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Building a Competitive Position in Europe's Charging and BESS Markets

*A study in understanding market competition in Europe and key criteria for an
OEM to differentiate with a competitive offer related to charging infrastructure
and battery energy storage systems*

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Abstract

This study explores how original equipment manufacturers (OEMs) can build a competitive position in the emerging European markets for charging infrastructure and battery energy storage systems (BESS) related to heavy-duty vehicles (HDVs). As electrification accelerates, OEMs face increasing pressure to extend their value propositions and move beyond their traditional roles as vehicle manufacturers. The literature review draws on theories that provide an understanding of both key characteristics and competitive dynamics of the market, as well as ways to build a competitive position within this market. A qualitative methodology was applied, including semi-structured interviews with industry consultants and firm representatives, supported by thematic analysis to identify the key criteria that shapes competitiveness in the industry.

The findings highlight that while the market is still fragmented and evolving, differentiation is increasingly driven by combining products and services, strategic partnerships, and adaptability to customer needs. This implies that OEMs must develop capabilities beyond manufacturing, particularly in software, data management and collaboration. The analysis shows that success for OEMs depends on the ability to innovate the business model and differentiate by offering turnkey solutions that span all the way from the electric HDV to the installation of charging infrastructure and BESS, as well as providing after sales service and support. These insights offer practical implications for OEMs navigating electrification and contribute to the academic understanding of competitive positioning in emerging markets.

Keywords: *Electric Mobility, Charging Infrastructure, Battery Energy Storage Systems, Competitive Dynamics, Competitive Strategy, Business Model Innovation*

Definitions

Heavy-Duty Vehicle (HDV)

In Europe, heavy-duty vehicles consist of trucks, buses and coaches which have a weight of more than 3.5 tonnes or more than 8 passenger seats (European Commission, 2014).

Charging Infrastructure

The U.S. Department of Energy (n.d.) describes charging infrastructure as “...structures, machinery, and equipment necessary and integral to support an EV, including battery chargers, rapid chargers, and battery exchange stations”. Through a connector, which is the physical interface between the vehicle and the recharging point, electric energy is delivered to the electric vehicles (EVs). In the European Union, EV charging equipment is categorized into two categories based on the speed at which it can charge a vehicle’s battery and the power output. Category 1 is recharging via Alternating Current (AC), while category 2 is recharging via Direct Current (DC). Within the categories, chargers are classified into sub-categories based on their power output and speed (European Alternative Fuels Observatory, n.d.).

Although electric HDVs can often use the same charging stations as light-duty vehicles, their larger size and battery capacity typically lead to longer charging times, which can disrupt operations, thus creating a need for dedicated equipment and facilities (IEA, 2024). Thereby, charging a HDV with AC Level 1 chargers is possible, but would be very time-consuming, hence an AC Level 2 or DC fast charger is more suitable (National Renewable Energy Laboratory, 2024).

Battery Energy Storage Systems (BESS)

A battery energy storage system is a system where electrical energy is stored in the form of chemical energy that can be discharged at any time. The BESS can be used for several different applications, but primarily works as a provider of electricity during outages or by reducing the purchase cost of electricity by shaving peaks, facilitating power reliability and lower cost of the energy system (Cready, Lippert, Pihl, Weinstock, Symons & Jungst, 2003).

HDVs require roughly 8 times more energy per mile as compared to light-duty vehicles, suggesting an even greater need for higher power to support charging. With the help of smart charge control strategies the peak demand of charging sites could be mitigated (National Renewable Energy Laboratory, 2024), but to improve grid stabilization, flexibility, resilience and efficiency, a BESS can be integrated with these charging systems (Muratori et al., 2021). The storage systems work as local distributed energy sources and supply some of the power needed during high demand, or to power the charger entirely during off-grid scenarios (National Renewable Energy Laboratory, 2024).

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1. Introduction

1.1 Background

The ongoing transition toward electrified transport is reshaping the competitive landscape across the automotive and energy sectors. In Europe, the electrification of heavy-duty vehicles (HDVs) is gaining momentum, driven by technological advancements, regulatory pressure, and evolving customer demands (IEA, 2024). In the European Union, the transport sector is currently responsible for a quarter of total EU CO₂ emissions (European Automobile Manufacturers' Association, 2020), and HDVs account for over 25 % of these emissions (Council of the European Union, 2024).

Several initiatives, such as the “EV30@30” campaign launched by the Clean Energy Ministerial with the objective of achieving a 30 % sales share for electric vehicles (EVs) by 2030 (Clean Energy Ministerial, n.d.) and the EU regulation mandating a 90 % decrease in CO₂ emissions for new HDVs from 2040 and onwards (Regulation (EU) 2024/1610), have been introduced to support the process of reaching the goals of lowering emissions and facilitate the transition to electrification. Although the sales of electric trucks grew 35 % between 2022 and 2023, the electrification of HDVs is advancing at a slower pace compared to electric cars, where electric trucks still account for only 1.5 % of total truck sales in Europe (IEA, 2024). This puts growing pressure on original equipment manufacturers (OEMs), firms that design and produce vehicles or key components, as these firms are central to the electrification of HDVs, but face growing pressure to adapt as markets evolve rapidly (IEA, 2024).

According to studies, several reasons such as charging time and the limited range hinders the adoption of EVs (Qasim & Csaba, 2021), however, the lack of charging infrastructure poses the biggest barriers to widespread electrification (Liimatainen, van Vliet & Aplyn, 2019; Anderhofstadt & Spinler, 2019; Qasim & Csaba, 2021; Melander, Nyquist-Magnusson & Wallström, 2022). This problem is often described as a chicken-and-egg dilemma, where EVs depend on a robust charging infrastructure, while the development of this infrastructure requires a sufficient number of EVs on the road to become profitable (Raoofi, Mahmoudi & Pernestål, 2025; Ziegler & Abdelkafi, 2022). As more electric HDVs such as trucks and large buses hit the road, dedicated and flexible charging is needed and is the next frontier to be approached (IEA, 2024). This interconnected system becomes even more critical in the context of electric HDVs, where energy demand and infrastructure requirements are even bigger (National Renewable Energy Laboratory, 2024).

The growth of EVs requires a massive expansion of charging stations, which in turn places increasing pressure on the grid (McKinsey & Company, 2023). A key challenge for rolling out charging infrastructure is ensuring that it can provide secure, low-emissions and affordable electricity (IEA, 2024). To meet rising energy demands, charging infrastructure can be combined with a battery energy storage system (BESS) (McKinsey & Company, 2023), which can provide power reliability or work as a provider of electricity during outages (Cready et al., 2003). According to Meyer, Schauensteiner and Riquel (2024) the growing demand for EVs are expected to drive the needs for these energy storage systems across all EU countries, and

the energy storage systems will become commonplace in the late 2020s. Furthermore, BESS plays an important role in the switch to renewable energy sources as it ensures a consistent energy supply while sources like wind and solar are inherently intermittent sources (IEA, 2021).

1.2 Problematization

The rapid transition toward electrification in the transport sector is reshuffling cards and reshaping global markets, creating both opportunities and challenges for industry players, and OEMs must compete fiercely to be able to capture their share of the growing pie. The demand for EVs, charging solutions, and BESS is increasing, and EV companies perform well in financial markets and have outperformed the stock markets and major traditional carmakers since 2019. Despite this, volatility in the form of, for instance, supply chain disruptions, battery metal price fluctuations, increased competition and price wars, raise concerns and lead carmakers to make direct deals with battery makers and companies involved in the mining and processing of critical minerals. In addition to this, shrinking margins push the least profitable out of the race, and while China's EV industry is consolidating around a small number of robust players, these are also looking abroad for expansion, posing a threat to European and US carmakers, and forcing them to adjust their strategies (IEA, 2024).

A key structural barrier in the EV transition has been the chicken-and-egg dilemma. This dynamic affects how OEMs can design their business models, as these can no longer be developed independently of the charging infrastructure but are increasingly intertwined with it (Ziegler & Abdelkafi, 2022). These interactions between technologies, actors, and infrastructure cause a complex interconnected system between all the elements (Abdelkafi, Makhotin & Posselt, 2013). The transition is further complicated by the fact that many new stakeholders have not previously been part of the internal combustion engine (ICE) vehicle value chains nor electricity supply (Kley, Lerch & Dallinger, 2011). The trend encourages players from the information and communication technology sector, mobility providers, electric utilities and others to broaden their business models and apply their competencies (Krommes & Schmidt, 2017). As a result, established companies and OEMs may face the risk of their business models, capabilities, and networks becoming obsolete (Antikainen & Valkokari, 2016). Furthermore, the capabilities required in this new ecosystem are not aligned with the capabilities that OEMs possess today (Lu, Chen & Shen, 2018), and traditional resources are no longer sufficient to secure competitive advantage (Teece, 2018). With new players and changing roles, there is a need for redesigning current value networks and business models, and radical innovations and disruptive business models are needed (Antikainen & Valkokari, 2016).

At the same time, the demand for BESS has increased, both due to the rising EV demand (Meyer et al., 2024), but also due to reduced prices on batteries in recent years, resulting in heavy investments which are expected to be more than doubled by 2030. However, the market is still highly fragmented with companies struggling to determine where and how to compete. The fragmentation is exacerbated by the presence of many customer segments and multiple business models on the market making it difficult for firms to decide on the best strategy

(McKinsey & Company, 2023). Furthermore, developing appropriate strategies and effective business models can create alternative revenue streams that can potentially lower the cost of EVs for consumers in the future (Jiao & Evans, 2016). Due to the complex interactions between technologies, actors and infrastructure (Abdelkafi et al., 2013), a key success factor will be to employ a multi-stakeholder perspective and form inter-industry partnerships. However, the fact that the energy market and the automotive sector are very different in nature complicates this (Meyer et al., 2024), but with the help of business model innovation, the currently isolated sectors could be linked (Jiao & Evans, 2016).

1.3 Purpose & Research Questions

The purpose of this study is to analyze the European market for charging solutions and BESS, with the aim of identifying key competitive factors that can enable OEMs of HDVs to achieve a strong market position. As the electrification of HDVs progresses, OEMs face increasing pressure to move beyond their traditional roles as vehicle manufacturers. This requires OEMs to innovate and develop new business models, reconfigure internal capabilities, and strategically navigate a dynamic market landscape.

Due to the fact that the HDV charging and BESS sector is an emerging market with significant growth potential, there is a lack of clarity on what competitive strategies will be successful in the market and how OEMs should position themselves to achieve long-term success. In addition to this, limited attention has been given to the specific strategic challenges faced by OEMs seeking to compete in these markets. This study will bridge that gap while also contributing to academic discussions on competitive positioning in emerging markets. Since the market for charging infrastructure and BESS is tightly connected to the broader development of electric mobility, this study takes a broader perspective when mapping key market characteristics, as this allows for a more complete understanding of the factors shaping competition. By providing insights into market structures, competitive dynamics, and critical success factors, the study supports strategic decision making for OEMs entering or expanding within this sector. The study will first identify the current dynamics of the charging infrastructure and BESS market in order to find a potential within the market space, which will then be used to understand how OEMs can differentiate within this potential. Thus, the research questions are stated as follows:

1. What are the key characteristics and competitive dynamics of the European market for charging solutions and battery energy storage systems?
2. How can an OEM build a competitive position in the European market for charging solutions and battery energy storage systems?

1.4 Delimitations

Due to limited resources and the risk of the research topic becoming too broad, a number of delimitations must be applied. While most attention in the EV sector has its focus on passenger cars, this study places a specific emphasis on HDVs. These vehicles are central to decarbonizing the transport sector, but present unique challenges due to their significantly higher energy demands and more complex charging requirements. Furthermore, the study will

focus on the European market. The geographical delimitation is motivated by the region's increasing regulatory framework on sustainable transportation and the fact that the region is at the forefront of the ongoing development of electric mobility, which makes it a relevant context for our research. However, it is important to acknowledge that the European market is not a homogenous entity, and countries may differ in terms of policy and electrification progress. Although regulatory and policy frameworks shape market conditions, they will not be examined in detail. In addition, the focus on firm-level differentiation strategies allows for a generalized view of Europe to be used in order to identify broad trends and strategic implications relevant to OEMs. Furthermore, the research will focus on the final part of the value chain, on the providers that sell the products directly to industrial consumers. This focus is chosen to allow for a more targeted analysis that enables the identification of key criteria for market offers in a clearly defined segment.

1.5 Thesis Disposition

This thesis is structured into six chapters. The first chapter introduces the topic through a background on the field of study and a problem discussion and outlines the research area. The literature review presented in the second chapter describes what is already known on the topic in existing literature, and ends with the theoretical framework. In the third chapter, the chosen research strategy and research design as well as the methodology for data collection and data analysis are presented. The chapter also includes considerations for research quality and ethics. The empirical findings from the conducted interviews are presented in the fourth chapter, followed by the fifth chapter where empirical findings are discussed and analyzed using the theoretical framework. The fifth chapter ends with a framework discussion, where the initial framework is revised and an improved version of the framework is presented. In the sixth chapter, the analysis performed in the previous chapter is concluded, the research questions are answered and the practical implications of the study are explained. The chapter ends with explaining the limitations of the conducted study, and proposes suggestions for future research.

2. Literature Review

The literature review aims to provide a deeper understanding of the existing research on the topic of the study. As the markets for charging infrastructure and BESS are closely linked to, and directly influenced by the adoption and diffusion of EVs, this thesis draws on literature from the broader EV field to inform its analysis. Although the primary focus is on charging infrastructure and BESS, the dynamics of EV adoption such as market demand and user behavior, are deeply intertwined with the development and competitiveness of charging and BESS markets. The use of literature on EVs in general is also motivated by limited previous research on electric HDVs specifically. The reliance on EV literature offers valuable insights into the broader dynamics of electrification that may also apply to the HDV segment, and is thus used as a foundation for understanding market forces and competitive implications.

The chapter begins by defining and discussing the diffusion of innovation and the concept of industry attractiveness to help identify the current state of the BESS and charging infrastructure industry. It then presents theories of competitive strategy and business models to explore how

firms compete in this emerging market. Finally, the resource-based view and concept of dynamic capabilities are introduced to examine what is needed to compete. The chapter concludes with a theoretical framework that links the preceding concepts.

2.1 Market Adoption

According to Rogers (2003) the diffusion of innovation theory describes the process of how innovations are spreading across individuals within a social system. In the theory, an innovation is defined as an idea, a technique or a good, which is considered to be new by individuals. The innovation follows a life cycle from commercial introduction, polarization, and wide adoption and eventually declines. The characteristics of the innovation itself influences the diffusion speed, but the environment or the social system in which the innovation diffuses also has an impact on the diffusion process.

Rogers (2003) identifies five key characteristics of innovations that influences the speed of which the innovation is adopted. The *relative advantage*, or the extent to which an innovation is perceived as superior to the one that it replaces, influences the diffusion rate. This perceived level of superiority does not have to be based on technical or economic reasons, but might as well be linked to aspects such as practicality, physical comfort or social recognition. How well the innovation fits within the existing social or cultural context and aligns with already existing values, past experiences and the needs of potential adopters, i.e. the innovation's *compatibility*, also influences the rate of diffusion. The third characteristic is *complexity*, where the perceived difficulty in understanding and using the innovation means that the innovation faces a slower adoption rate. *Trialability* describes the ability of the innovation to allow its users to test and explore with the innovation before committing to full adoption. Finally, the extent to which the results of an innovation are visible to others, the *observability*, also affects the adoption of the innovation.

While Rogers (2003) theory has been widely used to understand innovation diffusion, according to MacVaugh and Schiavone (2010), the theory assumes that consumers are rational and utility-maximisers, and based on this the new technology will eventually replace the old. However, market research has shown that this process does not happen easily, automatically or even completely. MacVaugh and Schiavone (2010) instead emphasizes that the adoption of an innovation is also shaped by technological, social and learning conditions, which affects the single adopter of the innovation, the adopting community, and the market for the innovation differently. Even though a technology offers apparent technical advantages, what Rogers (2003) calls its relative advantage, factors like switching costs, network externalities, and complementary technologies can impact the rate of adoption. Switching costs are costs that the adopter of a new technology has to afford in order to learn how to utilise the new technology, and depends on how much time and effort the individual has spent on learning the old technology and its features. Furthermore, network externalities refer to the utility an adopter achieves by the increase in total number of adopters in the market. Complementary technologies refer to the fact that switching from an existing technology to a newer alternative makes it more difficult if the technology is dependent on other, complementary technologies (MacVaugh & Schiavone, 2010).

Rogers (2003) also categorizes adopters of a new innovation into five distinct groups, based on their willingness to adopt the new technology at different stages of the diffusion process. The five groups are *innovators*, *early adopters*, *early majority*, *late majority* and *laggards*. Across these groups, the distribution of individuals follows a normal distribution curve, with the highest concentration between the early and late majority. Furthermore, the market adoption of the innovation follows an S-shaped curve, starting with slow uptake which accelerates when innovation spreads and peaks at a point where among half of the potential adopters have adopted it. While Rogers (2003) focuses on who adopts and when, a complementary model that also describes the S-shaped adoption pattern is the Bass model, which focuses on the drivers of adoption and why adoption accelerates over time. Bass (1969) differentiates between *innovators* and *imitators*. Innovators are individuals who adopt a new innovation based on external influences such as mass media or marketing, and adopt the technology in the first phase after the innovation is launched. Imitators on the other hand, are influenced by internal factors such as other consumers and word-of-mouth communication, and adopt the innovation during the peak adoption phase.

2.1.1 Market Adoption in Electric Mobility

According to Xia, Wu and Zhang (2022), EVs are innovative products as they introduce new experiences to users through the use of alternative energy sources, new systems and new technologies, as compared to traditional ICE vehicles, and finds that the diffusion of innovation theory has strong explanatory power when it comes to the adoption of EVs.

The diffusion speed and patterns vary between the countries in the European Union when it comes to EVs (Fluchs, 2020). In Europe, electric truck sales increased almost threefold in 2023 as compared to 2022, and in countries such as Belgium, Norway and Switzerland, the sales share of electric HDVs were above 50 %. The global number of installed public charging points in the EU was up 40 % in 2023 as compared to 2022 (IEA, 2024). The implementation of financial government incentives, for instance in the form of purchase price advantages, seems to boost the adoption speed, and countries with this type of incentives have higher diffusion speed (Fluchs, 2020). Similar to Fluchs (2020), Xia et al. (2022) finds that monetary subsidies will increase the perceived relative advantage of EVs, and thereby affect the adoption speed. A study performed in Sweden by Melander et al. (2022) also found that subsidies influences the adoption speed, but that environmental benefits were the primary driver of adoption. A similar study conducted in Germany by Anderhofstadt and Spinler (2019), showed the same results, but added the ability to enter low-emissions zones as a driver of adoption.

Regarding the five characteristics defined by Rogers (2003), the relative advantage of EVs compared to ICE vehicles is primarily in regards to environmental benefits, prestige, social status and driving pleasure. On the other hand, EVs have other characteristics that make them inferior, for instance their limited range and their charging times (Biresselioglu, Kaplan & Yilmaz, 2018). Furthermore, Fluchs (2020) mentions the observability of the innovation as initially being low for EVs, which made the adoption speed for the innovation come off to a slow start. However, due to increased media attention and the presence of EVs on the road, the observability has increased significantly and now shows good conditions for large-scale

adoption, in line with what Bass (1969) calls external influences which affect the adoption by innovators. In addition, early adopters play an important risk-reducing role in the diffusion of innovation, and in the case of alternative fuel vehicles, the early adopters serve as key indicators of product quality which reduces the uncertainty among imitators (Sällberg & Numminen, 2024), who adopt the innovation at a later stage (Bass, 1969).

Xia et al. (2022) further elaborates on the five characteristics defined by Rogers (2003), with a primary focus on compatibility, complexity and relative advantage. According to Xia et al. (2022), these three characteristics can predict the consumer adoption of EVs. Regarding compatibility, the study suggests that consumers are willing to switch to EVs as long as the vehicles are perceived to meet their daily needs. As long as this condition is fulfilled, other factors are less influential in the adoption decision. In the same way, if the use of EVs generates excessive concern or unease, i.e. if the perceived complexity is too high, individuals will develop a resistant attitude toward adoption (Xia et al., 2022). This is in line with the problem of switching costs, complementary technologies, and network externalities brought up by MacVaugh and Schiavone (2010), which might hinder the adoption of EVs. The perceived relative advantage depends on many factors, and both EVs and ICE vehicles are viewed as having some drawbacks. Consumers who perceive the advantages of EVs such as lower operating costs and less polluting emissions to be of high importance, are more likely to adopt the technology.

Regarding barriers to adoption, the lack of charging infrastructure hinders the electrification process and is often seen as the biggest barrier to adoption (Liimatainen et al., 2019; Anderhofstadt & Spinler, 2019; Qasim & Csaba, 2021; Melander et al., 2022). This has been described by Raofi et al. (2025) as a chicken-and-egg dilemma, where the lack of charging infrastructure results in low adoption and demand for electric HDVs, while the low demand for electric HDVs also reduces the incentives to invest in building charging infrastructure. Other barriers to adoption is the uncertainty regarding which sustainable transport solution that will dominate in the future (Melander et al., 2022), the initial cost of purchase of an EV due to the high cost of batteries (Anderhofstadt & Spinler, 2019; Qasim & Csaba, 2021), the required charging time, the limited range of the vehicles, little variety in the available types of vehicles (Qasim & Csaba, 2021), low payload capacity and driver comfort (Sällberg & Numminen, 2024). To mitigate the higher purchase costs of EVs, new business models are being introduced to minimise the high upfront cost of acquiring an electric HDV, where some OEMs offer a service based concept (Qasim & Csaba, 2021).

2.2 Industry Attractiveness

In 1979, Michael Porter presented what has come to be known in literature as Porter's Five Forces framework. The framework aims to explain the nature and degree of competition within an industry and thereby analyze the attractiveness of an industry. Porter (1979) claims that analyzing the structural factors that influence the competitive environment is highly important in order for a company to understand how they are affected by these factors and how they can strategically cope with competition. Five structural forces are identified which heavily influence the industry landscape and in turn, the profitability and competitiveness of the

industry. The five forces identified by Porter (1979) are: *threat of new entrants*, *threat of substitutes*, *bargaining power of suppliers*, *bargaining power of buyers* and *industry rivalry*. The weaker these forces are collectively, the greater is the possibility for a firm to achieve superior performance compared to its competitors. By analyzing the five forces that shape the industry competition, a firm can find their place within the industry where they can best defend themselves against the competition or where they can influence the forces in their favor (Porter, 1979). Furthermore, it is important for firms to be aware of major technological change, such as the one experienced in the markets studied in this thesis, as it can heavily influence the industry structure and by that, shift the intensity of competition and reduce the attractiveness of an industry (Porter, 1985).

New players that are entering an industry bring new capacity, and a desire to gain market share, and they often come with resources to support this initiative. To what extent the threat of new entrants affect the existing players depends on the barriers already in place and how the existing players respond to this threat of entry. Entry barriers can stem from economies of scale, where these economies would deter new entrants since they would need to enter on a large scale or compete on a cost disadvantage compared to competitors. Entry barriers can also stem from product differentiation as high brand identity causes new entrants the need to spend resources in order to overcome higher levels of customer loyalty. High capital requirements can further limit the possibility of new entrants, as well as the access to distribution channels. Government policies have the potential to heavily affect the entry barriers, as policy can both open the possibility to enter the industry as well as limit new entrants. Porter (1979) further explains that incumbent companies may have cost advantages over new entrants that stem from the effect of the learning and experience curves, access to better materials, proprietary technology and government subsidies, all of which creates higher entry barriers. However, Porter (1979) argues that if technological advancements that are general to the industry influences lower prices, the experience curve will not pose an entry barrier. Instead, this could cause new entrants to achieve a cost advantage over incumbents as they are free from past investments (Porter, 1979).

Powerful suppliers have the ability to raise prices and reduce the quality of goods and services. With this, suppliers have the ability to squeeze the profitability of an industry if the firms cannot raise their own prices in order to respond to higher supplier prices. Suppliers become more powerful if the supplier group is dominated by a few concentrated companies or if their product is unique and differentiated. Suppliers can also strengthen their bargaining power if high switching costs exist. Powerful buyers, on the other hand, can also affect the profitability of an industry. They can demand lower prices, higher quality and more services. Buyers are more price sensitive and gain more power if the product is not differentiated or the product does not contribute to the buyers saving money in terms of the product paying itself many times over (Porter, 1979). Another way that increases the power of the buyers is through technological advancements that increases transparency (Porter, 1985).

As long as substitute products or services are in place, the potential of an industry is limited (Porter, 1979). New technologies often create alternative solutions that compete with existing products, which makes technology a key driver of substitution (Porter, 1985). In order to overcome the threat of substitutes, the product or service needs to be differentiated or

experience an upgraded quality, otherwise the industry can suffer from less growth and decreased profits (Porter, 1979).

The rivalry between existing firms in an industry is affected by many factors. The industry rivalry can become more intense if there are a lot of competitors in the industry, which are similar to size. The industry rivalry can also become more intense if the product or service is undifferentiated or there are high switching costs (Porter, 1979). Depending on how it influences cost structures and differentiation, major technological change can intensify or reduce industry rivalry (Porter, 1985). Furthermore, high exit barriers will also make the industry rivalry more intense as exit barriers keep companies within the industry even though it might not be profitable. Exit barriers can exist due to the existence of specialized assets that are tied to the specific industry (Porter, 1979). However, technological shifts have the potential to lower the exit barriers and change the competitive dynamics of an industry (Porter, 1985).

However, the Five Forces model has been criticized by multiple authors, (e.g. Grundy, 2006; Stonehouse & Snowdon, 2007) for placing the industry as the principal unit rather than the individual firm. With the industry as the principal unit of analysis, it is assumed that all firms are affected in the same way by the five forces, but due to the differences between firms within the same industry, the forces affect different firms in different ways (Stonehouse & Snowdon, 2007). Grundy (2006) elaborates on the criticism by adding that there are difficulties in identifying the boundaries of an industry, where industry boundaries are becoming more and more fluid. The criticism placed emphasis on expanding the model and combining it with other tools in order to optimize its applicability in industries influenced by policy interventions and technological shifts (Grundy, 2006).

Isabelle, Horak, McKinnon and Palumbo (2020) places the Five Forces framework in the context of newer and more knowledge intensive industries and argues that the framework is not suitable in today's more complex industry environments. The authors argue that the framework should be expanded and include four more forces in order to capture the nature of today's business environments. The additional forces that the authors propose are: *threat of digitalization*, *competitor's level of innovativeness*, *exposure to globalization* and *industry exposure to de/regulation activities* (Isabelle et al., 2020).

Despite its limitations, Porter's Five Forces will be used in this thesis to gain an understanding of the competitive landscape in the BESS and charging infrastructure industry. While Stonehouse and Snowdon (2007) criticizes the model's use of the industry as the level of analysis, the framework still offers a solid starting point for identifying key external pressures that shape the competitiveness of an industry. While remaining mindful of its limitations, the framework and the analysis will be complemented with additional firm-specific and dynamic frameworks that help build a more holistic analysis in order to optimize the applicability of the model, as proposed by Grundy (2006). Combining the Five Forces framework with the additional forces presented by Isabelle et al. (2020) and other firm-specific models, allows for an understanding of the competitive forces in the industry, along with the understanding of how these forces in turn affect the firm itself and how the firm should respond to these forces.

2.2.1 Industry Attractiveness in Electric Mobility

Fedotov (2022) analyzes the EV industry by using the Five Forces framework. The author claims that the industry rivalry of EVs is at a medium level as the rapid technological developments and cost reductions have caused traditional automakers to enter the industry. The industry has also received major governmental support, which has impacted the degree of industry rivalry (Fedotov, 2022). Jiang and Lu (2023) argues that there is a new species that will win over incumbents in the EV industry, while Murmann and Vogt (2023) argues that incumbents can leverage their established capabilities and resources in order to gain advantage over new entrants. Competition in the industry is now also fueled by the need to scale up production as soon as possible, in order to establish a leadership position in the changing market dynamics (Jiang & Lu, 2023).

Fedotov (2022) further claims that the bargaining power of buyers is high due to high purchase prices, limited range of the EVs and long charging times causes the EVs to be less attractive compared to ICEs, which enhances the bargaining power of buyers. The level of the bargaining power of suppliers is medium, where the manufacturers of EVs are highly dependent on batteries and the decision of whether to produce them in-house or outsource, will affect the bargaining power of the suppliers (Fedotov, 2022).

The threat of new entrants is explained to be medium, much due to high capital requirements, high research and development spending and the need to have experience in the industry in order to scale and enable efficient manufacturing (Fedotov, 2022). However, as Hoeft (2021) argued, many new entrants are usually backed by venture or risk capital which provides adequate capital to enter the industry. Jiang and Lu (2023) states that the Chinese EV market has experienced many new entrants in recent years, despite the heavy initial capital requirements. Fedotov (2022) further argues that the industry is not likely to become profitable in the near future. This leads to the threat of entirely new manufacturers being low, but the existing automakers have the resources and expertise in order to enter the EV market (Fedotov, 2022).

The threat of substitutes is high, according to Fedotov (2022), where consumers that want to reduce their carbon footprint easily can switch to cheaper substitutes such as public transport and bicycles. For other consumers who want to purchase a vehicle, the traditional automotive market offers plenty of substitutes (Fedotov, 2022). Traditional ICEs still dominate the market, but forecasts suggest a massive increase in the sales of EVs in the upcoming years, which indicates that customers are substituting traditional vehicles with electrical ones in an increasing amount (Hoeft, 2021).

2.3 Competitive Strategy and Competitive Advantage

The competitive landscape is shaped by struggles for market share, resource allocation, and customer loyalty, all of which are factors that influence a firm's position in a market. It is therefore crucial for companies to strategically position themselves in order to navigate the competitive landscape and gain competitive advantage. Porter (1998) defines the term

competitive strategy as a firm's deliberate positional choice in a market that will lead to long-term advantage over competitors. Furthermore, Porter (1998) stresses that setting a competitive strategy is not just about reacting to the market and its complexities, but a successful competitive strategy can allow the firm to shape the industry structure to their benefit. Being proactive in the market and shaping the structure of the industry to one's advantage involves identifying opportunities, leveraging the internal strengths of a company, and mitigating the external threats of the industry. Due to the dynamic nature of industries and competition, firms need to adapt and be flexible in their positioning and phrasing of competitive strategies (Porter, 1998). Failing to do so, can put a firm in a position to become obsolete in the industry as technological advancements evolve the industry structure (Porter, 1985).

Porter (1998) identifies two fundamental sources of competitive advantage: low cost and differentiation. The two types of competitive advantage along with the scope, leads to three generic strategies for achieving above-average profitability within an industry: cost leadership, differentiation and focus. Cost leadership aims to achieve the lowest operational costs in the industry, typically through leveraging technology, optimizing processes and pursuing economies of scale (Porter, 1998). By being the low-cost producer, the firm can achieve above-average profits, even though the price is below the industry average (Stonehouse & Snowdon, 2007). The differentiation strategy focuses on providing unique attributes that are valuable to the customers through product features, marketing and brand reputation. The uniqueness rewards the firm with premium prices. The focus strategy narrows the competitive scope to a specific niche segment within an industry, where the firm pursues either a cost focus or a differentiation focus within the niche segment (Porter, 1998).

Porter (1998) states that firms usually need to make a clear strategic choice between the generic strategies. A firm needs to pursue cost leadership or differentiation or a focus strategy, otherwise firms risk being stuck in the middle, losing out on the benefit of the strategies (Porter, 1998). However, this view has been challenged by several scholars. Hill (1988) argues that differentiation can be a tool to gain cost efficiency and further claims that in many industries, there is no unique low-cost position which forces firms to blend attributes of the differentiation and cost-leadership strategies. Miller (1992) provides evidence on companies that have successfully pursued hybrid strategies without becoming stuck in the middle. According to Christensen (2001), the ability to integrate a hybrid strategy successfully depends on the capabilities of the firm, availability of resources, and adaptability to dynamic industry changes.

Building on this perspective, Salavou (2015) emphasizes the rise of hybrid strategies, which intentionally combines elements of differentiation and cost leadership strategies. Contrary to Porter's (1998) idea of firms being stuck in the middle, Salavou (2015) argues that hybrid strategies are now a way to allow flexibility and responsiveness in changing environments. The author shows evidence where hybrid strategies, particularly in Europe, outperform firms that pursue pure strategies. The most effective hybrid strategies are shown to be ones that combine elements of all three generic strategies; cost, differentiation and focus, rather than focusing on just two or one alone (Salavou, 2015).

Another complementary view is offered by Mathur (1992), who argues that the competitive strategy should be defined in terms of how offerings are positioned relative to competitors in the eyes of customers. The author emphasizes the focus of the positioning of the offer itself, compared to the position of the entire firm. Similar to Porter's (1998) cost leadership and differentiation strategies, Mathur (1992) claims that offerings compete on two dimensions, differentiation and relative price, which are highly customer-centric, that is, the importance is how customers view the positioning. Differentiation can come from either merchandise, which is the product itself, or from support. From this viewpoint, the author introduces four types of strategic offerings: system-buy, product-buy, service-buy and commodity-buy, where each one represents a different balance between merchandise and support uniqueness.

2.3.1 Competitive Strategy in Electric Mobility

The industry of BESS and charging infrastructure is a relatively young one, where Hu, Armada and Sánchez (2022) reports low profit margins, and Ramos, Tuovinen and Ala-Juusela (2021) states that business models for storage have not always proven to be profitable. This, along with the demanding high capital investments and dependence on raw materials such as lithium and nickel, creates challenges for achieving a low-cost leadership during the early and evolving stages of the industry which it is currently in (Olabi, Wilberforce, Sayed, Abo-Khalil, Maghrabie, Elsaid & Abdelkareem, 2022). Beuse, Steffen and Schmidt (2020) makes the claim that the materials used in batteries have experienced heavy price fluctuations. The manufacturing processes have, on the other hand, experienced cost reduction, which has increased the importance of the cost of raw materials. The price fluctuations and the increasing share of the cost of batteries, causes the cost leadership strategy to be difficult to manage under the fluctuating circumstances (Beuse et al., 2020). Christensen (2001) explains that during evolving industries where new technology is occurring, vertical integration is often necessary. It is at later stages, where technology has matured, that firms can gain cost advantages by being "non-integrated" (Christensen, 2001).

The competition in the industry evolves not just around price, but on factors such as technological capabilities and a growing importance of service offerings (Ramos et al., 2021), which are clear factors of differentiation (Porter, 1998). Tesla, for example, is one of many companies within the industry that is differentiating based on expanding their charging infrastructure and investing in integration with their vehicle ecosystem (Figenbaum, Wangsness, Amundsen & Milch, 2022). By expanding the offer towards customers with services, more strategic partnerships in the industry need to be formed. Engaging in partnerships and joint ventures has become a new differentiation factor in the industry, where firms collaborate with local power generation companies and global players to promote technology transfer and expanding consumer offer (Yoo & Ha, 2024).

2.4 Business Models

According to Teece (2010), technological innovation does not guarantee the success of a business, and every new product development effort should be coupled with a business model. A good business model design together with careful strategic analysis are necessary for

technological innovations to succeed commercially (Teece, 2010). The business model connects technological development with economic value creation, and ensures that the innovation delivers value to the customers (Chesbrough & Rosenbloom, 2002). In short, the business model defines how the enterprise goes to market and how to create, deliver and capture value (Teece, 2010). In contrast to strategy, the business model framework does not include competition and has a bigger focus on how the business works as a system and less on execution and implementation of the strategy. The business model refers to the way the firm does business and represents a description of the firm at a specific point in time, while at the same time allowing for alignment between strategy, business organization and technology (Osterwalder, Pigneur & Tucci, 2005).

In the business model, management's hypothesis about what customers want and how the enterprise should be set up to best meet these needs are reflected. Advancements in technology and more open global trade have increased consumer choices and made comparison shopping easier, forcing businesses to adopt customer-centric business models with compelling value propositions. Without a well-defined business model, innovators will fail to either deliver or to capture value from their innovations, and despite having superior technology, products, people and governance, a business model that is not adapted to the competitive environment will not produce sustained profitability. To profit from innovation, enterprises must master both product innovation and business model design and have a clear understanding of business design options, customer needs and technological trajectories, (Teece, 2010), as well as insights both into the technology and the market (Chesbrough & Rosenbloom, 2002). The firms that succeed with their business models are those that are able to discover the fundamental needs of consumers, and how competitors are, or are not, satisfying those needs, and what technological and organizational possibilities these leave for improvements (Teece, 2010).

To work with the business model is a continuing task that often requires experimentation, learning and trial and error. In emerging industries, the right business model is not likely to be apparent early on, and only those who are well positioned and who are able to learn and adjust are likely to succeed. However, developing a successful business model is not enough to gain sustained competitive advantage, as imitation is often easy, and a business model that is differentiated and hard to imitate is more likely to yield profits. To design a business model that generates sustained competitive advantage, strategy analysis also needs to be included (Teece, 2010). Even though imitation might be easy if the elements of a business model are transparent, Teece (2010) describes some of the barriers that may prevent competitors from imitating a business model. Firstly, to implement a certain business model may require certain systems, processes and assets that are hard for competitors to replicate. In other words, the capabilities of the enterprise matters and may not be easy to replicate for competitors. Secondly, the business model may contain certain elements that are difficult for competitors to understand in detail which makes it hard to imitate the business model. Thirdly, even though it is obvious how a business model is to be replicated, incumbents in the industry might restrain from doing so if they believe that it might involve cannibalizing their existing sales and profits (Teece, 2010).

Once a business model has been established, it is generally hard to change the current model, as it requires a change in the way the firm goes to market, and inertia is likely to be considerable (Teece, 2010). Despite having valuable resources such as capital, knowledge, and workforce, established firms face difficulties to overcome existing mental models and organizational inertia (Ziegler & Abdelkafi, 2022). Established firms often have an inability to adapt to technological change, and it can often be attributed to their challenges in perceiving and implementing new business models when such changes demand it. A startup on the other hand is likely to be less constrained in the evaluation of alternative models (Chesbrough & Rosenbloom, 2002). While incumbents may struggle to introduce new value propositions and make changes that conflict with their current business model, this creates opportunities for new entrants to gain competitive positions in the market (Ziegler & Abdelkafi, 2022). New entrants are less constrained in their evaluation of alternative models and more flexible in pursuing radical business models, and are therefore expected to come up with new business models by bundling products and services in unique ways with the help of non-traditional partners and in this way target novel customers (Bohnsack, Pinkse & Kolk, 2014).

2.4.1 Business Model Innovation

Having a successful business model does not imply having a sustained competitive advantage, but according to Teece (2010) and Osterwalder et al. (2005), business model innovation can be a way to achieve competitive advantage, if the business model is sufficiently differentiated and hard to replicate. Even though the innovation of the business model might not lead to competitive advantage, new business models, or refinements to existing ones, often result in lower costs or increased value to the customer (Teece, 2010).

Technological innovation often needs to be matched with business model innovation if the innovator is to capture value (Teece, 2010), yet companies often have huge investments and big focus on processes for exploring new ideas and technologies, but the ability to innovate the business models through which these ideas will pass is often limited. In some cases, an already familiar business model can be applied to a new innovation but in other cases no such obvious model is available, and technology managers must expand their perspectives to find an appropriate business model in order to be able to capture value from the technology (Chesbrough & Rosenbloom, 2002). Furthermore, a new business model can either create a new market or allow a company to create and exploit new opportunities in already existing markets (Amit & Zott, 2012).

Amit and Zott (2012) argues that business model innovation is not only changing the product and service offerings, but requires a change in the way you do business and must go beyond processes and products. Business model innovation can take place in several ways, either by making a change in the activities that the company performs, making a change in the ways that the activities are linked, or by making a change in who performs specific activities (Amit & Zott, 2012). Often, the key differentiator is not the individual resources and processes themselves, but how they interact and connect with one another (Johnson, Christensen & Kagermann, 2008). With business model innovation, an entire new activity system can be created which is often harder for competitors to imitate or replicate, as compared to process or

product innovation, and can therefore be a valuable source of sustained competitive advantage (Amit & Zott, 2012). When companies are able to integrate their key resources and processes in a distinctive way to effectively fulfill specific customer needs, it often leads to sustained competitive advantage (Johnson et al., 2008).

When experimenting with business models, businesses face significant barriers (Chesbrough, 2010). According to Amit and Zott (2012), transforming the whole activity system rather than improving individual activities requires a systemic and holistic thinking which can be challenging. Managers are more likely to resist experiments that could undermine the current value of the company, and business model design often goes unchallenged for a long time (Amit & Zott, 2012). Managers might also disregard a business model because it is conflicting with the current one, even though the new business model would have been superior (Chesbrough, 2010). Johnson et al. (2008) suggests that the first step when formulating a new business model should be to shift focus away from the business model itself and instead begin with identifying the opportunity to satisfy a real customer need, and then define how the need will be met.

Furthermore, companies can compare their business models to those of competitors. Comparing the business model to one of a company in a completely different industry may provide new insights and foster business model innovation. This can be a way for incumbents to understand how aggressive new competitors and start-ups work (Osterwalder et al., 2005), as competitive threats often come from outside of the traditional industry boundaries, often with the help of business model innovation as a powerful tool (Amit & Zott, 2012).

2.4.2 Product-Service Systems

Several authors have proposed the concept of product-service systems (PSS) as an alternative business model where consumer demands are fulfilled with the use of services instead of physical products (Mont, 2002; Lewandowski, 2016; Antikainen & Valkokari, 2016; Tukker & Tischner, 2006). Lewandowski (2016), describes this as a model where the company offers access to a product but retains the ownership, as an alternative to the traditional buy and own model. Antikainen and Valkokari (2016) points out that companies nowadays perceive their customers as users rather than buyers, and there is a trend towards the service business. This type of business model is also described as a source of huge, untapped opportunities for both existing companies as well as new players (Antikainen & Valkokari, 2016), and has the potential to enhance both competitiveness and sustainability (Tukker & Tischner, 2006).

Formerly, most of the value of a product came from the production processes that transformed raw materials into products. Today, added value is generated by non-material aspects of the product such as technological improvement, intellectual property, branding, product aesthetics and design, causing the boundary between manufacturing and services to become increasingly blurred (Mont, 2002). The PSS integrates both tangible and intangible aspects designed and combined to jointly meet the needs of end customers (Tukker & Tischner, 2006). The traditional relationship between consumers and products and services changes and the concept of owning are replaced with buying access and performance, and instead of paying for

ownership, customers pay per use or a fee for monthly access (Antikainen & Valkokari, 2016). While some companies integrate PSS as an extension of their already existing offer to customers, others adopt it as a survival strategy, positioning it at the center of their business model transformation (Mont, 2002).

For manufacturing companies, the integration of PSS to the strategy allows the company to attach additional value to a product and to improve relationships with customers as a result of increased contact and flow of information. The increased information flow also enables the company to better respond to changing market trends and companies adopting this system often have early insights into consumer tastes, preferences and buying habits (Mont, 2002). The PSS also offers opportunities to improve the total value for the customer by offering more customized solutions through both tangible and intangible aspects of the offer (Tukker & Tischner, 2006). Consumers also benefit by gaining access to a wider range of choices, flexible payment options and tailored usage models that best fit their ownership preferences. It enhances customer value by offering more customized, high-quality solutions that align with individual needs and preferences (Mont, 2002). However, Mont (2002) also discusses some of the barriers to a PSS, and highlights that consumers might not be overly enthusiastic about ownerless consumption, and the assumption that the customer prefers use rather than ownership does not represent the reality.

2.4.3 Business Models in Electric Mobility

The previously described chicken-and-egg dilemma in the market for EVs (Raoufi et al., 2025; Ziegler & Abdelkafi, 2022), also has implications for the business models of OEMs, as their business models cannot be developed independently of the charging infrastructure (Ziegler & Abdelkafi, 2022). Due to complex interactions between stakeholders, the whole ecosystem must be considered when dealing with business models related to electric mobility, and many of the stakeholders have not been part of the value chains of ICE vehicles nor electricity supply (Kley et al., 2011). The interactions between technologies, actors and infrastructure cause a complex interconnected system between all these elements (Abdelkafi et al., 2013). In order to develop successful business models, the focus needs to switch from being focused on one single actor, and should instead span various actors (Ziegler & Abdelkafi, 2022).

For OEMs, the switch to EVs will affect their business, while at the same time encouraging players from the information and communication technology (ICT) sector, mobility providers, electric utilities and others to broaden their business models and apply their competencies. Offering electric mobility products and services means that OEMs must enter unfamiliar industrial sectors when implementing their business models, and partnerships are established to cover the need of these competencies (Krommes & Schmidt, 2017).

Apart from charging infrastructure challenges, the adoption of EVs faces other hurdles as discussed in section 2.1.1, causing opportunities for new business model applications (Abdelkafi et al., 2013), and a successful business model must be able to offset the perceived disadvantages of EVs (Shao, Xue & You, 2014). The understanding of the real motives for why customers would buy an EV will be crucial in order for companies to capitalize on their

value propositions (Ziegler & Abdelkafi, 2022). Companies in the EV value chain must also leverage digitalization to create new ways of value creation for the customer (Ziegler & Abdelkafi, 2022), and it is expected that ICT will play a greater role in EVs, with vehicles being connected to the internet and unlocking new opportunities for vehicle control systems (Abdelkafi et al., 2013). As new sources of value emerge, companies must develop and offer new types of value propositions to their customers. This raises questions about defining the right value proposition, and specifically, whether to focus on products or services and how to effectively reach their target customers (Bohnsack et al., 2014).

According to research, companies should increasingly focus on the integration of value-adding services into their EV-based value propositions, as value-added services of high quality motivates drivers to buy EVs (Ziegler & Abdelkafi, 2022). Shao et al. (2014) also states that the value proposition of EVs must shift focus from product to product-service. In other words, the focus should be on the implementation of PSS business models. By using business model innovation, technologies would create new sources of value for customers, and by moving from product-based to service-based business models, EVs can benefit customers by enabling more comprehensive mobility solutions (Bohnsack et al., 2014).

The service component is of high importance and a relevant factor in purchasing decisions in the EV industry, and companies use it to increase competitiveness (Cherubini, Iasevoli and Micheli, 2015). The ability to reduce the risk for the customer is also discussed, as well as to develop a product-service bundle with a price that reduces the total cost of ownership for the customer. Meyer et al. (2024) also highlights the relevance of combining products and services, and that this type of business model offers possibilities for customers to address hesitations and build trust in the quality of products. As the integration of the service level increases, customers become more willing to adopt and pay for new technologies, and concerns about safety or costly defects can be mitigated if the manufacturer retains ownership and carries the risk.

Manufacturers of vehicles face the risk of losing the customer contact and instead take the role of just suppliers in the mobility value chain and must therefore rethink their business models. EVs, together with the EV product system, provide the opportunity to gain new customers and to increase customer loyalty, as the customer will interact with the product system in multiple ways, strengthening the customer relationship and providing relevant data about the customer and use patterns. This offers opportunities for OEMs to tailor and improve products and services to the specific customer. OEMs must have close relationships with, and information on, customers and their vehicles to be able to create a successful business model. One way of doing this is to offer mobility as a product, where deeper insights into customers' mobility behaviors and increased brand loyalty can be obtained (Krommes & Schmidt, 2017).

2.5 Resources and Capabilities

2.5.1 Resource-Based View

Understanding the sources behind firms' sustained competitive advantage have long been an important focus in the area of strategic management. Previous research on the area of sources

of sustained competitive advantage has often focused on external factors, such as industry structure and market positioning. The work of Wernerfelt (1984) proposed the idea that firms could be viewed as bundles of resources rather than the traditional product-market approach. This perspective became the foundation of what is known in the strategic management literature as the resource-based view (RBV), which assumes that firms gain competitive advantage through their own internal resources.

The resource-based view provides a way for analyzing and interpreting the internal resources of organizations, and it emphasizes resources' role in formulating strategies to achieve sustained competitive advantage. The RBV suggests that firms' unique resources and capabilities determine their ability to add value within the value chain, develop new products, or expand into new markets (Madhani, 2010). According to Barney (1991), resources must possess four key attributes in order to be a source of sustained competitive advantage: they must be *valuable*, *rare*, *imperfectly imitable*, and *non-substitutable*. With these attributes, Barney (1991) created the well-known VRIN-framework. Valuable resources enable a firm to exploit opportunities or neutralize threats, rareness ensures that resources are not widely distributed by competitors, inimitability protects firms against replication by competitors, and non-substitutability ensures that competitors cannot achieve the same outcome by using similar resources (Barney, 1991).

One of the fundamental assumptions in the RBV is that firms possess different bundles of resources and capabilities, which are not easily transferable across organizations. The assumptions of resource heterogeneity and imperfect mobility challenge earlier models that presumed that firms have access to identical resources and capabilities and that these are highly mobile, which leads to similar strategies. Instead, the RBV argues that firms with unique and superior resources can generate and sustain competitive advantage because competitors cannot easily replicate or substitute these resource configurations (Barney, 1991).

Wernerfelt (1984) introduced the concept of resource position barriers, which are partly analogous to Porter's (1979) entry barriers, but operate at the resource level. A firm with a valuable resource can create a structural advantage that is difficult for others to imitate, which limits competition. Unlike Porter's (1979) entry barriers which restrict new market entrants, the resource position barriers limit the competitors efforts to acquire or develop comparable resources. Resource position barriers are vital in order for firms to gain competitive advantage from the resources and it is crucial that firms find the resources that lead to the resource position barrier. Further, it is important that no other competitor already has a resource position barrier in that particular resource (Wernerfelt, 1984).

Ultimately, the resource-based view shifts the focus from external industry dynamics to the internal strengths of the firm. It suggests that sustained competitive advantage arises from a firm's ability to acquire, develop, and protect resources that meet the VRIN-criteria. It has laid the foundation for later developments in strategic management research, such as the dynamic capabilities framework.

2.5.2 Dynamic Capabilities

The dynamic capabilities framework developed by Teece, Pisano and Shuen (1997), came as a response to limitations in the existing strategic management theories. This framework is a natural extension to the RBV, as it remains the resource-focus, but extends the focus into how the resources and capabilities adapt in times of change. According to Teece et al. (1997) the existing theories were insufficient when it came to markets that are characterized by high levels of innovation and technological change, such as the market for charging solutions and BESS. The dynamic capabilities framework shifts the focus from VRIN-resources to firms' ability to deploy resources and continuously adapt in response to changing markets.

Teece et al. (1997) refers to the term 'dynamic' as the capacity to renew competencies that align with the changing external environment, while the term 'capabilities' emphasizes the strategic role of management in appropriately reconfiguring, adapting and integrating organizational skills, resources and competences to match the changing environment. The authors noted that unlike previous theories, which focus on creating value by deterring other competitors from entering or altering the industry structure, dynamic capabilities stress the importance of firms to sensing opportunities, seizing them, and reconfiguring internal processes to align with external changes (Teece et al., 1997).

Eisenhardt and Martin (2000) expands the perspective by directing criticism towards RBV for its overemphasis on static resource heterogeneity. They define dynamic capabilities as strategic and organizational processes that enable firms to adapt to dynamic environments by manipulating resources into new value-creating strategies. According to Eisenhardt and Martin (2000), dynamic capabilities can have different purposes. Some have the purpose to integrate resources, while others focus on reconfiguring resources within firms. Dynamic capabilities can also be connected to the gain and release of resources. These purposes show that there is a focus on how resources are actively managed and transformed, with less focus on performance outcomes alone (Eisenhardt & Martin, 2000).

At the foundation of the dynamic capabilities framework lies the assumption that sustained competitive advantage arises not only from the possession of valuable resources but also from developing distinctive organizational processes (e.g. coordination, learning, and reconfiguration), building firm-specific positions (e.g. technological assets, customer relationships, and complementary resources), and navigating evolutionary paths that shape the future capabilities (Teece et al., 1997). However, Eisenhardt and Martin (2000) say that it is not the dynamic capabilities themselves that create sustained competitive advantage. Instead, they argue that it is the resource configurations produced by the capabilities that leads to competitive advantage. While some commonalities exist between firms dynamic capabilities, such as communication, learning and decision-making routines, Eisenhardt and Martin (2000) argues that this does not mean that any dynamic capabilities among firms are exactly alike. However, they argue that due to the existence of certain commonalities, this implies that they cannot fulfill the VRIN-criteria proposed by Barney (1991). Based on this, Eisenhardt and Martin (2000) makes the argument that it is not the capabilities themselves in dynamic

environments that leads to competitive advantage, but that it depends on how firms deploy the resources to create value-creating strategies that lead to advantages.

A key insight from Eisenhardt and Martin (2000) is that the effectiveness of dynamic capabilities depends on the level of market dynamism. High-velocity markets, such as the electric mobility market, are unpredictable, fragmented and rapidly changing. Effective dynamic capabilities in these markets rely on new knowledge rather than existing, and they are often experimental and fragile in character. This implies that the sustainability of capabilities depends on the type of market and that the dynamic capabilities need to adapt to the market dynamism (Eisenhardt & Martin, 2000).

2.5.3 Resources and Capabilities in Electric Mobility

Hoefl (2021) emphasizes that the changes occurring in the automobile industry with connectivity, autonomy, sharing and electrification (CASE), has placed the industry in a dynamic and complex situation that has not been seen in the industry before. The CASE-framework, originally developed by Teece (2018), is a way to evaluate how OEMs respond to the transformation occurring in the industry. The transformation connected to CASE, creates both opportunities and threats to incumbents as well as for new entrants and has created a situation where traditional resources are no longer sufficient to secure competitive advantage (Teece, 2018). Recent research has focused on what type of resources and dynamic capabilities that are necessary in order to tackle the changing environment (Cabanelas, Parkhurst, Thomopoulos & Lampón, 2023).

Jiang and Lu (2023) provide a re-evaluation of the dynamic capabilities framework in the context of China's rapidly changing EV industry. They argue that incumbents' existing capabilities are insufficient to navigate the transformation toward electrification, especially when compared to the speed and scale that new Chinese EV startups have entered the market and gained market share. The authors claim that the traditional dynamic capabilities framework may be inadequate in such dynamic environments. Dynamic capabilities should in theory help firms navigate and tackle change, but Jiang and Lu (2023) argues that no incumbent currently possess sensing capabilities strong enough to act on the amount of emerging firms in the Chinese market. As a result of this, incumbents are now being outpaced by diversifying entrants and new entrants (Jiang & Lu, 2023).

In contrast, Murmann and Vogt (2023) argue that incumbents are better positioned in terms of ordinary capabilities, which potentially could lead to an advantage. Jiang and Lu (2023). however, argues that it is not the ordinary capabilities that is the critical difference between new entrants and incumbents, but the strategic thinking and mindset of the startups. While incumbents benefit from greater resources and strong ordinary capabilities, they often suffer from path dependency and cognitive rigidity, which can limit their ability to reshape their strategies to align with the dynamic environment. New entrants, on the other hand, are free from path dependent thinking which may allow them to create value in new ways. The authors further state that the central challenge for all actors in the industry is not only to adapt but also to achieve scale rapidly in order to secure long-term competitiveness (Jiang & Lu, 2023).

Furthermore, Lu et al. (2018) emphasizes the emergence of new ecosystems that will likely be in place which requires capabilities that are not adherent to the capabilities that OEMs possess today. This suggests that being successful in the automotive industry would require new capabilities in the new ecosystem that will be developed. Teece (2018) acknowledges that incumbent OEMs might experience technical skills gaps when the market is transforming, but they are described not to be particularly large. Cabanelas et al. (2023) also highlights a possible gap between existing and emerging technical capabilities as a recurring challenge. Key dynamic capabilities for bridging this gap will be flexibility and agility, collaborative ecosystem building, and co-creation (Cabanelas et al., 2023).

Teece (2018) also argues that OEMs have the possibility to retain competitive advantage if they have strong integration capabilities along with dynamic capabilities. By having those, incumbent OEMs have the potential to lead the upcoming transformational wave of the automotive industry (Teece, 2018). In contrast, MacDuffie (2018) put the emphasis on how new entrants can challenge incumbents by leveraging integration capabilities. The industry is concerned with high entry barriers, but Perkins and Murmann (2018) argue that these can be overcome with sufficient capital, which new entrants usually have as many of them are backed by venture or risk capital (Hoeft, 2021). This difference in the financial situation, identified by Hoeft (2021), can lead new entrants to be more aggressive in the development of EV technologies than incumbent OEMs, who may be constrained by capital intensity, corporate culture, and limited talent pools (Hoeft, 2021).

The increasing value of the entire service system, rather than hardware such as EV alone, is another important insight from Jiang and Lu (2023). If incumbents want to compete with new entrants, they need to develop resources and capabilities in services and do it faster than the new entrants are. They distinguish between three levels of competition, where startups are now competing on a three-dimensional level (hardware, software and services) as opposed to the one-dimension that incumbents typically have competed in. Diversifying entrants are said to compete on a two-dimension level. The different dimensions conclude that it is not just about selling hardware anymore, but that the diversifying entrants and startups are expanding the dimension on which to compete by including services and new system architecture (Jiang & Lu, 2023). Cabanelas et al. (2023) further claims that the mobility sector is experiencing innovation with new service models, such as Mobility-as-a-service (MaaS), personalization, and subscription-based transportation. These new service models require firms to reconfigure their existing capabilities and develop new ones. Moreover, revenue streams have diversified and now come from three sources: hardware products, data-driven services and software licensing and digital solutions, which is similar to the three dimensional level of competition mentioned by Jiang and Lu (2023). Cabanelas et al. (2023) further argue that it is therefore important to view the rise of software as an important selling proposition, whereas the industry has long been dominated by the selling of hardware.

In the waves of transformation regarding electrification in the transport sector, multiple authors claim that partnerships have emerged as a practical strategy (e.g. Teece, 2018; MacDuffie, 2018; Cabanelas et al., 2023). Teece (2018) further adds that this has led to many incumbents facing make or buy decisions and chosen to create partnerships with tech firms in order to take

advantage of software capabilities. MacDuffie (2018) discusses the potential entry by tech giants and claims that these will only be possible by partnering with OEMs since the tech giants lack manufacturing capabilities. The author further states that new actors are joining the transformative industry, but since they often lack every necessary capability, partnerships have become a crucial and useful way for new firms to enter the market. The potential entrance by tech giants can also be a way to address the growing importance of service integration, by allowing OEMs to gain critical software capabilities through tech giants (MacDuffie, 2018). The importance of participation in networks and alliances is also discussed by Cabanelas et al. (2023). They argue that firms should collaborate with diverse actors with different capabilities in order to enable the sharing of resources. The ability to form alliances and partnerships is viewed by Cabanelas et al. (2023) as a dynamic capability in itself which can lead to the enhancement of competitiveness and competitive advantage.

2.6 Theoretical Framework

From the literature review, several factors influencing the competitive positioning of providers offering HDV charging and BESS have been identified. The literature review addresses the concepts individually and discusses their implication in shaping market success in a rapidly evolving sector such as the one studied in this master thesis. However, the literature does not explore how they interconnect and can be utilized in order to understand how to build a competitive position. This theoretical framework aims to bridge that gap by explaining the relationships between market potential, firms positioning, and the resources and capabilities needed to reach this potential in an emerging market. A theoretical model has been developed in Figure 1, providing a structured overview of the critical aspects that influence success in this emerging industry.

The industry of EVs, and electric HDVs in particular, is an emerging industry in which the diffusion and adoption is still taking off and which is directly connected to the market for charging infrastructure and BESS. As the industry is constantly evolving, the characteristics and competitive dynamics of the market is crucial to map out, as it allows for an understanding of how an OEM should act and position themselves to reach a competitive position. The first part of the theoretical framework, grounded in Diffusion of Innovation theory and Porter's Five Forces, provides insights into the fundamental market forces and adoption mechanisms that shape the industry. The aim is not to evaluate whether each force is high or low, but rather to use the framework as a lens to explore how ongoing market dynamics interact with and influence these competitive forces. The first part of the framework serves to answer Research Question 1 as combining the two frameworks allows for a comprehensive understanding of the key characteristics of the market and the competitive dynamics that shapes the European market at the time.

With the market potential defined, attention turns to how an OEM can position itself within this potential in order to gain a competitive position. By analyzing the current industry dynamics, firms are more likely to position themselves correctly. The framework on competitive strategy addresses different positioning strategies that firms can leverage in order to gain a competitive advantage. The three competitive strategies described are the first step in

deciding how to compete in the market by choosing how to be positioned. Positioning within the identified market potential is further explained by business models, which should be aligned with the competitive strategy identified. In emerging industries such as the one studied in this master thesis, the right business model is not yet apparent, but is particularly important when firms are to develop new ways of monetizing and differentiating their offerings. OEMs must navigate the competitive pressures strategically to establish a sustainable market position and formulate a business model that enables them to create, deliver, and capture value. Based on this, the concepts of competitive strategy and business model innovation will be used to assess how OEMs in the charging infrastructure and BESS sector can design their offerings to build a competitive position. In addition to the theoretical concepts, this section incorporates key criteria that have been identified in the literature review as particularly important for building a competitive position in this specific market context. This part of the framework, along with the following section on resources and capabilities, addresses Research Question 2, focusing on how an OEM can effectively act to gain a competitive position.

Once the positioning is defined, it is important to understand what is needed in order for an OEM to reach that potential and gain a competitive position. The resource-based view explores the topic of how firms can use their existing and internal resources strategically to build themselves a competitive advantage which in turn can lead to a competitive position in the market. Since the market for charging solutions and BESS is dynamic and fast-evolving, the resource-based view is also complemented with the dynamic capabilities framework. This framework explains the importance of firms having dynamic capabilities in order to respond to the changes that occur in fast-moving industries, and adds the perspective of being flexible and responding to new market developments. When used together, these two frameworks complement each other and address how the internal resources and capabilities within a firm can be used to reach a competitive position and respond to the market potential. This section also integrates criteria identified in the literature review related to internal capabilities that have been shown to be of importance in the industry. Together with the positioning concepts, this section further answers Research Question 2 by exploring what resources and capabilities are needed to reach the market potential.

The theoretical framework, shown in Figure 1, provides a holistic understanding of the industry of charging solutions and BESS. The framework highlights how the identification of the market potential leads to the exploration of potential market positionings within that potential, which in turn requires appropriate resources and capabilities. The three critical steps all serve a purpose in being able to answer the research questions of this thesis. The theoretical concepts being used provide different perspectives and provide a thorough path to discover where and how to compete under the specific market conditions.

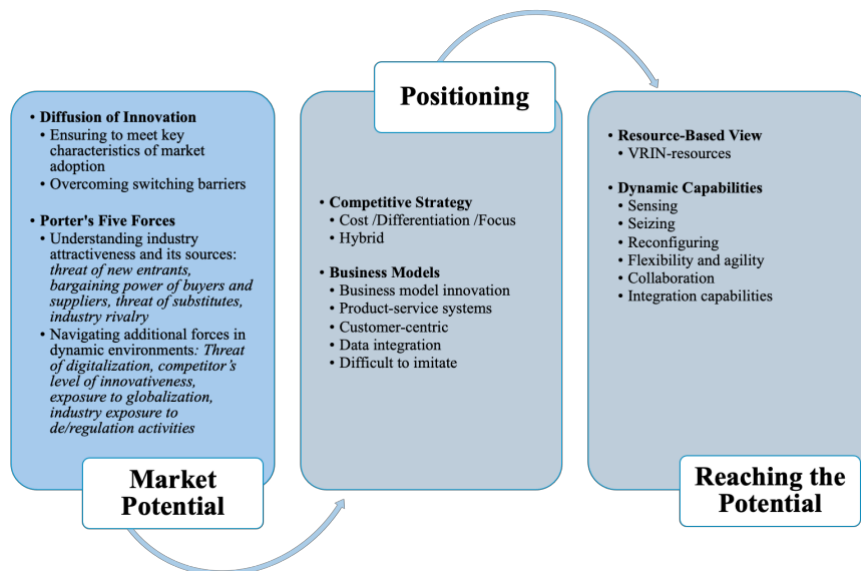


Figure 1: A framework illustrating the dynamic relationship between market potential, strategic positioning, and successfully reaching the market potential. It highlights key criteria that OEMs must address to build a competitive position.

3. Methodology

3.1 Research Assumptions and Philosophy

To start with, how research is conducted is shaped by philosophical assumptions. The philosophical assumptions made will guide the way that the world is understood and how to go about investigating it, and the assumptions are therefore critical as they influence decisions about research strategy, design, and methods. According to Bell, Bryman and Harley (2019), philosophical assumptions consist of two components, ontology and epistemology, which will be addressed below.

Ontological assumptions define what the research aims to understand about the world, and can either take a position of objectivism or constructionism. The objectivistic position describes social phenomena as objective realities beyond our influence and exist whether we are aware of them or not, while the constructionist position sees social phenomena as created through social interaction and it is therefore not fixed or objective (Bell et al., 2019). In this study it is assumed that competitive advantages, market differentiation and business models are shaped by active choices made by individuals and organizational actors. The core themes of this study are highly dependent in its context, meaning that this study is guided by the constructionist perspective, implying that knowledge will not be gained solely by observing the world, but also by interviewing social actors to understand both how they shape, but also how interviewees understand the world.

Epistemological assumptions on the other hand is the theory of knowledge, and describes how we come to know things. According to Bell et al. (2019), interpretivism emphasizes the understanding of subjective meaning and experiences of individuals in a social context. As this study aims to explore how competitive positions and competitive offers are created and

delivered to customers within the charging solutions and BESS market, the focus is on the perspective and experiences of individuals within the market and its organizations, rather than seeking to find objective truths, and thereby align with the interpretivism view.

3.2 Research Strategy

According to Bell et al. (2019) the research strategy refers to the overall approach you take in your research project. It is common to assume two types of research strategies; qualitative or quantitative, or a combination of the two. The qualitative approach focuses more on words and images in the data collection and analysis process, as compared to the quantitative approach (Bell et al., 2019). In line with the assumptions made above and the fact that this study takes an interpretivist view, assuming that the reality is socially constructed by the views of individuals, leads to the choice of a qualitative method for this study. The qualitative method is more appropriate as the research questions require a deeper understanding of the current competitive landscape and successful competitive offers in the market for charging solutions and BESS, and these insights are more likely to be captured by a qualitative method. As part of the qualitative strategy, semi-structured interviews will be conducted with industry consultants and company representatives, which allows for flexibility in exploring emerging themes. Bell et al. (2019) also highlights that the qualitative research strategy emphasizes the interpretation of the social world by individuals. This is highly relevant in this study, as it aims to capture individuals' perceptions and understanding of emerging market trends in the highly dynamic market identified in the study.

However, the qualitative approach has limitations. Qualitative studies are often perceived to be difficult to generalize, since insights draw from specific cases and may not be applicable to the broader contexts. However, the primary objective of a qualitative study is not to achieve generalizability, but to offer a deep, nuanced and exploratory insight into a specific concept or problem. The approach is often criticized for its subjectivity, as the researcher's personal perspectives and biases may influence the results and guide the interpretation of the data in a particular direction (Bell et al., 2019). In this study, these problems are addressed by including a diverse set of interviewees that have been provided the same interview guide in order to ensure consistency. Further, the interpretations and findings were discussed between the two researchers to minimize individual bias, and the findings are not presented as universal truths, but as recurring themes. Additionally, detailed documentation of the data collection process, sampling criteria, interview design, and analytical steps has been maintained and is presented in the methodology chapter. By doing this, the problem of replicability and transparency is addressed, which is also a common critique against the qualitative strategy (Bell et al., 2019).

Furthermore, the approach that is taken in research can either be deductive, abductive or inductive, and a qualitative research strategy is often associated with an inductive approach. This study adopts an inductive research approach where the aim is not to test pre-existing theories but to develop new insights grounded in empirical data (Bell et al., 2019). Rather than formulating hypotheses, the study explores meanings, patterns and contexts through semi-structured interviews which allows theory to emerge from the data itself (Gioia, Corley & Hamilton, 2013). As Gioia et al. (2013) highlight, inductive research enables the generation of

novel insights by remaining open to what the data reveals, while Saunders, Lewis and Thornhill (2007) emphasize its strength in permitting alternative solutions of what is going on apart from the theory formulated beforehand. Together, these characteristics make the inductive approach particularly valuable in our study given the novelty and complexity of the research area, where existing theories may not fully capture the characteristics of the evolving, competitive landscape.

By using a qualitative, inductive approach informed by interpretivist assumptions, it is possible to study how different companies position themselves in the markets. By collecting data through semi-structured interviews with key actors in the industry, it will be possible to get insights into the characteristics of business models that seem effective, and how providers within this sector can differentiate and build a competitive position in the market.

3.3 Research Design

The research design provides a framework for implementing the chosen research method and guiding the analysis of the resulting data. Bell et al. (2019) identifies several research designs, and in this study, the multiple-case study is used. As indicated by the name, case study research is not limited to studying only a single case but can involve the investigation of several cases, and multiple-case study designs are becoming more used in business research (Bell et al., 2019). This is particularly relevant for this study where the purpose is to explore multiple cases of providers of charging solutions and BESS. With the multiple-case study, the researcher can compare and contrast findings from different cases, which allows for reflection on the findings and its similarities and differences (Bell et al., 2019). The fact that the multiple-case study allows for comparison and contrast between companies makes the research design fit our study well. The design allows for the identification of both common patterns and unique strategies across the cases studied, which enhances the depth of the analysis but also allows for the discovering of broader trends within the industry.

As compared to a cross-sectional design where the focus is on creating generalizable findings, the multiple-case study focuses on each case and its unique context (Bell et al., 2019), and is appropriate to use if the goal is to get a deep understanding of the research context and the processes involved (Saunders et al., 2007). This makes the multiple-case study appropriate to use in this study, as the unique characteristics and strategic positioning of each company will be important to grasp in order to understand what creates competitive positions in the industry. Solely generalizable findings will not be useful in this study, as the aim is to identify the competitive offer that best serves the consumers. The multiple-case study design also aligns with our qualitative, interpretivist and inductive strategy as it enables the exploration not only of what firms in the industry are doing, but also why and how, which is one of the strengths of the case study mentioned by Saunders et al. (2007). Furthermore, the use of different data collection techniques may be used in one study to ensure that what the data tells you is accurate. This is referred to as triangulation of data (Saunders et al., 2007), and as this study entails a multiple-case study which integrates different sources it allows for triangulation of data and for different insights to be generated. This way of collecting data also allows for a more comprehensive understanding of markets and actors.

3.4 Data Collection

3.4.1 Literature Review

In this study, a literature review is conducted in order to gain deeper understanding of the relevant research in the areas of charging solutions and BESS. Bell et al. (2019) claims that a literature review is the basis of the empirical research and its purpose is to provide justification for the research questions. The purpose of a literature review is not to summarize everything that has been researched on the area, but to provide a review on the most relevant research on the topic of the thesis (Saunders et al., 2007). It is therefore important to make judgments regarding what to include and exclude, as the research should emphasize why the research questions are important (Bell et al., 2019).

In this study, the literature review is conducted systematically based on secondary data using various databases. The literature is located through online resources such as Google Scholar, SCOPUS and other resources available through the GU library. In order to locate the literature used, keywords are identified that are connected to the research questions. The keywords are identified early in the process based on the authors' understanding of the area at the time, where further keywords and synonyms are identified and added throughout the process. Some of the main keywords used include: *market adoption, diffusion of innovation, business model, product service system, competitive strategy, differentiation strategies, sustained competitive advantage* and *dynamic capabilities*. Furthermore, to connect the literature to the industry of charging solutions and BESS, keywords include: *battery energy storage systems, charging infrastructure, charging solutions, heavy-duty vehicles, electric vehicles* and *electric mobility*. The industry-related keywords were used in addition to the theoretical ones in order to find literature on the theoretical frameworks in connection to the target industry, using boolean operators such as 'AND', 'IN' and 'OR'.

As Bell et al. (2019) emphasize, it is important to define clear inclusion and exclusion criteria to ensure relevance and quality of a literature review. In this study, due to the dynamic nature of the charging solutions and BESS industry and its close connection to EVs and electric mobility, related literature from these areas are included after careful consideration of its applicability to the study. Another inclusion criteria is that of peer-reviewed articles from high-impact journals in order to enhance credibility of the study. However, some non-peer-reviewed sources are included in the literature review as well. These are selected due to their significance of their applicability to the specific industry examined, and since the market for charging solutions and BESS is relatively new, it has not been extensively addressed by peer-reviewed articles. The non-peer-reviewed literature are selected based on trustworthy sources, such as agencies and high-regarded consultancy firms. To maintain consistency and relevance, literature not written in English or with low citations are excluded in order to ensure a common language and high academic quality. Additionally, industry-related articles from before 2010 are also excluded as the EV industry is an emerging field and the exclusion of older articles secures recent developments in the field. Once the initial selection is made based on these criteria, abstracts and conclusions are reviewed to assess relevance, and the most pertinent articles are then read in full and incorporated into the study.

3.4.2 Primary Data Collection

Due to the nature of this study, the method to collect qualitative data is through semi-structured interviews. The basis of semi-structured interviews is that the researchers will typically have a foundation of questions and themes that the interview will cover, but where the conversation is allowed to go into other directions, depending on the interviewee's perspectives. This includes follow-up questions and changing the order of the questions in order to ensure the flow of the conversation and achieving new insights (Saunders et al., 2007). The semi-structured format allows for a balance between structured and unstructured interviews where the main topics and paths of the interviews are set beforehand with predefined questions, but where the flexibility allows for changing the direction of the interview based on responses from the interviewees. This allows for emerging themes during the interviews which can add unexpected topics to the conversation and provide directions that were not known previously (Bell et al., 2019). This makes the semi-structured interviews particularly suitable for this study, as they provide the flexibility needed to explore complex topics in depth. Given that the research aims to understand current market developments, this method allows for a richer and more adaptable data collection process that can capture the depth and variability of the respondents' insights. Saunders et al. (2007) also states that the formulation of questions is critical in order to achieve success in this type of interviews, where the ability of the interviewers to pick up on new insights and ask additional questions is crucial in order to maximize the advantages that the flexibility of the interviews provide.

3.4.2.1 Sampling and Selection of Respondents

In qualitative research, purposive sampling is a common method to use, however, Bell et al. (2019) states that it is the characteristics of the research questions that should decide on an appropriate sampling method. Since the research questions of this study aims to analyze how OEMs can build a competitive position in the market of charging solutions and BESS, the purposive sampling method is used in order to specifically target respondents that are active in the particular industry. The purposive sampling method is a sort of non-probability sampling technique where the sampling is based on its connection to the research questions (Bell et al., 2019). Saunders et al. (2007) states that the purposive sampling approach enables the researchers to act on judgment when selecting a sample that aligns with the research objectives. The purposive sampling method can take various forms, where this study used a theoretical sampling approach, which implies that the sampling is not limited by a prior selection (Bell et al., 2019). There is no clear number on an appropriate size of a sample (Bell et al., 2019; Saunders et al., 2007). While Saunders et al. (2007) states that the sample size should depend on the research questions and the objective of the study, Bell et al. (2019) claims that the most important thing is to justify the sample size, rather than predetermining an exact number of the sample. The goal is to reach saturation, that is, when there is nothing more to gain from further interviews.

The selection of participants in this study is based on the industry being explored. In order to gain insights from the industry and on how companies compete within it, the selection includes consultants specialized in the industry, and strategic representatives from OEMs and other companies currently operating in the industry. A criteria for the industry consultants is that they

need to represent a firm which is currently active within the EV sector, and specifically in charging infrastructure or BESS. The participant should also have worked in the industry for at least three years, to make sure that they are aware of ongoing trends and the transformation which has occurred in the industry. The targeted companies also need to be active in the industry and operate in the end of the value chain, offering charging solutions and/or BESS to industrial customers of HDVs. Lastly, the criteria for the companies sampled is that they need to be operating across Europe. The mix of industry consultants and representatives from companies is sampled in order to gain insights on both market trends as well as company-specific information on strategies and business models. Furthermore, the aim is to have a mix between traditional OEMs and other actors in the industry.

For the sampling, companies that are active in the industry are found using Google and LinkedIn as well as insights from interviews and knowledge from our personal networks. The potential candidates are initially contacted through an email which contains information on the purpose of the thesis and an invitation to participate in an interview. Around 50 potential candidates are contacted of which 11 are willing to participate in the study. However, due to competitive strategies being a sensitive strategic topic, 3 of the interviewees deemed the interviews performed to include sensitive information which results in the decision to exclude these interviews from the empirical findings and the subsequent analysis. The 8 remaining interviewees represent OEMs, new actors and industry consultants. The interviews are offered to be performed online via Microsoft Teams or in person. In cases where the potential candidates are located outside of Gothenburg and Sweden, only the online-option is offered. Online interviews are preferred by all respondents, as this is more easy to schedule and limits the dedicated time needed to participate. All interviews are conducted with video-sharing in order to mitigate the risk of missing non verbal signs or body language.

Interviewee	Company Role	Industry	Language	Date	Duration	Method
I1	Strategy Consultant	Electric HDV, BESS, Charging	English	2025-03-18	49 min	Microsoft Teams
I2	Consultant	Electric HDV, BESS, Charging	English	2025-03-19	43 min	Microsoft Teams
I3	Process management	Charging	Swedish	2025-04-09	47 min	Microsoft Teams
I4	Sales management	BESS	Swedish	2025-04-10	58 min	Microsoft Teams
I5	Business development and asset management	BESS	Swedish	2025-04-11	49 min	Microsoft Teams
I6	Aftersales management	BESS	English	2025-04-16	46 min	Microsoft Teams
I7	Sales and business development	Charging	Swedish	2025-04-24	50 min	Microsoft Teams

I8	Business development	Charging	Swedish	2025-04-24	43 min	Microsoft Teams
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Table 1: Information about interviews and interviewees.

3.4.2.2 Interview Process

Before the first interviews are conducted, interview guides are constructed which aim to structure the questions in accordance with the research questions and the literature review. Due to the different participants, two separate interview guides are created in order to tailor the interviews depending on the participant. The interview guide created for interviews with industry consultants are found in Appendix A, and the interview guide constructed for interviews with firm representatives are found in Appendix B. According to Bell et al. (2019), the interview guide is not a way to provide a structured interview, but to maintain a structure in the semi-structured format. The interview guide is provided to the respondents before the interview, in order to provide a dependability of the study, as well as showing the researchers' main goal of the interview. The interview guide is structured in three main themes, each with their own subquestions. Due to the semi-structured format, the questions asked changes depending on the interview and the interviewee's perspective. However, the three main themes are important to keep throughout all of the interviews in order to ensure that the interviews cover the major areas of the study.

The length of the interviews varies between 40 and 60 minutes depending on the respondent's availability. The language of the respondents varies, and interviews are being conducted in both Swedish and English. All the interviews are recorded by consent, and the interviews are directly transcribed using a function in Microsoft Teams. The transcripts are thoroughly revised by watching the interview again after its occurrence in order to fill in potential blanks and misspellings created by the software tool. The removal of disfluencies such as repetitions and false starts are also made to improve the flow. The transcriptions of the interviews performed in Swedish are also carefully translated into English, without changing the content of the interviews. The recording of the interviews allow the researchers to fully attend and not be distracted by keeping notes during the interviews, which allow for higher presence and better follow-up questions. The recordings are also useful in order to re-listen to the interviews, where the tone and presentation was critical in order to understand certain statements. The respondents are made aware that their participation is anonymous and that the recordings are only to be used by the researchers and will be deleted once the study is concluded. In regards to the confidentiality of the topics studied, the finalized transcriptions are sent to the respondents who are asked whether there is anything that should be added or deleted from the transcription, or if there are any additional questions.

3.4.3 Data Analysis

The analysis of qualitative data can be difficult due to the large and complex datasets that the method usually generates. In order to be able to analyze these datasets, the data need to be structured and grouped according to the characteristics of the data (Bell et al., 2019). To do this, an inductive approach using thematic analysis is applied, and according to Bell et al. (2019), it is one of the two main methods used to analyze qualitative data. The thematic analysis

implies that the data is broken down and categorized into different codes which later results in themes that are common throughout the dataset (Bell et al., 2019). The initial coding provides a structure of the data which is needed in order to continue the analysis and further enhance recurring themes. Saunders et al. (2007) describes the data collection and analysis to be an interactive process where codes are being refined as new patterns, themes and relationships emerge during the process. Due to the interactive process, it is also possible to re-categorize and adjust future data collection based on identified key themes (Saunders et al., 2007). The thematic analysis is suitable for this study, as it aims to explore the perspectives of different actors in a relatively new and highly dynamic market. The use of an open-ended analytical approach allows themes to be detected directly from the data, and enables the researchers to identify both anticipated as well as unexpected insights.

Categorizing data and finding themes can be challenging. Bell et al. (2019) states that when identifying codes and themes, the most important criteria to look at is repetition. This means that you should find topics that recur throughout the dataset. However, it is not only repetition that qualifies a topic into a theme, Bell et al. (2019) argues that it is important that the theme is also relevant in regards to the research questions and the topic of the study. Other criterias that is looked for when finding themes, and mentioned by Bell et al. (2019), is identifying similarities and differences, metaphors and analogies, transitions and missing data.

In this study, the software tool NVivo is used in order to aid the process of the thematic analysis. Both Bell et al. (2019) and Saunders et al. (2007), describe the rise of software programs that simplify qualitative data analysis as one of the most notable developments in the qualitative research fields. NVivo is accessed through the GU library and is used as a tool in the coding process of the data analysis. The tool is used to effectively and systematically identify themes and codes among the interviews. However, the interviews are still manually coded but with the aid of the tool it is possible to organize the codes more efficiently. The codes are identified based on the criterias of repetition, relevance and differences, as mentioned by Bell et al. (2019). The identified codes and themes are thereafter revised, linked, and sorted in order to connect them to the context of this study. Finally, the identified groups, themes and codes are compiled into a table, which provides a comprehensive picture of the relations and connections between the occurring themes and the context of the research. The table of the identified codes, themes and groups are found in Appendix C.

3.5 Research Quality

The assessment of the quality of a research can be based on its reliability and validity, but these criteria have been discussed to be more suitable for quantitative research rather than qualitative. It has therefore been suggested that qualitative research should be evaluated based on different criteria, but these criteria can still be seen as equivalent to reliability and validity (Bell et al., 2019). According to Guba and Lincoln (1994) trustworthiness is a highly relevant criteria for evaluating the quality of a qualitative study. This criteria is seen to be made up of four sub-criteria; *credibility*, *transferability*, *dependability*, and *confirmability*. The criteria and its implications for this study are further discussed below.

3.5.1 Credibility

Credibility refers to the act of ensuring that the research findings are accurate, trustworthy and believable from the perspective of the people who took part in the study. The criteria should address whether the observations made by the researchers match with the theoretical ideas developed (Bell et al., 2019). In this study, particular attention is given to accurately capture the perspectives of the participants, while at the same time maintaining objectivity throughout the research and its interpretations. Furthermore, to achieve credibility, it is important that the study is carried out according to good practice. Bell et al. (2019) also suggests that the findings of the research should be submitted to the members of the social world studied, to confirm whether the researcher has correctly understood the social world or not. In this study, findings are sent to the participants in order to validate interpretations and findings. Furthermore, Guba and Lincoln (1994) mentions triangulation as a recommended technique to increase the credibility of a study. The method is a way of cross-checking findings and data to ensure that interpretations are not limited by the biases of a single case for data collection, increasing the credibility of the study. As described above, this study is combining data collected from several semi-structured interviews to get a more comprehensive and balanced understanding, allowing for stronger and more trustworthy interpretations that reflect different perspectives.

3.5.2 Transferability

According to Bell et al. (2019), qualitative studies tend to be focused on a small group of participants or cases which are studied in depth, meaning that the findings may only be applicable to the small social world and its specific context being studied. The transferability of a study refers thereby to the extent to which the findings of a qualitative study can be applied or transferred to other contexts or settings, or if the findings are context-specific. The issue of transferability is addressed in this study in several ways. Even though the sampling of companies are companies within the same industry, they are diverse in the way that they represent different types of organizations such as OEMs, electrification companies, or BESS producers. This variation allows the study to capture a wider range of perspectives and organizational contexts. In addition, the study also includes representatives from consultancy firms, enhancing the transferability as these offer broader, cross-company perspectives. Bell et al. (2019) also highlights that in a qualitative study, rather than aiming for generalization, the goal is to offer thick description. Even though participants are anonymous in the study, the study provides rich descriptions of the context and the companies. This allows the readers of the study to assess whether the findings are applicable to other firms or contexts. The transferability of the study then depends on how well the context is described, and the judgment of applicability is shifted to the reader (Bell et al., 2019).

3.5.3 Dependability

Guba and Lincoln (1994) also mentions dependability as a way to demonstrate that a qualitative study is trustworthy, and explains that each step of the research process, from problem formulation to data analysis decisions, should be accessible to the reader. This allows the reader to assess whether proper procedures have been followed and whether the conclusions that are drawn are justified based on the information provided. In this study, the issue of dependability

is addressed by including clear records of the entire research process. Apart from detailed descriptions of the problem formulation, choice of research strategy and design, and choice of research participants, the study also includes the interview guide, and the coding procedures used in the analysis to arrive at the conclusions made. Thereby, the study allows the reader to follow all the decisions made during the process and assess whether proper procedures have been followed. Furthermore, while a formal external audit is not conducted, the research process is regularly reviewed and discussed with academic supervisors and peers, which contributes to the overall dependability of the study.

3.5.4 Confirmability

Confirmability is highly connected to objectivity and refers to the potential bias of the researchers to interfere with the research findings. Although Bell et al. (2019) states that it is impossible to be completely objective in business research, confirmability is a way for the researchers to show that they have acted with good faith and intentions. It is also important that the results of the study are not skewed in favor of the researchers' own interests and that empirical findings are not affected by personal bias and subjective interpretations (Bell et al., 2019). In this study, a number of processes are applied to ensure confirmability and the objectivity of the researchers, for instance through the transcription of interviews and a consensus among the researchers about the findings. The results are also shared with the study's supervisor and peer-reviewers in order to gain their perspectives on conclusions made, as inputs from others help maintain the confirmability by minimizing the personal biases of the interpretation of the results. Frequent re-readings are another way in which objectivity has been maintained, which further enhanced the confirmability of the study.

3.6 Ethical Considerations

It is important to protect a research's integrity and reputation by identifying and addressing ethical considerations. Saunders et al. (2007) describes the role of ethics in research as the appropriateness of the researchers behavior in regards to the rights of the participants and others affected by the research. This means that the design of the research should be morally defensible to all parties affected by the research (Saunders et al., 2007). As ethical issues can occur throughout the research process, it is important to view ethics as an integral part of the research where it is necessary to keep revisiting and discussing these matters throughout the entire process. Bell et al. (2019) identifies four major ethical principles that all researchers need to take into account and comply with. These are: *avoidance of harm*, *informed consent*, *privacy* and *preventing deception*. Saunders et al. (2007) also includes principles such as managing data confidentiality and maintaining objectivity as a researcher. All of these principles imply that the safety of the participants is maintained throughout the research process. This also includes respecting the anonymity asked by participants, as well as providing them an option to withdraw their previous given consent. Participants also need to be informed on what they are agreeing to participate in, where they need to be provided with as much information as possible in order for them to make an informed decision regarding their participation (Bell et al., 2019; Saunder et al., 2007).

In order to ensure that this research is conducted ethically and adhering to the ethical principles presented, the initial contact with potential participants provided descriptive information regarding the purpose of the study as well with the anonymity applied. This is done in order to ensure that the participants can make an informed decision and provide consent to participating in the data collection. During the interviews, the participants are asked for permission to be recorded, where they are informed regarding the private use of the recordings and that recordings are being deleted after the research process is finished. Neither the name of the participants nor the company they work for is published in this study, since the topics surrounding competitive positioning and business models can be regarded as sensitive information in the competitive landscape. The interviewees were in no way pressured to provide confidential information and they are given the option to refrain from answering questions that would impose on their personal and professional boundaries. In terms of the industry consultants, they are not asked to disclose confidential information regarding who their customers are and they laid clear boundaries on what specifics they are able to go into detail to. The participants are also given the option to remove information from the interviews, both during the actual interview as well as later when transcriptions were shared and before any conclusions were made.

4. Empirical Findings

4.1 Market Potential

4.1.1 Current Market Situation

All of the interviewees began with discussing the current market landscape in order to understand what the major factors are that influence the current market situation. The market for HDVs is clearly characterized by one way forward, which is towards electrification, which all interviewees agreed upon. The interviewees express that the details of that path is not yet entirely set, but that there is a clear understanding that the future is moving towards electric mobility and that it is more important now than ever before. Interviewee 1 mentions that, despite the forecasts of electric adoption going down a bit, the underlying drivers of the market transformation are still in effect.

“If you look into the big picture and there is a clear path towards, and many talk about, different decarbonization paths and the rates and then electrification, like it’s getting more important than less important.” - I2

Interviewee 2 states that the market for charging infrastructure and BESS has moved towards being less about growth to being more about creating value in the market. In other words, the interviewee states that it has become less about where to play, turning more focus on how to play instead. In order to capture the value and create a favorable position in the market, interviewee 2 claims that the market is now seeing processes becoming more standardized and automatized in order for the player to become quicker and achieve more output. The interviewee elaborates this argument by saying that having an unique selling proposition is

becoming more important as it is necessary for the players to go back to the basics of having the right price, being the most efficient and having the right site.

“Less growth, growth, growth, as it used to be a couple of years ago. It’s more value creation. So essentially, how can I actually perform successfully on the growth path I had initially in mind?” - I2

When it comes to HDVs, interviewee 1 states that the electrification and charging infrastructure is now starting to focus more on heavy and long haul transportations, whereas charging infrastructure previously have had its focus on urban and light transports, although adding that the number of charging points is still fairly low. Interviewee 2 provides information on what distances is actually conductible to electrify in terms of HDVs, and says that distances under 500 kilometers can be fully electrified. Distances above 500 kilometers, however, still face challenges and its ability to become fully electrified is not yet apparent. The interviewee puts this in a Nordic context and states that distances above 500 kilometers does not exist in any large volumes, which showcases the potential to electrify more HDVs in the Nordic countries.

“It shows like the big potential of electrification for decarbonization of transport and road transport in general.” - I2

Technological developments have changed the dynamics of the electric mobility industry, and interviewee 5 states that the developments have caused serious decreases in the prices of BESS over the last years. Interviewee 2 explains this by the technological developments causing the cost of batteries to significantly decrease, causing cheaper cost of storage. Interviewee 3 also discusses that in general, technologies in electric mobility are still very new and its high prices causes a barrier needed to be overcome before anyone can start to earn profits on these technologies. The interviewee highlights the interconnectedness of the industry, and that it is therefore necessary for other players to do their part and also develop the technology before anyone can start to actually capture value and earn money in the market.

“But since it’s new technology, and expensive technology, there’s a threshold before you get to the point where you can start making money from it, and it requires that someone else does their part as well before I can start making money from it.” - I3

Interviewee 7 dedicates the massive technological advancements in the market of electric mobility to the entry of Tesla. The interviewee claimed that the technology was not existing until Tesla entered the electric mobility market, and their entry caused the technological advancements to improve significantly. However, the interviewee claims that almost no one was able to act at the same pace as Tesla, and interviewee 3 adds that it is important for the development of the market to have these new players, who are usually more risk prone, who can enter the market and increase the rate of development.

“The technology and the timing simply weren’t right until Tesla did it, and after that, everyone was more or less slow to jump on.” - I7

The market is moving rapidly, much due to technological changes. Interviewee 4 states that fast technological shifts can affect the launch of new systems and services where it has occurred

in the past that during the development of a new system, the supplier has developed their components so much that the old one, necessary for the new system, was not able to be used in the new system. These fast technological changes have also caused the old ways of competition to change. Interviewee 4 describes that previously, big firms were more interested in acquiring small firms in order to reduce competition, but a change in the market that has been identified is that it is more common nowadays to form partnerships over a certain time period. The reason for this is because technological changes happen at such a rapid pace nowadays that big firms are more hesitant towards acquiring smaller firms solely for their technology.

“That approach doesn’t work as well today, partly because there’s fear around the technology, will it hold up for ten years?” - I4

4.1.2 Market Adoption

In terms of the rate at which the electric mobility market has adopted new technologies, interviewee 1 explains that there is a difference between the adoption rate of countries, and also which segments that are electrified first, and the interviewee claims that it is a matter of looking at where it makes more sense to electrify first. The interviewee states that the electrification does not happen very aggressively, but that the transition happens gradually.

“The transition speed is a little bit different [...], kind of which segments first, which countries first and within the countries there’s also very different, different kind of subsectors of where it makes sense to electrify first.” - I1

How the regulatory environment affects the market adoption of electric mobility has been discussed by several interviewees. Interviewee 2 states that in the short- and mid-term the electric mobility market will face a lot of pressure due to the changes that occur in the regulatory environment, although claiming that the regulatory environment regarding electric mobility in general has slowed down. According to interviewee 2, the current targets that does not allow the selling of ICE cars from 2035 in Europe is nowhere near to be met, and in order to move the electrification forward, it is necessary to have more regulatory pushes.

“We’re nowhere close to a world where we cannot sell any cars of internal combustion engine from 2035 onwards, so if we take that seriously, or to some extent, seriously, there has to come a regulatory push from one angle.” - I2

In regards to the electric mobility market, interviewee 7 discusses the rate of which electric trucks are being sold. In terms of market adoption, the market is in phase two, which means that electric trucks have not yet become mainstream which interviewee 7 claims to be partly due to the high expenses related to producing an electric truck. The interviewee describes how the forecasts for adoption of electric trucks have shifted along with Tesla entering the market. When Tesla first entered the market for electric trucks, their plan was to sell these at a much faster pace than initially believed. This spurred the other actors to shift their forecasts and projections as well. Interviewee 1 takes the customer perspective and states that it is expensive to purchase an electric truck, and it is not yet economically profitable to own an electric truck in most cases. The interviewee however, claims that there are some cases in which it has been

economically favorable to purchase an electric truck, but that the vast majority do not experience these favorable economic conditions yet. Interviewee 3 adds that right now, there is not enough demand for electric trucks for it to become mainstream, which, according to interviewee 7, has made the forecasts taking a less optimistic approach. However, a larger widespread adoption has now been observed, where companies acquire everything from 20-300 electric trucks, which raises the demand for charging depots.

“What we’re seeing now is essentially a return to the original plan, the one people initially believed in, and that seems to be the timeline we’re ramping up towards now” - I7

For truck owners, interviewee 7 believes that their transition towards electric trucks will happen according to their normal replacement cycle, meaning that truck owners will not buy an electric truck if their fossil-driven truck is not planned to be replaced. When the wider market adoption eventually occurs, interviewee 7 states that they as a charging company are ready for it. This is a notion that interviewee 1 also discusses, where the interviewee claims that the bottleneck in the market is not the charging infrastructure in itself, but that the challenge is the availability of EVs that right now slows down the market adoption, along with interviewee 3’s claim that demand for electric trucks is too low for a wider adoption. Interviewee 1 states that there are multiple companies which can provide the chargers and that the inventory and knowledge is there, it is the trucks that have not been widely adopted by the market yet.

“There’s enough companies that know how to do this, so I think it’s really about the cost and availability of vehicles.” - I1

Other challenges in the market for electric mobility, and for the charging infrastructure and BESS markets specifically, have been discussed in the interviews. One of the major challenges in terms of charging infrastructure lies in the inability to capture value. First and foremost, interviewee 2 states that the margins are low for companies that offer charging solutions, and that the necessary investments are substantial and therefore narrows the margins even more. The interviewee further discusses how it is not possible today to only be the hardware provider, but also to provide software, and without the software, it’s hard to be in control of the value capturing. The interviewee has made the observation that the market is now moving from having charge point operators and electric mobility service providers, to being more integrated along that, which is a way to try to capture more value by providing both the hardware and the software. However, the optimal way to capture value is, according to the interviewee, still undecided.

“It’s not super easy to capture value with EV charging in particular, margins are very slim and the CapEx invest you have to do is quite big” - I2

What was also brought up in terms of challenges connected to charging infrastructure and BESS, is who the end customer will be. Both interviewees 3 and 4 mention the problem with having enough capacity in the grid, and that this creates challenges that have implications for the entire electrification transition. Interviewee 3 discusses the responsibility issue of grid capacity, by claiming that the grid supplier does not take the responsibility to provide a stable grid and grid access, and that it is up to end customers to electrify and solve the problems that

arise due to it. Interviewee 4 states that the average person does not have the knowledge necessary to understand the energy market and grid access, but that the structure of the market and the responsibility of electrification has been placed on the people. However, interviewee 3 brings up recent discussions regarding how, in the future, BESSs can be placed directly with the grid suppliers in order to move responsibility away from the end customer.

“[...] but in the long run, I believe this is something the grid suppliers will have to manage themselves” - I3

Another challenge in the charging infrastructure market is the low utilization rates in relation to its high upfront cost, which is discussed by interviewees 3 and 5. Interviewee 3 states that customers have realized that they do not utilize the chargers as much as initially thought when purchasing the truck. Interviewee 7 also adds that, even though you have a charger at your home depot, there is a need to have access to chargers while being on their routes, otherwise driver schedules and logistics will be ruined. Interviewee 5 mentions that it is difficult for customers to project how much the charger will be utilized at its home depot, which creates challenges for the customers when determining whether the charger is a good investment decision.

“And the first phase has been about buying a truck and buying a charging station, that way you have the security on your side, but now people are starting to realize that they’re not using that charging station nearly as much as they’re using the truck” - I3

4.1.3 Dynamics of Competition

In several interviews the dynamics of competition in the market of charging infrastructure and BESS have been discussed. The market has experienced a lot of new players entering over the last couple of years, which all of the interviewees agreed upon. However, interviewee 2 highlights that the amount of new entrants have started to slow down. Interviewee 1 and 2 describes the market as fragmented, where interviewee 2 states that there are a lot of different positionings occurring in the market. The amount of new players and existing players moving into new spaces, has splurged the fragmentation of the market. Interviewee 6 has noticed in the market that there is an increased interest from charging solution providers looking into opportunities with BESS, and vice versa, BESS companies showing interest to move into the charging space which could serve as an indicator that these two markets are converging more and more, both in terms of hardware and software. Both interviewees 1 and 2 explain that they have not yet experienced any majority leader in the market. Many of the interviewees believe that the market will consolidate soon, where interviewee 2 stated that this has already started to appear. Interviewee 1 claims that this market consolidation is necessary and unavoidable due to the amount of charging infrastructure that is being built today, where the sales of electric trucks are not moving at the same pace as the infrastructure.

“There’s pockets of very good companies that do certain things very good and have a high market share, but it’s way too early, I think, to say who’s winning and who might not be winning, since it’s still a very nascent market.” - I1

It is also necessary to discuss what kind of players that are active in the market. All of the interviewees stated that the market for charging infrastructure and BESS is currently characterized by many different actors that come from different backgrounds and therefore have different expertise. Interviewee 1 divided the actors that are currently observed in the market into five different types of players. The interviewee stated that firstly, there are the OEMs that are moving into the space of charging solutions and BESS. Secondly, there are the hardware players that produce the actual hardware. Thirdly, the oil and gas players are also moving into the charging and energy storage space. Fourth, turnkey providers exist. These providers, as explained by interviewee 1, do not necessarily produce any of the individual components themselves, but they bring all of the hardware, software and services together and provide that to the end customer. Lastly, is the utility or grid providers that are starting to expand into the market space as well.

”There are several players offering electrification services” – I1

The topic of how the entry of Asian players has affected the market and on what grounds they compete with the European players has been discussed during several interviews. Interviewee 5 states that China dominates the BESS market and that these Asian players have started to enter the European market and gained market share. Interviewee 4 and 5 discusses the implications of this in terms of BESS, and states that the Asian players can offer lower prices than the European players can. Interviewee 4 states that they have chosen to have the majority of their production in Europe, which increases the cost significantly and that they therefore cannot compete on prices with the Asian players that enter the European market. Interviewee 5 states that the Asian players are building a physical presence in Europe, since this is a customer demand in order to provide services connected to a BESS. However, interviewee 7 claims that the Asian players do not have physical presence in Europe, and thereby cannot provide long-term offers supported with services.

“Many are trying to build up local, how should I put it, local presence, because it often becomes a requirement if you want to have a system operating in Europe. [...] you want people on site, or at least reasonably close, who can step in and provide support.” - I5

Furthermore, interviewee 5 states that they as a company cannot compete in terms of prices with the Asian players, and that they are significantly impacted by their entry in the European space. Interviewee 4 further states that the entry of the Asian players is more about gaining market share than actually building customer relationships. Both interviewees 4 and 5 state that since they cannot compete in terms of prices with the Asian players, they need to be able to come up with other competitive offers in order to still remain competitive, such as building a European presence in order to provide service locally where it is needed.

“We’re clearly affected by, and clearly see, the current price-cutting competition around BESS, so it’s really important to keep up in order to offer competitive solutions in the projects we’re developing” - I5

4.2 Positioning

4.2.1 Strategic Market Positioning

When it comes to the segmentation of the BESS market, the interviewees viewed this in different ways and pointed out different possible customer segments. Interviewee 1 described one segment of the market as the case where the customer installs rooftop solar panels and combines this with a BESS in order to get cheap electricity during the day that you can store in the BESS and then, at a later stage, charge it into the vehicle. Interviewee 1 believes the connection between BESS and charging solutions is of high value for customers.

“Batteries make a ton of sense like in your home, especially if you can install rooftop solar and you can kind of get cheap electricity during the day, store it and then charge it into your vehicles.” - I1

The connection between solar panels and BESS is also discussed by interviewee 5, who mentions that they are currently working on co-locating a BESS with parks of solar panels in order to be able to support this kind of source of renewable energy. The connection between a BESS and charging solutions is further discussed by interviewee 2 and 4, and is mentioned as something that is becoming a key area of focus in the market. Both interviewees discuss the case where people are currently interested in installing charging solutions, however, the power in the location where the charging solutions are to be set up is often not enough, and that is where a BESS could support with additional power. Interviewee 5 also discusses a case where grid access can be an issue, and where a BESS can be installed to support short term until grid access has been put in place.

“But the hottest thing right now, if I were to describe the market situation, is electric vehicle charging.” - I4

Interviewee 1 brings up the possibility to use a BESS in order to temporarily store electricity and then release it during times of high demand. Interviewee 1 also highlights that this can be used both in the homes of private customers, but also by businesses. Similar to interviewee 1, interviewee 4 sees the potential for BESS to enable customers to lower their costs of energy, by charging the BESS during hours where cost is low and using the energy when cost is high.

“[...] a battery could come in and help reduce those tariffs, by charging the battery during low-tariff hours and then using it during high-tariff hours.” - I4

Contrasting the views in the other interviews, interviewee 5 works for a company that does not see the traditional end-customers as their customers, as compared to other BESS providers, but they see the energy market as their customer. Interviewee 5 points out the usage of a BESS as a way to support the local power grid or to provide energy balancing services to national grid operators. With the help of partners, and by using multiple BESSs, the company is able to make energy capacity available from the systems which can then be sold into the energy market through a bidding process. In this case, it is the grid operators that constitute the customer segment that the company is directing their offer towards. Interviewee 2 also discusses the case

where a BESS can be used in order to tap into new revenue pools by participating in electricity markets. Furthermore, interviewee 4 highlights the possibility of BESS producers to sell their products to OEMs, and allowing them to put their own logo on it as a possible customer segment.

In regards to market segmentation, interviewee 2 raises an important note regarding who you are directing your offer towards, especially when it comes to charging solutions. When talking about industrial consumers in the HDV sector, you have to keep in mind that there might be two different buying centers, the driver of the vehicle and the company that the driver is working for, and these two might value different criteria differently. While both the company and the driver values reliability, criteria such as costs are more highly valued by the company, while the driver puts a higher emphasis on criteria such as comfort and efficiency.

“If you go on a driver's perspective, obviously this cost part actually goes totally out and then speed and efficiency, comfort, and these kinds of factors are getting more important, while reliability is still the most important one.” - I2

In all interviews, the question of what is valuable for the customer when evaluating different alternatives of charging solutions and BESS was brought up. According to interviewee 2, reliability and availability are the most important criteria when evaluating charging solutions. People do not want to have any troubles when charging their vehicle, and because of that, they might pay a small premium just for a seamless experience. Similarly to interviewee 2, interviewee 8 concurs that from a customer perspective, reliability and availability is of utmost importance. Basic operations and functionality need to be ensured as a baseline and from there additional services are likely to add value in the future.

“Customers just want things to work in a reliable way and when they need it, and it should be a robust solution. There is no need for flashy systems with several hundreds of adjustable parameters, it just needs to be reliable and accessible.” - I8

According to interviewee 1 and 8, another important criteria when evaluating charging solutions are that the providers are able to offer a broad range of services, and can take care of all the activities needed in order to have everything installed and in place, i.e. to have a provider that offers the “one-stop-shop”. According to interviewee 1, customers who are looking for charging solutions are not interested in talking to five different companies, but rather to have one company do everything from planning to installation, as well as service in case of disruptions.

“I think what basically our clients say, [...] 'one-stop-shop' is one of the top criteria. So that you have somebody who can do a lot of the different activities” - I1

Speed, efficiency and safety are also brought up as important criteria according to interviewee 2. Interviewee 1 agrees that speed and safety are important factors, but also adds that credibility or track record is also of value for customers, since it is a relatively new field and it is not clear yet what every player is able to do. Due to customers wanting continuous support, credibility or a track record might also imply that there is less risk of the company going out of business

in the next year, which might be valuable for customers when considering installing charging solutions. The possibility to scale the charging solutions in the future is also valuable criteria for customers according to interviewee 1.

Regarding the key evaluation criteria for BESS, this was discussed in interview 4 and 5. According to interviewee 4, customers primarily look at where they can get the best price for the product, or the best return on their investment. While some customers value the performance of the energy management systems in the BESS, it almost always comes down to the price of the product in the end, as customers often have a hard time in understanding the technical specifications of different systems, and thereby often compare systems with different abilities only based on price. Opposing the views of interviewee 4, interviewee 5 believes that rather than having the lowest price, building a brand that represents and ensures reliability in deliveries and as a provider of solutions that work as intended is more important, especially since the product involves a lot of new technology.

“If you can build a brand that is associated with delivery reliability, I think that’s more important than offering the lowest price.” - I5

Both interviewees 4 and 5 state that the question of safety and data handling are important criteria for some customers when evaluating BESS, especially in regards to whether the system is produced in Europe or in China, and where their data is stored as a result of this. Interviewee 5 means that some customers do not have any problems buying a Chinese system, while some customers have another view on safety, but mentions that this is a strategic decision that companies have to make. According to interviewee 4, even though customers highlight the problem of data and value European products, the choice often comes down to price either way, as systems produced in Europe have a higher price.

“It’s more expensive to produce in Europe, but ultimately it’s the end user who pays in the end. And when the price differences become too large, you can’t hold back, you have to go with the cheaper option.” - I4

4.2.2 Business Models and Strategy

When discussing business models, interviewee 3 states that there is still a lot of confusion around what business models will dominate and be successful in the industry. There is also a lot of confusion on who the investors of charging infrastructure will be. Interviewee 3 believes that the investors will be different types of actors for a while onwards, before there is a common view on how investments and expansion of charging infrastructure are done most effectively.

Interviewee 1 states that “as-a-service” models are very popular now in electrification as in other industries, and interviewee 8 agrees that services are becoming more and more important from a business perspective. Interviewee 1 further elaborates on this topic and mentions that there are possibilities for companies to offer this kind of model with different names such as “charging-as-a-service”, “infrastructure-as-a-service”, “energy-as-a-service” or “electrification-as-a-service”, and with slight changes to the offerings. According to interviewee 1, the “as-a-service” models offer companies possibilities to move away from just selling stuff to take advantage of longer relationships and also extract, as well as provide,

additional value to the customers. Companies can start with offering the vehicle not just as a product purchased by the customer, but as a service that is leased rather than purchased. The vehicle can then be combined with other services that the company offers, such as software services, which provides a lot of value for the customer but does not require a ton of capital invested. However, interviewee 2 has another view and mentions that there are limited possibilities to increase the value added and captured by adding software services.

“There you have a whole kind of buffet of options and you can kind of pick and choose what do you wanna offer and how do you wanna price it.” - I1

Some of these additional software services were mentioned in several interviews. Interviewee 8 mentions opportunities to offer advisory and software services to help guide customers in how to optimize their running operations related to electric HDVs, when and where to charge, and optimize charging taking into account battery health onboard the vehicle. Interviewee 7 discusses the possibility to see changes in temperature in your charger to know whether there are any issues with the hardware and whether service is needed. In addition to this, interviewee 7 mentions software services that offer opportunities to for instance schedule your charging if you have a fleet of vehicles. The interviewee also highlights the need to stay up to date and update your software. Interviewee 2 mentions that with software services today, and the communication between the vehicle and the charger, you can basically support all the fleet management applications needed. Interviewee 1 mentions operating system, fleet management software, load management, energy management and data analytics as possible software services that could be included with the charging solution. Regarding BESS, interviewee 5 mentions that they are currently developing a digital platform that will be used to control their BESS.

In regards to BESS, interviewee 5 also mentions the “as-a-service” model as a viable option. The option to offer the BESS as “battery-as-a-service” in combination with for instance solar panels, enables the customers to use the BESS as they prefer during a pre-specified period, while charging a fee for it. Similar to the business model described by interviewee 5, interviewee 4 describes a business model where a BESS is needed in order for a customer to continue its operations, for instance to run the factory. With the help of a financing partner, the customer can then lease the BESS over a certain period.

“That is, they lease a product for X amount of money over X number of years, and then it has helped them.” - I4

Interviewee 1 also mentions integrated, lean, and asset light as important criteria in a business model in order to drive success in the charging industry. To support the asset light model, having good partnerships are of utmost importance, for instance if chargers are down, you need to have service partners that respond quickly to restore operations for the customer. In general, anything that offers companies the possibility to save costs for running the vehicles will be successful, according to interviewee 1.

Both interviewees 1 and 2 discuss the importance of being able to scale your operations, especially in the case of charging solutions, as a fundamental part of the business model in

order to succeed. Interviewee 1 highlights the importance of finding clients where there is a possibility to scale in the future, and the ability to offer this is an important part of the value proposition towards customers. With high competition, interviewee 2 mentions the ability to find clients with many sites and offer as many charging points for the same contract as possible as the key to a successful business model. Those companies that are good at identifying the clients, and that have an effective operating model, are those that will succeed, according to interviewee 2.

“And essentially, they all tap into more or less the same pools, because you just try to find multipliers, so you try to find for one contract as many charging points as possible.” - I2

Interviewee 5 also adds that an optimal business model in the future would be to secure long-term contracts with customers. Interviewee 4 also mentions that an important part of their business model is to provide products that they, as well as the customer, can trust and that will last in a long-term perspective and will lead to long-term relationships. Furthermore, they base their work on being a secure provider and having returning customers who know what they will get.

“[...] it's about being that reliable supplier who considers data security, or the sustainability of the products, which products you're working with, whether due diligence has been done, whether traceability has been checked [...].” - I4

Another important factor in order to make your business models work are partnerships, which all interviewees agree on, both when it comes to the charging infrastructure and the BESS market. Interviewee 2 points out that the use of partnerships in business models is widespread in the industry and explains that it helps to reduce the inherent risks associated with the business. As an example, interviewee 2 mentions the case where truck OEMs have come together in order to push for a joint ecosystem of HDV charging in Europe. Furthermore, both interviewee 1 and 5 mentions that partnerships are an important enabler if you are using the “one-stop-shop” business model. In order to make that business model work, companies must subcontract with partners, as they are not able to do everything on their own. Interviewee 1 also adds that an important factor to take into account when establishing partnerships is to be selective with who you choose as your partner. As your reputation as a company is tied to the partners, if one of them fails or is not doing their job well, it will damage your reputation as well.

“Of course they don't do anything more than the old players did. They might even do nothing but the planning... But then they subcontract with everybody they need and everybody they know.” - I1

Interviewee 5 discusses the same case but for the BESS market. As customers are looking for turnkey solutions, companies need to have partnerships in order to be able to deliver these solutions. According to interviewee 5, there are few actors on the market that have the capabilities to do everything on their own, and partnerships are needed in order to be able to offer these turnkey solutions. However, interviewee 5 also highlights the need to establish flexibility in the business model, to not be overly dependent on one partner.

“It's important not to make yourself 100 % dependent on a single partner, but rather to build some flexibility into your system so that you can switch between others if needed.” - I5

Interviewee 4 agrees that partnerships are important, especially for smaller companies who do not have all the resources in-house. However, interviewee 4 shifts the focus away from the “one-stop-shop” solutions and focuses more around the discussion of having the right technology. According to the interviewee, big, established players might not always have the right or latest technology. To acquire it, they often form partnerships with smaller, more innovative firms.

4.2.3 Offer Design and Differentiation

In several interviews, the possibility to offer “one-stop-shop” or turnkey solutions have been discussed, both in the market for charging solutions and for BESS. According to interviewee 1 there is a trend towards more integrated services. Interviewee 1 also adds that it is hard for customers to understand everything in this market, and if a company can take care of everything, this will provide additional value for the customer. Interviewee 8 states that before, companies focused more on delivering chargers, but nowadays customers are more interested in an integrated solution. Customers do not only want the hardware, i.e. the chargers, but are also looking for additional services. However, this will only add value once the hardware works without any disruptions. Interviewee 2 also highlights that positioning solely as a hardware player today is hard, as access to the software is what enables you to really capture value.

“Once you've reached the point where you know you can guarantee uptime, avoid issues, and so on, then you become more interested in delivering an outstanding user experience, and so forth. So I believe the key is first to ensure the baseline, that things work reliably, and then build on that moving forward.” - I8

Interviewee 1 believes that being able to offer additional services, and having the capabilities to be able to combine them well, provides companies opportunities for economies of scale and to charge an extra margin. The interviewee also adds that once you have the customer, it is easy to upsell with adding additional services.

“I think that integrator play is both commercially attractive because, as with everything, if you offer a bunch of stuff and you combine it well, you can kind of get economies of scale and you can charge... an extra margin on top.” - I1

In regards to charging solutions, both interviewee 7 and 8 discusses how they can provide this for the customers. To be able to offer an integrated solution, interviewee 8 emphasizes the need to understand customer needs, e.g. what kind of vehicles, what routes and timing, and what charging solutions are available for the specific customers. From there, it would be possible to look into different bundling options and customization to help guide and support the customers in the solution design and commissioning. Once commissioned, there could also be opportunities in providing support structure to help customers in their running operation with their charging solution.

“It could be a broad scope to be delivered to the customer depending on customer needs ranging from initial solution design to support in operationalizing the solution, including everything in between.” - I8

Interviewee 7 also discusses how they are able to offer customers these kinds of turnkey solutions, and mentions that if a company with a fleet of HDVs wants to electrify, they can help with a lot of the work in this regard. Interviewee 7 also highlights the need to provide aftermarket services, and mentions that they have both internal technicians but also partners which enables them to quickly address any potential issues.

According to interviewee 8, customers today are also looking for solutions where they have only one point of contact. This would provide opportunities for companies to take a position in the market where the offer spans different products, services and across different parts of the value chain and operations to be able to offer a more comprehensive all-in-one solution towards customers, and offer a single point of contact to support customers in the case of e.g. problem solving and troubleshooting.

“Then there’s also the support structure, that you have a single point of contact. If customers are experiencing down-time or deviations in the integrated solution you have provided them, they immediately know who to turn to.” - I8

Turning to the market for BESS, interviewee 5 agrees that turnkey solutions offer great possibilities for companies to succeed in the market, and describes the company that the interviewee is working for now as an end-to-end provider of energy solutions. Solely offering a product is not enough to meet customer demand, and the offer needs to include services as well in order to be successful.

“[...] they wanted a comprehensive solution, someone who could take care of the entire package. That’s when we realized, quite early on, that we couldn’t just sell a product; we also needed to bundle it with services in order to be competitive and provide everything the customer was looking for.” - I5

One of the services offered in a turnkey solution is according to interviewee 4 to be able to offer a safety net for the customers once the BESS has been sold, similar to what interviewee 7 and 8 describe for charging solutions. By combining the purchase of the BESS with a service level agreement, the company that interviewee 4 works at promises the customer that going forward, they will take care of service and maintenance of the product. In addition to this, the company is able to offer both internal technicians and service partners that can support customers in case of disruptions. Interviewee 4 means that these are services that provide additional value for the customers, as other competitors are not able to offer the same type of service in the aftermarket.

“What happens if it doesn’t work perfectly? What kind of safety net do you have, or what can you fall back on? Can I make a call and say, ‘You need to send a technician’? Will someone answer on the other end, or did they just take the money and move on?” - I4

4.3 Reaching the Potential

4.3.1 Resources and Capabilities

When it comes to capabilities and resources needed to reach a competitive position, interviewee 4 claims that since it is such a dynamic market, it is really necessary to always know what is going on in the market and what changes are occurring, in order to stay competitive. Interviewee 5 makes the same statement and claims that it is important to be observant of any technological shifts that might occur. Interviewee 4, however, argues that it is impossible to know exactly what will happen in the BESS market in 10 years from now, but that it is important to always conduct market analysis and try to keep up with the changes that occur in order to be competitive.

“It’s like this, things are changing very quickly, and if you’re not part of that change, you probably won’t be around. I mean, if you develop a product, that product has to keep evolving.” - I4

Interviewee 8 explained that it is important for the companies to be agile and able to adapt to changes quickly. According to interviewee 8, this could include being able to quickly adapt to new features that are going into the applications of the solutions provided. Interviewee 7 adds that being agile as an organization also means having short decision paths within the organization. However, interviewee 3 claims that the larger players in the market, such as OEMs, usually have less agile organizations and therefore it becomes harder to adapt quickly to new occurrences. Interviewee 5 enhances this view and claims that since they are a smaller company, they are more flexible and agile and that this opens up the possibility to capture new market opportunities.

“But as a small company, we’re a little faster, more flexible and agile to be able to adapt to when we see that the market situation changes or an opportunity opens up somewhere.” - I5

Being a large and established market player can have many advantages and many of the interviewees discuss the difference between these market players, and what kinds of resources and capabilities they have. Interviewee 3 adds that established players have the advantage of having their brand and an already established market position, and that these things give them an advantage over new players, but also adds that being a larger organization might lead to less flexibility in the organization.

“And that’s the advantage of the larger established ones, that they have a position in the market and have the entire administrative set-up, they are known and have an advantage because of that, but then they lose out in that they are not as flexible and not as fast-moving and adaptable.” - I3

According to interviewee 1, providing a holistic solution and having the capabilities to provide more than just the HDV is necessary in order to be competitive. Interviewee 5 shares that perspective in terms of OEMs and adds that the OEMs can gain significantly more data in terms of their HDVs and by analyzing it, being able to predict where the charging solutions are

necessary and needed by the customers, which provides them a competitive advantage over other players.

“With that type of data, you can probably get a pretty good competitive advantage by seeing where the needs will arise.” - I5

Interviewee 5 and 7 both discuss the access to resources that opens up when a company is backed by a larger one. Having a larger principal owner opens up, in interviewee 5's case, to the possibility of exploring a broad network across Europe with knowledgeable and experienced people. Interviewee 7 explains that by being a part of a larger group, they also gain access to a wider geographical scope and network, which makes them a global player in the market of charging solutions. The interviewee further claims that this provides them the opportunity to gain prioritized access to components of higher quality.

“Through our main owner [...], we have a very broad network in Europe with very expert people who can both help us find good opportunities but also provide insight into the energy landscape.” - I5

Interviewee 3 states that smaller players in the charging space are more in need of collaboration and cooperation than established OEMs. However, the interviewee further adds that the large industry players need to collaborate in this market space as well, since the dynamics of the markets indicates that established players do not have the capabilities necessary to be competitive in the market without collaborating with other players. Interviewee 1 and 4 also makes the claim that having existing networks and relationships with customers can aid in navigating this complex market.

“Then the large ones realize that they have to work together because they can't do it on their own either.” - I3

There can also be differences in financial resources between large established players and smaller players in the market. Interviewee 5 explains that for smaller companies, the commitment of an investment becomes more vital. If that investment were to fail, smaller companies might not have the financial resources to deal with that setback, while larger companies, who usually are involved in many projects, can better manage if one investment fails. Interviewee 7 makes a similar notion by stating that since they are part of a large corporate group, they have the financial means to deal with those types of setbacks, which their competitors might not have if they are smaller.

“If they deliver chargers that then break [...] and they need to take them back and repair them for maybe the same cost as the charger, they don't have the money. They simply don't have the liquidity to pay for it. We do.” - I7

Interviewee 8 discusses the importance of having appropriate data collection capabilities and explains that the right data can provide vital information that leads to stronger decision making. The data can also be used in order to better understand the customer's needs by collecting operational data which can provide better insights and lead to better decisions. Interviewee 2 also highlights that a company needs to build themselves an efficient and effective operating

model. This is elaborated on by claiming that competitive companies have the capabilities to efficiently identify what customer segment to focus on.

“To be very good in identifying what kind of sites make sense to put an effort into and what not, what kind of clients to pursue and not. [...] it’s just like a, rather a core capability to have internally.” - I2

Furthermore, the importance of having a track record and using this as a resource was brought up by interviewees 1, 4, 5 and 7. Due to the market of BESS and charging infrastructure being a rather new market place, interviewee 1 states that having a credibility or track record is quite important as of now, since the dynamic market implies that it is not yet clear what the different players can do and if they can do it to the same extent.

“Credibility or track record is still very high because, I mean it’s still a fairly new place.” - I1

Interviewee 4 explains that the strength of their company is their track record and previous experience with batteries and BESS. Their track record has provided them with the knowledge and credibility among their customers, which have enabled them to build strong customer relationships. The company that interviewee 5 represents have previous experience in the entire BESS value chain, which according to interviewee 5 provides them an understanding of the resources necessary to develop new platforms and expand into new markets. Interviewee 5 also states that by having a track record of being a provider of turnkey solutions, they have a clear understanding of the resources and capabilities required to deliver such solutions. This enables them to more effectively evaluate whether it makes sense to operate parts of the value chain internally, or to form partnerships.

“Our strength is our experience.” - I4

5. Analysis

5.1 Market Potential

5.1.1 Drivers and Barriers to Market Adoption of Electric Mobility

The adoption rate of EVs directly influences the demand for charging infrastructure, which in turn drives the need for BESS, as BESS can help secure grid access and support charging infrastructure. Due to this interdependence, understanding EV market adoption and trends is key to anticipating the adoption of both chargers and BESS. This dynamic reflects the well known chicken-and-egg dilemma (Raofi et al., 2025), where consumers are hesitant to purchase EVs without reliable charging infrastructure, while charging providers want to delay investing in infrastructure until there is sufficient demand for EVs.

In the case of electric HDVs and charging infrastructure, the chicken-and-egg dilemma can complicate the diffusion of the innovation. Raofi et al. (2025) emphasize that the absence of sufficient infrastructure deters buyers, while low vehicle adoption discourages infrastructure

investment. Yet, the empirical findings suggest that the bottleneck lies more with the adoption of electric HDVs than with infrastructure availability. This contradicts perspectives like MacVaugh and Schiavone (2010), who argue that complementary technologies, such as chargers, must be in place first in order to increase the adoption rate of an innovation. This would imply that in order for the rate of market adoption of electric HDVs to increase, the complementary technologies, in this case charging infrastructure, need to be in place first, which contradicts the empirical findings. A possible explanation for this contradiction is that, in the case of electric HDVs, although charging infrastructure remains a major barrier, it is the combination of multiple challenges that collectively hinder adoption. These include high switching costs, long charging times, and range limitation, and infrastructure alone is not sufficient to accelerate adoption if additional barriers are not addressed. It should not be a surprise that companies do not want to build chargers unless there is a demand for it as this would cause a great amount of costs and inventory that would not be utilized and lead to no profits. The optimal solution to this problem would be to address both sides of the dilemma simultaneously where OEMs have an opportunity to provide both the HDV and the charger at the same time in order to expand the rate of adoption of electric HDVs.

According to Rogers (2003), adopters of innovations fall into five categories: *innovators*, *early adopters*, *early majority*, *late majority* and *laggards*. The empirical findings state that the adoption of electric HDVs is at phase two where electric HDVs have not yet become mainstream. This second phase can be interpreted as corresponding to the early adopters which Rogers (2003) describes. The empirical findings show that the rate of electric HDV sales have been lower than the initial forecasts, but that there is now starting to become a rollout of the vehicles. This would enhance the view that the market is growing, but that it has not yet become mainstream to own electric HDVs, implying that the market is moving towards more sales, but that the diffusion of the technology has not yet reached an early majority stage. This is in line with Rogers (2003) diffusion curve, which predicts a slow start followed by acceleration as adoption becomes more widespread. This affects actors in the industry of charging solutions and BESS, as the adoption of HDVs directly influences the demand for these products. For actors in this industry, this means that although current demand may still be limited, adoption is expected to accelerate and the market will approach the early majority phase, where the largest share of adopters reside. Firms that act now and position themselves strategically have an opportunity to gain early mover advantages and capture substantial market share when the third phase, early majority, takes off. This highlights the need for OEMs to understand and develop a competitive position at this stage, as delaying action may result in missed opportunities to grab market shares.

The empirical findings also reveal a shift in industry focus from aggressive growth to value creation through standardization and efficiency. The theory, however, states that the market is affected by the need to scale up (Jiang & Lu, 2023), which contradicts the empirical findings that suggest that the market has moved from having growth focus to ensuring efficient processes. This discrepancy can be explained by the fast-moving nature of the industry, where the market has evolved since the literature was published and has, according to the empirical findings, entered a new phase. For actors in the industry, this implies an opportunity to capture

the early majority by effectivizing their processes and being able to fulfill larger customer demands as the market transitions toward broader adoption. By capturing the early majority, companies can gain a favorable position in the market and gain market share. The phase represents a critical window to refine offerings, secure strategic partnerships, and scale operations in a controlled and cost-effective way.

What is clear from both theory and empirical findings is that in order for electric HDVs to reach wide adoption, it needs to be reliable and fulfill the basic needs. The innovation must be compatible with user needs in order for adoption to occur (Rogers, 2003), which is also supported by Xia et al. (2022) in regards to the adoption of EVs. The empirical findings show that in regards to HDVs, it is now possible to completely electrify distances under 500 kilometers, but distances longer than that still face challenges. Since there are limits on what distances are able to be electrified, truck owners with longer distances will not have their basic needs met and therefore be less willing to change their fleet to electric HDVs. The switch to electric when their needs of distances cannot be met would imply large switching costs, as discussed by MacVaugh and Schiavone (2010). Further, electric HDVs require more frequent stops to charge compared to traditional refueling of ICE HDVs, and the process of charging takes significantly longer, something truck owners are not used to. Adjusting the operations and logistical planning to adhere to charging time and placement of charging stations, could complicate the daily operations for the fleet owners and drivers. This also implies higher switching costs, and the technology is deemed to increase the complexity which creates a higher barrier for the truck owners to transition to electric fleets. Furthermore, the empirical findings also support the notion of Anderhofstadt and Spinler (2019) and Qasim and Csaba (2021) that the investment of an electric truck is higher than the investment of ICE trucks, which further enhances the switching costs and creates a barrier to adoption. If the switching costs are deemed too high, the adoption of electric trucks is likely to have a slower adoption rate which implies less charging infrastructure being incentivized.

Despite these challenges, certain mechanisms can help overcome barriers and facilitate adoption. According to Rogers (2003), five characteristics influence the rate of adoption: *relative advantage*, *compatibility*, *complexity*, *trialability*, and *observability*. In the case of electric HDVs, these characteristics are closely connected, where observability can play an important role in the current early adopter phase. As more electric HDVs become visible on the roads, potential adopters are increasingly exposed to the technology being used in the real world, which helps reduce uncertainty and perceived risk. This visibility can signal that the technology offers relative advantages such as cost savings or that it is compatible with daily logistical operations, and is less complex than initially assumed. Observability also indirectly supports trialability, as seeing others adopt the technology shows that it is being tried and used in practice. As Fluchs (2020) notes, the initial observability of EVs was low but increased through sales and marketing, resulting in great potential for large-scale adoption. A similar trend is likely for electric HDVs, where growing adoption and road presence can help mitigate high switching costs by providing confidence in the technology's functionality and reliability. The same reasoning applies to the charging infrastructure and BESS, which are essential for widespread adoption. As these systems are increasingly implemented and seen in operation,

they too become more observable and familiar. This increased visibility can reduce uncertainty around their availability and effectiveness, demonstrating that the related infrastructure supporting the adoption of electric HDVs is also maturing.

According to the Bass (1969) diffusion model, innovators adopt based on external influences, while imitators wait until the innovation has been proven effective. In this context, early adopters of electric HDVs, and the associated infrastructure, provide critical quality assurance and observability, which helps imitators gain trust in the technology. As Sällberg and Numminen (2024) emphasize, the actions of early adopters and innovators are essential for reducing perceived barriers and enabling the transition to the early majority phase.

An insight from Fluchs (2020) and Xia et al. (2022) is that government incentives and monetary subsidies seem to boost the rate of adoption. As is found in the empirical findings, the regulatory environment concerning electric mobility in general has seemed to slow down, which could slow down the diffusion rate. However, the empirical findings also suggest that there will come more regulatory pushes in the future, if the targets set by the EU are to be met. Such pushes could raise electric HDV demand and, by extension, the demand for chargers and BESS. However, as Porter (1979) explains, government incentives have the potential to affect the entry barriers to an industry. More regulatory pushes force OEMs to enter the industry of EVs, which is in line with Fedotov (2022). The regulatory pushes can also enhance the entry of more innovative companies, which believes they can gain market share and exploit an environment in which the main leader has not been decided yet. Since the regulation pushes towards electrification, the traditional oil and gas players can start entering the EV industry as well, since fossil fuels are becoming less prevalent. Regulation can therefore increase industry rivalry and reduce entry barriers which creates a situation where players from other sectors enter the industry in an attempt to extract market potential. However, regulation could also raise entry barriers by increasing the requirements for operating in the industry, such as stricter sustainability standards or compliance obligations. This could make it more complicated to be active in the industry and hence, reduce the threat of new entrants, but can be beneficial for the firms already active in the industry as they would face less competition from new innovative companies.

5.1.2 Competitive Landscape and Industry Forces in Electric Mobility

Regulatory pushes towards EVs can also reduce the threat of substitutes, as the ICE vehicles are viewed as a substitute to the EVs, as stated by Fedotov (2022). If regulation hinders the sale of ICE vehicles, eventually, the threat of substitutes will be reduced just by regulation. However, the empirical findings shows that it is not yet economically favorable to purchase an electric HDV, much due to high switching costs, as stated by MacVaugh and Schiavone (2010). The findings further shows that the innovation is not fulfilling the characteristics needed in order to ignite widespread adoption pointed out by Rogers (2003), which leads to the ICE vehicles composing a high threat of substitute until the innovation fulfills the basic needs and becomes economically favorable. The threat of substitutes can, however, be mitigated by providing a differentiated product (Porter, 1979), which in a way the electric HDVs can be viewed as in relation to ICE vehicles, but the electric HDVs can further be differentiated by

adding additional services in order to add value for the customer. Providing additional value by including more in the total offering, such as offering charging infrastructure but also adding software services and support, has been found in the empirical findings as an important competitive strategy in the market, and is described in more detail in section 5.2. This would imply that it is crucial for companies to provide a more comprehensive offer towards the customer that not only fulfills Rogers (2003) characteristics to market adoption, but that also adds additional value that gives the customers incentives to switch to electric HDVs and therefore mitigate the threat of substitutes.

Technological advancements, as explained by Porter (1985), have the potential to alter industry structure and affect all of the five forces. The empirical findings show that the BESS industry has experienced a decrease in price for the product over the years due to technological advancements, implying that the threat of new entrants has increased. For the existing BESS players, it seems disadvantageous that prices have gone down over the years as it pushes margins and decreases profits. But on the other hand, the technological improvements might have reduced the cost of production, which can increase the margins of the industry, but also make the industry more attractive for new entrants. Further, if the purchasing price of a BESS is reduced, increased demand and sales are likely, which further spurs the entry of new firms trying to catch market share in a growing industry, and thereby increase the threat of new entrants.

In regards to charging solutions, the empirical findings indicate that margins are low and that the initial investments are high, which further decreases the margins. Porter (1979) states that the threat of new entrants will be reduced if there are high capital requirements to an industry, which is the case in terms of charging infrastructure. However, Hoefft (2021) provides the perspective that new entrants are usually backed by venture capitalists providing them with the necessary capital in order to enter the industry, implying that the capital requirements causing higher entry barriers are not as prominent. The low margins, on the other hand, can reduce the threat of new entrants since it becomes increasingly more difficult for new entrants to achieve a profitable position, especially since the empirical findings indicate that it is complex to capture value in the industry. Low margins can also potentially enhance the industry rivalry. If the margins are low, this could imply that the competition between the players in the industry intensifies as the players want to capture as much of those margins as possible, implying that competition is identified in order to gain more market share. Entry barriers are further enhanced by the complexity connected to the product offerings of charging solutions and BESS. To succeed in the industry today, not only hardware is needed, but software and additional services are an important part as well. If it is more complex to offer a product in the market, then new entrants might not be as inclined to enter as it would require more resources and knowledge in order to be competitive in the market.

Entry barriers are also influenced by how existing players respond to the entry of new players in the market (Porter, 1979). The empirical findings show that technological changes in the market have caused the old ways of competing to shift. Due to the rapid pace that technology changes, it is now not as common for existing firms to acquire companies, which would reduce competition. Instead, they form partnerships to access technology as this does not bind them to

a certain technology for too long. When the incumbents do not acquire firms, this could imply that the barriers to entry decrease, as entry is more likely to be encouraged if the new company knows that they will not be acquired immediately upon entering. If partnerships are more common, this could also imply incentives to enter the market as the entering company can gain access to a wider network and access resources of the incumbents. However, if entry is more likely to occur, this could pose a potential threat to OEMs, as new entrants might be more innovative and hard for OEMs to compete with, especially if they are less agile in their organizational structure, as the empirical findings suggest. Further, if partnerships are increasing, instead of acquisitions, this can lead to more companies accessing and competing with the same technology, as the technology of the entrant becomes widely accessible to all competing companies. With technology widely accessible, the technology will not be a differentiation factor for companies anymore. Instead, they would have to compete on other premises.

However, the decision to partner instead of acquiring or creating the technology or product in-house, could also lead to stronger bargaining power of the suppliers. This is especially true if the product or technology that is gained access to is connected to high switching costs (Porter, 1979). In the case of charging infrastructure and BESS, if a company decides to partner in order to gain access, it can be assumed that the company becomes reliant on the supplier and its technology. This can especially be true if, as in this industry, companies now compete by having more parameters included in the offering, such as hardware, software and services, as the empirical findings suggest. The entire offering towards the customer becomes reliant on the partnerships created and the suppliers of the parameters, and creates high switching costs for the company if they want to change partner or supplier. Further, if suppliers are able to differentiate their products or technologies, they can strengthen their position even more and push down the profitability of the industry (Porter, 1979). Since charging infrastructure already reports low margins and BESS reports price reductions, low profitability in the industry would keep new entrants away and reduce competition, creating a more favorable position for OEMs that have already entered the industry.

The dynamics of the market competition is affected by many new players entering the industry, causing market fragmentation. Both current players and new players entering have backgrounds in different fields, and different areas within electric mobility are also becoming more interconnected. For instance, new turnkey providers without knowledge in vehicle production might not produce any of the components themselves, but their ability to combine a competitive offer and partner with others to deliver it might be enough to be competitive, indicating that previous experience from specific industries may be less important. With previous experience becoming less important, entry barriers are lowered. On the other hand, with more parameters included in the final offer towards the customer, previous experience from other industries might instead become very valuable. For instance, software developers might enter the industry with competitive knowledge regarding software services and can outcompete the traditional OEMs, which have previous experience in vehicle manufacturing but not the same knowledge surrounding other parameters of the offer. At the same time, the empirical findings show that the market is heading towards a consolidation in the coming years,

implying that the market is heading towards being dominated by a few large firms, and firms must exit the industry. This decreases the threat of new entry, but it could also imply strengthened industry rivalry as the existing players want to become the majority leader and grab their share of the market before it consolidates. However, this fragmented and dynamic phase of the industry can also be seen as beneficial, as increased competition may act as a necessary driver for innovation and development, keeping the industry evolving rather than stagnating.

Industry rivalry is intensified by exit barriers, especially when firms hold specialized assets that are difficult to repurpose outside the industry (Porter, 1979). This appears relevant in the case of electric HDVs and charging infrastructure, where the automotive sector is heavily reliant on such specialized assets. However, traditional OEMs, as Fedotov (2022) notes, are now transitioning into the EV space, leveraging their existing assets and experience. For instance, OEMs that are entering the EV industry from the ICE vehicle industry are likely to experience economies of scale also in the EV industry, as they already have established processes that can provide them with cost advantages. This can enhance the entry barriers for other players, as they need to enter the industry on a big scale in order to compete with the OEMs. However, the technological advancements that have been made, might lead to previous experience being less important (Porter, 1979), and many of the assets that OEMs possess remain closely tied to ICE vehicle production. While technological advancements have enabled OEMs to move toward EVs, it raises important questions about how much of their traditional assets can be transferred and reused and how much they can utilize previous experience in order to be competitive in the electric HDV market, as the industry continues to evolve. If the pace of technological change continues to accelerate, these traditional assets may become obsolete, and no longer contribute to competitiveness in its new form, decreasing the exit barriers that have existed in the ICE vehicle industry and encouraging new entrants to compete with traditional OEMs.

Porter (1979) states that the bargaining power of buyers are influenced by how much the products contribute to the buyers saving money. According to Porter (1985), the bargaining power of buyers can also be enhanced through technological advancements that increase the transparency towards buyers. It is found in the empirical findings that customers do not utilize their chargers as much as was initially believed. This means that the bargaining power of buyers is lowered as the investment is not fully utilized and therefore not paying itself by helping the customer save money. It is also found in the empirical findings that it is hard for buyers to project just how much the chargers will be utilized, which increases the difficulty of determining whether it is a good investment decision or not. All of this implies that there is information asymmetry existing, where the buyers do not have the knowledge and information regarding the investment decision, which lowers their bargaining power. One way to mitigate the problem is by increasing transparency and access to data, such as predictive tools or usage analytics, for buyers. Providers can also offer flexible business models that lower the upfront investment risk for the customers. By increasing buyer understanding and making it easier for customers to assess the value of the product, suppliers not only reduce uncertainty but also enhance the perceived compatibility, and thereby supporting market adoption (Rogers, 2003).

This approach may simultaneously strengthen buyer bargaining power and foster stronger buyer-supplier relationships.

Isabelle et al. (2020) expands Porter's Five Forces by introducing additional forces that are particularly relevant in modern, dynamic industries: *threat of digitalization*, *competitor's level of innovativeness*, *exposure to globalization* and *industry exposure to de/regulation activities*. The empirical findings confirm that exposure to globalization is high, as several OEMs are already operating globally, and smaller players often benefit from being backed by large and more global companies. Regulatory exposure is also significant, where there are more regulatory pushes expected to occur, which can further reshape market access and requirements of products. Further, more complex services and improved digital tools have the power to differentiate offerings, which enhances the threat of digitalization. This will also impact competitor's level of innovativeness, as the empirical findings suggest that the market is moving towards more total offerings which includes more service and software solutions, which suggest that the competitor's level of innovativeness is not only dependent on the hardware, but that more parameters are included in the innovativeness.

5.2 Positioning

5.2.1 Choosing a Strategic Market Positioning

The analysis above highlights how OEMs must navigate a rapidly evolving market where their traditional experience and resources may no longer guarantee competitive success. In this context, the choice of competitive strategy becomes critical, as it should lead them to long-term advantage over competitors (Porter, 1998). Porter (1998) identifies three types of generic strategies as sources of competitive advantage: *cost leadership*, *differentiation* and *focus*, and states that firms must make a strategic choice between these three or they will be stuck in the middle and lose out on the benefits of the strategies. The analysis in part 5.1 and the empirical findings show that the competitive landscape for charging infrastructure and BESS in Europe is shaped by the entry of new players, and in particular new players from Asia. These Asian firms are trying to gain market shares by offering products at low prices. By wanting to gain market share, the Asian players are able to leverage the benefits of economies of scale, something that is necessary in order to pursue the cost leadership strategy according to Porter (1998). The empirical findings also indicate that these firms are more interested in market share than building long-term customer relationships, which can have implications for their ability to offer tailored solutions and flexible support.

For European players, this presents a strategic constraint, as they are unable to compete on price due to high capital investments and expensive raw materials (Olabi et al., 2022), making a cost leadership strategy unsuitable. Instead, according to Porter (1998), they should be competing with a differentiation or focus strategy. The differentiation strategy focuses on providing unique attributes that are valuable for the customers, and for which they are willing to pay a premium price (Porter, 1998). Given the technical complexity of the BESS and charging infrastructure, customers evaluate different suppliers based on price according to the empirical findings. However, the empirical findings also show that price is not the only decision

criteria. Customers also value reliable products of high quality and “one-stop-shop” solutions. This suggests that there is room for strategic differentiation for the European firms by, for instance, being physically close to customers, offering after sales service and support, and ensuring reliable product deliveries. These are all characteristics that the customers value according to the empirical findings, but which the Asian players lack in the European market. These characteristics also align with Mathur’s (1992) view that differentiation can be achieved not only through product features but also through bundled services and support.

The implications for OEMs is that competing on non-price attributes will be essential to remain relevant in the face of low-cost entrants. European firms can leverage customer proximity, reputation, and the ability to integrate solutions into a broader offering which are also elements that build customer trust and long-term relationships. OEMs that focus on these aspects will likely be in a better position to withstand price pressures by creating value propositions that go beyond the initial purchase costs.

The empirical findings also show that actors in the market are directing their offering towards a smaller customer segment, what Porter (1998) defines as the focus strategy. According to the empirical findings, these segments include customers combining BESS with solar panels or charging infrastructure, those using BESS to lower electricity costs or access new revenue streams, and those offering BESS to support grid operators. Furthermore, a niche segment of customers who values data privacy and safety and products originating from Europe was identified. As this cannot be fulfilled by the Asian players, this offers possibilities for European firms to target this niche segment and potentially justify a price premium. However, Porter (1998) also adds that within the focus strategy, firms must still choose between being the cost leader or having a differentiation focus. Hill (1988) also adds that differentiation can be a way to achieve cost efficiency, meaning that within the identified focus segments, European firms have opportunities to combine the focus strategy with a cost leadership, to also target price sensitive customers within segments. Research by Miller (1992) also shows that firms pursuing this type of hybrid strategies have been successful.

Even though price is a major purchasing criteria for BESS customers according to the empirical findings, customers also value reliability and products of high quality. Similarly, customers in the charging infrastructure industry also value criteria such as speed, efficiency, safety or the ability to scale the solutions in the future. Taken together, these insights suggest that neither a pure cost leadership nor a pure differentiation or focus strategy is sufficient on its own for European OEMs to succeed in the market. Instead, combining the strengths of multiple strategies appears to be more effective, as mentioned by Hill (1988). Hill (1988) also argues that differentiation can be a way to achieve cost efficiency, and Miller (1992) highlights that firms pursuing hybrid strategies often perform successfully. In contrast to Porter’s (1998) suggestion that firms must choose one generic strategy to avoid being stuck in the middle, our findings support the growing body of literature (e.g., Salavou, 2015) advocating for hybrid approaches. Given the dynamic and evolving nature of the market, a hybrid strategy allows firms to remain flexible and responsive while still building customer trust and long-term value. For European OEMs, a strategy where they are leveraging differentiation through adding

additional services, targeting a specific segment, and at the same time are able to keep costs down in order to appeal to more price-sensitive customers, would be the optimal approach.

5.2.2 Differentiation Strategy in the Market for Electric Mobility

Providing additional services as well as support once the product has been sold was highly emphasized in the empirical results, which is in line with the differentiation strategy proposed by both Porter (1998) and Mathur (1992) and the research by Shao et al. (2014). Services and after sales support provide additional value by helping customers navigate the complexity of technical systems, reducing perceived risk and uncertainty in their purchase decisions. In a market where customers' knowledge is limited and where technical specifications are hard to understand, these services act as a form of guidance and assurance, ensuring correct installation, maintenance, and system integration. This not only enhances the overall user experience but also increases trust in the supplier, which can justify a price premium. This integration of services can be understood through the concept of the product-service system (PSS), which refers to business models where value is created not only through the physical product, but through a combination of products and tailored services (Mont, 2002; Tukker & Tischner, 2006). In a PSS business model, companies retain the ownership of the product (Lewandowski, 2016), and the customers are seen as users rather than buyers (Antikainen & Valkokari, 2016). Due to the fact that markets and technologies are nascent, retaining the ownership at the companies offer further possibilities to reduce the risk for the customers, and to build trust in the quality of products, which in turn may increase the adoption of these technologies.

It is of utmost importance that the services that complement the product are of value for the customer, otherwise the price premium cannot be motivated. As Mathur (1992) states, offerings must be evaluated from the customer's perspective, meaning that the value-adding services must meet real customer needs, not just internal assumptions. This is also highlighted by Ziegler and Abdelkafi (2022), who mentions that the real motives for why customers buy an EV must be understood if companies are to capitalize on their value proposition, as the inclusion of value adding services could also motivate the decision to buy an EV. One type of service that is emphasized in the empirical findings are software services, as these have high possibilities to offer added value for the customer while not being too costly, something that is important to consider in this industry as customers seem to be highly price sensitive. However, the empirical findings also show that these additional services only add value once the reliability of the system can be ensured, indicating that OEMs trying to differentiate with additional services will not be worthwhile if the baseline cannot be ensured as they are not able to meet the real needs of the customers in that case. The empirical results also highlight that firms must not only offer relevant services but also package them effectively. If an OEM is able to package the offering well, for instance by tailoring the right combination of services to specific customer needs, and ensuring that customers understand and can effectively use them, it adds value for the customer, and the company is thereby able to charge a premium for it.

From the empirical findings it has also been found that customers want providers that can offer a broad range of services, but they are also looking for companies that are able to take care of

all the activities needed in order to have everything installed and in place as a part of the PSS. This is referred to in the interviews as a “one-stop-shop”, or turnkey solution. Bundling products and services to create integrated and tailored value propositions creates additional value for customers, especially in a market where technological complexity is high and the customer is not likely to have sufficient knowledge. If the customer were to coordinate the value chain this would be very time consuming and costly. To have someone else combine it and offer it saves the customer this burden, and adds value for the customer that they are willing to pay extra for.

5.2.3 Opportunities for OEMs to offer PSS

Mont (2002) highlights that the boundaries between manufacturing and services are becoming increasingly blurred, and that many companies are now adopting the PSS business model as a survival strategy. Ziegler and Abdelkafi (2022) also emphasizes that OEMs can no longer develop business models independently of the charging infrastructure, indicating that there is a need for OEMs to innovate their business model, which is often the case when new technological innovations appear, according to Teece (2010). Chesbrough and Rosenbloom (2002) also mentions that some new innovations can employ an already existing business model, but often it is the case that the already existing business model will not fit with the new innovation or market opportunity. This indicates that OEMs need to make a switch in the business models that they are currently pursuing in order to capture value in the market for electric HDVs, and the switch is likely to include switching from product-based business models to service-based, i.e. to utilize a PSS business model, or a “one-stop-shop” or turnkey solution as referred in the empirical findings.

The use of PSS offers possibilities for OEMs to add value for customers by including services, but also to improve the relationship with customers due to increased contact and flow of information. This enables firms to get to know the customers better and to offer more tailored solutions. According to Krommes and Schimdt (2017), OEMs would risk losing the customer contact if they take the position as just a supplier in the field of electric mobility, and offering PSS helps OEMs maintain customer contact. However, the use of a PSS also benefits customers as they have access to a wider range of choices, flexible payment options and tailored usage models that fit their preferences (Mont, 2002), further enhancing value by having more customized, high quality solutions that aligns with individual needs and preferences, something that was also emphasized in the empirical findings.

The empirical findings highlight OEMs’ advantage in offering not only the charging infrastructure and BESS in a PSS, but also HDVs, something BESS or charging infrastructure producers cannot, and likely never will. This means that OEMs have opportunities to offer an even more extended “one-stop-shop” solution and also take the one point of contact role. This enables OEMs to have access to a lot of data, both about the HDV but also about driving routes and schedules. By having the customer interact with the system in multiple ways, this strengthens the customer relationship, mitigating the problems of losing customer contact. With detailed information about customers’ use patterns, increased brand loyalty can be obtained (Krommes & Schmidt, 2017), leading to further advantages for OEMs. The data collected can

also be used to identify what type of additional services that would be useful for specific customers and tailor the PSS for each customer. This would further add value for the customer, and allows the OEMs to differentiate by offering both more, but also better, services in the eyes of the customer which enhances the value of the offer.

Furthermore, by having access to data and knowledge about the HDV, OEMs can make better decisions when it comes to, for instance, the location of the chargers and the optimal amount of chargers in that location, and what the optimal charging schedule looks like for a specific customer. The OEMs have a more holistic perspective when offering this type of turnkey solutions which puts them in a favorable position, as for instance BESS providers have to establish partnerships with OEMs to have a chance in gaining this type of knowledge. In addition, according to Mont (2002), using a PSS where the customer interacts with the firm at many points in the system, allows the company to better respond to changing market trends, and companies adopting this system often have early insights into consumer tastes, preferences and buying habits. Being an OEM and offering the whole turnkey solution from the vehicle to the installation and support of the charging infrastructure allows the company to collect a lot of information about the vehicle, the customer and the system, which will reveal information that OEMs can utilize to innovate business models and strengthen and customize the offer further. However, this requires that the OEMs have capabilities both in data collection and data analytics, a capability gap between OEMs and new actors that might be existing in this industry (Teece, 2018; Cabanelas et al., 2023).

To be able to offer a PSS requires the supplier to have a lot of knowledge and capabilities in many different fields. Jiang and Lu (2023) states that if OEMs are to deliver these PSS, they need to develop resources and capabilities in services, and they need to do it faster than the new entrants are. In the case where an OEM offer “one-stop-shop”, or turnkey, solutions consisting of the HDVs itself, the charging solutions and combines this with a BESS, this requires the OEM to not only have knowledge in HDV production, but also in areas concerning energy, a field in which they are likely to not have been involved in before. OEMs must enter unfamiliar industries when implementing their business models, and according to the literature, partnerships are established to cover the need for these competencies (Krommes & Schmidt, 2017). Ziegler and Abdelkafi (2022) also emphasize that in order to develop these business models in a successful way, the focus needs to switch from being focused on one single actor and should instead span various actors. The empirical findings also show that in order for the OEM to be able to offer these turnkey solutions, there is a need to establish partnerships in order to access important knowledge, as creating it in-house would simply take too much time in such a fast-moving market. OEMs might not always have the right or latest technology, but by partnering with smaller, more innovative firms, OEMs are able to access this type of resources and utilize it in their offerings. However, these partnerships also involve a certain level of risk, as the OEMs carry the total responsibility for delivering the turnkey solution and are the ones facing the customer. If a partner underperforms or fails to deliver, it is still the OEMs brand and reputation that are at stake. The use of partnerships in the PSS also raises critical questions around data ownership and control. As firms collaborate to deliver integrated solutions, it becomes increasingly important to define who owns and has access to the data

generated by the different parts of these systems, as the data also constitutes a potential source of sustained competitive advantage.

However, in the empirical findings it was found that due to the market for charging infrastructure and BESS still being new, it is still unclear who the end customers will be. While some people argue that electric HDV buyers will also be responsible for the required charging infrastructure and BESS that this brings, others argue that this responsibility will fall under grid providers. This creates problems for providers of charging infrastructure and BESS, as it is not yet clear who they should direct their offer towards. As Teece (2010) and Chesbrough and Rosenbloom (2002) emphasize, it is of utmost importance to know your customer and their needs when designing the offer, however, this becomes highly difficult in such an uncertain setting. For OEMs, the ideal situation would be if the electric HDV buyer also takes responsibility for infrastructure. This would enable OEMs to offer integrated, “one-stop-shop” solutions of vehicles, chargers and BESS together with additional services, with a single point of contact. If this niche segment emerges, OEMs can differentiate significantly and control the customer relationship end-to-end. However, if the responsibility for infrastructure falls on grid providers, they are not likely to consider OEMs of HDVs as relevant suppliers of these products. In such a scenario, the opportunity for OEMs to enter this part of the value chain would be significantly reduced, and their ability to build a business case around integrated solutions would be limited or entirely eliminated.

The empirical findings also highlight another difficulty of knowing whether to address the driver of the truck or the company that the driver is working for. To satisfy both parties may require an even more extended offer that integrates additional services. This also highlights the need to know your customers and be able to tailor and package solutions based on the specific preferences of the customer. As stated in the empirical findings, customers are comparing different suppliers when choosing their BESS, which has become easier nowadays due to technology and more open global trade (Teece, 2010), forcing companies to have even more customer-centric business models with compelling value propositions, which becomes highly difficult when the question of who to address with the offer is yet unclear.

5.2.4 Business Model Innovation for OEMs

According to Teece (2010), it is hard to change the current business model, especially for established firms who may face inertia (Ziegler & Abdelkafi, 2022). For OEMs, changing to a PSS requires a total change in the way they go to market and requires more than adding services to their already existing products. It requires a fundamental restructuring of internal capabilities and processes, as they are traditionally accustomed to selling products, and their existing experience, knowledge, resources, and organizational structure will no longer be fully applicable or effective in this new business landscape. The shift will not only entail building service capabilities, but also challenges such as creating and aligning new departments, redefining internal processes and developing new ways of understanding and interacting with customers, for instance through the extended use of data and customer touchpoints. The shift is likely to entail significant financial and organizational investment, especially for OEMs who typically have been large, product-oriented firms.

The view of established organizations being less agile and struggling to respond to market changes and innovate their business model as a response to this (Teece, 2010), is also shared in the empirical findings. To mitigate these problems, the empirical findings show that some organizations have made changes in their organizational structures and created subdivisions to allow greater agility in these fast moving sectors. However, it is not clear from the empirical findings how well this works in practice, as these units still operate within larger, traditionally product-oriented and slower organizations. It can be assumed that while these subdivisions may benefit from increased flexibility and are working closer to the market which allows for better responsiveness to customer needs, they are still likely to be constrained by centralized decision making, internal hierarchies, and cultural inertia. If firms want these agile units to succeed, they may need to rethink not only their structures but also their degree of autonomy, which enables the units to act with greater independence while ensuring alignment with overall strategy. This could allow established firms to respond more quickly to technological shifts, regulatory changes, and evolving customer demands in the charging and BESS landscape, and will be critical for OEMs aiming to remain competitive and succeed in the rapidly evolving charging infrastructure and BESS market.

Furthermore, established firms are more scared to cannibalize profits, and are thereby more afraid to experiment with their business models (Teece, 2010), and often have a hard time in perceiving and implementing business models when such changes demand it, whereas a startup is more likely to explore alternative business models (Chesbrough & Rosenbloom, 2002). This implies that while OEMs may struggle to innovate their business model as the shift requires a fundamental reconfiguration, new actors entering, unburdened by such constraints, have greater opportunities to bundle products and services in innovative ways, reaching untapped customer segments and gaining competitive positions in the market. However, although established players typically have a harder time with altering their current business model, the empirical findings highlight that established players might have more resources and thereby are willing to take on more risk as compared to smaller players, because they have financial stability to do it. Larger firms' ability to diversify risk across multiple projects grants them greater strategic flexibility, allowing them to experiment with new technologies or business models, opposing the view of Teece (2010) and Chesbrough and Rosenbloom (2002). This poses big opportunities for OEMs in such a dynamic market, as the iteration of business models are likely to be what will enable firms to build a competitive position in the market.

If a firm is able to innovate its business model, this can lead to competitive advantage if the business model is differentiated and hard to replicate (Teece, 2010; Osterwalder et al., 2005). To make the business model hard to replicate it should contain elements that are difficult for competitors to understand and to have it include certain systems, processes and assets that are hard for competitors to replicate, according to Teece (2010). According to Amit and Zott (2012), creating a new activity system often makes it harder for competitors to imitate. This could be argued to be the case for PSS. By having an interconnected system of products and services it will be hard for competitors to identify and understand each part, and thereby hard to imitate the whole PSS, protecting the OEM from external competitors. Furthermore, as OEMs are able to offer the HDV, an asset that other players in these markets are not able to

offer, this further complicates the imitation of the business model and protects the OEMs from competition from other players. However, other OEMs are still able to imitate this type of business model, implying that the use of an activity system where each part is hard to understand and thereby imitate offers increased protection, as business model innovation that entail changes in the whole system and which are hard for others to imitate, are more likely to become a valuable source of sustained competitive advantage (Amit & Zott, 2012). This offers great opportunities for OEMs to secure a position in the market for electric mobility by innovating business models, and designing integrated and hard-to-replicate systems that leverage their unique positions as vehicle manufacturers.

Teece (2010) also notes that in emerging industries, the right business model is not apparent directly from the start, and those who are able to learn and adjust are those more likely to succeed. Given the current uncertainty, firms need to build in flexibility in their business model in order to adapt when the market is changing. For instance, the empirical findings show that in order for additional services to provide added value for customers, the system must first work without disruptions. This implies that business model innovation, and moving from selling a product to incorporating it into a PSS should happen in stages, and to upsell by adding advanced services before reliability is ensured might mean that the customer rejects the offer altogether. The business model must be designed to scale the value proposition in layers, beginning with ensuring dependability, and then expanding with value-adding services. Johnson et al. (2008) also states that the first step when formulating a new business model should be to shift focus away from the business model itself and instead begin with identifying the opportunity to satisfy a real customer need, and then move on to define how this need will be met. However, this approach becomes highly difficult in a nascent market where the customer that the business model should target is yet to be decided.

5.3 Reaching the Potential

5.3.1 Ability to Form and Manage Partnerships

In the empirical findings as well as in the section above, the importance of having long-term contracts have been highlighted, as close relationships with customers and suppliers are crucial for sensing opportunities, designing offers, and building tailored business models. This highlights the importance for firms to have capabilities in building long-term relationships, and that this type of capabilities becomes strategic assets in highly complex and rapidly evolving markets that should not be underappreciated.

Establishing partnerships will be a key factor in being able to deliver successful PSS in a sector where no single actor possesses all the necessary competencies. To establish partnerships will be a requirement both for small players, who lack in-house resources, but also for large OEMs which must engage in partnerships to deliver full turnkey solutions that span from HDV provision to charging and storage infrastructure, as well as after sales services. By forming partnerships rather than developing capabilities in-house, OEMs can reduce costs while maintaining a high-value offer, enabling them to lower the price of their turnkey solution, in

line with what Salavou (2015) and Christensen (2001) proposes as a hybrid strategy where a cost and differentiation strategy is combined.

However, partnerships are problematized by the fact that resources and capabilities are not easily transferred across organizations (Barney, 1991). The capability to form and manage partnerships, and to integrate the knowledge gained through these collaborations, emerges as a critical success factor in the industry. Partnerships provide access to complementary resources that would be too costly or complex for OEMs to develop internally. However, partnerships also introduce strategic concerns. According to Barney (1991), sustained competitive advantage requires that a firm's resources meet the VRIN criteria, and that competitor cannot be able to imitate either your resources or business model. When firms rely on external partnerships rather than developing resources and capabilities internally, there is a risk that competitors can access similar resources or technologies through equivalent collaborations, thus limiting the potential to achieve differentiation through these partnerships. However, Eisenhardt and Martin (2000) argue that it is not simply the possession of resources that creates competitive advantage, but the way in which those resources are configured and deployed within the firm. In the context of charging infrastructure and BESS, customer value lies less in individual hardware or software components and more in the seamless integration and functionality of the overall solution. As long as the system performs reliably, customers are less concerned with the specific brand of each component, as long as the OEM can act as a single point of contact for the customer. This suggests that OEMs cannot rely solely on proprietary technologies or exclusive partnerships to build competitive advantage, but must instead focus on how they package, tailor and deliver their offerings. Furthermore, the combination of resources into a business model that offer PSS solutions to customers, can be complex for competitors to understand, and thereby protects it from imitation. Therefore, even if the underlying components are accessible to competitors, the overall configuration and delivery may still be unique, providing OEMs with a potential path to sustained competitive advantage.

The interconnectedness of the industry has been highlighted in the literature as well as in the empirical findings, which puts further emphasis on the role of partnerships in order to succeed in the industry. Delivering integrated solutions in charging infrastructure and BESS requires both hardware and software capabilities, and no single firm is likely to possess the full range of technical and operational knowledge needed. This means that the collaboration between different firms is not optional, but a structural necessity. Even large OEMs, despite their legacy assets, must collaborate as the rapidly evolving nature of the market means no single firm holds all required competencies. Partnerships enable companies to get access to skills, competencies and knowledge that they do not have or cannot develop themselves. This aligns with the principles of the resource-based view, which suggests that firms should concentrate on leveraging their unique internal strengths while acquiring external capabilities through collaboration to build competitive advantage (Wernerfelt, 1984; Madhani, 2010). The empirical findings further supports this, highlighting that firms with visibility and control over the value chain are better positioned to make informed decisions about which activities to retain internally and which to outsource. However, managing these partnerships effectively requires

its own set of capabilities, particularly regarding integrating the knowledge and capturing the value of the partnership. In this regard, established firms with a history of managing complex partnerships may hold an advantage, as they are more likely to possess the organizational routines and capabilities needed.

5.3.2 Differences in Capabilities between OEMs and Other Actors

The empirical findings show that in such a dynamic market as the one studied in this thesis, it is necessary to know what is going on in the market and to stay alert to the changes occurring in order to stay competitive, for instance by regularly performing market analysis. To have resources and capabilities to continuously adapt in times of change is referred to as dynamic capabilities (Teece et al., 1997), an area where OEMs may have an advantage over new entrants due to their greater experience with market analysis and strategic planning. Furthermore, Teece et al. (1997) highlights the importance of being able to sense, seize and reconfigure, i.e. to have dynamic capabilities, in a market with these characteristics. In the context of the charging infrastructure and BESS industry, this involves not only staying informed about technological developments and competitive business models being explored, but also acting strategically on those insights. Sensing, in this case, includes conducting regular market analysis and gathering customer data through all the touchpoints of the PSS as it allows for the detection of emerging trends and usage patterns. Seizing requires identifying and prioritizing key customer segments and tailoring integrated solutions that deliver specific value, also with the help of the data obtained from the PSS. Reconfiguring entails adapting internal structures, processes and resource allocation to support new offerings, something OEMs may struggle more with as compared to new entrants, as discussed earlier. Firms that understand customer needs and are able to act on them through flexible and responsive business models, i.e. firms that possess these dynamic capabilities, are better positioned to stay competitive in this dynamic environment.

However, being part of a large organization, or at least being backed by one, offers greater possibilities when it comes to access to valuable resources and knowledge. By being part of a bigger organization, you typically have access to a bigger network, and also access to an already established customer base. This saves time for the established players, whereas the new players need to spend time on establishing a position in the market. The empirical findings also highlight the possible advantages of being owned by other firms, and that this can be something that gives you access to an even broader network with actors from different industries. To be a part of this interconnected industry and to be able to deliver PSS requires the integration of different types of knowledge from different sectors. By having access to a broader network of diverse owners, the possibilities to access the right type of knowledge are higher compared to OEMs, which typically only have access to knowledge regarding vehicle production and related areas.

Brand reputation and track record also plays a central role in customer decision-making according to the empirical findings. The brand, as well as having a track record, is also seen as a highly valuable asset according to Teece et al. (1997), as it is impossible for competitors to imitate. Throughout the empirical findings and the analysis, it has also been discussed that

established players such as OEMs have a favorable position in the market as they already have access to resources, established processes, knowledge, and an already established customer base and are more likely to be perceived as safe bets. However, although OEMs benefit from strong brands and established processes within the HDV sector, their credibility in the energy market is not guaranteed. While their reputation may influence the purchase of an HDV alongside charging solutions and BESS, it is unlikely to carry the same weight with standalone energy customers. Therefore, OEMs must actively build trust and reliability as well as visibility in the energy space, rather than relying solely on their existing brand recognition.

In the empirical findings, the importance of being able to scale both the business model and individual customer solutions was strongly emphasized. OEMs are often in a more favorable position to meet these scaling requirements due to their existing infrastructure, such as established supply chains and experience in managing large-scale projects. These capabilities offer better possibilities to meet the scaling criteria that customers value, however the applicability of legacy capabilities from ICE vehicle production in the electric HDV market is not certain, as earlier discussed. In contrast, new entrants must set all these processes and find a way to leverage economies of scale, before they are able to deliver big scale solutions. However, there are possibilities for entrants that are backed by bigger companies to accelerate this process, as they have access to a big network and resources from their parent companies. While the ability to scale efficiently will be a key success factor in the market, it remains uncertain which actors will be best positioned to meet this challenge.

5.4 Framework Discussion

The theoretical framework, presented in 2.6, provided a holistic understanding of the industry of charging solutions and BESS, and the dynamic relationship between market potential, strategic positioning, and the realization of that potential. It integrated key theoretical concepts, such as diffusion of innovation, Porter's Five Forces, competitive strategy, business models, the resource-based view, and dynamic capabilities, to frame how OEMs can build a competitive position in the rapidly evolving landscape of charging infrastructure and BESS.

Following the empirical findings and analysis, the framework can be revised with insights derived from the data collected and analyzed. The updated framework, shown in Figure 2, reflects a more detailed understanding of the key criteria necessary for an OEM to build a competitive position in charging solutions and BESS. The additional elements, highlighted in green, demonstrate the nuanced and operational characteristics that OEMs must prioritize in order to align strategic positioning with market demands and internal capabilities.

In the Market Potential dimension, Rogers' (2003) key characteristics for market adoption have been extended to include *reliability* and *availability*. Although these characteristics were not part of the original framework, the empirical findings consistently highlight their importance for customers when considering the purchase of electric HDVs. These characteristics are particularly critical in the context of electrification, as they influence customer trust and willingness to adopt the technology. Furthermore, while the diffusion of innovation theory is traditionally viewed from a market level perspective, it is now suggested that it can be

considered from a firm perspective. This shift means that OEMs must actively ensure that their HDVs, charging infrastructure, and BESS meet these characteristics as a baseline, in order to support widespread adoption and build a competitive market position.

The Positioning dimension was developed in greater detail. While the original framework highlighted the need to choose between one of the generic strategies (cost, differentiation, and focus), the updated framework highlights the use of a differentiation strategy, preferably in combination with one of the other strategies into a hybrid strategy. The term “*one-stop-shop*” and associated concepts such as *turnkey solutions*, *one point of contact*, *after sales service and support*, *software services* and *packaging*, underscore the importance of delivering integrated and convenient offerings. It provides more detailed information on how the business model should be formulated and the competitive offer designed in order to build a competitive position. These findings align with the growing importance of product-service systems in industrial markets, where bundling hardware and digital services is key to differentiation. Furthermore, the updated framework highlights the importance of incorporating *flexibility* in the business model in order to quickly adapt to changes. The initial framework included the importance of a business model to be customer-centric, and the updated framework adds to this by highlighting that *improved relationships* with customers and *tailored solutions* are ways to make the business model more customer-centric. This represents a shift from an internal focus to a market oriented perspective and reflects OEMs opportunities to better understand and meet the evolving needs of customers.

In the Reaching the Potential dimension, several new insights emerged regarding resources and capabilities needed in order to build a competitive position in the industry of charging solutions and BESS. Capabilities such as *data collection and analytics*, *knowing your customers*, and *building long-term relationships* were identified as particularly important for OEMs aiming to deliver product-service systems. These capabilities support not only the effective delivery of turnkey solutions but also the ability to navigate a complex and interconnected market, thereby strengthening competitive positioning.

By integrating insights from empirical findings and the analysis, the revised framework provides a more detailed overview with key criteria for how OEMs can build a competitive position in the charging solutions and BESS market. Notably, the three dimensions, *Market Potential*, *Positioning*, and *Reaching the Potential*, are not isolated components, but closely interconnected. Several elements identified within *Positioning*, such as the delivery of integrated offerings or the emphasis on customer centricity, have direct implications for the capabilities required in *Reaching the Potential*. Similarly, understanding *Market Potential* informs both how firms position themselves and what capabilities they must develop. These interdependencies highlight the importance of a holistic approach, where strategic choices in one area both shape, and are shaped by, conditions and actions in the other areas. As such, the framework serves as both a strategic guide and a practical reference for OEMs aiming to compete effectively through integrated, customer-centric, and value-adding product-service offerings.

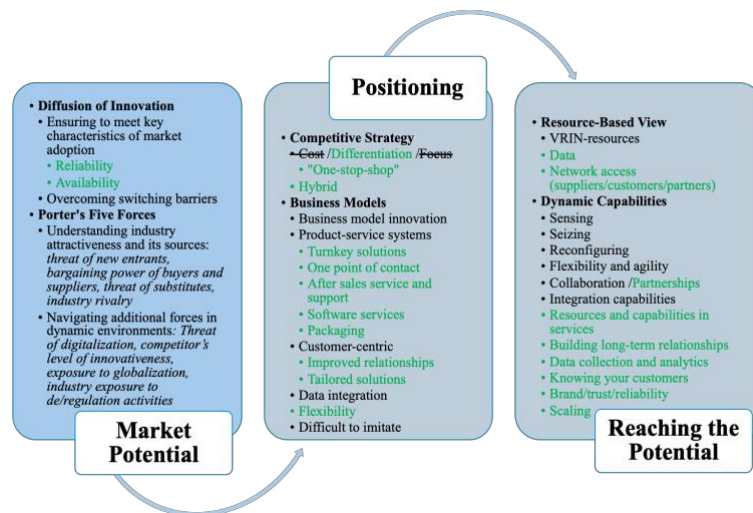


Figure 2: Updated framework illustrating the dynamic relationship between market potential, strategic positioning, and successfully reaching the market potential. It highlights key criteria that OEMs must address to build a competitive position.

6. Conclusions

The first research question “*What are the key characteristics and competitive dynamics of the European market for charging solutions and battery energy storage systems?*”, aimed at gaining an understanding of the current market situation and the dynamics driving competition in the market today. The research question explored the rate at which electric HDVs have been adopted in order to understand the demand for charging infrastructure and BESSs. This gained an understanding of where the market potential lies, which led to the second research question “*How can an OEM build a competitive position in the European market for charging solutions and battery energy storage systems?*”, where the understanding of the competitive dynamics could be applied into analyzing where OEMs can position themselves within this potential and what resources they need in order to build a competitive positioning.

6.1 Key Characteristics and Competitive Dynamics of the Market

The European market for charging infrastructure and BESS is characterized by rapid technological advancements, high complexity and strong interdependencies. One of the defining features of the market is the chicken-and-egg dilemma, where charging infrastructure is needed to drive HDV adoption, but firms need demand for electric HDVs to have incentives to build charging infrastructure. However, the empirical findings suggest that the bottleneck currently lies more with the adoption of the electric HDVs than with the infrastructure itself. This dynamic indicates that simultaneous development of vehicles and infrastructure could accelerate market adoption. The market is in the early adopter phase and while the rate of adoption is increasing, electric HDVs have not yet reached mainstream and the early majority phase, posing an opportunity for actors in the industry to act strategically now to gain market shares when adoption takes off. High switching costs, range limitations, incompatibility with current operations and high upfront investments still affect the adoption rate and may deter potential new adopters. However, with the increasing adoption rate, the observability of electric

HDDVs is increasing, which can help accelerate adoption as it helps reduce uncertainty and perceived risk of the new technology.

The competitive landscape is fragmented with many new players entering the industry from different sectors, which intensifies the industry rivalry. The dynamics of the competitive landscape is further intensified by low margins, high capital requirements and technological complexity. Technological advancements in BESS have lowered costs and may increase demand, but can also reduce entry barriers, increasing the competition of the industry. Charging solutions are affected by low margins and high initial investments which limit the profitability and the possibility to capture value, which further intensifies the industry rivalry, but deters new entrants. The market is heading towards consolidation, increasing the industry rivalry as the existing players compete fiercely in order to establish their position in the market before consolidation occurs.

The market is affected by increasing complexity where the offers consist of hardware, software and services, which entails that companies need to have more knowledge and capabilities in order to be competitive and meet customer needs. Partnerships are replacing acquisitions as a way to access technology and resources, lowering entry barriers and making the market more dynamic, while at the same time making the firms dependent on more suppliers. Regulatory pressure is another dynamic that affects the market, and while current regulatory incentives have started to slow down, future regulatory pushes are expected to accelerate the adoption. This can reshape the market boundaries and increase the threat to incumbents as more actors are incentivized to enter the industry.

6.2 Building a Competitive Position in the Market

Due to the competition from the Asian players in the European market for charging infrastructure and BESS, employing a cost leadership strategy is not viable for most European firms. As the Asian players prioritize market share over customer relationships, their focus is on providing low-cost products at big scale. Based on this, a combination of a differentiation and focus strategy which emphasizes service, quality and proximity to customers are more suitable for European firms in general, and for OEMs in particular. However, as customers in the market for charging solutions and BESS seems to be highly price sensitive, in part due to high technological complexity and limited understanding of how different systems compare, simply focusing on differentiating the offer will not be enough to gain a competitive position. Firms in the European market must either employ a cost-efficient or focused strategy, and be able to differentiate their offer on dimensions that customers truly value, for instance by providing reliability and availability.

Due to the complexity of the technologies and the customers' lack of knowledge, customers value integrated PSS, or turnkey solutions, which offers good opportunities for firms, and especially OEMs, to differentiate their offer. In the turnkey solution, OEMs can combine hardware and software, with installation service as well as after sales service and support. OEMs have a unique advantage in being able to offer electric HDDVs, chargers, and BESS and delivering a comprehensive solution that is hard for competitors to replicate. In addition, by

offering this type of solution, OEMs can also employ the one point of contact role, where customers know who to turn to in case they are encountering any issues regarding either the HDV, the charging infrastructure or the BESS.

As OEMs primarily have had a focus on selling products, innovating their business models to a service-based model requires a total shift in the way they go to market, and inertia is likely to be encountered which must be overcome. Furthermore, in order to be able to offer these turnkey solutions, OEMs must partner with energy firms, software companies and other stakeholders, as they do not have all the knowledge in-house. This also requires the OEMs to have the capabilities to integrate the knowledge captured from these partnerships, and also to reconfigure their internal resources. By offering integrated solutions that spans all the way from the vehicle to the installation and after sales service of the charging infrastructure, enables OEMs to gather data on customers at several touchpoints, which is a source of competitive advantage that can both be used to improve and tailor offerings, but also to sense early market trends and changes in customer behavior, enabling OEMs to build a competitive position in the highly dynamic market for charging infrastructure and BESS.

6.3 Contributions and Practical Implications

Based on the insights derived from answering the research questions, some implications can be recommended for OEMs in order to differentiate their offerings and build a competitive position in the European market for charging solutions and battery energy storage systems.

First of all, the chicken-and-egg dilemma presents managerial challenges as it affects how OEMs can, and should, design their business models. The dilemma highlights the need for OEMs to collaborate with other stakeholders to drive widespread adoption of both electric HDVs and charging infrastructure. Without such coordination, OEMs will struggle to generate customer interest.

Implementing a differentiation strategy through the use of a PSS, or turnkey solution as it is referred to in the empirical findings, that is tailored to the specific needs of each customer will be the way for OEMs to build a competitive position in the market. For managers of OEMs, this implies a shift in the organizational thinking, as the way that they go to market must change compared to the traditional way of having a product-based offering. The organization must overcome inertia and possess dynamic capabilities in order to change the organization in a way that is demanded by the market. To be able to offer integrated turnkey solutions also necessitates the use of partnerships for OEMs, as they do not have all the knowledge and resources in-house. In order for these partnerships to work, managers of OEMs must make sure that they have the right capabilities to make these work and to be able to integrate the knowledge and complementary resources gained from partnerships. The use of partnerships also has managerial implications as it requires identifying which parts of the value chain that should be retained in-house by the OEM, and which can be more efficiently managed through external partners.

Offering the integrated turnkey solution to customers also enables OEMs to gather more data on customers through several touchpoints, which also has managerial implications as it both

requires the OEMs to setup these touchpoints, but also to be able to gather data on customers and to know what to do with the data, as simply just collecting the data without knowing how to utilize it will not make it a source of competitive advantage. Managers of OEMs must make sure that the firm both has the capabilities to collect data but also how to utilize it effectively to make informed decisions, as well as how to manage the data in order to ensure the safety of the customer. The collection of data from several touchpoints also has managerial implications in terms of market analysis, as it allows for the detection of early patterns related to changing market trends, preferences and buying habits, which will be a key source of competitive advantage in such a dynamic market.

Furthermore, managers of OEMs must ensure that their business models are aligned with actual customer needs, rather than based on internal assumptions about customer preferences. To accelerate the adoption of electric HDVs, key barriers such as high upfront investments and switching costs must be overcome, and OEMs must actively mitigate these challenges to support customer transition. For integrated turnkey solutions to deliver real value and foster further market adoption, the added services must directly address and solve customer pain points. Managers must make sure that they are able to sense the needs of the customers and that they integrate these into their business models. This can partly be facilitated by the increased use of customer touchpoints, as these enable OEMs to discover fundamental use patterns and needs of the customers.

6.4 Limitations and Future Research

Although the authors have aspired to reduce limitations and biases throughout the thesis, it has its limitations. The empirical findings are based on interviews with industry consultants and representatives from companies, which creates some biases that one needs to be aware of. All of the interviews have touched upon what customers are looking for and what challenges exist for customers in order to increase the adoption rate of electric HDVs, but since these are secondhand perspectives, these may not fully reflect the customers' viewpoints. In order to eliminate perspective bias, interviews with customers would have to be done as well to validate the findings regarding customer expectations, which have not been a possibility within the scope of this thesis. As a result, this affects the validity of the analysis of customer needs and preferences. This weakens the ability to make firm conclusions about customer expectations or to assess how well current offerings align with real market demand. Additionally, the topic of this thesis covers aspects of businesses that contain confidential and sensitive information regarding strategic competitive decisions, leading to the interviewees not wanting to share full transparency regarding their strategic decisions. Hence, the possibility to get complete and nuanced information regarding business models and ways to compete, was limited to some extent. This restricted the depth and transparency of the empirical findings, and while the study identifies patterns and strategic trends, it is limited in its ability to fully capture competitive positioning across firms.

While the study provides valuable insights into the competitive dynamics of OEMs in the charging infrastructure and BESS market, the limited number of interviews affect the generalizability of the findings. The relatively small sample size means that the perspectives

captured may not be fully representative of the broader industry. In particular, since the study focuses on OEMs, the limited number of interviews from this group may restrict the depth and diversity of the insights specific to OEMs. As a consequence of this, while the conclusions drawn are indicative of general tendencies within the industry, they should be interpreted with caution. Another consideration that may influence the generalizability of the results is the geographical context of the study. Although the research aimed to explore the European market, several of the companies interviewed were based in Sweden but operating across Europe. While these actors provided valuable insights regarding the European market landscape, the study may have been conducted through a predominantly Swedish lens, and market dynamics may differ across Europe, which could influence how business models are developed, perceived and implemented. The findings may therefore primarily reflect the European market through a Swedish lens.

In this research, the possibility to offer turnkey solutions that consist of OEMs covering the entire value chain from the electric HDV to charging solutions and BESS along with aftermarket services, have been identified. As sustainability is a core driver of electrification, the handling and repurposing of batteries after their use in EVs is a critical component of the value chain that was not explored in this study. This represents a limitation, as it excludes an increasingly relevant dimension of business model innovation related to battery end-of-life management and second-life applications. In particular, repurposed EV batteries hold the potential for use in BESS solutions, which could further enhance the value of OEMs' turnkey solutions. Future research could therefore explore how integrating battery recycling into business models influences competitiveness, and how such expanded offerings compare to those that do not include an end-of-life strategy.

The choice of a qualitative research strategy means that the competitive assessments done in this study are solely based on qualitative data from interviews. Future research could build on this by incorporating quantitative methods to complement the qualitative insights presented here. The quantitative approach would enable benchmarking across firms in terms of market share, cost structures and business model performance. Further, due to the dynamic characteristics of the industry, technological advancements and changes in market structure are occurring at a fast pace which implies an interest in evaluating business model performance over a long period. This creates an opportunity for future research to quantitatively assess and benchmark business models and their long-term performance in this dynamic market, and would provide a more comprehensive understanding of what offers are truly competitive in the industry.

In conclusion, while this thesis offers valuable insights into the competitive dynamics and strategic positioning of OEMs in the charging infrastructure and BESS market, it is important to acknowledge that certain limitations have influenced the scope and depth of the study. Although these constraints do not diminish the relevance of the findings, they suggest that future research could build on this work to provide a more comprehensive and nuanced understanding of the industry. By addressing the limitations of this study, future studies can deepen the insights offered here and contribute to a more holistic view of how competitive positions are built in this evolving market.

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Appendices

A. Interview Guide (Industry Consultants)

1. Market Potential & Growth Opportunities

A. Market Trends & Developments

1. How would you describe the current state of the European market for charging solutions and BESS?
 - a. What is the most important development occurring in the market at this moment?
2. Which customer segments (e.g., private EV owners, fleet operators, heavy transport, grid services) are driving demand in your experience?
3. From a customer perspective (primarily B2B), what factors drive decision-making in selecting energy storage and charging solutions?
4. What do you see as the biggest gaps or unmet needs in the market?

B. Business Models & Market Positioning

5. How are companies currently positioned in the market (e.g., premium technology provider, cost leader, integrated energy solutions)?
6. What are the main revenue models in this industry today (e.g., hardware sales, leasing, energy-as-a-service, subscription-based models, Product-service system)?
7. Do you see new business models emerging in the market?

2. Competitive Landscape & Strategy

8. Who do you consider to be the biggest competitors, and how do they differentiate themselves?
9. What are key competitive advantages in the industry? What key resources are used to gain these competitive advantages?
10. How important is brand reputation vs. technological innovation vs. pricing vs. offering a total package (product-service system) when competing in this market?
11. Are partnerships (e.g., with automakers, energy providers, municipalities) a critical part of the competitive strategy? If so, how?

3. Requirements for Success & Future Outlook

12. What are the most important resources/competencies needed to be successful in the market in the future?
13. What services will provide added value for customers in the future (hardware, software, data analytics etc.)?
14. What role do software solutions, AI, and data analytics play in optimizing customer offerings?
15. What types of investments or partnerships are needed to unlock further market potential?

16. What are the biggest challenges companies face in terms of charging infrastructure and BESS solutions?
17. Where do you see companies focus shifting in the next 5-10 years?
18. If you had to predict one major industry shift that will reshape the market, what would it be?

4. Closing

19. To wrap up, what will the “perfect” business model look like in the future?
20. Is there anything else you think is important for us to consider in our analysis of the industry?

B. Interview Guide (Firm Representatives)

1. Market Potential & Growth Opportunities

A. Market Trends & Developments

1. How would you describe the current state of the European market for charging solutions and BESS based on your company's experience?
2. What do you see as the most important development in the market right now, and how is your company responding to it?
3. Which customer segments are currently driving the most demand for your offerings (e.g., private EV owners, fleet operators, heavy transport, grid services)?
4. From your perspective, what are the main factors B2B customers consider when choosing charging and energy storage solutions?
5. What unmet needs or market gaps do you encounter most frequently when engaging with customers?

B. Business Models & Market Positioning

6. How would you describe your company's positioning in the market (e.g., premium provider, cost leader, integrated solution provider)?
7. What revenue models are you currently using (e.g., hardware sales, leasing, energy-as-a-service, subscription)?
8. Are you exploring or already offering any emerging business models?

2. Competitive Landscape & Strategy

9. Which companies do you see as your key competitors, and how do you differentiate your offerings from theirs?
10. What would you say are your company's main competitive advantages or most important resources?
11. Which factors do you consider most important in competing successfully - brand, technology, pricing, integrated services, or others?
12. Are strategic partnerships (e.g., with automakers, energy providers, municipalities) important to your competitive strategy? If so, could you describe some examples?

3. Requirements for Success & Future Outlook

13. What value-added services do you believe will become more important going forward (e.g., software, AI, data analytics, customer platforms)?
14. How are you currently working with software solutions, AI, or analytics to improve your customer offerings or internal efficiency?
15. What types of partnerships or investments would help unlock further market potential for your business?

16. What are the biggest challenges your company is facing today in terms of charging infrastructure or BESS offerings?
17. Looking ahead 5–10 years, where do you expect your company - or the industry in general - to focus more of its efforts?
18. If you had to name one major shift that you think will reshape the industry, what would it be?

4. Closing

19. To wrap up, in your view, what would an ideal or future-proof business model in this industry look like?
20. Is there anything else we should consider when analyzing this industry from a company perspective?

C. Table of identified Codes, Themes and Groups

Code	Theme	Group	
Market landscape	Current market situation	Market Potential	
Value creation			
Technological developments			
Rate of adoption	Market Adoption		
Regulatory environment			
Barriers to adoption			
Current players	Dynamics of competition		
Incumbents vs new entrants			
Market segmentation	Strategic Market Positioning		Positioning
Customer preferences			
Business models	Business Model and Strategy		
As a service models			
Data			
Partnerships			
Scale			
Safety			
Complete offer		Offer Design and Differentiation	
Product service system			
Aftermarket			
Hardware and software			
Unique selling proposition			
Market analysis	Capabilities	Reaching the Potential	
Flexibility			
Large vs smaller players			
Collaboration			
Data collection			
Credibility			