user experience is too complex. Therefore, E2 states that a large demonstration could increase technology usage. E6 also mentions the need for demonstrations, and E6 added the need to find out what we can get from this market and give people a rundown of how much money it involves.

To find the right incentives for the customers to get them to plug in their vehicles, E4 adds the need to show the customer an attractive approach and work with regulations and laws to make V2G a base scenario and not a what-if scenario. If V2G does not become a base scenario, E4 expresses a fear that the vehicle battery will not be used for storage purposes. Instead, companies will install additional batteries to fend off power peaks, which would only lead to a double battery infrastructure in society with vehicles not being connected. E6 expresses the same issue but adds the perspective of prices in this equation. If V2 G-connected cars are too expensive or create too low economic incentives, there is a risk that there will be a lot of stationary battery systems and that V2G would not create a business case. Moreover, E6 mentions that in 5-10 years, many cheap stationary batteries will be available when the vehicle's lifetime has passed. These batteries will still have the capacity left to be used as stationary batteries, whereas E6 expects a market where we can balance power with very cheap batteries. This can also affect the price. Therefore, E6 thinks that it might be challenging to know what the market price will be in the next several years.

Moreover, C4, C10, and C13 elaborate on the added investment cost V2G will force the driver to invest in. For example, C13 brings up an extra investment that will be needed for the charging points for companies, as well as the end driver, if they want to connect to V2G at home. Since most leasing customers switch cars every third year, and not all models are compatible with the same charging facilities, C13 expresses that the customers might need to invest in another charging box. This would add further investment costs. Furthermore, C5 believes that V2G can be a good sales argument but also highlights the importance of not only making this technology compatible with high-end products. Instead, to make the mass of sold cars V2G compatible, since this can enable more customers to use the technology.

4.3.5 Immature market

C4, C5, C7, C9, and C10 discuss how the market is not mature enough to discuss V2G today. They also discuss how the initial technological understanding can be a barrier for their customers since they have little to no knowledge about V2G today. According to C5, the market is still immature, and most technical questions are related to the initial charging, range anxiety, and general questions about EVs. Hence, C4 explains how leasing companies and OEMs are important in being the experts. C8 adds that their customers are still looking at the vehicle as a tool to reduce emissions

associated with driving. Additionally, C13 mentions a challenge with getting people interested in the topic. Currently, C13 means that V2G is new to most of their customers, which leaves them with a low understanding of the benefits of the usage. C4 and C7 agree and state that when the end driver is mature enough to discuss the technology, the information about the benefits of V2G is extra important to push for. C9 mentions how the concept of V2G is rarely even discussed within their company. This is because their current focus is on the charging infrastructure. Additionally, C9 highlights the obstacle of harmonising the V2G solutions with the existing solutions and ecosystem that are now being constructed. C9 says that right now would be the right momentum to work with it:

"The sooner the solution, of V2G, is integrated into the current way of thinking, the better we are, because otherwise I see potential difficulties to harmonise." - C9

C9 means that a specification or a technical description of V2G, as soon as this exists, would help to integrate the concept before the entire charging infrastructure has been built. C9 also expresses an interest in collaborations and working with the leasing companies they are buying from to test new solutions together. E5 mentions that a standard for communication between the vehicle and the charging station has been released. However, the function between the charging station and the aggregator is still under investigation. C10 mentions the importance of communicating and increasing the understanding of V2G among the first movers who want to try it because they are the ones that will spread the word and create a higher adoption of V2G:

"It is a big upheaval for the customers and therefore we must start small. We must help to get over the edge and find the people and the product that can handle it to the river." - C10

E4 elaborates on the S-curve and how some technologies have a less steep adoption curve. EVs are one example of a technology for which this can be applicable and where adoption hence takes longer. E4 also explains how general requirements for adopting new technology are normally described as customer acceptance, need, and the adaptability of the technology to the current system. When applying this to V2G:

"The general impression is that it might not be that hard to make it work with the system. But then starting to look into the details, it is much more difficult than at first sight." - Jon Williamsson

According to E4, what complicates things is that the ability of the vehicle and the charger to bring power has a cost, both connected to the battery and its degradation, but also the equipment needed and infrastructure. Then E4 brought up the question of whether the value exceeds the cost. E4 continues and states that it depends on how the different needs of the different actors connected to the energy system are defined. C8 elaborates and states that the leasing industry always considers the

cost perspective of all new products. Since historical data on this is hard to find or does not exist, it can be hard to calculate the economic benefit of the technology. Right now, according to C8, we are incredibly far ahead in this whole line of thinking since the Swedish vehicle market only has 10% of Sweden's total vehicle fleet electrified.

E1 mentions technology as the other primary challenge that he can see today. E1 explains this with the fact that vehicles and chargers that can handle V2G need to be produced. There needs to exist a market with vehicles that are V2G capable, in addition to infrastructure that can control it. According to E1, this is on its way. Then, when the technology and the business model are in place, E1 also mentions the need for existing standards of how to use the technology, in addition to how the vehicle, charger, and aggregator can communicate and send the correct information and signals to each other.

4.3.6 Required standards and legislation

C5, C8, C10, C11, E1, E2, E4, E5, and E6 all mention the importance of having clear guidelines and regulations in place before an adoption of the technology can take place:

"The energy law that manages regulations connected to the electricity grid cannot even spell energy storage that travels on wheels." - Henrik Forsgren

E6 mentions that laws and regulations are currently the biggest challenge for adoption and ensuring that the power quality will be good enough to be a part of the grid. Hence, the quality of the power and the action of sending the power back to the grid are regulated by law. It is proven that cars can be a part of the grid, but E6 mentions how we need to have rules in place to one day make the technology mainstream. As of right now, there exist cars that have the potential to send energy back to the grid but are not allowed to do it.

C11 mentions how they see that the OEMs need to be clear in their communication, suggest charging station operators, and not only think about the aspects of the car but rather make everything else around the technology work too. C11 also mentions that a relationship between a private leasing customer and the energy supplier is easy since the user pays for their own electricity and the electricity to their house. However, when talking about a company car and a third party being responsible, many rules apply. C13 states that the leasing car is an additional salary for the end driver. Hence, it will be challenging to earn money on a tax benefit. Regarding corporate customers, C10 and E5 see the tax benefits as one of the biggest challenges, especially since their customers can charge their cars at work and potentially sell energy through a V2G charger when they return home. C8 and E4 agree that legal regulations and the need for a tax system to support V2G are challenging in the implementation process.

Moreover, E4 discusses how understanding what V2G implies to a business purpose decides how complex the business model is and how difficult it will be to implement. Hence, there might be a need to have several different models for these purposes. Furthermore, C13 and E5 discuss the importance of standards aligning the different car models. E5 states that as the technology is relatively new, one needs to consider two components in the power grid and regulation: the charging station and the EV. E6 states that we need market leaders to pressure these laws and regulations. C8 agrees and sees lobbying as an important tool to put pressure and create awareness of the need for regulations that enable the usage of V2G.

5. ANALYSIS

The following section will connect the empirical findings with previous literature on V2G and technology diffusion. The empirical findings will be compared to the prior literature, further emphasizing the research phenomenon. This section is divided into two parts that structure the empirical findings to highlight the aspects of this research that build up to important considerations.

5.1 Benefits and opportunities with V2G to fleet customers

5.1.1 Benefit the society

In accordance with Clement-Nyns et al. (2010), all experts' interviews highlighted the fact that V2G could help to match the generation and consumption of renewable energy. This aligns with C2, C4, C8, C10, and C13's reasoning about stabilising the grid and the benefit it could bring to the society. Due to this advantage, C2 highlights that they and other companies have a responsibility to be involved, influence, and further push for the implementation of V2G.

Additionally, V2G offers the possibility to use and store more localised renewable energy (Uddin et al., 2017; Clement-Nyns et al., 2010) which especially E2 and E3 mentioned as one of the main reasons why the implementation of V2G should be accelerated. E5 also highlighted the advantage that V2G could enable the use of more renewable energy, which aligns with many of the respondent's sustainability strategies of becoming CO2 neutral in the near future. C4 should reduce their CO2 emission by 35% in 2025, and C10 founded the global project EV100 and aims to be CO2 neutral by 2030. Moreover, C9 has started a zero-emission transformation of the company, where the transport of delivery services should create zero emissions by 2025. If V2G can help push for more renewable energy, C9 explained that it is of interest for them to investigate. Hence, the advantages V2G brings to the society align with most customers' sustainability strategies.

Moreover, several leasing customers discuss how they must support their customers toward a green transition. E4 and E5 confirm that V2G will be an important component of a more sustainable energy system and hence a part of the green transition. In alignment, C7 points out that the strongest argument to push for this technology is because it adds another parameter to their companies' and customers' sustainability strategy. Thus, helping their customers choose sustainable solutions will indirectly also help them in their course in accelerating the reduction of CO2 emissions. Referring to Kaluza's (2022) study on why the driver participants wanted to start using V2G, one of the most prominent reasons was 'reducing their carbon print.' This is aligned with several of the fleet customers' perceptions as well. Furthermore, C4, C10, and C11 mention that most of their

customers choose EVs because of their internal CSR strategy, which will continue to be a selling point to push for current and new sustainable technologies.

5.1.2 Selling point

All customers mentioned that EVs have been requested from their customers on a larger scale over the last couple of years. C8 elaborates and means that the increased sales of EVs have been created naturally without a push from the company. This is mainly because of their customers' ambitious CSR strategy, which C8 explains is an important reason their EV sales have been boosted. This is because their customers' mobility services need to align with their sustainability goals, and thus a boost in EV sales has naturally been created. Furthermore, C6 and C13 mentioned that V2G could boost their EV sales, coherent with how C8 sees how CSR strategies boosted overall EV sales.

Another perspective that C4 and C6 discussed was how V2G could help their customers to use more renewable energy sources and thus become more self-sufficient with their energy production at home. Seeing this, C6 brings up self-sufficiency as a selling point for their customers due to environmental and economic incentives. C2 also mentioned that this is how they work today, to package a whole solution for their customers, bringing an additional selling point. This is aligned with C9's strategy of utilising the energy they produce with solar panels at their buildings. C9 highlights the V2G technology implementation as a possibility to have renewable energy sources in place and hence be coherent with their strategy. This is in accordance with E4's discussion about how the car can be combined with other renewable energy sources and function as backup electricity for the users to ensure that the energy will be renewable at a certain time.

Regarding economic incentives, E5 states that V2G can lower the energy cost for the end user if they, for example, use electricity when it is cheaper and trade it through frequency markets. This is coherent with Kaluza's (2022) study of how V2G users could eliminate their household energy costs, where the average customer could save 466 to 960 dollars per year, depending on how active and engaged participants were. C6, C7, and C10 all mentioned the advantage of how V2G technology can save money for the end user, which will be a selling point to their customers. This aligns with C2 and C7's reasoning that, in the end, most of their customers are financially oriented. This was also shown in Kaluza's (2022) survey, where the driver participants stated that 'saving money' was one of the main reasons they wanted to use V2G. C9 confirmed this and stated that the costs that V2G can save make it interesting to investigate the subject immediately. Hence, the economic incentives for the driver will be important considerations to boost the usage of the V2G technology and the overall EV sales.

Most experts see economic incentives as an opportunity to increase the adoption of V2G at the beginning of the implementation. If the incentives further lead to a spread of the adoption, it creates high observability, which according to Rogers (2003), is one of the success factors for a high adoption spread in new technology. Hence, incentivising the customer and thereby creating higher observability will be important to achieve a high adoption of the technology.

5.1.3 New business opportunities

Besides the environmental advantages V2G brings to the society and the case company's CSR strategy, some fleet customers also stated the opportunity of building a new business around V2G. Huang et al. (2021) bring up the aggregator function as a potential new business model within V2G, where aggregators are allowed to manage the EV's battery, and the EV driver can get remuneration for the inconvenience of having the EV plugged in for specific hours a day. Bringing up potential vehicles that can be connected, C2, C4, and C5 see the possibility of connecting their vehicles to work as an aggregator since they own a fleet of vehicles that have a lot of energy capacity together. This is further aligned with E1 and E5's reasoning about having a leasing company take on a potential aggregator function. C2 mentioned this as an opportunity within the remarketing of their vehicles since they have many cars standing still in their parking lot for weeks before they sell them to the secondary market. Hence, if they had V2G capable cars in this parking lot, they could be connected to form a giant battery with energy capacity that could be sold to balance the grid. Khezri et al. (2022) mentioned the importance of the aggregator role to have an efficient V2G strategy, which confirms that the fleet customer's possibility to take on this role could be exciting and important to investigate.

E1 and E4 confirmed this V2G opportunity for the case company's fleet customers since they can connect all their vehicles, become aggregators, and sell electricity to grid providers. Another perspective that both C4 and E5 discuss is the advantage of car-sharing vehicles being V2G compatible since those cars often have one owner and stand still most of the time. With all these new opportunities, V2G opens new revenue streams in an existing product, which fleet customers can use.

5.2 Challenges with implementing V2G to fleet customers

5.2.1 Creating value for all stakeholders

One of the challenges mentioned by almost all experts and customers was the complexity of taking all stakeholders into account and creating incentives throughout the whole value chain. Roger (2003) interpreted the different stakeholders as a social system of interrelated units that together are engaged in joint problem-solving to achieve a common goal. However, this is something the

interviewees see as complex practically. Especially, E3 mentions the importance of finding the interfaces and areas of responsibility between the different actors in the V2G market. E4 believes V2G has the potential to be part of the existing system. However, E4 also states that it depends on to what extent the different actors need to be influential in the business model, which leaves him with the insight of V2G being more complex than at first sight. E4 further mentions the connections between different actors as required for V2G to work and discusses that, at present, the unclear roles between the different actors within the V2G market are preventing the technology from adapting to the existing technology system.

Most of the customer respondents discuss the importance of having a clear and attractive business model in place where both themselves and their customers capture value to push out the technology and achieve adoption. C2, C5, and C10 want this value to be economic and part of the revenue stream. However, C2 also thinks that, in the end, it is only important to be part of the revenue stream to ensure a proper working vehicle. On the other hand, C4, C6, C7, C8, and C13 do not necessarily see the value of V2G as economical in terms of the revenue stream it could make but rather as a boost in their sales of EVs or to add another sustainability parameter to their strategy. Seeing this, E4's discussion about mapping out values for each customer segment is critical. E4 further stated that the business model could potentially look different in different countries due to both differences in regulations and incentives.

Regarding an end user or driver, some respondents state that they are financially oriented, which makes the financial incentives important at the beginning of adopting the technology. Seeing that C2, C5, and C10 all want to be a part of the revenue and how C5 highlights the fact that they own the batteries and, therefore, should have all the advantages that V2G brings makes it a more complex to push out the technology for the users. The opinion on whether the fleet customers should be integrated into the revenue stream or not was divided among the customers, which will make it difficult to fulfill every requirement. This could potentially slow down the implementation process.

Moreover, according to E4 and E5, creating incentives for the user to plug in the car for a certain time can also be a challenge. This is further in accordance with earlier studies which showed that most drivers were concerned about the inconvenience of long plug-in times due to a fear of not having the required energy stored in the EV when unpredicted journeys become necessary (Geske & Shuman, 2018; Huang et al., 2021; and Zonnevald, 2019). Hence, finding the right incentives for end drivers will be crucial for the higher adoption of V2G. Another perspective that C13 brought up is the added investment costs that V2G can force the driver to invest in if the driver wants to use the technology at home and have its charging box. Connecting it to Painuly's (2001) study about social barriers to the commercialisation of renewable energy solutions, the findings showed that the

financing option is a primary barrier as it may include a high cost of capital, which can be the case if the fleet customer or their customer needs to make new investments to use the technology.

5.2.2 Finding the early adopters

Several customers and experts highlight the fact that the market for this technology is still very immature. C5, C7, C9, and C10 raise technical understanding as a reason why the market is not mature enough for discussion yet. This is mentioned together with statements about the high investment cost for the technology, the need for new chargers, and still minimal knowledge from the end customers. This is fully connected to Juszczyk et al. (2022) study on new renewable energy technologies barriers, where the researchers found the shortage of financing options and poor social awareness as significant barriers to diffusion. Juszczyk et al. discussed the lack of consumer acceptance and stated that it could be hard to penetrate the market if the product is new and unknown and therefore lacks appeal to its customers.

C10 and C13 elaborated that it will be important to communicate and increase the understanding of V2G among the first movers since they are important to create a higher adoption. Connecting this to the diffusion of innovation theory and the S-curve, where new technologies adopt over time, this customer adoption starts with innovators, to be followed by early adopters (Roger, 2003). According to Roger, early adopters can be treated as change agents to speed up the diffusion process and are important individuals to trigger the critical mass when adopting new technology. E4 refers to this S-curve and states that, in cases with technologies such as EVs, this curve might be less steep, implying longer adoption times. Since many customers and experts mention the challenges of how the technology is young and few people still understand what it means or will imply, there might exist a need to find these early adopters.

In the renewable energy transformation processes, Jacobsson and Johnson (2000) concluded that primary movers leading the change are important promoters for the technology to raise awareness of the technology at the beginning of the diffusion process. Here, the case company plays an important role in wanting to accelerate this implementation of V2G. However, it can only happen with customers who want to try the V2G functionality. The low initial understanding of the technology that both customers and experts point out implies that the case company needs to look for customers interested in collaborating and trying out different potential solutions.

Furthermore, C8 mentioned how the leasing industry always thinks about the cost perspective of new products. Since historical data does not exist and it is hence difficult to calculate the actual financial reward that V2G could create, there might be a need to look for customers to test who can be pioneers and see the non-economical wins and potentials in the technology. C6, for example, sees

how V2G will be a step towards the green transition, which is the center of their core strategy. Further, C9 mentioned that they are in the middle of their charging infrastructure decisions and that now would be the right time for them to understand the implications of the infrastructure of V2G. Acting on this implication soon, C9 may find it easier to harmonise the new V2G solutions with the current ones being built. Since it is also in their interest to ensure that the power grid is not collapsing and to use more self-produced energy, they would be open to collaborating and trying out the technology in the early stages. C9 says it would be interesting to also work with the leasing companies they are buying their cars from to try out new solutions.

C2, C11, E2, and E6 mentioned that a large demonstration has the potential to lead to an increased usage of the technology, which is why testing and tryouts, together with early adoption, seem to be an important step in trying to accelerate the V2G technology. E6 sees potential in doing tryouts with companies rather than retail customers since it can include many vehicles in one tryout, and companies would probably be eager to help due to their strict targets and objectives of adding to their CSR strategy. Moreover, in accordance with Rogers (2003), high trialability is one of the factors that contribute to an innovation's success. Testing an innovation at firsthand can lead to a higher success, which is something C2 is also pushing for, as it will be crucial to show how the technology works in an early stage to get many users convinced.

5.2.3 Calling for transparency

Several customers mention a concern regarding the separation of the ownership and usage of the battery. E5 also mentioned this as a challenge since it will be required to guarantee a good battery condition. Since current studies from a couple of years back state opposite findings (Dubarry et al., 2017; Uddin et al., 2017), customers are still determining how to calculate the value of their vehicles. E2 and Uddin et al. (2018) expressed the different types of battery degradation, which is dependent on either age or usage, and E2 elaborated on how the battery gets affected and potentially harmed will depend on the usage of the battery. E5 stated that models and calculations need to be in place to prove the actual states of the battery, and this aligns with what customers express as necessary when calculating the value of the car. C5 and C8 expressed the need to understand the car's residual value since this is a critical aspect of calculating correct prices for a leasing company. This can also be connected to the state of charge, which C2 brings up as necessary not to reduce significantly to sell the cars after the leasing periods. Since EVs are relatively new to the market, the state of charge after several years has not yet been stated. This, C2 thinks, will put further pressure on the V2G technology to show that the technology does not significantly reduce the state of charge due to high uncertainty in the battery condition. Additionally, C3 highlighted how a leasing business builds

upon the expertise of calculating the risks and knowing the value of the car. These risks mentioned, C2 says, need to be included in the discussion about what V2G means for everyone involved.

The importance of the potential battery degradation was previously brought up by Uddin et al. (2018) as a crucial concern connected to implementing V2G. Although C6 is not worried that the V2G technology would harm the battery, especially not more than what fast charging is doing, C6 expresses the need for an open dialogue between OEMs, themselves, the driver, and the company leasing the vehicle for the driver. This is because there needs to be an open platform where data can be shared, and discussion can take place for how the V2G usage works. He also states the need for an "open sanity check" to have a standard for controlling the battery condition. C2, C4, and C5 also expressed the need for transparency, shared data, and open discussions.

Further, C2 and C10 mention that the OEM needs to provide a warranty that can account for the V2G usage. Since no historical data exist, customers feel the need to be part of the data that will be produced and to understand the implications of the implementation of V2G to their businesses. C4 discussed the importance of testing and seeing how V2G affects the battery before they could make it accessible to all customers. The need for the customers to understand the value of the vehicles can also be connected to the need to find these early adopters, as discussed in the previous section. These tests and trials will be important to make the leasing companies save by pushing out this technology to their customers.

5.2.4 Enable actual usage

To make it possible to offer the technology to the end users, most respondents, both customers and experts, express the need to make this work with legal requirements and packaging this easily and understandably for the user. C9 highlighted an obstacle in harmonising the technology in the current ecosystem of energy solutions, which will be important to penetrate the technology into the market. Additionally, all markets require different standards and the adoption of local systems, which might apply to different business models that need to be created. C1 stated significant differences between their different markets and how it, to bring this forward, is important to investigate each market specifically. E4 also mentioned this challenge and that some markets allow for support services to be offered to the grid while others do not. This implies that opportunities connected to new business opportunities will not apply to all markets. One big challenge can be to create these types of markets, but because of this, it will be important to find the markets that are most mature and ready to adapt to this new technology and EV infrastructure. Here, C2 expressed that northern Europe, for example, is far ahead of the southern countries. E5 mentioned an aspect to this where some markets, such as Portugal, Spain, and Germany, are using gas networks or natural

gas for heating, which will be a considerable barrier to V2G adoption since these markets would need to focus on investing and expanding their energy systems to enable this usage.

For the markets where the infrastructure and the electricity grid allow V2G technology usage, regulatory barriers are among the most important things to overcome to implement V2G. Elaborating on this, C8, C10, E1, E4, E5, and E6 expressed the need for regulations before starting to use the technology. E6 explained how regulations are necessary for the technology to become mainstream and achieve high societal adoption. C10 sees the tax benefits as one of their biggest challenges since their customers can charge at work and potentially sell their energy back to the grid when they come home. E1 confirmed these challenges by mentioning that the current laws "cannot even spell energy storage that travels around on wheels." As Reddy and Painuly (2004) found when researching outstanding diffusion barriers in renewable energy projects, they found financing, taxation, and regulation as the three main barriers in their study, which are aligned with important barriers mentioned by the respondents. Reddy and Painuly pointed out governmental intervention as an essential tool to remove barriers connected to these projects, which is aligned with C8 and E6 discussion, where they highlighted the importance of putting pressure on the government to accelerate the creation of these laws and regulations. Other findings from studying barriers to energy storage solutions found that the classification of storage as a generation asset was one of the main barriers (Gisset et al., 2018), which created uncertainties in regulations. Ruz and Pollit (2016) found similar results of how Europe lacks energy storage jurisdiction in the energy storage legislation. Hence, the definition of the value seems to be a problem for both customers and regulatory frameworks.

5.2.5 Creating an easy user experience

Besides the regulatory requirements, many respondents mention the need for clear guidelines and standards on how V2G should be used. C6 refers to how there needs to be discussions about how the battery suffers from someone optimising their energy consumption. It means there should be some standards and recommendations on what is agreed upon when using V2G. C5 claimed that the facilitation of V2G will be necessary. Hence C5 proposed the need for a contracted behavior to ensure that the monthly leasing cost offered to the driver reflects the conditions the car will be in after the contract.

Similarly, C2 said they would like to have some assurance if something happened to the battery. Hence, fleet customers need to understand and be compensated for what potentially can happen to the battery. E2 agreed that it is important to control the usage of V2G since the goal is to maximise the benefit of the battery during the period of use, and E5 emphasised the need for models to be in place on how to use it to meet the demand of balancing the peaks. C4 and C11 referred to this as the

need to package the offer so that it is easy to understand, and E1, as well as E4, confirmed this by stating how they need to put the V2G information in a good user story and create a straightforward explanation of the technology. Both E2 and E3 highlighted the need for a seamless customer experience and how it needs to be easy to understand the technology, hence, the offer needs to imply simplicity. This confirms Rogers (2003) previous theory, which states that high complexity will lead to low user adoption.

The V2G concept is still unknown to most EV drivers, and the more extensive trials that were made deploying 300-400 chargers with OVO costumes found that it is crucial to build customer confidence and to create ease and simplicity around the technology. Most customers mentioned the consulting approach they need towards their customers about what options exist on the market, which implies that leasing companies can affect their customers' choices and push for new technologies such as V2G. However, leasing companies need to feel safe about the offer to make their customers and the end driver understand how this can be used easily.

Moreover, C6 brought up the need for a discharging rate that allows for discharging more energy than possible in vehicles that are V2G compatible today. This is to incentivise the driver to become self-sufficient and use self-produced energy and V2G as a solution for their homes. Hence, this comes back to finding the right incentives to ensure the customers plug in their vehicles. Additionally, the different aspects of financial incentives, packaging the technology into an easy offer, and understanding what the customers want to use it for needs to be added together. C6 brought up the difference in if customers are likely to use it as a self-sufficiency storage solution or if it will likely be used for optimising energy consumption and lowering costs as much as possible. This again connects to the need to contract the behavior to not end up in a situation described by C2, where the battery has suffered a lot due to someone optimising its own energy consumption through their company car.

The technical performance of EVs is shown to influence EV owners' willingness to participate in V2G adoption (Geske & Shuman, 2018; Tan et al., 2015). Additionally, Huang et al. (2021) found that technological barriers can be erased if it is possible to guarantee a minimum battery level in the widespread adoption of V2G. Hence, this confirms the importance of overcoming technical restrictions for the end user for the leasing companies to sell V2G contracts. This also implies that fleet customers need to be aware of the driver barriers to account for these when creating an offer.

6. CONCLUSION

This chapter concludes the main findings from the study. The first section answers the research questions, including what the case company needs to consider regarding the benefits to provide and the challenges to overcome. The second section provides practical and theoretical implications of the findings and suggests future research based on this study and its limitations.

6.1 Answers to research questions

The analysis found themes that both confirm the previous literature review and provide a new perspective from the fleet side of the business. The first part of the study aimed to find fleet customers' perceptions of how they can benefit from V2G adoption to gather important considerations for the case company to accelerate the implementation process. The concluded perceived benefits for the researched fleet segment are that V2G creates (1) benefits for the society, (2) additional selling points, and (3) new business opportunities. The benefits for the society are the main reason the case company wants to accelerate this implementation, and leasing companies confirm this importance too. These benefits include stabilising the grid and transitioning towards utilising more renewable energy in societies. This can further be formed into selling points for EVs for the leasing companies' customers to align with their CSR strategy and have the potential to become more energy self-sufficient. Another important selling point for the corporate company, or end driver, will be cost savings, seeing that the respondent highlighted the economic incentives as important. Lastly, several respondents mention the possibilities for new business opportunities. Owning a fleet of vehicles makes it possible to connect these vehicles and fill an aggregator function with the energy capacity they can offer to the electricity suppliers or grid operators. The benefits for the society, the possibility of selling more EVs, and the new business opportunities are important considerations to account for to get fleet customers on board the V2G adoption.

The second part of the study aimed to find perceived challenges by fleet customers that can limit the V2G adoption and establish important considerations of what the case company needs to overcome. The concluded perceived challenges to the V2G implementation are to (1) create value for all stakeholders, (2) find the early adopters, (3) respond to transparency, (4) enable actual usage, and (5) create an easy user experience. It is found that most customers want to ensure that V2G creates value for both them and the end driver since the fleet customers are the owners of the vehicle, and the driver needs to be incentivised to keep the vehicle plugged in. It is a complex ecosystem of many different parties involved, which creates a need to clearly specify where value should be created and create business models where all stakeholders can benefit from the technology. It is also important

to define the different roles within the system since unclear roles between actors prevent the technology from adapting to the existing technology system. Due to this complexity, finding early adopters who can lead the adoption is important. These customers can work as promoters and raise awareness at the beginning of the diffusion process. Furthermore, it will be important to have open discussions with everyone involved and show transparency concerning the battery condition. This is due to the need for leasing companies to calculate the correct residual value of the vehicle, which their business is built upon, and the unknown effect of V2G on the battery. Additionally, it will be necessary to overcome the regulatory and technical barriers to make it possible to integrate V2G into current systems and package the offer into an "easy-to-use" functionality. These mentioned challenges all point out the need to ensure that fleet customers are confident about the technology and its implications before they can push their customers or the drivers to adopt the technology.

6.2 Implications and Contributions

6.2.1 Theoretical implications

An older study from Jacobsson and Johnson (2000) found three main components for the renewable energy transformation process; (1) Actors on the market, specifically prime movers who are leading the change, (2) networks and different organisations, and lastly (3) institutions including capital market, legalisation, or educational systems. V2G is an accelerator of the renewable energy transformation, and the findings from customers today of what is required for the adoption today are similar to those from Jacobsson and Johnson. This strengthens the suggestion to find the actors and early adopters who want to lead the change together with the case company, which is also confirmed by other researchers (Hutt & Speh, 1992; Brierty et al., 1998; Kotler, 2003). Consequently, the case company needs to lead the way to enable adoption and create markets within current systems and regulations to accelerate the V2G implementation as soon as possible. In addition, the previous literature on commercialisation of energy storage technologies (Reddy and Painuly, 2004; Gissey et al., 2018; Meijer et al., 2019) have found regulations, financing options, technical understanding as well as social awareness as barriers for commercialisation, which this study also confirmed.

Moreover, the findings show a new perspective to previous research regarding the implementation of V2G. The fleet side has been unexplored in the literature regarding this topic, although fleet customers are often the majority customer segment of an automotive company. Hence, this customer segment owns most of the vehicles sold by OEMs, making them a critical segment to include in adopting the V2G technology. This implies how understanding the opportunities for fleet customers in the V2G value chain and capturing them in the business model is an important step in

achieving widespread adoption as soon as possible. One of the important findings concerning these opportunities is the possibility for fleet customers to fill an aggregator function and connect their fleet of vehicles to offer the grid operators additional capacity. However, the aggregator role and which actor should fill this function are still under consideration. Another new aspect of the study is the possibility of customers becoming energy self-sufficient. This can be a significant incentive for end drivers and companies trying to utilise the energy they produce more efficiently.

The study further confirms and aligns with several findings from previous research and literature on the benefits and barriers of the technology. The possibility to stabilise the grid, utilise more renewable energy sources, and cut costs are all recognised as advantages and brought up by the study's findings and the literature review. Furthermore, the perspective of fleet customers in this study confirms many aspects that the literature review found on barriers to V2G. These similarities include battery degradation, the requirement for intensive communication, infrastructure changes, and social, political, and technical obstacles (Yilmaz & Krein, 2013). Tan et al. (2015) also mentioned how the technology is immature and that economic, technological, and social challenges must be overcome for full adoption. Although previous research on customer acceptance has been low compared with the technical aspect (Sovacool et al., 2017; Park Lee, 2019), a study from Kaluza (2022) researching retail customers' willingness to participate in V2G discovered that saving money, being a first adopter and reducing their carbon print was the three most important factors for adoption. When comparing the results to fleet customers' willingness to participate, the financial incentives and reducing their carbon footprint are also important. However, being an early adopter is not mentioned as a reason for adoption. Instead, the case company needs to find these early adopters to make sure that others want to follow. The conclusion of this study and the fleet perspective also confirmed previous research from the driver's perspective of how it is crucial to build customer confidence and to create ease and simplicity around the technology.

6.2.2 Practical implications

The implications of the results to the case company are the need to consider the fleet customers and adapt the business model towards this segment when preparing the implementation of V2G. There might be a need to create different models to make sure that they capture the need of each stakeholder and the value that each participant wants to perceive. The leasing companies have a consulting role towards their customers and end drivers, which means they can push the drivers in different directions depending on what they believe is a great offer. This implies the importance of creating a V2G offer that adds value for the leasing companies to ensure that they inform about this technology to their customers and incentivise the driver to have the vehicle plugged in even when the car is fully charged. It was also found that some customers expressed that they would like to be a

part of the revenue stream created with V2G. However, this is connected to ensure that they do not suffer from a harmed battery which would result in a lower residual value. This is why mapping out values for the different customer segments is important. On the other hand, the customers who do not express a will to participate in created revenue express the need to know that they can trust that no harm will be done to the battery or believe that they will sell more EVs if they can offer V2G capable vehicles.

The results also imply that several fleet customers want to be a part of investigating the effect that V2G might have on the batteries. Many respondents express a will to participate in the testing process and receive the data created from this to create an open platform with discussions about the effects of V2G over time. Previous research has also suggested how firms should, to succeed in the launch of innovation, be increasingly interactive with their customers during the development of the innovation (Von Hippel, 2010), which aligns with the willingness of customers to participate in the early phases. The mentioned need by the customers to be a part of a V2G revenue model or not could also be dependent on how involved they want to be in the initial steps of finding a business model and how the contractual behavior for the usage of V2G is created. The higher risks included in the adoption, the more likely it is that the customers need to be compensated by taking part in the revenue streams that the technology has potential to create. For example, one reason mentioned for wanting to be a part of the revenue created was the need to ensure a properly working vehicle.

Moreover, it is discussed how it might be easier to test V2G on fleet customers rather than retail customers since fleet customers already have a fleet of vehicles that could easily be connected. Hence, since several fleet customers express a will to collaborate to find suitable solutions, these customers could be potential collaborators in new pilot projects where many available vehicles are needed. Previous research also found that the users involved in the developing process often are the early adopters of the innovation (Droge et al., 2010). Additionally, one customer explained how they are now building their charging infrastructure and that discussions of the implications of V2G need to be a part of this setup. Hence, creating awareness now about V2G solutions that are awaiting in the future will be important for customers to understand how they need to design the charging infrastructure today. The overall findings show that customers expect an implementation of this technology, and the question is rather about when this will be possible. This implies that the case company will need to take the lead and create a way to adopt this technology in society.

6.2.3 Limitations of study and suggestion for future research

Due to the willingness of customers to be a part of the testing phase for V2G and participate in collaborations to take part in open discussions related to this topic, future research is suggested to be performed in pilot projects where the technology and business models can be tested together with

both leasing companies, corporate customers, and end drivers. Due to the existing technology and the complexity of creating value for all stakeholders, trying out different potential solutions or models should be the next step in accelerating this implementation. This brings us to the topic of creating the business model, which also needs to be enabled within regulations and systems. Future research is hence suggested to be in collaboration with the early fleet adopters that this study concluded to be essential to find in the next steps of overcoming the challenges with creating a complete offer that is going to be easy to adopt for all EV drivers within the near future.

To finalise, this paper has discussed a new technology that is inseparable from the need for a new business model. Therefore, old literature may not give us enough tools to provide the needed information. We overcame this by drawing on new results from interviewing people close to the industry to address the research questions. This showed how we can open new research directions where further investigation and contributions on this topic are suggested.

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APPENDIXES

Experts respondents

ORGANISATION	NAME	ROLE	DATE	LENGTH
Göteborg Energi	Henrik Forsgren, E1	Senior Project Manager - Mobility and Energy Consumption	3/4	46 min
Case Company	E2	Project Leader for V2G	12/4	41 min
Case Company	E3	Manager Charging & Energy	12/4	55 min
Gothenburg University	Jon Williamsson, E4	Senior Lecturer and Researcher within Sustainable Businesses	13/4	52 min
Chalmers University of Technology	David Steen, E5	Researcher at Electric Power Engineering	17/4	51 min
GodEnergi	Jan Darville, E6 & Kasper Hjort, E7	CEO and Founder & Area Manager for EVs	18/4	50 min

Customers respondents

CUSTOMER	NAME	ROLE	DATE	LENGTH	MARKET
Leasing Company	C1 & C2	Global Procurement Manager & International Business Owner e-Mobility	9/3	62 min	Global
Leasing Company	C3 & C4	Head of OEMS Relationship & Head of Mobility Partnership	13/3	60 min	Global
Leasing Company	C5	Consultant Project Manager	13/3	35 min	Sweden
Leasing Company	C6	Managing Director	21/3	37 min	Finland
Leasing Company	C7 & C8	Key Account Manager & Country Manager	27/3	57 min	Sweden
Corporate Company	C9	Global Category Manager - HR, Travel Services, Fleet and Mobility	11/4	45 min	Global
Leasing Company	C10	E-mobility and Fleet specialist	14/4	30 min	Denmark
Leasing Company	C11 & C12	EV expert & Product Manager for Value Added Services	17/4	38 min	Denmark
Leasing Company	C13 & C14	Business Developer - Sustainability & International Sourcing Manager	20/4	28 min	Global

Interview Guides

A. Leasing Companies

Introduction

- Are you comfortable with the interview being recorded?
- Could you tell us your position and your relationship with the case company?

  How do you work with the case company?

Sales & understanding of the business

- Can you briefly take us through the process of how you normally buy a car from the case company?
- What is the standard time for a leasing contract with a customer?
- What do you do with the car after the leasing period?
    - If sold, to who and how? How do you calculate the value of the car?
- Does a new leasing contract with a customer always include a new purchase of a car? Meaning, do customers always get a new car? Or do you also offer "old" cars to leasing customers?
- Are you happy with the warranties you get from the case company? Especially considering the battery warranty.

Sustainability

- How does your company work with environmental sustainability and with reducing carbon emissions? Is this something you work actively with?
- Do you see an increase in demand for electrical vehicles?
    - Do you have a set goal for the percentages of EVs bought compared to combustion engine cars?
- Do you see any differences in environmental awareness among customers who are ordering electrical vehicles?

Introduction to V2G

- How much do you know about Vehicle-to-Grid?

Potential benefits with V2G

- Do you think the advantages that we have told you about would motivate your company in trying to push for this technology to your customers who are buying a new car?
- Besides the V2G advantages we already told you about. Can you see any other direct benefit to your firm with implementing V2G?

Potential challenges with V2G

- Can you see any direct challenges to your firm with implementing V2G? Including both economic and technical barriers.
- When you hear about this technology, would you believe that the customers would be positive to adopt it?
- Would you need to know about the effect the technology might have on the battery?
- Do you see any problems with the fact that customers would earn money by selling their electricity during off-peak hours? Would this affect you who is the owner of the car?
    - How do you see that you would like to be a part of this created revenue?
- How do you think that you would need to "sell" this technology to the customers?
    - Are customers normally aware of new technology and informed about their options?
    - Do you often get technical questions from your EV customers? Could you see the technical understanding as a barrier initially?
- Do you think about something specific that would be required in order for you to push for this new technology? Can you see yourself communicating about this technology as an opportunity?

B. Corporate Company

<u>Introduction</u>

- Are you comfortable with the interview being recorded?
- Could you tell us about your position and your relationship with the OEM?

<u>Sales & understanding of the business</u>

- Could you briefly elaborate on the sales process for when you are buying a vehicle. Are you buying cars via direct purchase or via a leasing company?
    - If direct purchasing, what do you do with the car after the leasing period?
        - If sold, to who and how?
- What is the standard leasing time/contract for an employee at your company?
- Do you provide your employees with charging stations at the office?
    - If so, are you providing free charging for employees?

<u>Sustainability</u>

- How does IKEA work with environmental sustainability and with reducing carbon emissions? Is this something you work actively with?
- Do you have any specific sustainability requirements when entering new partnerships?
    - Do you set any type of requirement when it comes to company cars? Or can the employee choose whatever car he or she prefers?

    - Do you have a set goal for how many of your fleet cars should be EVs? Or are you promoting this in some way?

Introduction to V2G

- How much do you know about the concept of Vehicle-to-Grid?

Potential benefits with V2G

- Do you think the advantages above would motivate your company in trying to push for this technology to your employees who are leasing a new car?
- Besides the V2G advantages mentioned. Can you see any other direct benefit or possibilities to your firm with implementing V2G?

Potential challenges with V2G

- Can you see any direct barriers to your firm with implementing V2G? Including both economic and technical barriers.
- Do you see any problems with the fact that customers can earn money by selling their electricity during off-peak hours?
    - Could it be a potential problem that employees charge their car at the office and perhaps later sell the energy at home?
- How do you see that you as a company would like to be a part of this revenue that your employees can create?
- Could you see the technical understanding as a barrier initially?
    - Are employees normally aware of new technology and informed about their options?

If buying cars direct:

- Would you need to know about the effect the technology might have on the battery?

Final questions:

- Do you think about something specific that would be required for you to push for this new technology? Can you see yourself communicating about this technology as a good alternative for your employees?
- Lastly, is it something you want to add that you think can add valuable insights to our study?

C. Case Company Experts

Introduction

- Are you comfortable with the interview being recorded?
- Could you tell us about your position at the case company?

Energy distribution & Renewable Energy

- What challenges do you see currently related to the electrical distribution system?
- What challenges do you see with producing and using renewable energy?

Introduction to V2G

- How much are you involved in V2G?
- How does the case company currently work with V2G? How far have you come in the implementation process?
- Why is it important for the case company to accelerate the V2G implementation?

Potential benefits with V2G

- What advantages do you see with V2G (including different stakeholders such as end drivers, OEMs, energy suppliers etc.)?
    - Who do you think will benefit from the introduction of V2G?
- To what extent do you see V2G as an opportunity to solve problems connected to challenges with electricity distribution?

Potential challenges with V2G

- What specific challenges can you see with V2G? Include both technical, economic, and social challenges.
    - What do you think are the barriers from a V2G user perspective?
    - What do you think are the challenges from the OEMs perspective related to the implementation process?
- Who do you think needs to benefit in terms of revenue creation?
    - The driver will be able to sell energy back and earn money. What role do you think that companies such as leasing companies or rental companies will have in this?
    - From the case company's perspective, do you see any problem with the fact that employees can charge their company car at work, and then sell back the energy at home?
- Do you have any internal investigations regarding how V2G might affect the battery?

Final questions

- What do you think would be required before being able to achieve a high adoption of V2G in society?
- Where are you today in terms of a potential revenue model?
- Finally, would you like to add anything that you think could be valuable for the thesis?

D. Energy Supplier

Introduction

- Are you comfortable with the interview being recorded?
- Could you tell us about your position at Göteborgs Energi?

Energy distribution & Renewable Energy

- What challenges do you see currently related to the electrical distribution system?
    - What patterns do you see in the demand of electricity?
    - How do you think that the increased usage of EVs in society will affect the power grid?
- What challenges do you see with producing and using renewable energy?
    - How can Sweden reach the target of 100 percent renewable energy by 2040?

Introduction to V2G

- How much are you involved in Vehicle-to-Grid?
- Is V2G on the agenda for Götebors Energi and something that you are talking about?
    - If yes, in what way do you currently work with V2G?

Potential benefits with V2G

- What advantages do you see with V2G (including different stakeholders such as end drivers, OEMs, energy suppliers etc.)?
    - Who do you think will benefit from the introduction of V2G?
- Could you see that Göteborgs Energi would try to push for this technology to customers who are owning an EV? Hence, being positive to use V2G at home or at work.

Potential challenges with V2G

- What specific challenges can you see with V2G?
    - What do you think are the barriers from a V2G user perspective?
    - What do you think are the challenges from the OEMs perspective related to the implementation process?

    - From an energy supplier's perspective, what would be the challenges if a mass adoption of V2G would take place?

- Who do you think needs to benefit in terms of revenue creation?
    - The driver will be able to sell energy back and earn money. What role do you think that companies such as leasing companies or rental companies will have in this?

Final questions

- To what extent do you see V2G as an opportunity to solve problems connected to challenges with electricity distribution?
- What do you think would be required before being able to achieve a high adoption of V2G in society?
- Finally, would you like to add anything that you think could be valuable for the thesis?

E. Interview Guide - Professor within Energy and Environment

Introduction

- Are you comfortable with the interview being recorded?
- Could you tell us about your position at Chalmers University of Technology?

Energy distribution & Renewable Energy

- What challenges do you see currently related to the electrical distribution system?
    - What patterns do you see in the demand of electricity?
    - How do you think that the increased usage of EVs in society will affect the power grid?
- What challenges do you see with producing and using renewable energy?
    - How can Sweden reach the target of 100 percent renewable energy by 2040?

Introduction to V2G

- How much are you involved in Vehicle-to-Grid?
- In what way do you currently work with V2G?

Potential benefits with V2G

- What advantages do you see with V2G (including different stakeholders such as end drivers, OEMs, energy suppliers etc.)?
    - Who do you think will benefit from the introduction of V2G?

Potential challenges with V2G

- What specific challenges can you see with V2G?
    - What do you think are the barriers from a V2G user perspective?
    - What do you think are the challenges from the OEMs perspective related to the implementation process?
- Who do you think needs to benefit in terms of revenue creation?
    - The driver will be able to sell energy back and earn money. What role do you think that companies such as leasing companies or rental companies will have in this?

Final questions

- To what extent do you see V2G as an opportunity to solve problems connected to challenges with electricity distribution?
- What do you think would be required before being able to achieve a high adoption of V2G in society?
- What do you think is the most important for OEMs to consider before implementing this new technology?
- Finally, would you like to add anything that you think could be valuable for the thesis?

F. Professor within Technology Innovation and Energy

Introduction

- Are you comfortable with the interview being recorded?
- Could you tell us about your position at Gothenburg University?

New technology

- What would you say are the most important aspects to think about before introducing a new technology that's creating an additional area of use for an existing product?
- How does a company need to involve their customers in the process of introducing a new technology?

- Are there any general requirements before being able to achieve a high adoption of a new technology in society?

Introduction to V2G

- How much are you involved in Vehicle-to-Grid?

  Varit involverad i Volvo AB och ett projekt i Danmark kopplat till fastigheter.

  - Are you currently working on anything related to V2G?

Potential benefits with V2G

- What advantages do you see with V2G (including different stakeholders such as end drivers, energy suppliers etc.)?
  - Who do you think will benefit from the introduction of V2G?
  - What benefits with implementing V2G can you see from an OEMs perspective?

The business model behind V2G

- What different stakeholders do you think need to benefit in terms of revenue creation?
  - The driver will be able to sell energy back and earn money. What role do you think that companies such as leasing companies or rental companies, hence the owner of the car, will have in this?
  - How do you think that companies might react to employees charging their car at work and then discharging and selling the energy when they come home?
- How do you think OEMs would need to work with partnerships or networks to implement this new technology among their business customers?
  - How much involved do you think the customers need to be?

Potential challenges with V2G

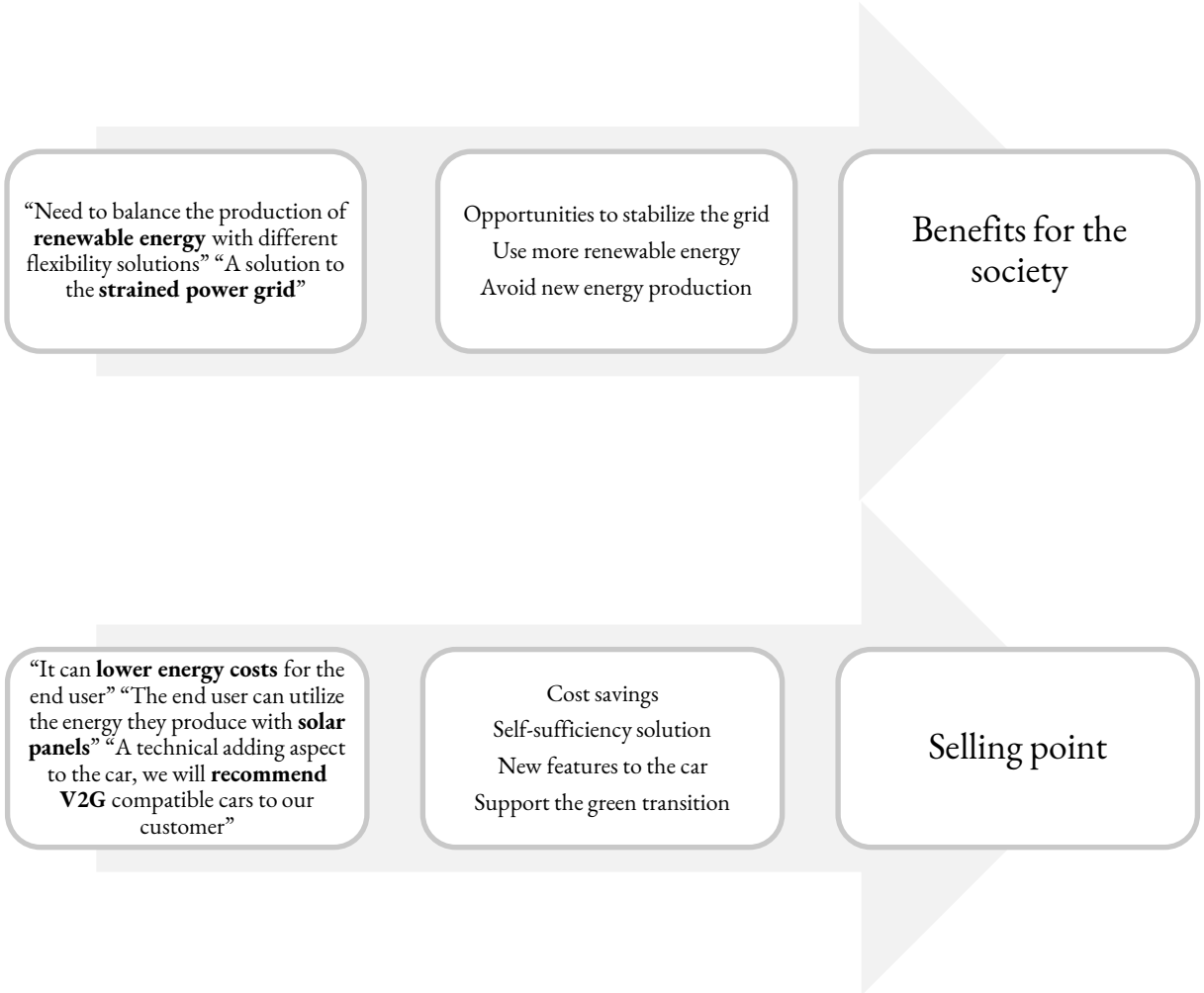
- What specific challenges can you see with V2G related to the current business model?
  - What do you think are the challenges from the OEMs perspective related to the implementation process?
- What do you think are the barriers from a V2G user perspective?
- Do you think that technical understanding is often an initial barrier when it comes to new technologies such as V2G?

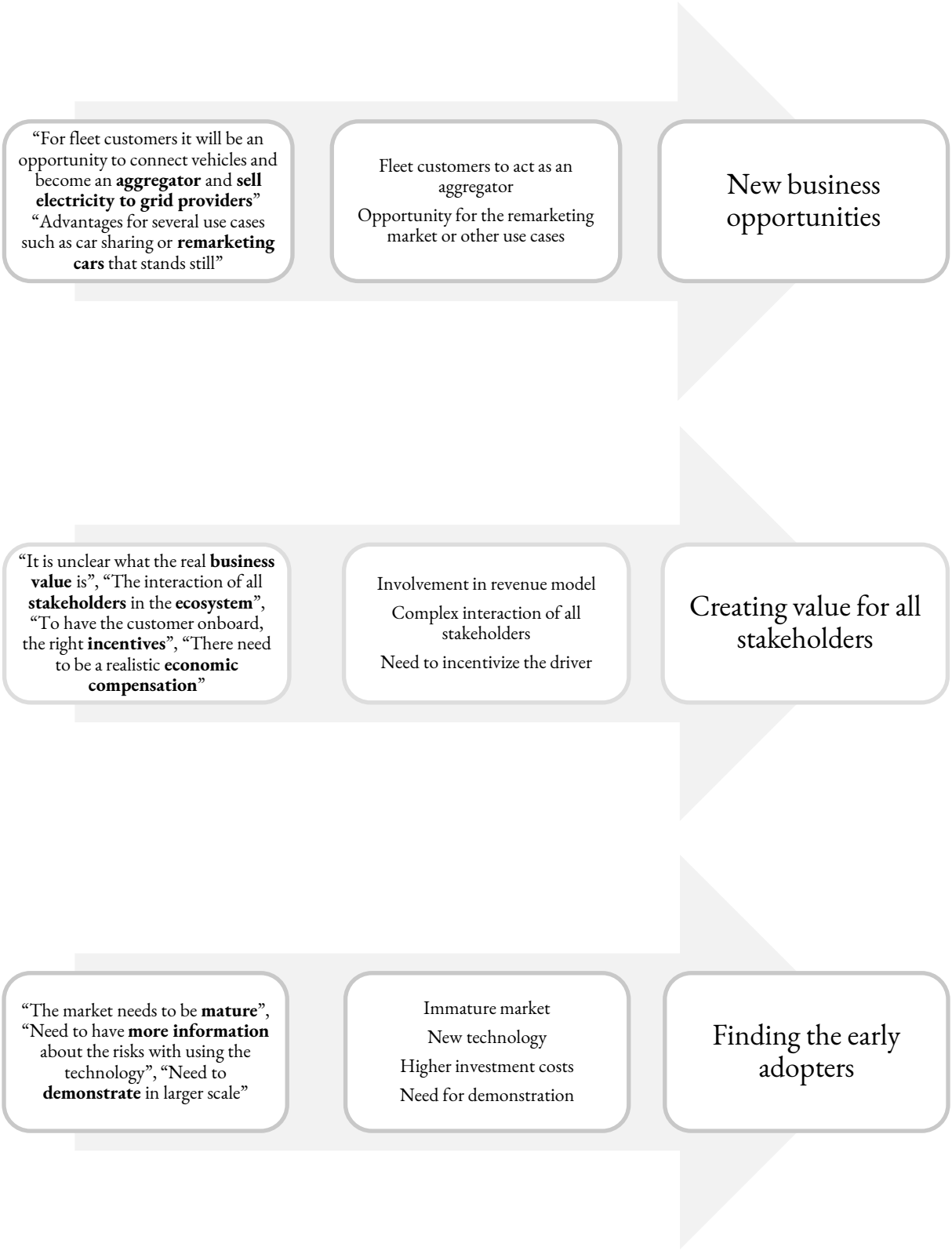
Final questions

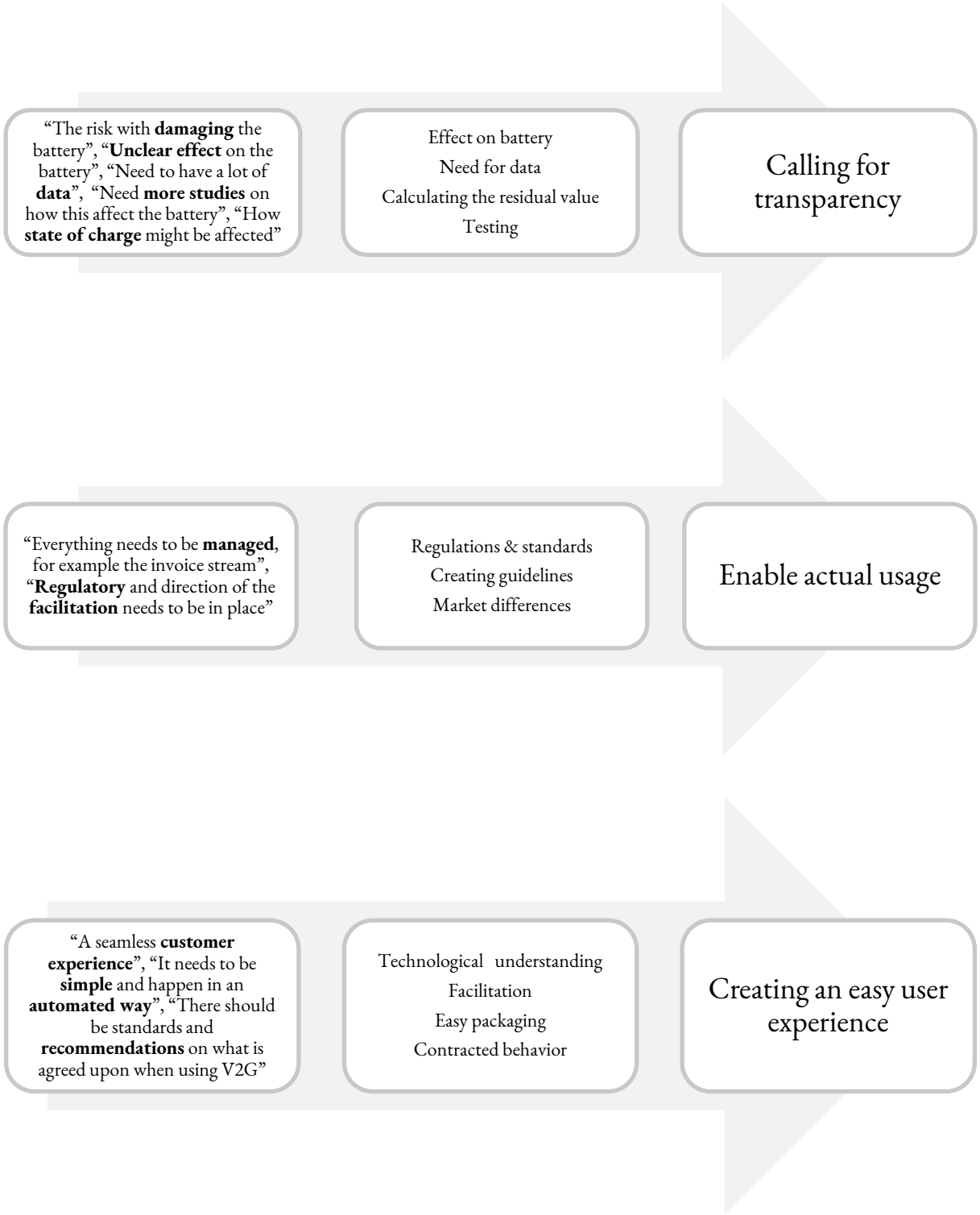
- What do you think is the most important for OEMs to consider before implementing this new technology?
- What do you think would be required before being able to achieve a high adoption of V2G in society?
- Finally, would you like to add anything that you think could be valuable for the thesis?

Data analysis process – coding examples

Examples on the process of identifying codes and concepts forming the themes.




"For fleet customers it will be an opportunity to connect vehicles and become an **aggregator** and **sell electricity to grid providers**"
"Advantages for several use cases such as car sharing or **remarketing cars** that stands still"
Fleet customers to act as an aggregator
Opportunity for the remarketing market or other use cases
New business opportunities
"It is unclear what the real **business value** is", "The interaction of all **stakeholders** in the **ecosystem**", "To have the customer onboard, the right **incentives**", "There need to be a realistic **economic compensation**"
Involvement in revenue model
Complex interaction of all stakeholders
Need to incentivize the driver
Creating value for all stakeholders
"The market needs to be **mature**", "Need to have **more information** about the risks with using the technology", "Need to **demonstrate** in larger scale"
Immature market
New technology
Higher investment costs
Need for demonstration
Finding the early adopters


"The risk with **damaging** the battery", "**Unclear effect** on the battery", "Need to have a lot of **data**", "Need **more studies** on how this affect the battery", "How **state of charge** might be affected"
Effect on battery
Need for data
Calculating the residual value
Testing
Calling for transparency
"Everything needs to be **managed**, for example the invoice stream", "**Regulatory** and direction of the **facilitation** needs to be in place"
Regulations & standards
Creating guidelines
Market differences
Enable actual usage
"A seamless **customer experience**", "It needs to be **simple** and happen in an **automated way**", "There should be standards and **recommendations** on what is agreed upon when using V2G"
Technological understanding
Facilitation
Easy packaging
Contracted behavior
Creating an easy user experience