Moving towards Electric Mobility

Competitive driving forces in the automotive industry.

Master's Thesis

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Executive summary

Tesla was the first to introduce desirable electric vehicles (EVs) to the market and overcome the common misconceptions about EVs and their usability compared to traditional internal combustion engine vehicles (ICEVs). Currently, Tesla is the market leader in EV sales and became the most valuable automotive company. (Statista, 2021; Klebnikov, 2020) Tesla saw the opportunity for EVs on the market, despite established manufactures thought otherwise. Tesla had developed a new innovative drivetrain system based on lithium-ion batteries, and all of it was packed into a desirable sportscar to receive attention and win over the enthusiastic market first. This quickly became Tesla's main internal resource, as Elon Musk's visionary business model starts with gathering money from the high-end market segment, which eventually helps to create cars for the mass-market, all with keeping in mind the end goal of a greener, less pollutive future.

Industry forces are examined to assess the external factors, as well as Tesla's and Volkswagen's resources, are studied, what possibly enabled them to successfully introduce their EVs on the market. All with keeping in mind innovation, which gives additional depth to the research and opens new perspectives. New technical knowledge, expertise and capabilities from the software industry are essential to be present to stay competitive in the future vehicle market. The industry is undergoing a technological transformation which will bring more challenges in the future. The external factors identified in this analysis will make the competition fiercer as more and more manufacturers will need to attain similar core competencies, establishing capabilities differentiated by their internal resources will be sustaining competitive advantage.

Currently, almost all major manufacturers are involved in developing EVs, even prior to Tesla, several manufacturers have developed innovative EVs. This trend is due to external factors, as we found out the main driving factor is governmental involvement. The pressure on vehicle manufacturers has increased over the last decade, political concerns are grown regarding climate change. 95% of the global transportation methods relying on burning non-renewable fossil fuels. The transportation sector contributes 14% of the global CO_2 emissions. New regulations were formed to restrict the emissions of road vehicles, and the answer to greener mobility is in the form of EVs.

Prior to Tesla, GM was the first to introduce EVs for the mass market in the form of their model called EV1. Manufacturing EVs was proven to be a costly effort, and the initial investment cost was unlikely to return. Another problem arose with introducing EVs, as it was promoting greener mobility at the expense of their main profitable segment of ICEVs vehicles. The early 2000s emission standards were less restricting than nowadays, therefore justifying the cost of EV manufacturing was impossible, and

the first mass-produced EV was scrapped, focus was put back to the traditional ICEVs. The case of GM is a good example of the innovator's dilemma, as the introduction of EVs interfered with the core business model, and as an end result, they disrupted themselves with the introduction of new technologies. Similar situations can easily occur at other manufacturers as well.

After studying the problem area, we can conclude that the main driving factor currently is the governmental involvement which sets the emission restrictions, and overall political institutions have an effect on the other external factors, such as tax benefits and cash returns can generate a wider spread of EVs, which will accelerate the overall innovation and development. Tesla showed the industry that manufacturing desirable and affordable EVs are the right way to move towards greener mobility, and following that direction will be beneficial for the future vehicle models which will be developed by traditional manufacturers.

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Definition of terms

EV	**Electric Vehicle**	Common term for vehicles which are power partially or entirely by electricity.
BEV	**Battery Electric Vehicle**	A fully electric vehicle with rechargeable batteries. (EV is more frequently used)
ICEV	**Internal Combustion Engine Vehicle**	Vehicle driven by a traditional internal combustion engine
HEV	**Hybrid Electric Vehicle**	Uses both internal combustion and electric motor.
PHEV	**Plug-In Hybrid Electric Vehicle**	Hybrid vehicle with the possibility to charge the batteries externally, which provides longer range only on batteries.
FCEV	**Fuel-Cell Electric Vehicle**	Uses fuel cell (hydrogen), which generates electricity for the batteries.
SUV	**Sport-utility vehicle**	
OEM	**Original Equipment Manufacturer**	

1 Introduction

1.1 Background and Motivation

During the last century, the competitiveness in the automotive industry sharpened. Globalisation and international trade started to gain momentum around the 1980s. In the early '80s, little notice was taken in the Western world, but towards the end of the decade, Japanese imports started to secure a significant proportion of the US auto market, and concerns have been raised. The Japanese were twice as productive as the American or European counterparts, and at the same time, Japanese cars showed higher product quality and denied the preconception of the trade-off between quality and productivity (Holweg, 2008). The main driving factor for this highly competitive environment is the limited number of dominant companies who control the innovation and development processes, which further accelerated the competition in this highly concentrated environment (Holweg, 2008).

As connectivity and autonomous driving will dominate in the industry, cars are made in the near future will be upgradable, which will further increase the speed of innovation. At first glance, it looks like Tesla has all the advanced features that can take over the industry, which is difficult for traditional manufacturers to follow. The increasing number of academic literature about innovation and its application to a highly competitive industry gives the thesis's foundation. The industry is humongous and has a constantly changing landscape, which has a substantial role in shaping the social and economic environment.

Since my childhood, even before I could drive, I loved everything about cars. The passion for cars did not seem to decrease even to this date. Therefore, it was apparent that I would like to study the automotive industry in my master thesis and gain a deeper understanding of it. I am lucky enough to be involved with vehicles daily at my workplace, which I genuinely enjoy because I could turn my passion into a career.

My first encounter with an electric car also happened at work, since then, I genuinely believe that electric vehicles will be the future of mobility. The first time I drove the Tesla Model S, I understood why Tesla gained popularity in such a short time as a relatively young automaker, and I felt that they could disrupt the established automotive industry. The sleek design, autopilot, a petrol-based car like range of 400 km, the seamless and noiseless acceleration refused all my preconception towards electric vehicles.

1.2 Problem statement

Currently, the pressure on manufacturers further increases as customer demands and environmental concerns call for new innovative solutions that have not been faced before. The need for greener and safer cars requires automakers to transform the industry. Digitalisation, shared mobility, and connected services further strengthen the requirement for innovative solutions as these will be the main facilitators for increasing profits in the current decade, which is a relative new challenge for automakers.

The thesis's primary purpose is to study the automotive industry, specifically focusing on electric vehicles' innovation and its external driving factors. These identified external factors will be applied to Tesla and Volkswagen in order to see how it forms the competitive environment. Tesla perceived as leading innovator whereas Volkswagen is a traditional manufacturer who recently shifted the focus on electric mobility.

It is important to study the automotive industry as it has a major influence on the global economy. The industry turnover combined would be the sixth-largest economy in the world. It contributes to socio-economic development globally as 14 million people works in the automotive industry. Therefore, it is important to study how this sector can stay competitive and profitable in the future as the global economy highly depends on it. (ILO, 2021)

1.2.1 Research question

What are the main drivers of the electric vehicle innovation, and how does this innovation affect the competitive advantage in the automotive industry?

Additional questions are asked which support the research question:

- *What external forces put pressure on the automotive industry?*
- *How Tesla and VW using their internal resources and innovative approaches to sustain their competitive advantage?*

Hypothesis 1: *The emission regulations set by the government and political institutions are driving the electric vehicles innovation which affect the overall industry's competitive advantage.*

Hypothesis 2: *In order to stay competitive on the market and keep the leading position, vehicle manufacturers need to continuously innovate and attain new technical knowledge in manufacturing, and adopt expertise from the software industry.*

2 Literature Review

2.1.1 Radical and Incremental innovations in the automotive industry

Regardless of product or process innovation, it can be divided into two distinct types, based on the characteristics and effects on the economic system. Radical innovations often transform the way we think, and sometimes they are so radical that they change the basis of society (Tidd & Bessant, 2014). The Industrial Revolution and today's communicating and computer technologies are the most prominent examples of radical innovations. As opposed to that, incremental innovation is the continuation of what has been already done but doing it better by looking for opportunities that reach gradual improvements. (Abernathy & Utterback, 1978)

Most of the innovation is incremental, and most organisation's resources are made towards incremental improvement for products and processes (Salter & Alexy, 2014). The reason behind it is that organisational capabilities are not set up for radical innovations as often modifying these capabilities comes at a high cost. Often incremental innovation increases the firm's capabilities, whereas radical innovation requires the focus on a completely new approach, technologies, and skills to employ it on the market (Trott, 2012). Radical innovation poses a high level of uncertainty and risk as moving away from established markets with new or improved technologies is very different from the company's already established capabilities (Salter & Alexy, 2014).

The two separate dimensions can be observed of incremental and radical innovation. The first is the internal dimension which is focusing on the resources and knowledge involved. It builds up existing knowledge and resources and enhances its competitiveness, whereas radical innovation in this dimension will require new knowledge and resources to reform many of the existing core competencies.

The external dimension is based on competitive technological and market changes. Incremental innovation in this dimension is when an existing product is enhanced with modest technological changes to stay competitive in the current market. A radical innovation with large technological advancement makes existing products uncompetitive and obsolete on the market (Trott, 2012).

As the automobile was a radical innovation itself, since then, incremental innovations have been continually made in modern cars, which changed our perception of cars. Nowadays, car manufacturers offer a wide range of models which can be customized for the taste of the customer, and the accessibility through complex networks of distribution cars are accessible in a short time.

The debate of what counts as radical or incremental innovation in the automotive industry is not settled because the opinion amongst researchers varies. Radical innovation, as it was discussed earlier, is changing the whole perspective of how things were done before (Salter & Alexy, 2014). Cars, since the 20th century, has not changed fundamentally, because still to this date cars, are having four wheels, driven by an engine and a steering wheel is used for directional input. Therefore, if we approach the question of radical or incremental innovation from this point of view, a total transformation in the form of a radical change has not happened yet.

Jaegul Lee and Nicholas Berente (2011) in their research, address the question of radical and incremental innovation, namely they analyse the era of incremental change in the automotive industry after a radical technological change has been introduced. Regarding to them, the last radical innovation in the automotive industry was the emission control system, the catalytic converter, which was designed as a regulatory emission standard system. Lee's and Berente's paper contributes to the understanding of the era of incremental changes in the automotive industry after a radical innovation. As Salter and Alexy (2014) describe: dominant new designs can be grown from both radical and incremental innovations, therefore a dominant design does not necessarily have to come from radical innovation. Lee and Berente find evidence through their research that innovations are not decreasing in the era of incremental change, and going towards the end of the product's life cycle is not an uninteresting phase (Lee & Berente, 2011).

Their findings suggest that the automotive industry is, in fact, technologically advancing by incremental innovations, and it is one of the most stable industry for selecting incremental improvements. Researchers have expected that this pattern will be interrupted with radical innovations, mainly because of the oil crisis in the early 80s (Altshuler, Anderson, Jones, Roos, & Womack, 1986) or because of the rising environmental concerns (Nieuwenhuis & Wells, 1997). Clayton Christiansen (1997) states in his book called 'The innovator's dilemma' that the car industry is not threatened by these concerns enough, and the industry is healthy, petrol engines reached a point of high reliability, which can be delivered for customers at a low price point, and aside from a few political mandates the established automakers have no reason to pursue making EVs. He adds that EVs will most probably be a disruptive technology in the future and a potential threat for ICEVs. (Christensen, The innovator's dilemma, 1997)

2.1.2 Disruptive innovation

Christensen (1997) posits that there are two distinct technological innovations: disruptive technologies and sustaining technologies. The disruptive technology brings to the market a product with a different value proposition that was not available before, whereas sustaining technologies improve the performance of the existing products. Large companies tend to have a problem dealing with disruptive technologies because the potential risk comes with challenging their business model. Established companies aware of new technologies, but they cannot capitalise on their innovation as it would undercut their own established business model (Christensen, The innovator's dilemma, 1997). The Innovators Dilemma (1997) addresses this issue because, contradictory, established manufacturers should disrupt themselves with new technologies.

However, as Utterback and Suárez (1993) states, it is easier to introduce and materialise disruptive technological innovation when a company is not invested heavily into existing technologies, and they are not dependent on the existing business model

Clay Christensen asked his Harvard Business School collages to study the question in-depth. Tom Bartman conducted the analysis by asking five key questions to determine if Tesla is disruptive. The questions are the following:

"First, does the product either target overserved customers (by offering lower performance at a lower price) or create a new market (by targeting customers who couldn't use or afford the existing product)? Second, does it create "asymmetric motivation," meaning that while the disrupter is motivated to enter higher performance segments over time, existing players aren't motivated to fight it? Third, can it improve performance fast enough to keep pace with customers' expectations while retaining its low cost structure? Fourth, does it create new value networks, including sales channels? Fifth, does it disrupt all incumbents, or can an existing player exploit the opportunity?" (Harvard Business Review, 2015)

Bartman concluded through his analysis through these set of questions that Tesla is sustaining innovation rather than disrupting it. He is using Christensen's sustaining innovation definition because Tesla offers incremental performance upgrade at a higher price, and their cars are only made for a niche, who prefer electric cars over gas-powered ones. Regarding to him, Tesla is only betting on preferences, that someday millions of people would want to drive EVs. He argues that competition is not fierce for Tesla because they did not introduce a variety of affordable cars, and if the customer

preferences would change, incumbent manufacturers, like Volkswagen, could quickly shift the trend to their favour (Harvard Business Review, 2015).

The study and the article, which was released by HBR, sparked particular interest and gave further depth by introducing other views of the topic. Some are disappointed that the study has a narrow view of the approach. Some opinions were published by HBR, which were opening other perspectives.: Customers are not buying just a vehicle, they are buying the Tesla experience, which is incomparable to other vehicles on the market. People refer to Tesla, not an EV or a regular vehicle, and it will be hard for anyone to match. Others emphasise the significance of the battery technology, to which Tesla is heavily invested in, and the core technological competencies of Tesla will be hard to match by the competition as Tesla will be ahead of the curve by the time established manufacturers figuring out producing EVs (Harvard Business Review, 2015).

Elon Musk also reacted to this article, and his statement is the following.: *"Clayton is wrong. New tech is always expensive. Tech disruption occurs at *high end*, eg computers & cell phones. It takes many design iterations & vast economies of scale to achieve mass market affordability."* [1]

2.1.3 Innovator's dilemma: GM's Revolutionary Electric vehicle

There can be a misconception about the automotive industry that well-established manufacturers do not want to create disruptive technologies, or they do not have the ability to do so. The slow incremental change in the automotive industry would suggest that manufacturers cannot bring new radical innovations to the market therefore, the basic concept of cars have not been changed much in the past century.

The case of GM's EV1 is a perfect example of the Innovators Dilemma, which is described by Christensen. In 1996 Michael Shnayerson wrote his book about GM's internal struggle where he experienced first-hand how GM's electric vehicle, - which was the first electric vehicle for the public - has failed due internal struggles within the organisation.

At the time, GM wanted to illustrate their leading position of technological advancement, therefore created a solar-powered car for an invitational race. They have won the race with a great distance ahead of the competetion.GM received great public attention, and the decision was born to bring an electric car to the mainstream market. In the late 80's GM rehired AeroVironment with the goal of designing a concept electric car. The first prototype was successfully made and has been shown to the

[1] https://twitter.com/elonmusk/status/1075126514851602432

public in 1990 by Roger Smith, CEO of the time. The response from the public was welcoming, and Roger was pleased with the results, and in the same year, on Earth Day, he announced that GM would bring this concept to the market (Shnayerson, 1996).

The announcement of the first electric vehicle was at seemed perfect because not long after the California Air Resources Board (CARB) announced their regulation that all manufacturers in California state have to produce 2% of their fleet completely emission-free by the year of 1998, which meant that GM would be prepared with their new EV. However, there was a major issue with the EV1. Around 1100 EV-1's were produced, and it was available through leasing to selected drivers at a monthly charge of 250 to 500 USD. The users thought it is covering the cost of manufacturing, but this was not the case. This step had been made by GM to make it available for the public and conduct valuable information from the users. Otherwise, the car would have to be sold for 50 000 to 60 000 USD to cover the cost of manufacturing and development. Taking into consideration the inflation, it would cost around 100 000 USD in 2021. At that price point, only a limited number of people could afford it, which would make it an unprofitable product for GM compared to their regular ICEVs (Shnayerson, 1996).

However, the profitability aspect of the EV1 is understandable, the way GM closed the program is unreasonable and not rational. Customers loved the EV1, and the market was enthusiastic about the first electric car, but it seemed like GM tried everything to make it look like a failed project. People desperately wanted to keep their cars, and they would offer to pay the price for them but instead, GM collected all EV1s from customers and crushed them at a junkyard, only a few survived which went to museums or universities, with their powertrains removed. GM did not want the EV1 to stay on the road by any means. The production and development was a difficult task, but the internal struggles were rather magnified by GM because of the imposed mandate by CARB. GM wanted to emphasise the difficulty of production, to slow down further emission regulations as it was against their core business with ICEVs. Moving towards EVs meant to be a greener solution than ICEVs, which was a value proposition, GM certainly did not want to be associated with. The majority was not ready for green mobility at the time, as EVs resonated only with a special group of customers on the market. (Paine, 2006).

The resistance to disruptive technology is rooted in the established organisation itself. If the market has attractive properties which align with the current business model, companies rarely allocate resources for new paths to shift away from the traditional operation (Teece, Pisano, & Shuen, 1997). GM had a heritage building of traditional ICEVs, therefore following the path of developing EVs would disrupt themselves on the market. They were simply not ready for it, and the fact shortly after closing

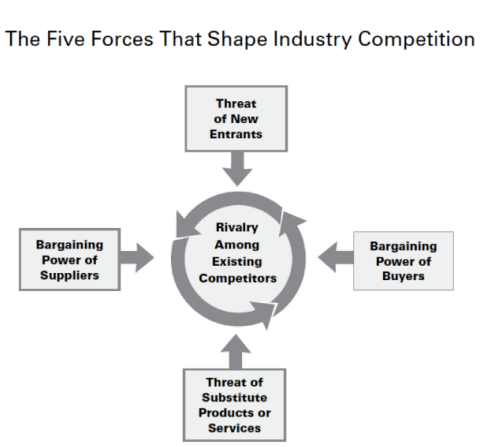
the production of the EV1, they committed to invest in Hummer simply because Hummer had the potential to make money for them (Paine, 2006). Shortly after in 2006 the Rick Wagoner who decided to scrap the production of EV1, declared his decision was a mistake (Motor Trend, 2006). Wagoner has been asked about his worst decision as a CEO of GM, and his response was: *"Axing the EV1 electric-car program and not putting the right resources into hybrids. It didn't affect profitability, but it did affect image."*

3 Theoretical foundation

3.1.1 PEST analysis and Porter's 5 Forces

In the previous decades, important debates emerged on how firms can achieve and sustain competitive advantage. As globalisation evolved rapidly, competitive advantage has an even more significant role in an organisation's life to be profitable and survive on the market. The rapid adoption of new environmental threats is seen as the key factor to stay in business and stay ahead of the competition. Therefore, tools are necessary to analyse the business environment and successfully react to new emerging challenges. In 1979, Michael Porter addressed this in his article called: "How Competitive Forces Shape Strategy". The systematic way of describing a market or industry from an external perspective has been born, referred to as Porter's Five Forces. Porter's emphasis is on the action that needs to be taken to capture superior profits by creating a market position against competitive forces. The attractiveness of the market or industry regarding long-term profitability is examined through these factors that determine the firm's relative actions. (Porter, 1985)

Figure 1 Porter's Five Forces Model
(Porter, Harvard Business Review. 2008)



The model can be described on two axes where the horizontal one represents suppliers and buyers' power. The suppliers have power by their control over the prices or reducing the quality of the supplied products or services. Customers also have the force to reduce prices as they demand higher quality or more service, and with it, they face competitors to each other at the expense of the industry profits. Buyers naturally want to pay less and get more which is also true for the suppliers by delivering less and expecting to earn more. The vertical axes are the threat from new entrants and the threat from substitute products or services. New entrants desire to gain market share, which puts pressure on the current players to keep their market position. If the threat of entry is high, existing players need to invest more to discourage new competition. When new entrants come from other markets with the goal of diversification, they leverage resources to gain a competitive advantage. Substitution has its threat by introducing same or similar function products or services in an already existing industry. The more attractive or better the price-performance ratio is with a low trade-off offered by this substitute product or service, the higher the established industry's risk of losing market share. Usually,

these substitutes are always present, but they can be overlooked as they might appear completely different from the industry's offerings. (Porter, 1979)

Fleisher and Bensoussan (2007) combined the macro-environment and industry-level analysis to develop the business strategy formulation further. The framework presented in their book is based on enhancing Porter's five forces model with PEST analysis. (Fleisher & Bensoussan, 2007) Their framework adds another layer to understand what shapes the competitive environment, which is highly valuable in the case of studying the automotive industry.

The PEST analysis is a framework that categorises Political, Economic, Social and Technological as macro-environmental forces. Sometimes additional factors are added, such as the Environmental and Legal layer to the framework (PESTEL). PEST framework analysis the impact of each factor on an industry or business. Understanding the results is used to take advantage of the opportunities and create plans for threats when framing the business and strategic planning. Kotler (1998) viewed PEST as a valuable strategic framework to understand market growth, business opportunities, and directions for the business environment's operations. PEST framework is an excellent addition to Porter's five forces model, and with its combined help, identification of SWOT (Strenght, Weakness, Opportunities, Threats) are more easily identifiable. The pragmatic choice to use these tools helps to identify and explain issues. (Porter, 1985)

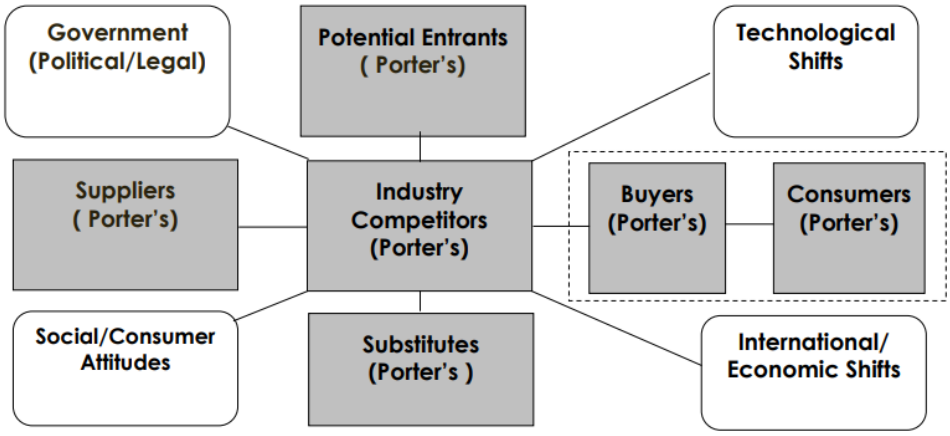


Figure 2 The nine industry forces (FT Press 2007, By C. Fleisher & B. Bensoussan.)

3.1.2 Resource-based view

As the importance of an organisation's external environment has been discussed before, addressing the internal environment has the potential role in emphasising the competitive advantages. This is done through the resource-based view that analyses the resources of a firm that are valuable, rare, and unique to the organisational characterises. It is based on the belief that firms are distinct based on their strategic resources what they own and control, and most importantly, these resources are specific to the firm; therefore, it is not possible to apply in other environments, and therefore RBV is analysing the firm resources to create and sustain the competitive edge.

This has been first addressed by Wernerfelt in 1984, who stated that resources and products are on the same coin for a company because products require the necessary services of resources and most resources are used in the products themselves, which means that specifying the resource profile will possibly enable the company to focus on the optimal product-market activities. Success cannot be found or explained solely on focusing on external factors (Wernerfelt, 1984). Therefore, RBV suggests that firms look inward and establish or find resources internally that enhance their competitiveness, rather than solely focusing on the external environment where they operate. Therefore Barny (1991) defined and categorised these resources of an organisation that relies on tangible and intangible resources.

Tangible assets are physical objects which the company owns. These are the buildings, machinery equipment, capital, land, and the organisation's people. These assets can be acquired by the competition over time, without much difficulty (for example, buying new equipment or acquiring new buildings or factories); therefore, focusing the strategy on tangible assets has little offer an advantage for maintaining competitiveness.

Intangible assets: They are the intellectual property of a company that are not physical objects. Intangible assets are heritage, brand name, trademarks, and manufacturing know-how, and everything falls under the category of intellectual property. Therefore, these are harder to acquire and take a much longer time to gain intangible assets, it often stands as the primary competitive advantage source.

Heterogeneous resources are combining tangible and intangible assets and employing them differently than the competition do. If two competitors are exposed to the same external forces but have different resources, they can reach different organisational performance.

Immobile resources: These assets cannot be moved from one organisation to another. Even though tangible assets can be acquired in the short run, the processes, knowledge, and intellectual property does not come with it. Immobile resources are difficult for the competition to copy and implement to their strategies.

The combination of these resources can lead to the success of the company. Barney (1991) stated that the competitive advantage could be attained if the right resource characteristics are present. These characteristics can be categorised based on rarity, value, inimitability and non-substitutable. This means that the resources must be valuable to exploit the opportunities and neutralise the threats of the firm's external environment (Barney, Firm Resources and Sustained Competitive Advantage, 1991).

Dynamic capability theory is based on the older discussions of identifying strengths and weaknesses to gain competitive advantage. Older paradigms do not identify the main mechanics for sustaining competitive advantage, as nowadays innovation capability needs to be applied to a modern perspective of an ever-changing market environment. In these rapidly changing environments, firms with agile and good observing capabilities will adapt faster than the competition, which ultimately leads to a competitive advantage. This concept was first introduced by Teece, Pisano, & Shuen in 1997. It can be described as integrating and learning reconfiguration of the internal and external resource. Ever since it is a favourable theoretical framework for explaining the competitive advantage. Dynamic capabilities are critical, especially when innovative companies create a new product category. It determines the time of generating returns by using firm-specific resources. Therefore, it is a useful extension to paradigms on strategic management that cannot fully address the processes in regards to achieving and sustaining competitive advantage. (Teece, Pisano, & Shuen, 1997)

3.1.2.1 VRIO Analysis

Undertaking the VRIO analysis helps to objectively identify resources and processes. VRIO comes from its original form of VRIN which was proposed by Barney in 1991. VRIO analysis – what stands for Valuable, Rare, Inimitable and Organized – helps to understand what resources and capabilities must be in place in order to have a competitive advantage in an organisation. (Barney, 1991) The framework is based on RBV as it advocates took look inwards of an organisation in order to identify the attributes for sustained competitive advantage. Ultimately it is a categorization of the above discussed tangible, intangible heterogeneous resources, and immobile resources. The distinct categories of the framework are the following.:

Valuable resource or capability

If the resource in question adds a value to the organisation it means that new opportunities or customers can be captured which generates the desired profit. It can be done through increasing differentiation of the product or lower the end price of the product. The resource is also valuable if it can reduce external threats. Valuable resources are able to withstands the competitive forces which was proposed by Porter. If valuable resources are not present, than it leads to competitive disadvantage.

Rare

Rare resources are considered to be unique to the organisation which cannot be acquired by the competition. Tangible resources are usually costly to acquire but certainly not impossible to do so, therefore they are usually not considered as a rare resource. If a certain resource or capability is present at very few companies than there is a competitive parity, because if few companies have similar resources than competing organisations cannot reach superior profits.

Inimitable

If an organisation has costly to imitable resources it means that the competition can't substitute the resources at a reasonable price, or don't have the intangible resource to imitate the product or service. Firms usually with valuable, rare and inimitable resources have a sustained competitive advantage which regarding to Barney (1991) can come from historical conditions, which were developed over a long time, or other organizations can't identify the source for the competition advantage or because of social structures where the culture of the company is based on social relationships.

Organised

The last element is the organised attributes which means that even, so the company has all the resources to gain competitive advantage they need to have the right organisation structure to fully realize and exploit the resources of the company.

3.1.3 SWOT Analysis

SWOT analysis is simple but quite powerful framework for analysing the organisation's internal strengths and weaknesses as well as the external environment by considering the opportunities and threats. It's significance lies in the situational analysis what helps to identify the organisations resources and environmental factors where the company operates in. By identifying the strengths and opportunities organisational objectives can be reached whereas weaknesses and threats are underlying the obstacles what the company has to face. The SWOT analysis has gone through many variants since its origins in the 1950's. First George Albert Smith Jr. and C. Roland Christensen Harvard professors has used SWOT to analyse case studies.

In this paper, SWOT will be a useful addition to connect external factors and internal resources which are identified through the VRIO analysis. Its flexibility will be useful to summarize in a presentable way the findings, and draw better conclusion with its help.

4 Methodology

4.1 Research philosophy

Quantitative and qualitative research design present different research strategies, and each carries major differences in terms of epistemological or ontological issues. The nature of the proposed research question advocates the choice of qualitative research methods because theories are used to emphasise words rather than quantifying the collected data. Qualitative research in this context is a more feasible approach as the complex social issues need to be understood, which is not possible with using exclusively quantitative methods (Bryman & Bell, 2011). The impact of EVs on the automotive industry is studied, and the society which adopts it, therefore the goal is to understand what is going on currently and what will happen in the future by going forward with electric mobility. Therefore, this thesis's approach can be described as knowledge-generating rather than testing of theories.

The biggest differences between quantitative and qualitative approach come from the epistemological and ontological paradigm characteristics. In this case, these paradigms' role is to reflect on how the researcher perceives the world. Epistemology is concerned with the knowledge itself, while ontology is concerned with social entities, like the nature of being or reality (Bryman, 2012). Considerations were made based on these two research paradigms. The choice has been made to follow the epistemological approach, as it aims to question what knowledge is. Epistemology is concerned about the validity, scope, and methods used, leading to acquiring the desired knowledge

and interpreting the analysed findings. As the research will follow a qualitative strategy with epistemological orientation, mainly interpretivist research philosophy will be applied.

4.2 Research design

The thesis will be based upon the above-mentioned paradigms, which is the foundation for the research design. A case study approach will be used to entail a detailed and immerse analysis of the proposed research question. The case study approach's focus is the complexity and nature of the case in question, which is widely used in business research. Case study design provides features that enable several qualitative methods to be combined therefore, the thesis will not be limited to one single approach (Bryman & Bell, 2011). Findings through combined methods will give an insight into the automotive industry and its surroundings where it operates. According to Robert Yin (2003), case study design should be used when the researcher wants to answer 'how' and 'what questions. Yin categorises case study research as explanatory, descriptive, and exploratory.

This paper will utilise the exploratory approach because there is no single set of outcomes of the proposed problem area, and one or more data collection methods are used to describe the case in depth. This will include utilising the literature review, range of internet-based sources, scientific sources, expert reports, annual reports, and media publication to collect primary and secondary data.

4.3 Source categorisation and evaluation

After the identifications of the research topic, sources for the research was narrow down on the information that provides the most reliant data which can be applied to the research are. The search for further secondary data during the research phase was done cautiously to verify the validity of sources. The researcher used mainly the RUC library database, which offered full access to books, e-journals, bibliographic databases, and electronic handbooks. The automotive industry is studied extensively, therefore professional consultancy reports, investors reports, agencies reports, critics in media, and annual press releases by companies were also utilised during the data collection. The reliability and credibility of these sources have been evaluated to a great extent.

4.4 Delimitations

China has emerged significantly in vehicle manufacturing, but a majority of their vehicles are domestic products and not available globally. Therefore, their EV and traditional vehicles will not be studied extensively in this research even though China has an important role in moving towards greener mobility at their own market sphere. The main focus will be on the Western world, namely on the

European Union and on the United States of America. The research will be centred around passenger cars.

The research will try to assess the situation without the current pandemic as much as possible, because the outcome of the pandemic is still unknown, therefore the focus of the research will try to gravitate towards the future without the global pandemic. However, we do note that the possible adaptation of EVs and future innovations might be possibly postponed because of the global pandemic, and therefore it is important to mention in the research as well.

Autonomous driving will be examined to a lesser extent, however we note that it is an important feature of many EVs, but currently, autonomous driving is not at a state which would have a significant effect on the proposed research area.

5 Findings and Analysis

5.1 Main drivers of the electric vehicle innovation

5.1.1 PEST-Analysis

5.1.1.1 Political involvement

In the last decade, the issue of global warming has been a priority in the political scene. It started at the Earth Summit in 1992, and shortly after, the United Nations Framework Convention on Climate Change was established in 1994 to define the targets for greenhouse gas (GHG) reduction. Under the Kyoto Protocol framework (1997) the first global agreement has been made to combat the climate change issue by industrial countries reducing their GHG emission by 5% until 2012 (Abbas, 2012). The transport sector accounts for 14% of the global CO_2 emissions, including road, rail, and marine transportation methods. The world's 95% of transportation methods relying on burning fossil fuels like petrol and diesel. The road emissions are the highest from all of them, which accounts for 50% of the whole transport sector, resulting in 7% of the global CO2 emissions coming from road vehicles (Hannappel, 2017). The following section will focus on light vehicles and passenger vehicles and their restriction of emissions, mainly in Europe and in the USA.

CO_2 emissions are yearly monitored in Europe, which is published by the European Environment Agency (EEA). Emissions are controlled by standards which have a restricting nature, what forces vehicle manufacturers to increase R&D towards manufacturing more efficient engines. The regulations are usually a combination of quantitative values (maximum pollution in gram/km) and other tests which measures pollution (Wee, 2019). The first emission standard was introduced in 1970. The Euro standard scale was introduced 22 years later and started with Euro 1 after catalytic converters were fit to reduce CO_2 emissions. Currently, the standard is at Euro 6 which measures the not only CO2 emissions but also other pollutive gasses. Namely, Carbon Monoxide (CO), NOx (Oxides of Nitrogen), HC (Hydrocarbons), PM (Particulate matter)[2]

With the introduction of Euro 6, Real Driving Emissions (RDE) has been introduced as well to test if cars are meet the emission standards during a wide range of driving conditions. RDE lasts between 90 to 120 minutes and mixing rural, urban and motorway driving.[3] (European Commission, 2020)

[2] Euro emissions standards | AA (theaa.com)
[3] Euro emissions standards | AA (theaa.com)

The Euro scale and RDE aim to categorise the 'cleanness' of the engine, but the main concern is the greenhouse gas (CO_2) emission. If manufacturers exceed the CO_2 targets, they must pay an excess emission premium. The fines until 2018 amounted to:

- €5 for the first g/km of exceedance
- €15 for the second g/km
- €25 for the third g/km
- €95 for each subsequent g/km.

(European Commission)

The fines after the phase in period, which ended in 2018, has been unified to €95 for each g/km of target exceedance. The set targets are getting stricter, which is currently 95 g/km in 2021 compared to 130 g/km in 2015. Last year the emission target applied to the manufacturers 95% least emitting new cars, but from 2021 the average emissions of all new cars manufactured will be considered. (European Commission) Tightening emissions are a commitment for keeping the Kyoto Protocol which set the goal to reduce GHG by 20% compared to the base year of 1990. The following years will be committed to the Paris agreement to further reduce GHG emission, and by 2050 the European Union set itself the target of net-zero GHG emissions. (Continental Automotive, 2019)

In 2010 the federal government of the USA had harmonised the standards for light vehicles. Environmental Protection Agency (EPA) established GHG emission standards and the National Highway Traffic Safety Administration (NHTSA) corporate average fuel emission standards (CAFE). There are federal standards set by the EPA, which are called tier standards. The earlier Tier 1, Tier 2 standards are suppressed in 2014 by the Tier 3 standard. In between tiers, there is not a sharp deadline, but rather between each tier, the standard is getting phased out over several years. The latest phase requires manufacturers to certify a percentage of their newly manufactured vehicles fleet to meet the NMOG+NOx standards. The remaining vehicles are still certified to the previous emission regulations. The standards are set to different vehicle categories, which varies by the weight of the vehicle. The testing is a cycle complex process that tries to represent the average driving style. The test consist of a cold start transient phase, stabilised phase, hot soak, and hot start transient phase. These phases have a total duration of 1877 second, 11.04 miles, and an average speed of 21.2 mph. (DieselNet)The US system, through its testing, implementation and enforcement of emission standards, is significantly tighter, more coherent and comprehensive than the EU standards.

The California Standards (CARB) has slightly stricter rules, and some states adopted the California standards instead of the federal ones. During recent years harmonisation has been made with CARB

and the federal emission standards, and Tier 3 federal standards are aligned with the California Standards. (DieselNet) Compliance with these standards takes place throughout the lifespan of the vehicles. The emission certificate is issued by EPA for the manufacturers after thorough emission testing both on the production site and after the vehicle has been introduced to the market.[4] If EPA finds violations, the agency has the right to use an administrative compliance order and issue administrative penalties up to.:

- $47 268 per non-compliant vehicle or engine
- $4 527 per tampering event (incl. defeat devices)
- $45 268 per day for violations pertaining to reporting or record keeping[5]

Governmental influence on the automotive industry is also present not just by introducing stricter emission rules but also through different incentives, which drives the consumer demand and the innovation towards alternative fuels and other clean technologies. These initiatives focus on EV purchase, developing the charging infrastructure, and urban access city regulations (Frost & Sullivan, 2021).

The European EV initiatives benefit the customers by the purchase of an EV, these can be, for example scrappage benefits which give cash in return for scarping old diesel cars and purchasing instead new a EV. Tax benefits are also made for especially for EVs, which makes them much more beneficial to own than ICEV (Frost & Sullivan, 2021). These initiatives are the most successful in Norway, where the government offered tax-free purchase, provided bus-lane access, toll-free road usage, and at the same time extensively invested into charging stations (European Commission, 2018). Government involvement led to the spread of EVs, 54% of all new cars sold in Norway was full-electric vehicles (Automotive News Europe, 2021). The tendency is similar in other European countries, tax exemptions, company vehicle taxation, and charging point installations are the main points of all EV incentives and policies (Frost & Sullivan, 2021).

In the USA, similar incentives are present, customers receive federal tax credits for buying new EVs. It was introduced in 2010, and the federal tax credit is up to 7 500 USD for a new EV purchase. The amount is based on the capacity of the batteries and the power of the vehicle (U.S. Department of Energy). Barack Obama granted 2.4 billion USD to boost EVs' development by domestic manufacturers (Shepard, 2009). By accelerating the development of EVs. Obama's set goal of one million registered

[4] Mobile Sources Compliance Monitoring Program | Compliance | US EPA
https://www.epa.gov/compliance/mobile-sources-compliance-monitoring-program
[5] Clean Air Act Vehicle and Engine Enforcement Case Resolutions | Enforcement | US EPA
https://www.epa.gov/enforcement/clean-air-act-vehicle-and-engine-enforcement-case-resolutions

EVs by 2015 fall sort because in 2016, only 563 700 EVs were registered in the USA. (ZSW, 2020) Donald Trump rolled back the Obama administration standards and eased up the rules of fleetwide average gas usage.

In contrast, the new president Joe Biden announced that his administration will prioritize climate change, including assisting the spread of EVs, similarly how the Obama administration did (Wayland, 2021). Biden aims to create extra jobs through the automotive industry by promoting the development of EVs. 400 billion USD will be invested into clean energy, including pure-electric vehicles and their essential charging infrastructure. This investment will be highly beneficial for US automakers like Tesla and GM. Biden's presidency will likely accelerate the spread of EVs, with significant investments from the government towards clean energy, electric vehicles, and ambitious new clean air regulation, which will compel force manufacturers to focus their majority of resources on electrifying their fleet. (Ahuja, 2020)

5.1.1.2 Economic uncertainty

The current pandemic hit the world economy in 2020. For several months, uncertainty and panic was present in most economies, both in developed and developing economies. The world GDP has fallen by 4.3% in 2020, the sharpest decrease since the Great Depression. In comparison, even during the Great Recession in 2009, the world GDP has shrunk by 1.7%. In developed economies, GDP fell by 5.6% in 2020, but on the positive side, growth is projected to happen in 2021 by 4% (United Nations, 2021). The pandemic has created an economic decrease which has not seen since the Second World War. It weakened the fundamental drivers of growth and amplified the slowdown of labour productivity growth, which has been already undergoing before the pandemic. The previous experiences show that after past recessions, the global economy will only recover at a slow pace. Possibly it can take a decade long slow growth, and repeated growth disappointments will occur in the future. The lasting economic damage is the most likely outcome, but better scenarios cannot be ruled out. The emergence of new technology and policy breakthroughs can possibly boost opportunities that countries with the right conditions can turn into their favour (World Bank Group, 2021).

The automotive industry is capital-intense and plays an important role in any country's socio-economic development. The annual turnover of the automotive industry would be the size of the sixth-largest economy in the world (ILO, 2021). The industry operates in a wide range of business segments, which generates economic growth on multiple layers (Saber, 2018). The total number of vehicle production in 2019 was over 92 million units worldwide, from that, over 63.7 million was passenger vehicles. In 2020 due to the pandemic, the total number of vehicles produced decreased just to 77 million from

which, 53.6 million were passenger vehicles (OICA, 2020). It is estimated that the top 20 OEMs will face a profit decrease of 100 billion USD in 2020, which is a 6% decrease compared to two years ago. It might take years for the sector to recover from this decrease of profitability (McKinsey & Company, 2020). The sector is highly dependent on economic conditions, but in the past, it had the ability to recover in a relatively short time and continued to make significant contributions to global trade and employment (ILO, 2021).

5.1.1.3 Social aspects

The total number of employees in the motor vehicles, trailer, and semi-trailer segment in 2017 was 14 million. The number of employees has increased by 35% since the global financial crisis (ILO, 2021). This represents the direct involvement, but the majority comes from the supply chain, which indirectly connects to the automotive industry. Data suggest that each direct job includes at least five indirect jobs. In the EU, the trend is similar, where 2.6 million people work directly in the manufacturing of motor vehicles, and around 13.8 million people work indirectly in the sector. (European Commission) The size and impact of the automotive industry is large, therefore its role achieving the 2030 agenda of Sustainable Development is significant, especially Goal 8 is increasingly important. Goal 8 aims to promote sustained economic growth, productive and decent work for all. As the automotive industry has large effects on other social and economic aspects, further developments can contribute to road safety, occupational safety (SDG 3), lifelong learning (SDG 4), sustainable industrialisation, resilient infrastructure (SDG 9), sustainable cities (SDG 11), and to the responsible consumption and production. (SDG 12) (ILO, 2021)

Social aspects closely relate to the spread of EVs as well. Social acceptance is key in order for EVs to widespread on the market. Social anxiety is present about EVs, which is caused by several factors. Drivers do not necessarily feel the need to purchase EVs, as there are many unknowns and questions surrounding it. Also, habits are embedded into vehicle owners, ICEVs are currently more convenient to use, refuelling is fast and easy, and the price of the fuel alone is not sufficient to justify the initial buying of an EV. Government incentives are encouraging EV purchases in most countries, but even with governmental help EVs are a substantial expense for a large part of the society. The ownership of an EV currently is not only a big investment but requires new habits, which could be seen as less convenient than owning a traditional vehicle. The infrastructure is limited, and charging time is longer and more problematic than refuelling, not to mention that a large part of the society who lives in cities and apartments have even less access to the charging infrastructure. EV is seen as the solution for reducing emission in the transportation segment, but this solution needs to be promoted by political institutions and manufacturers in order to reduce concerns and popular anxieties which comes with

owning an EV. Therefore, releasing knowledge about EVs for the core society is essential for the spread of EVs. (Jabłońska, 2013)

5.1.1.4 Technological development

Technological developments take place in the automotive industry at a rapid pace. The growing concern about sustainability and climate change creates regulatory pressures on automakers, which continues to transform the structures that underpin the industry. Investments into new technologies in 2020 were 82 billion USD, which was utilised mainly to advance manufacturing, reduce lead times, and increase customisations. Digitalisation influences the entire supply chain, all the way from product design to the sale of vehicles. Technological advancements enabled manufacturers to develop vehicles, which meets the requirements of customers and environmental restrictions (ILO, 2021).

Sales of vehicles are increasingly transformed by digital technologies, shaping the way how manufacturers interact with customers. Large number of information is available online, and digital showrooms are transformed into a digital marketplace with virtual reality capabilities. Online sales creates increased opportunities, and manufacturers can directly deal with customers and sell vehicles or parts (Newman, 2017). The focus on online sales channels accelerated by the pandemic, according to a recent McKinsey analysis, the digital sales channel utilization has increased by almost 13% in Europe. Online channel sales growth is higher than ever before around the world, but the biggest boost was in Germany by 28%. Interestingly according to the analysis,70% of first-time users on these platforms in Germany will continue to be engaged in the online arena after the pandemic ends. The online presence and digital transformation of sales channels will be a game-changing business model. (McKinsey & Company, 2020)

Digital transformation will also enable manufacturers to add certain features and update the vehicle software through over-the-air updates. Using the vehicles self-diagnostic software, which can communicate with the manufacturer and collect information about possible issues, even remote service becomes a possibility. Proactive service will drastically reduce mechanical failures and recalls. The trucking industry is using similar systems, which enables companies to monitor data and ensure safety, better fuel management and efficient transportation. Analytic solutions have improved truck uptimes by 30%, and the prediction of failures works with the reliability of 90% in a 30-day period. (Newman, 2017)

With the new modern technologies, factories can rapidly change over production lines and shorten lead times, all with a smaller margin of errors. New technologies are blend in with the existing technologies, and the automotive industry pioneered to use of robots that work alongside humans.

Robots could reduce the repetitive tasks for workers and make the manufacturing processes easier while making the quality more consistent. The automotive sector uses the largest number of robots during its manufacturing process, which accounts for 30% of total installation in the manufacturing industries. The production processes are aligned with the new materials used in the industry, which are usually increased in durability, resistance to external forces, but still flexible and light enough to be moulded into complex forms and shapes. The new materials change the dynamics of the production, which increased the speed of manufacturing. (ILO, 2021)

Despite all the technological and digital transformation in the automotive industry, when it comes to EVs, the biggest concern is the battery itself. The two natural resources which are necessary for manufacturing batteries are lithium and cobalt. Since the introduction of EVs, the demand for lithium and cobalt is increased. The lithium demand from 214 kt in 2017 will increase to 669 kt by 2025. Cobalt demand will rise from 136 kt in 2017 to 222 kt by 2025. (McKinsey, 2018) The increasing demand for cobalt is more concerning for two main reasons. 70% of cobalt is mined and produced in the Republic of Congo, and the main problem is that the unethical form of child labour is used for mining cobalt. (U.S. Department of Labor, 2019) Further acceleration of EV productions will lead to cobalt shortage in an estimated time frame of 10 years, therefore the demand-supply gap will increase. (European Commission, 2018)

5.1.2 Industry analysis: Five Forces

5.1.2.1 Threat of substitutes

The research mainly focuses on EVs, which is by itself is a substitute to ICEVs, but this section will examine a broader spectrum of new cars in general. Substitute products and services offer similar benefits. There is a large spectrum of options when it comes to travelling as a person from point A to point B. These include planes, trains, busses, cruise ships which can carry a large number of people at once, but individual solutions, like bicycle or motorbikes, can be seen as substitutional products. However, these solutions might be seen by the end-user a less convenient, less reliable, and less significant as a status symbol. The threat of substitutes in dense urban areas are the highest, as usage of the car in these environments might be inconvenient due to traffic and parking limitations. This threat is mainly present in developed countries because developing countries tend to have a poorer infrastructure of urban public transport. One of the main substitute for new cars, usurpingly are the used cars, especially in price-sensitive markets. Dealerships are likely to sell more used cars than new cars, especially during economic downturns, because new vehicles purchasing is a big financial commitment, which customers prefer to avoid during uncertain times. (Marketline, MarketLine Industry Profile: Global New Cars, 2020)

The space between motorbikes and cars can be filled by small electric vehicles, which are not considered as cars either bikes. Although these vehicles cannot exceed certain speeds and lack many features compared to traditional vehicles, still they can bite a large share out of the total automobile industry. (Harvard Business Review, 2015) The attractiveness of this type of vehicles comes from its usability in urban areas, where it can be used with fewer restrictions than normal vehicles. It is projected the micro electric vehicle market will gain popularity, the value of the market was 4944 million USD in 2018, and it is expected to rise to 5814 million USD by 2026. (Fortune Business Insights, 2020). Micro EVs are affordable products, but the main concern is that they are not required to meet the same crash test as regular cars, and in some regions, they can be driven without a driving license which adds to the overall safety concerns.

5.1.2.2 Threat of new entrants

New entrants to the industry are rare, as it requires enormous resource for designing and manufacturing automobiles. The acquisition of the required manufacturing facilities and tangible resources are not aligned with the possible earnings in the industry. Incumbent companies like Toyota and Volkswagen has a dominant position on the market, not only with manufacturing capabilities but

also with intangible resources like brand recognition and reputability. The presence of large manufacturers makes the entry difficult as the incumbent companies already have a wide range of models which covers a large variety of segments. Toyota is offering small economical cars and premium cars in the luxury segment through Lexus. Volkswagen acquired major brands which cover the whole spectrum of the market. The industry is largely relying on external suppliers, which has contractual consolidations with already established manufacturers, and these contractual agreements are costly and hard to break. This further reduces the threat of new entrants (MarketLine, 2020).

One possible niche for entrance is the emergence of new technologies and innovations which can shape the industry in the long run. It has been proposed in the literature review that new innovations possibly comes from the outside because established companies focused on what they are best to do. The wide and rapid spread of smartphones enabled constant connectivity, which started to be present in cars as well, through their infotainment systems. This brought new players into the automotive industry, like Google and Apple, who released platforms especially made for cars. (Cassia & Ferrazzi, 2018). Autonomous driving is on the agenda of several manufacturers; therefore, the software will be increasingly important in the future, new players can capitalize on the industry and transform the traditional companies with dominant software solutions. (Proff, Pottebaum, & Wolf, 2020; MarketLine, 2020)

5.1.2.3 Bargaining power of suppliers

The mutual connection between the suppliers and manufacturers is crucial in vehicle manufacturing. Just after a few years of mass car manufacturing started, suppliers started to specialize in producing components, which enabled them to supply parts at a lower price than OEMs could manufacture in-house. The value chain is located around the globe, and suppliers are categorized by their specialisation level to first, second and third tier. Tier 3 suppliers have relatively low bargaining power as raw material suppliers like steel have small differentiation between each other. Tier 1 suppliers provide the majority of components for the manufacturers, and usually, they are involved with several manufacturers and present in other industries as well, therefore they do not solely rely on the automotive industry. Largest Tier 1 suppliers like Bosch, Denso and Magna International builds components in such a high percentage that they become OEMs themselves. Tier 2 suppliers are behind the front tier success of Tier 1 suppliers, usually they produce smaller parts which are essential for Tier 1 suppliers (MES Insights; Berylls, 2020). The supplier bargaining power is somewhat decreased if they have their own manufacturing plants for parts supply because plants are usually tied to produce special items for the car manufacturers. Therefore, it has an effect on the whole value chain as Tier 2 suppliers are dependent on Tier 1 suppliers. Suppliers and manufacturers are strongly interdependent

on each other, therefore the switching cost is high. Establishing the component design and specifications requires a large number of initial investments (MarketLine, 2020).

Automotive suppliers are facing problems due to the overlapping manufacturing of ICEVs and EVs. The value chain is established for manufacturing traditional powertrains, and the majority of the value chain is centred around that. The future is pointing towards electric mobility, which puts high pressure on suppliers, as the majority of parts that are essential ICEs are completely absent from EVs. As an example, the Chevrolet Bolt's electric motor only contains three moving parts, whereas a traditional four-cylinder engine would contain 113 moving parts. Furthermore, EVs does not require complicated transmissions, turbot chargers, supercharges, air supply and exhaust systems to remove waste gasses. (PWC)

The significant challenge is that currently, the market share of EVs are low, and therefore it does not make it profitable for suppliers to focus solely on EVs, but in the foreseeable future, a significant threat comes for many suppliers if they cannot adapt. As EV adoption will raise the value-added suppliers' market will shrink by approximately 15%, which will reduce the bargaining power is suppliers. (PWC)

5.1.2.4 Bargaining power of buyers

If we approach this industry force from an individual end-customers perspective, then the bargaining power is low because buyers purchase a single vehicle at the time. If we consider larger volume buyers, like corporations and governments, who would buy a fleet of vehicles at once, then they have a better position of negotiating prices. As automakers are usually not selling directly to the end customers, dealerships, who are the intermediaries between the end-customers and manufacturers, can be seen as buyers. New- car dealership tend to be large and few in number, which relative increase their buying power. However, it is important to note that these dealerships usually have contractual agreements with the vehicle manufacturers, and these agreements are limiting the dealerships bargaining power. The switching cost would be high, as rebranding the physical showrooms and restocking the dealership with new vehicles are costly (MarketLine, 2020).

When considering the end customers perspective, the switching cost is low because all cars are essentially serving the same purpose of transportation. Therefore, manufacturers attempt to differentiate their products by offering new features, which focuses on convince and safety features. Manufacturers offer a similar range of products; therefore, differentiation is important, which can be done through strengthening the brand image.

Sociodemographic factors are also key aspects of buyers because decision is made based on that factors. For example, customers in the USA have greater attraction to larger vehicles, similarly to Germany, whereas on price-sensitive markets, the trend is the opposite, smaller and more efficient cars are preferred. However, the major trend around the globe is the increasing popularity of SUVs and fuel-efficient cars (Marketline, 2020). Even though customer power is weak in negotiating prices, their preferences when buying cars do have an effect on the manufacturers. Consumers demands and expectations are shaping the automotive scene. The above-mentioned popularity of SUVs are one of the examples as customers prefer bigger and heavier cars in the last decade, as a result, there are over 200 million SUVs around the world. These cars have higher emissions and contribute more to the global CO_2 emissions, and drives up oil consumption (Cozzi & Petropoulos, 2019). The agenda for all manufacturers is to reduce the fleet average CO2 emissions, market trends and customer demands create a difficult situation for manufacturers, and possibly they are on a collision course, as they have to produce and sell SUVs in order to stay profitable and meet customer expectations, but at the same, they have to meet fleet emission standards, while offering the most inefficient type of vehicle on the market. (Taylor, 2020)

5.1.2.5 Internal Rivalry

The automotive industry is dominated by a small number of large companies, none of which can prevent others from having a significant influence on the market. Actors are not trying to cut prices at the expense of profit margin to win over market share from each other, which relieves the price competition. Traditional automakers are different in sizes, and rivalry is intensive to win over new customers or retain old customer on the market. The vehicles offered are differentiated, but all are developed to win over the same wide spectrum of customers (Marketline, MarketLine Industry Profile: Global New Cars, 2020). Therefore, the overall industry rivalry is high.

5.2 Case Companies: Tesla and Volkswagen

5.2.1 Tesla's background

Tesla Inc., formerly called Tesla Motors, was established in 2003 by entrepreneurs from Silicon Valley, namely Marc Tarpenning and Martin Eberhard, who were working on customer electronics before. They named the company after the Serbian inventor, Nikola Tesla.

They had no experience in building cars, therefore started looking into ways of getting started. First, they have reached out to a small company called AC Propulsion, which at the time was building handmade electric sportscar like vehicles. EVs at the time did not have a strong foundation back then therefore, they were on the edge of going out business. Martin saw an opportunity to invest in the company and cooperate with them to get help building their own electric cars sportscar. The first prototypes were powered with lead-acid batteries, which had a very short range and dangerous properties for the purpose of powering a vehicle. Therefore, Martin suggested considering lithium-ion, as he and Marc had experience from this type of battery from the consumer electronic segment.

After proof that lithium-ion batteries are much more suitable to use, they needed to figure out how to build a car around it. Therefore, they reached out to the English manufacturer, Lotus, who were interested in the idea, and agreed upon investing in it if it is proven to be a feasible concept. They needed more investors for the idea first to make it a reality. Through AC Propulsion, Marc and Martin tried got in touch with Elon Musk and pitched the idea of the first electric sports car to him. Elon Musk was the founder of PayPal, and he had a great sense for start-up businesses. Elon took on the idea of what Tesla had from the get-go to change the world how it thinks about electric cars. They wanted to create something radically different what people expected from an electric car, namely a high-performance sports car, with a desirable design and features to destroy the tiny and ugly car image of electric cars at that time.

Elon Musk invested in the idea with 6.35 million USD to help Tesla get off the ground and became chairman of the board. In 2006 they released the first prototype, the Tesla Roadster, which sparked a lot of interest on the market. Sales started in 2008 in a small portion, but the real momentum for the company started when they launched the Tesla Model S after the first success of the Roadster. The high demand for the Model S meant that they have met the expectations of the customer for an electric vehicle. Many believe that Tesla set the standard for desirable EVs. The Model S aimed at the premium segment in 2012, and since then, with the Model 3, they try to cover the more affordable segment, and with the Model X, the SUV segment. Recently they further advanced the model line with

the Model Y, which is based on the Model 3 but has SUV characteristics.[6] (CNBC, 2021). Currently, Tesla is the leading manufacturer in the EV segment, they have sold just over 500 000 vehicles. (ZSW, 2021; Tesla, Annual report , 2020)

5.2.2 VRIO Analysis Tesla

The following core competencies of Tesla comes from the internal resources and capabilities of the company. All assets can be classified as resource or capability which is owned by the company. This paragraph aims to analyse the resources and capabilities what helps maintain competitive advantage in the EV segment. Tesla as a relatively new player in the automotive industry, has achieved to break into the EV market and achieve competitive advantage in the sector, by utilizing and forming their internal resources and capabilities in line with the external forces. The following competencies are further analysed in order to have a clearer picture behind Tesla's success, and give a baseline how the company impacted the industry and what effects they have created.

Core competencies	Valuable	Rare	Inimitable	Organized	Advantage
Technological innovation	Yes	Yes	Yes	Yes	Sustained competitive advantage
Production	Yes	Yes	No	Yes	Temporary competitive advantage
Distribution	Yes	Yes	No	Yes	Temporary competitive advantage
Brand Image	Yes	Yes	Yes	Yes	Sustained competitive advantage
Product range	Yes	Yes	No	Yes	Temporary competitive advantage
Consumer experience	Yes	Yes	No	Yes	Temporary competitive advantage

[6] Information is based on recently announced interview with Tesla founders by CNBC.com

5.2.2.1 Technological innovation

At the early days of the company, Lotus has provided the shell for the Tesla roadster and only the powertrain was fully designed and assembled by Tesla. Tesla gained extensive knowledge about using lithium-ion batteries safely, which quickly become the main asset of the company. Tesla was the first to develop a water-cooled battery pack and figuring out the proper electrical connections for the packs with wire bonding method instead of welding. This is still used today within the company and the patented idea gave the foundations for all the future Tesla models. (CNBC, 2021).

The development of their powertrain is identified as Tesla's valuable resource, which is built up from the modular lithium-ion battery, gearbox, motors, power electronics, the controlling and operating software, which combines the whole system. Tesla used a mixed approach and identified their unique resources by selling products directly to their end-customers and their powertrain solutions to competitors. This created resources for expanding the company's tangible assets, and secondly, it follows the mission statement, which is promoting sustainable transportation. Scaling up production required to acquire expensive tangible assets, and for that, Elon Musk has used their main unique powertrain resource to create a strategic partnership with other manufacturers, who were looking into the know-how of electric mobility.

The whole powertrain is the key intangible asset of Tesla and the essence of their competitive advantage on the market. The powertrain itself is substitutable because other manufacturers can develop it over time and eventually reach the same end results. Elon Musk realised this therefore, in 2014, Tesla has released their powertrain patents. (Musk, 2014) Tesla has held their innovations in-house since the beginning of their operations, but because of the concern of other manufacturers would copy their technology, they have released their patents with certain restrictions. (Musk, 2014) At the same time, he also adopted the open-source movement to encourage the advancement of electric vehicle technology. Applying the open-source model in such a competitive environment and releasing their main asset is quite controversy. However, the reality is that it does not set back Tesla as it would some believe at first glance.

The free use of Tesla patents is only possible if the user does not enforce right against Tesla or against another party, does not copy Tesla's patents or design directly and use it against Tesla. Especially the first part would make other companies property rights ineffective, as patent claims cannot be made over Tesla, on the flip side, if any improvement is made on Tesla's technology patent by others, Tesla is free to use it. (Musk, 2014) This move strengthen their competitive advantage of Tesla on the market as their technological innovation is not imitable without the knowledge and control of Tesla.

Therefore, other manufacturers in the industry tends to avoid the use of Tesla patents as it comes cost of sharing their own patents as well, which in case of a major competitor, not beneficial. (Lambert, 2015)

Tesla is at the forefront of innovations in the industry, not only with their electric powertrain, but also with their software solutions built into their car. The automotive industry is transforming into a tech industry and Tesla was the first to realise and capitalize on the growing trends. Tesla is perfectly aligning with McKinsey's (2016) prediction, where they states the future of the vehicles will be centred around connectivity, autonomous driving, and electrification. Tesla was one of the first to introduce upgradeability through over the air updates which enables new features, without any physical interaction with the car. Tesla combined new technological innovations with existing and traditional technologies which attracted many, especially after the release of the Model S. The Model S was the first vehicle which had a huge tablet like centre screen, where majority of the controls of the features of the car takes place, and shortly after the autopilot feature was enabled through software updates, which was not typical at the time of the release.

As the Tesla Roadster was sold in a limited amount, the Model S was the first product that really disrupted the EV market, and its plans sparked a high interest. Mainly because the EVs at the time had a limited range, slow charging times, and to some, odd futuristic designs. The Model S offered a range of 500 km, and fast charging, all packed into a luxurious and spacious sedan form factor. A highly advanced Tesla factory in Fremont, California, was built to make plans a reality, it was key to acquire the first tangible assets and release the Model S on the market for the masses. [7]

5.2.2.2 Production and distribution

The next step for advancing Tesla's resources and assets was the birth of the 'Gigafactory', which is a planned to be fully automated and technologically advanced innovative product plant. The first Gigafactory aimed to ramp up production of batteries in house, which enabled Tesla to significantly increase the number of cars per year manufactured at a lower cost. The construction of the first Gigafactory started in 2014 and completed in 2017 (Tesla, 2014). Since the construction of the first Gigafactory, Tesla is committed to build more plants around the world. As Musk explains: *"The biggest problem we have to solve right now is having production on each continent, because it's insane to be making cars in California [and] shipping them to Europe and Asia."*[8] (Brown, 2020) Tesla is committed to solving this problem, and the company rapidly responds to arising problems. The Shanghai Giga

[7] Tesla Factory | Tesla.com
[8] Elon Musk says a factory on each continent will fix Tesla's biggest problem (inverse.com)

plant was constructed in a record time, less than a year after the construction, it started to begin production, which is extraordinary in the automotive industry (Fox, 2020). The total number of 3 Gigafactories around the world (Nevada, New York, Shanghai) and plans for the 4th one suggests that Tesla will construct the biggest factory yet near Berlin. (Deveza, 2019). Elon Musk stated on Twitter that the *"Gigafactory is the product even more than the car"*[9] which confirms how important the production resources are to stay competitive on the market and enable future growth. Even though the Gigafactory is the first production site with solely focusing on producing EVs with highly automated technology, and it is a valuable resource for Tesla, it is not difficult to imitate, takes huge amount of capital and inhouse innovation for the competition to catch up but certainly in the future similar production plants from other manufacturers can appear in the future, which gives Tesla a temporary competitive advantage in this regard.

Tesla's way of distribution is another innovation which is significantly different than from other traditional vehicle manufacturers. Ordering and configuring a vehicle is done online, directly through Tesla. The customers can customise many features of their new car on the platform, which ranges from tech packages to the exterior styling. When the desired customizations has been made, at the end of the process a deposit is required and the purchase is completed, similarly as a web shop. Ordering online high value premium cars wasn't possible before, but Tesla's innovative approach turned out to be successful. This new business model also gave the opportunity to have smaller dealerships with lesser cars, therefore the locations for Tesla shops, are better than other manufacturers' franchise locations, which are filled with cars to showcase the options which can be ordered; therefore, it can't be placed in busy centred locations. By having direct contact with the customers and the opportunity to place and order online, physical locations are more like an informational hub where Tesla employees focus more on product education, inventory management and maintenance. (Pereira, 2020) The distribution model gives a temporary advantage for Tesla, as it is not hard to imitate at a moderate cost.

[9] https://twitter.com/elonmusk/status/1283414126530686982?s=20

5.2.2.3 Brand image and Product range

Elon Musk has always played a central role in Tesla's image, and his ability to raise money in the early days of Tesla's life and his willingness to take risks which sets him apart from other CEOs helped to shape the future of Tesla (Davis, 2010)

Tesla has an image of innovator in the industry and made EVs comparable with their performance to the premium segment of the industry. To establish and keep this image, Elon Musk contributed to the hype build around the company. He is at the forefront with his visionary and ambitious approaches. The narrative of Elon Musk is carefully built up through the media and interviews in a way that we could call that an innovation itself (Harrison & Burfield , 2018). He is deliberately avoiding the questions of financial aims and emphasises the focus on social challenges that he aims to solve through Tesla and his other companies. He is always focusing on the reason of existence behind his companies, and he does a particularly good job at storytelling by turning farfetched ideas a plausibility. He is moving beyond the question if it is even plausible, he is going directly how it will be done and how long it will take, backed up real data. He is focusing on making things better for the society and using the media to generate attention for all his companies, which sparks the interest of customers and stakeholders (Harrison & Burfield , 2018). Therefore, the brand image of Tesla is dependent to some extent on the personality of Elon Musk because his personality keeps the direction for the organisation and future advancements.

The vision of Elon Musk and the original founders was based upon creating a desirable sports car with the sole purpose of changing the way people perceive EVs. (CNBC, 2021) That is why the first step was to introduce the Tesla roadster for the "innovators", as Roger calls them. The decision was smart because it reached out to a more enthusiastic customer base who are more forgiving towards less refined products, sports cars have a different value proposition than, for example, luxury sedans or SUVs. Tesla had to respond to the high demand, therefore they have created the Tesla Roadster Club, and members could reserve their Tesla Roadster by joining the club for 50 000 USD, which was about half of the base price of the base car. It showed that supporters have the resources to cope with the risk and acted as a gatekeeper for the spread of innovation. Tesla was interactive with new "innovators" by having a dialogue with them about the process of manufacturing the Roadster, and customers felt they were part of a beginning of an exciting journey (CNBC, 2021).

After establishment, the next step was to address the early adopters. This decided to be done by the Model S. Elon Musk said that: *"Delivering Model S is a key part of that plan and represents Tesla's transition to a mass-production automaker and the most compelling car company of the 21st century."*

(Tesla, 2012) Entering the market with large sized sedan would not be possible at the early stages in Tesla's life because the sedan market is huge, and the capital requirements are high. Tesla, at first, did not have the know-how in manufacturing to keep the standard with other manufacturers on the market (CNBC, 2021). After they have learned and developed their new technology through the Roadster, Tesla was ready to move forward and announce the Model S. The aim still was on the high-end market as customers there are prepared to pay the premium.

After production ramped up, the Model S quickly became the most popular EV on the market in 2015 (InsideEvs, 2016). The Model S overcome important obstacles of EVs by providing 300 km of base range, fast rechargeability, incredible performance, and a five-star safety rating (EuroNCAP, 2014), built into a desirable and elegant form factor. As a continuation of the plan, Tesla's SUV was announced called the Model X. Production started in 2015. The Model X features the first all-wheel-drive system by Tesla, seven seats, and at the time, it was the only EV with high towing capabilities. The Model X started at a price of 80 000 USD, and over 30 000 people have reordered it (Ayre, 2015). The success of the Model S and the Model X were key for Tesla to win the early adopters. As Elon Musk states: *"When someone buys the Tesla Roadster sports car, they are actually helping pay for development of the low-cost family car."* and the case was the same with the Model S and the Model X as well.

The success of Tesla enabled them to finally address the third stage.: EV for the masses. The Model 3, on the scale of Roger's diffusion model, accounts for the early majority. It launched in 2017 with a base price of 35 000 USD with a massive number of 325 000 pre-orders were made on the first week of the announcement (Bolton, 2016). The production of the Model 3 had difficulties, and productions were behind plans, what Elon Musk called "Production Hell" Several months passed by until they could finally reach the goal of 5000 units per week (Observer, 2019). Musk says that *"My creditability, the creditability of the whole team was at stake"* (Bloomberg Businessweek, 2018). Not long after the production problems have been sorted out, in 2019, the latest model of Tesla has been announced, called Model Y. The Model Y is the compact SUV form of the Model 3 and shares its parts 75%. (Forbes, 2020), which also aims to be a car for the masses, but in a popular form factor of a compact SUV.

Elon Musk is exactly following his plan and perfectly aligns with Roger's diffusion model. The steps of Tesla's business model is to build a sports car (Roadster), use the earned money to build an affordable car (Model S), and further utilizing that capital to build a car for the masses (Model 3). During the process Tesla is providing zero emission electric power generation options. (Musk, The Secret Tesla Motors Master Plan (just between you and me), 2006)

The brand image is a sustained competitive advantage for Tesla as they created an image around the company what separated them from the competition, their main business model is focusing on innovation which has led to the image of transformational leaders within the industry. Tesla was the first to offer desirable EV's and implement features from the tech industry, which inarguably helped the spread of electric mobility. The product line is not inimitable as for example Audi is already offering luxury SUVs (Audi E-Tron) as well as Porsche has introduced their luxury sport sedan (Porsche Taycan turbo s), therefore the product range of Tesla only gives a temporary competitive advantage, as major compete tors are closing the gap quite rapidly.

5.2.2.4 Consumer experince

Driving and owning a Tesla is a vastly different experience than owning an internal combustion engine vehicle. Especially at the time of the release of the Model S was superior in terms of acceleration and smooth driving experience compared to any other brand in the luxury sedan segment. The acceleration was outperforming supercars at the time which were only 2.4 seconds to 100km/h.

An article published by HBR, which were confirming how customers are perceiving Tesla. Customers are not buying just a vehicle, they are buying the Tesla experience, which is incomparable to other vehicles on the market. People refer to Tesla, not an EV or a regular vehicle, and it will be hard for anyone to match. Others emphasise the significance of the battery and charging technology, to which Tesla is heavily invested in, and the core technological competencies of Tesla will be hard to match by the competition. (Harvard Business Review, 2015) Tesla will be ahead of the curve by when it comes to customer experience, not only by the features of the car but also with the charging infrastructure which is solving the range anxiety of the customers. Tesla owners can enjoy trouble free motoring as the maintenance-related cost are lower than regular ICEVs. These features certainly helped Tesla to gain popularity on the market in a relatively short time. At the time of the release these features were unique, but competition catching up therefore it is not hard to imitate similar experience. EVs by nature are smoother, much more quiet and powerful than the ICEV counterparts. Premium brands like Audi and BMW already offers similar experience, which gives Tesla a temporary competitive advantage as competition is closing the gap.

5.2.3 SWOT Analysis Tesla

5.2.3.1 Strenght

Tesla during the years has built up a brand image as innovators within the automotive industry. As a newcomer they have reached just a few years to be to most valuable automotive company. The name Tesla and electric vehicles are bonded together during the years. The early bet on electric vehicles turned out to be a great success and the continuous innovation is further strengthening Tesla's position. Tesla has created the most competitive EV, earlier than any other manufacturer. Internally Tesla had less constraints in the beginning, they can solely focus on creating the best EVs.

5.2.3.2 Weakness

Being new in the industry also means that Tesla had no experience in vehicle manufacturing. There were several challenges during manufacturing which were delivery and quality problems. Troubles around manufacturing caused delayed deliveries. Delivering new vehicles remote markets just further lengthen delivery times. This can affect the brand value if production and value chain problems are not solved in the near future. The limited experience of manufacturing the Model 3 and Model Y at higher volumes and ramping up production at multiple locations around the globe must be addressed by Tesla promptly and accurately to improve manufacturing processes.

5.2.3.3 Opportunities

Governmental regulations are highly important for Tesla. Governmental influence on the automotive industry is increasing as stricter emission regulations are being implemented every year. Due to the fact the Tesla is only producing zero-emission vehicles and doesn't have to deal with stricter regulations opposed to the rest of competition in the industry. The trends in Europe and in the USA is to promote sustainable mobility therefore EVs and accelerate to innovate towards the electric mobility. Consumer demand is stimulated with incentives, the government benefits the customer who purchase EVs, with scrap benefits schemes, tax benefits and free road usage are just a few examples. This gives Tesla opportunity in the future for growth, firstly in the European and American market, but when global incentives will be more common and regulations getting stricter globally, new market opportunities will arise for Tesla.

Tesla has acquired key tangible assets, and with the help of the Gigafactories around the globe Tesla has the opportunity to be less dependent of external battery suppliers, like Panasonic. Manufacturing batteries and cars under one roof is the greatest opportunity for Tesla to decrease price, therefore

win over price sensitive markets and by that open to new markets, which will ensure continuous growth. Currently Tesla's product offering are only appealing to a small and rather wealthy group of customers, therefore continuation of the incremental innovation in order to address the mass market is necessary which will give the opportunity to increase interest from customer who are looking to getting and EV. If the expectations of the wider range of customers are fulfilled with even cheaper models, Tesla could gain sustained competitive advantage.

5.2.3.4 Threats

The greatest threat for Tesla is the increasing competition within the industry as traditional manufacturers are investing and working on capturing the EV market. Tesla was the first to introduce desirable EVs which enabled to build a brand image and reputation as the great innovators within the industry. The product range of Tesla is becoming less of a competitive advantage. In fact, Tesla doesn't have a diverse product portfolio as traditional manufacturers, therefore depending only on EVs poses a threat. Currently electrification is the most probable answer to the environmental concerns, but if new technological breakthroughs happen, for example in the fuel cell technology, Tesla doesn't have an easy alternative route to take as most of their resources and competencies are centred around EVs. Lithium and Cobalt are the main natural resources for manufacturing the current batteries and demand for this natural resource will increase in the future. With this rate of battery production, in 10 years there will be a shortage of these resources and the demand-supply gap will further increase. This threats the sustained competitive advantage of Tesla on the EV market, as their innovations, and many of the patents are centred around the lithium-ion batteries.

Threat not only posed by traditional automakers and natural resource shortage, but as connectivity and digitalisation is getting more important in the automotive industry as well, tech giants with niche emerging technological innovations can enter and shape the industry, similarly how Tesla entered. Software will be increasingly important in the future, which can bring tech giants like Google and Apple to the automotive scene, and transform the industry even further with dominant software solutions. (Proff, Pottebaum, & Wolf, 2020)

5.2.4 VRIO Analysis Volkswagen AG

Volkswagen was founded in 1937 in Berlin, Germany. It is the second largest auto manufacturer in the world and in 2020 VW Group has sold 9.3 million vehicles. (Statista, 2021) VW Group has acquired major brands, which are the following for the passenger cars.: VW, Audi, SEAT, Skoda, Porsche, Bentley, Bugatti, and Lamborghini. In the commercial segment, they own Scania and MAN, VW trucks and buses. The passenger car segment accounts for 73% of the total revenue of VW Group (MarketLine, 2020). The following competencies are analysed in this paragraph to see how VW is utilizing their main internal resources.

Core competencies	Valuable	Rare	Inimitable	Organized	Advantage
Brand Image	Yes	Yes	Yes	Yes	Sustained competitive advantage
Technological innovation	Yes	No	No	Yes	Competitive parity
Production	Yes	Yes	No	Yes	Competitive advantage
Distribution	Yes	No	No	Yes	Competitive parity
Product range	Yes	Yes	Yes	Yes	Sustained competitive advantage

5.2.4.1 Brand Image

Volkswagen is the largest car manufacturing in Europe, and previously the company set the goal to be the biggest automotive manufacturer of the world by surpassing Toyota. This goal was set to reach by their economic and by “environmentally friendly” diesel engines which is one of the core competencies of Volkswagen. The diesel engines of VW was highly praised and popular around Europe and by entering the US market – even though in the US petrol cars dominate the market and there was lesser need of diesel engines– VW diesel cars eventually got popular as well. The company was growing year by year until 2015 when the emission scandal has happened. VW has put a lot of effort and resource into convincing customers and officials that diesel powered cars are economical, powerful but yet more environmentally friendly than the petrol combustions engines.

In 2015 according to the Environmental Protection Agency (EPA) certain types of VW vehicles equipped with diesel engines, had a device installed into their engine management control unit which could detect if the vehicles was being emission tested and the software could consequently alter the performance to increase the testing results by keeping the emissions gases below the desired limits

therefore improving the end results of the tests. Without the software the real nitrogen oxide pollution of their diesel engines was 40 times above the limit to pass the emission test in the US. (Hotten, 2015)

Unsurprisingly after the so-called Diesel Gate incident the public opinion on Volkswagen and its socially responsible image has significantly decreased. The reputation what VW has built up during the years has been lost amongst stakeholders and consumers around the world. It took years to slowly regain their reputation. (Saga, 2017) Since than the company is focussing on their new strategy and product range for the future upcoming years. The Strategy 2023 set the goal that by 2025 in third of the Volkswagen Group vehicles will have an electric drive train or plug in hybrid technology. (Volkswagen, 2018) The new vision for the company is to become the world-leading sustainability mobility provider. In order to reach this, internal competencies has been redesigned to strengthen the innovative power and secure fundings for research and development. Volkswagen has maintained and regained their strong brand image aside from the diesel scandal, because they realigned their future vision by investing heavily towards sustainable mobility. VW's brand image has a high integrity which was developed over a long time, with continuous effort on customer satisfaction. Even though the trust and honesty of the brand was hurt, it is still a source of their sustained competitive advantage because it is valuable, rare, inimitable, and organised as the leadership was able to overcome the difficulties and set a new path for the organisation.

5.2.4.2 Technological innovation

Technological innovations are important part of VW's business strategy, the introduction of the modular base platforms across all of their brands starting from their premium-brands like Porsche and Audi has trickled down to the mainstream and eventually made vehicles cheaper, which give the basis for their competitive advantage on the market. Premium brands has driven profits which are based on new technological innovations. However, VW has the resources for continuously innovate, main competitors in the industry for example Toyota and Tesla has successfully captured the more environmentally friendly vehicle sectors, while VW was focusing on refining their existing internal combustion diesel and petrol engines. Up until the emission scandal, VW has incrementally improved their existing technologies and only after 2015 they have reoriented their business strategy to environmental sustainability which meant focusing more on EV's. (Blackwelder, Coleman, Colunga-Santoyo, S. Harrison, & Wozniak, 2016)

The key technological innovation regarding to Jürgen Stackmann – the head of VW sales and marketing division – is to focus the development programmes to increase battery capacity as drivers travelling

for longer distances, still favours combustion engine vehicles as they can be refuelled easily in a short amount of time and tends to have better range than EVs, therefore marginalizing the importance of traditional powertrains, and enhancing electric systems (battery, charging infrastructure) is the key to spread EVs in the future and get accepted by the majority of end-users. The efforts are constantly made by VW to achieve the best possible range on a single charge. The new technology needs special chassis which can carry the larger batteries in a ventilated space, therefore VW developed the MEB platform (Modularer E-Antriebs-Baukaste, which stands for modular electric drive toolkit) which will be used across all the Volkswagen Group, tailor made for all of their electric vehicles across all brands. (Blitek, 2016)

The reorientation of the technological innovations towards zero emission electric vehicles has led to extensive innovation efforts. VW has set the goal to transform into a technology company by developing new digital products and services while focusing on the electric powertrain. One of the first step was the implementation of the over-the-air software updates to VW's first purposely built electric car, the ID3. These updates provides new functions and assistance systems. Connectivity are opening up new innovations, like autonomous driving by collecting traffic and road information. No other automotive manufacturer plans to invest as much into sustainable mobility than VW. Their plan is to spend over 35 billion euro on electric vehicle and software development, which is a vast amount, as comparison in 2020 VW has generated 10.6 billion euro in profits. (Volkswagen, 2020)

Even though technological innovations nowadays have high priority within the company, so far nothing radical has been announced, the innovations announced are in line with Tesla's efforts, with few years of difference. VW has just recently started their efforts to break through the EV market, and similar approaches has been done by Tesla years earlier, therefore manufacturers who committed earlier has an advantage on the market. Currently their technological innovations are not rare or inimitable, but organised as for example fixing software issues has high priority, and leadership understand that is a key problem to solve. Currently 3500 IT experts work on the VW operating system and in the next five years the number of IT employees are planned to be increased to 10 000. (Volkswagen, 2020)

5.2.4.3 Production and distribution

Volkswagen group presented just recently during their Power Day keynote in 2021 that they will invest into battery and charging technologies in order to reduce the complexity and cost of the battery and to make electric cars available and attractive to as many people as possible, by reducing the cost of e-mobility and make it the dominant drive technology. It was announced that VW will build six new

Gigafactories (VW calls it the same as Tesla) around Europe which will have a production capacity of 240GWh. Battery factories are built in order to strengthen their position on the market by being less dependent of external battery suppliers like LG, Samsung, and Panasonic and with that having an advantage to compete with major electric car producers, like Tesla. VW is also planning to integrate recycling to their value chain to be much more efficient and environment friendly, and they aim to recycle approximately 95% raw materials of the used batteries. (Volkswagen, 2021)

Volkswagen heavily investing to acquire key tangible assets in order to stay competitive on the market. Volkswagen Group has produced 134 000 pure EVs and the growth in production is planned in the upcoming years. This is made possible with the established global production network. The MEB platform-based e-vehicles are made in Dresden, Zwickau, Anting and Foshan (China). Zwickau was the first plant which was converted to 100% EV manufacturing plant. It is planned that Zwickau plant in China will produce 1500 EVs a day which is 330 000 vehicles a year. This is a significant increase from last years combined EV production quantity. Similar production ramp up is planned for the Anting plant, followed by the Dresden site, which in total will add up to 900 000 e-vehicles produced a year. (Volkswagen, 2021) By combining and coordinating across these factories VW has the potential the be the largest EV manufacturer as comparison Tesla has produced just above 500 000 vehicles. (Tesla, 2020)

5.2.4.4 Product range

No other manufacturer runs so many brands under one roof, this makes the core competence of Volkswagen which helped to stay resilient during its history. The wide spectrum of brands ranges from premium luxury like Bentley, Lamborghini, and Porsche, to the cheaper mass production models like Skoda or Seat. Thanks to that Volkswagen reaches out to all customer types with its products globally. Even though they are all owned by Volkswagen they all run as individual brands. These brands share the same technologies across the board, mainly the platform and engines are the same between all brands. The diversified product range which covers big portion of the market is the sustained competitive advantage. (Volkswagen, 2020)

The tighter regulations around the globe has reduced VW's overall competitive advantage on the market. As a leading manufacturers VW Group had to shift their strategy towards fully electric vehicles, and reduce their overall emissions to fit in the strict quates defined by the EU and USA. VW had no choice left because of the external forces, they need to shift their strategy and business model in order to stay competitive on the market. (Marketline, 2021).

Since 2021 in the EU all new cars produced are considered to account for the fleet emissions and the fine for exceeding the limits is €95 for each gram. The new regulation is stricter than in 2015 when the VW diesel scandal happened, but still it cost over €31 billion in fines and settlements for VW that their vehicles were more pollutive than the regulations. (Reuters Staff, 2020) This brings us back to the innovators dilemma and the case of GM, as they developed their first EV earlier than any manufacturer, but at the time emission regulations weren't strict enough to worth selling EVs next to their much more profitable ICEVs. As comparison VW had no other choice left, they had to shift their focus towards electrification because focusing on internal combustion engines, is not a financially viable option as well as their brand reputation was at stake.

Still VW Group's total battery electric vehicle sales accounts for less than 0,3% of the total sales. The first generation of EVs were the e-Golf and e-Up, which were basically same as the normal Golf and Up just equipped with an electric powertrain. We can conclude that these models came to existence because of the fleet average emission targets, as these cars was built and designed around internal combustion engines, therefore the usability and features doesn't come close to purpose built EVs. That is the reason why soon after their release the production has stopped in favour of the new ID model line. The e-Golf and e-Up (and similar counterparts within the Group) was a temporary solution to reduce fleet average emissions and acts a short transition period for VW.

The first purpose built EV was the ID3 using the MEB platform which is positioned to be an affordable family-size car with the range of 300 to 400 kms. The ID brand is set to be the new flagship line up for VW which will stand for massive EV market breakthrough. Since the ID4 has been announced and started to be in production in 2020 November, VW has announced that existing factories will be progressively rolling back ICEV production and will transferring and equipping more factories to build EVs. (Volkswagen, 2020)

5.2.5 SWOT Analysis Volkswagen Group

5.2.5.1 Strengh

The brand portfolio of VW stands for the main strength of the whole organisation as multiple customer segments are covered. There is a synergy between brands which are controlled well. Over the years VW created a strong diversification strategy as their revenue is generated through different markets and products. VW up until 2015 had been slow to response to the industry trends and their traditional business models could not respond to the new technologies advancements like electrification, digitalization, or car sharing, however the new Strategy 2023 has proven that VW is able to cope with future trends. The controversial emission scandal seemed to accelerate the process, which shows that company management is able cope with complex issues and greatly dealt with the problem. The Strategy 2023 and new business model points towards efficient manufacturing, which is the key to deliver volumes for the market, and keep the brand reputation high. The strong international presence, distribution network are also the mains strengths of VW.

5.2.5.2 Weakness

Even though VW is manufacturing in 118 countries and present and sells its vehicles in 153 countries, compared to other country VW has only 2.1% market share on the US market . (Volkswagen, 2021; Statista, 2020) It is an important market to capture especially with their future EV products. In order to address that currently VW hasn't been announced ground-breaking innovations regarding their EV product line. In fact, their focus is perfectly in line with Tesla's approach. Their technological innovations are not rare amongst the competition; therefore it is not likely at the current state that they could increase their market share in the USA.

5.2.5.3 Opportunity

VW has an extensive experience from building traditional ICEVs, but VW is quite new at the EV market. In comparison Tesla has more knowledge on EV, battery and software development in order to keep their plans and announce 30 new electric vehicles, VW needs to acquire more expertise, knowledge, patents, and employees in order to reach their future vision. Product development, public relations and management capabilities will be increasingly important in the future to capture the opportunities in the transforming automotive industry. If VW successfully takes the obstacles what the future holds in connection with the EV market, significant opportunities can be captured on the long run.

5.2.5.4 Threats

The social acceptance of the new EV product line of VW is the key to be successfully in the future. As outlined earlier the EV ownership is different experience and social anxieties and unknows are still surrounding it. Promoting electric mobility to their customers, while still keeping their ICEVs and slowly phasing out them poses a threat as ICEV counterparts currently still more convenient and cheaper than EVs, therefore the adaptation can longer than expected, and the enormous investments into innovations are slower to be returned, which can lead to internal tension.

The new culture within the company is outlined in the Strategy 2023 requires old habits to be broken and value trust and open-mindedness. Turning back to the innovators dilemma there is a threat that the completely new type of management approach will backfire within the organisation and disagreements within the top management will stand in the way of to reach the ambitious goals for the company. So far VW successfully took these challenges, but it still poses a threat for the company that future disagreements will lead to less commitment to sustainable mobility.

6 Discussion

In this paragraph there will be discussion of the finding of this thesis. Starting with referring back to the research question which was the following: "*What are the main drivers of the electric vehicle innovation, and how does this innovation affect the competitive advantage in the automotive industry?*" Firstly, the emphasis will be put on the first part, namely what are the main drivers of the electric vehicle innovation. In order to identify these drivers, external analysis has been used namely PEST and Porter's Five forces.

The political influence on the automotive industry is high, and in the case of connecting specifically to the research topic of this paper, it is considered very high. The political sphere is concerned about consumption and emissions, therefore restricting regulations are made with a relatively short deadline. Automakers are forced to keep these regulations otherwise; they face an enormous amount of fines which effects their profitability. Regulatory efforts accelerate innovation toward EVs, which drives the industry as a whole. Political influence tries to promote greener mobility by providing tax benefits and cash returns, which creates consumer demand. The most prominent example is in Norway, where government involvement drove up EV sales, which currently accounts for 54% of all vehicle sales. Technology has a high impact on the industry as well, as new technological advancements, materials, or online possibilities, when applied successfully by an automaker, leads to cost-effective manufacturing or higher sales volume. As an outcome of the global pandemic, economic aspects are increasingly influencing the automotive industry. Long recovery phase is expected, and end customer tends to avoid expensive purchases in uncertain times, which can hurt the manufacturers on a longer run. The social factors are considered moderate. There is a large number of people employed in the industry, in the case of unemployment, the political institutions have to take into consideration the promotion of EVs, and mainly the political sphere needs to tackle the possible arising problems, like unemployment. Social anxieties about EVs are currently present, which limits the spread of greener mobility. Information spreading from manufacturers and governmental interaction can accelerate the acceptance and future adaptation.

Considering the five industry forces, the threat of substitution products are deemed as moderate if we consider the automotive industry as a whole. Car ownership is still crucial and essential for many. Urban areas the most probable places where substitutive services or products are used, therefore the lesser need for new cars. Threat of new entrants is low as the entry barrier is very high, new entrants need an enormous amount of capital, therefore it is rare that a new player appears on the market, however, new technological innovations could open up opportunities just like Tesla used a niche for

its advantage, but the probability is quite unlikely. The overall buyer power is considered to be moderate as the switching cost is low, all vehicles are fundamentally the same. Buyers have a weak position for price negotiation, customer preferences can drive up trends that manufacturers have to take into consideration. The SUV trend has been mainly driven by customer preference, therefore almost all manufacturers had to expand their offerings with SUVs in order to stay relevant in this segment and capture sales, even though these types of vehicles are worsening fleet average emissions. The power of suppliers is considered as low to moderate. Suppliers have a higher power in the ICEVs segment, where most of the value chain is established, but considering EVs, where fewer parts are required for manufacturing, the future market for parts supplier will shrink and will make them more dependent on automakers. The overall industry rivalry is high, as manufacturers compete for market shares with similar product offerings.

From the first part of the analysis four distinctive drivers are identified which are the following:

- Governmental influence
- Technological advancements
- Customer preferences
- Industry rivalry and competition.

Referring back to the first Hypothesis **:** *The emission regulations set by the government and political institutions are driving the electric vehicles innovation which affect the overall industry's competitive advantage.* It is turned out to be proven by the analysis, even though currently the governmental and political involvement is considered to be main driving factor, as it has been found out from the analysis other drivers are also relatively significant when it comes to the overall competitiveness. To implicate these factors, two case companies and their internal resources were analysed in order to answer the second part of the research question.

Tesla has managed to build their assets in a short period of time, which enabled them to produce more EVs than any manufacturers. The first tangible asset in Fremont, California, enabled Tesla to manufacture the Model S, which was crucial to their business model. Currently, Tesla has several Gigafactories, which are the main tangible resources. Intangible resources like powertrain design, brand, patents are important intellectual properties that give Tesla an advantage on the market.

Volkswagen has recently started their innovation efforts towards the EV market, after a controversial emission fiasco. The ability to drastically change its strategy goes to show that the company management has able to cope complex challenges. VW has spent the most on R&D in order to successfully innovate and enter to the EV market which is necessary as the required knowledge centred around EVs are still lacking compared to Tesla. The efforts what VW has taken goes to show that external driving factors are forcing traditional manufacturers as well to commit towards sustainable mobility. In order to secure VWs dominant position, new features and innovative development are necessary for the future. New technical knowledge, expertise and capabilities from the software industry are essential to be present to stay competitive in the future vehicle market. The industry is undergoing a technological transformation which will bring more challenges in the future. The external factors identified in this analysis will make the competition fiercer as more and more manufacturers will need to attain similar core competencies, so we can conclude that companies who put extensive effort into establishing capabilities differentiated by their internal resources will be sustaining competitive advantage.

Which leads us to the second hypothesis, which was confirmed throughout the case company analysis In *order to stay competitive on the market and keep the leading position, vehicle manufacturers need to continuously innovate and attain new technical knowledge in manufacturing, and adopt expertise from the software industry.*

Opinion differs what counts as radical or incremental innovation within the automotive industry, EVs themselves are not considered radical innovation in this research. Researchers have a different perspective on what counts as radical innovation when it comes to the automotive industry, but overall incremental innovations are the most prominent contributors to development. The industry is dominated by the ICE since the first radical innovation happened when the first car was created in a form as we know it today. The century long dominant design has been challenged by EVs, and as we saw from the example of GM, traditional automakers have a hard time successfully implement EVs into their business model. GM's case was a great example of innovators dilemma, which can be present in the future at traditional automakers as well. EVs disrupt their own business model and weaken their main driver of profit which comes from ICEVs. Disruptive technology brings innovation to the market, which is more affordable, accessible, and convenient than existing products. For established manufacturers, it is difficult to justify the cost of innovating towards EVs, which is less profitable than their core products.

7 Conclusion

Results show that the industry forming innovations are mainly driven by external factors, most notably, government involvement is forcing manufacturers, as stricter regulations and increasing fines are shaping the future of vehicle manufacturing. Without strict regulations, the industry would probably continue to focus on the most profitable products, in this case, ICEVs and postpone the innovation of EVs. Tesla entered a niche market, and they could use their resources and strategic skills to develop desirable EVs.

Tesla set the example of how to create desirable EVs, and broke the preconception about EVs, which was an important example for traditional manufacturers like Volkswagen, what they can learn from. Tesla has an effect on the industry by showcasing how EVs has a place in the future market, and their innovative approach is proved to be effective. The future trends point towards heavy investment into EVs, traditional manufacturers by the end of the decade will have a significant presence on the EV market. The demand will grow significantly in the future for EVs, and Tesla cannot serve the market alone. Traditional manufacturers already have a higher EV output than Tesla, and as their plans announced in the future, each manufacturer will have more model offerings available than Tesla has.

The future of EVs is dependent on technological breakthrough, most importantly on battery innovations. Battery innovations can change the landscape of the market, and make EVs more affordable and usable, which is the key to the spread on the market. The battery innovation alone would be a great foundation for future research. Currently, developments and innovations happening at speed in the automotive industry which have not been seen before, and it would be interesting to revisit the same research area in five years of time, to examine again how the EV segment has changed, by the investments from the traditional manufacturers.

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