



CHALMERS

Electric truck market analysis

An analysis on the implementation and development of the electric truck market for transportation in Europe 2023

Bachelor thesis for International Logistics Program

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CHALMERS UNIVERSITY OF TECHNOLOGY
Göteborg, Sweden. 2023

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PREFACE

We are delighted to present this report as the culmination of our studies in the International Logistics program at Chalmers University. This report is the result of our final project, which is a 15 hp requirement for the completion of our degree of 180 hp.

During the course of this project, we had the opportunity to interview employees from two of the most prominent companies in the industry. Their contributions and insights have been integral to the success of this project, and we are grateful for their participation.

We would also like to express our sincere gratitude to our supervisor, Peter Hartzell, from Chalmers University, whose guidance and support have been invaluable throughout this project. Additionally, we would like to thank the employees at the relevant businesses for their time and valuable contributions to this project.

This report has been an incredible learning experience, and we are grateful for the support and guidance of everyone who contributed to its completion.

Fabian Berntsson & Viktor Petkovski
Göteborg 2023-05-02

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SAMMANDRAG

I dagens globala samhälle har transportbehovet ökat både internationellt och inom Sverige. Transportsektorn genererar betydande mängder växthusgaser, och i Sverige står den ensam för ungefär en tredjedel av landets totala koldioxidutsläpp. Det är därför av yttersta vikt att hitta nya, klimatsmarta lösningar för transporter.

Elektriska lastbilar börjar bli allt vanligare transportmedel, främst inom kortare transportsträckor. Nyckelfaktorer som påverkar utvecklingen och adoptionen av elektriska lastbilar inom logistikbranschen har undersökts. Fokus ligger på frågor som laddningstid, säkerhet och räckvidd, som är stora hinder för utökad användning, infrastruktur och batteriteknik. Forskningen baseras på litteratursökningar och intervjuer av ledande företag i branschen, och analyserar de utmaningar som utvecklingen och spridningen av elektriska lastbilar på marknaden står inför.

Rapportens begränsningar diskuteras också, vilket inkluderar uteslutning av eventuella beräkningar och fokus enbart på elektriska lastbilar inom logistikbranschen i Europa. Betydelsen av resultaten framhävs, eftersom framsteg inom batteriteknik, laddningsinfrastruktur och regelverk driver antagandet av elektriska lastbilar, vilket förväntas fortsätta under de kommande åren. Studien understryker vikten av elektriska lastbilar för att uppnå hållbara transportlösningar och beskriver företagens engagemang att investera i forskning och utveckling för att uppnå detta mål.

Nyckelord: Elektriska lastbilar, logistikbranschen, laddningstid, säkerhet, räckvidd, hållbarhet, Volvo Lastvagnar, Scania, batteriteknik, laddningsinfrastruktur.

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ABSTRACT

In today's global society, the need for transportation has increased both internationally and within Sweden. The transportation sector generates significant amounts of greenhouse gases, and in Sweden, it alone accounts for about a third of the country's total carbon dioxide emissions. It is therefore of utmost importance to find new, climate-smart solutions for transportation.

Electric trucks are becoming an increasingly common means of transport, primarily within shorter transport distances. Key factors influencing the development and adoption of electric trucks within the logistics industry will be examined. The focus is on issues such as charging time, safety, and range, which are major obstacles to expanded use, infrastructure, and battery technology. The research is based on literature searches and interviews with leading companies within the industry and analyzes the challenges that the development and spread of electric trucks on the market face.

The report's limitations are also discussed, which include the exclusion of any calculations and focus solely on electric trucks within the logistics industry in Europe. The significance of the findings is highlighted, as advancements in battery technology, charging infrastructure, and regulations drive the adoption of electric trucks, which is expected to continue in the coming years. The study emphasizes the importance of electric trucks in achieving sustainable transportation solutions and describes the companies' commitment to investing in research and development to achieve this goal.

Keywords: Electric trucks, the logistics industry, charging time, safety, range, sustainability, Volvo Trucks, Scania, battery technology, charging infrastructure.

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Figure 1: Scania trucks electrification roadmap (Scania, 2023)

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ACRONYMS AND TERMINOLOGY

ACEA	European Automobile Manufacturers' Association
CCS	Combined Charging System
DAF	Van Doorne's Automobielfabriek
EU	European Union
EV	Electric Vehicle
UN	United Nations

1. INTRODUCTION

This chapter addresses the introduction and background of the electrification of transportation, with a primary focus on electric trucks and various objectives. Furthermore, the purpose of the report is explained, followed by the research questions and delimitations of the study.

The electrification of the transportation industry is a significant subject that is becoming more and more important in today's society. In order to meet the worldwide climate targets, the transportation sector must be electrified because it contributes significantly to global greenhouse gas emissions (IEA, 2021). According to Sahoo and Ko (2019), electric vehicles (EVs) have the potential to replace traditional fossil fuel vehicles as a clean and efficient transportation option because they emit no emissions and require less maintenance (Bertling & Ciftci, 2021).

A number of technical and infrastructure improvements are required to enable large-scale electrification of the transportation industry. For instance, increasing battery capacity is necessary to extend the range of EVs and lessen how frequently they must be recharged (Hossain, Mahmud, & Rahim, 2018). The expansion of the charging infrastructure, which is required to enable the charging of EVs in public locations like parking lots and along roadways, is another significant aspect (IEA, 2020).

Changes in consumer and corporate usage patterns are also necessary to make the electrification of the transportation industry more usable and accessible. It is crucial to provide incentives for people to purchase EVs, such as tax cuts or subsidies (Bertling & Ciftci, 2021). Businesses should create business plans that assist the electrification of the transportation industry, such as by providing charging services to their staff or clients (Hossain et al., 2018).

It is crucial that the electrification of the transportation industry becomes a top priority in today's society in order to lessen its impact on the environment. We can lower greenhouse gas emissions by using more electric vehicles and using less fossil fuel-powered automobiles (IEA, 2021). Moreover, the electrification of the transportation sector can help to improve energy security by lowering reliance on fossil fuels and enhancing energy efficiency (Nassiri & Rocco, 2021).

1.1 Background

The electric truck market has become increasingly common, and it is rapidly becoming a hot topic. Not only within the logistics market but trucks in general (Leijonhufvud, 2023). The biggest reason for this has to do with environmental aspects, to reach a sustainable future. There are many factors affecting the electric vehicle industry. Partly infrastructure and batteries, but also politics and investors play a big role in the industry as a whole.

Many manufacturers of both cars and trucks are competing with who can electrify their vehicles the fastest, which is a good thing considering the emissions from fossil-fueled vehicles

(Northvolt, 2022). Heavy trucks stand for around a quarter of the carbon emissions in the EU. Electric vehicles need to charge, and this is the main problem. That there are not enough charging stations in the world to support electricity to all the vehicles that are to be launched. Volvo Group together with Daimler Trucks and Traton Group (Volkswagen and Scania), have joined forces to further develop charging infrastructure with the focus to make it easier for long-distance transportation (Northvolt, 2022).

To reach the Paris Agreement set up by the UN, the demand for fossil fuels needs to decrease. The transportation sector is one of the sectors that are most concerned since 97% of the energy consumption within transportation comes from carbon fuels (IEA, 2017). The heavy-duty is an un-proportionally large contributor to greenhouse emissions compared to its size (SCB, 2018).

According to Strategy& and PWC, electrical trucks will dominate within 15 years and replace the current fossil-fuel-powered trucks. Vehicles with zero emissions are set to stand for one-third of all trucks in the USA, Greater China, and Europe by the year 2030. And by the year 2035, electric trucks are set to stand for 70% of the market (Strategy& PWC, 2023).

1.2 Aim of the study

This thesis looks into the major elements that affect the creation and uptake of electric trucks in the market. The thesis will specifically look at issues like charging time, safety, and range that come with expanding usage, infrastructure, and battery advancement. The thesis will also examine how politics, laws, and investors affect the advancement of electric trucks.

1.3 Research questions

- What are the key factors and challenges influencing the development and adoption of electric trucks in the industry?
- What role do politics, regulations, and investors play in the development of electric trucks?
- What did previous prognoses say about the future of electric trucks? Have the forecasts been correct over time?

1.4 Delimitations

This study has several delimitations that shape its scope and focus. Firstly, it will not involve any quantitative calculations. Instead, the research will concentrate on the qualitative aspects of electric trucks as a mode of transportation within the European logistics industry. While acknowledging the existence of competitors in the United States, the analysis will predominantly center on the European market, excluding other geographical regions.

This report will exclusively address electric trucks, not considering other alternative fuel options or vehicle types in the logistics sector. Although some economic factors will be incorporated into the analysis, these will be primarily derived from annual reports and related financial data. By narrowing the study's focus in this manner, a more in-depth understanding of the electric truck market within the European logistics industry can be achieved, allowing for a comprehensive examination of the challenges and opportunities in this specific context.

2. THEORY

In this part, a basic theory about the market for electric trucks is presented. It is followed by sub-chapters focusing on infrastructure and charging, batteries, and politics and regulations.

2.1 Development/adoption of electric trucks

The electric market for passenger cars is currently well established and improving rapidly every minute. But the electric truck market is not as developed yet (Leijonhufvud, 2021). Even though an American manufacturer called Autocar is considered the first major manufacturer to introduce electric trucks around 100 years ago in 1923. There is a big drive to go electric in the transport sector, which is mainly due to the world's effort to lower emissions due to tougher legislation. There has been a ban on selling non-electric vehicles in some parts of the world, therefore electric vehicles are an inevitable alternative for manufacturers if they want to keep up their business. The change could be a concern for some manufacturers if you are not ready due to it happening so fast (Autocar, LLC, 2021).

So far most of the technology in electrification has been implemented into passenger vehicles, with a lack of technology appearing in trucks for longer distances. The main reason for this is that the batteries currently existing simply don't offer the range needed for long-distance transportation. Meaning that the use of electrification simply occurs first in short-distance services such as mail delivering or home delivery of packages, before turning to longer distances when the technology has further improved (Aroq Just-Auto, 2022).

The development of the electric truck market is growing with two main players active within Sweden, Volvo Trucks and Scania. 7 of the biggest truck manufacturers in the world signed a statement about dedication towards electrification in 2020. The statement had a goal that all new vehicles will be carbon-neutral by 2040. (ACEA, 2020). Some of the leading truck manufacturers in Europe have created a joint venture in order to develop a new public charging network. This is mainly meant for heavy trucks or long-haul transporting across Europe (Northvolt, 2022).

The total number of electric trucks used for heavy transport in Sweden in the year 2021 was 72 units (Trafikanalys, 2021). If you look back even further to the year 2016, the number of heavy electric trucks was 0. Meaning that in 5 years the number of units has increased to 72. It may not seem so much, but it is a gentle start. By looking at the current statistics for the year 2023, there are currently 231 electric-powered trucks in use. An increase of around 230% in 1 year. To give further perspective, Trafikanalys also mentions that the number of light electric trucks in use from 2011 to 2020 has increased by 61% (Trafikanalys, 2022).

Volvo released their first electric trucks, the FL-series, and FE-series, in 2019 for transport operations meant for city distribution. For the American market, they released the VNR-series for regional transportation in 2020. Volvo further evolved its fleet with new models for 2021. These were medium-sized models developed for city distribution, as well as heavier models for regional use, both models offered in the European market. Volvo Trucks has also set an internal goal to only offer net-zero emission products by the year 2040. They mention that battery electric vehicles will be key for this journey to become a reality. (Volvo Trucks, 2023).

Scania is also developing electric trucks. They have the quote "For Scania, the future is electric". Scania believes that their sales of electric-powered trucks will be 10% for 2025, and land at 50% at the end of this decade. They present a good overview on their website where

they describe their roadmap over planned productions (see figure 1). Among their first electrical vehicles launched around 2021, the average range for smaller trucks was around 200 km. They released two new trucks for 2023, two larger models where one carries 40 tonnes and the other 60 tonnes. The 40-tonne truck can be driven for 4 hours or 280km, and the 60-tonne truck for 3 hours or 210 km. The planned fleet's range will increase drastically where the 40-tonne's range is set to be 4.5 hours or 560km, and the 60-tonne's is set to be 4 hours or 420 km. This means that if things go their way, and they can develop everything they want within this timeframe, the driving range will be doubled between the 2023 fleet and the 2025 fleet (Scania, 2023).

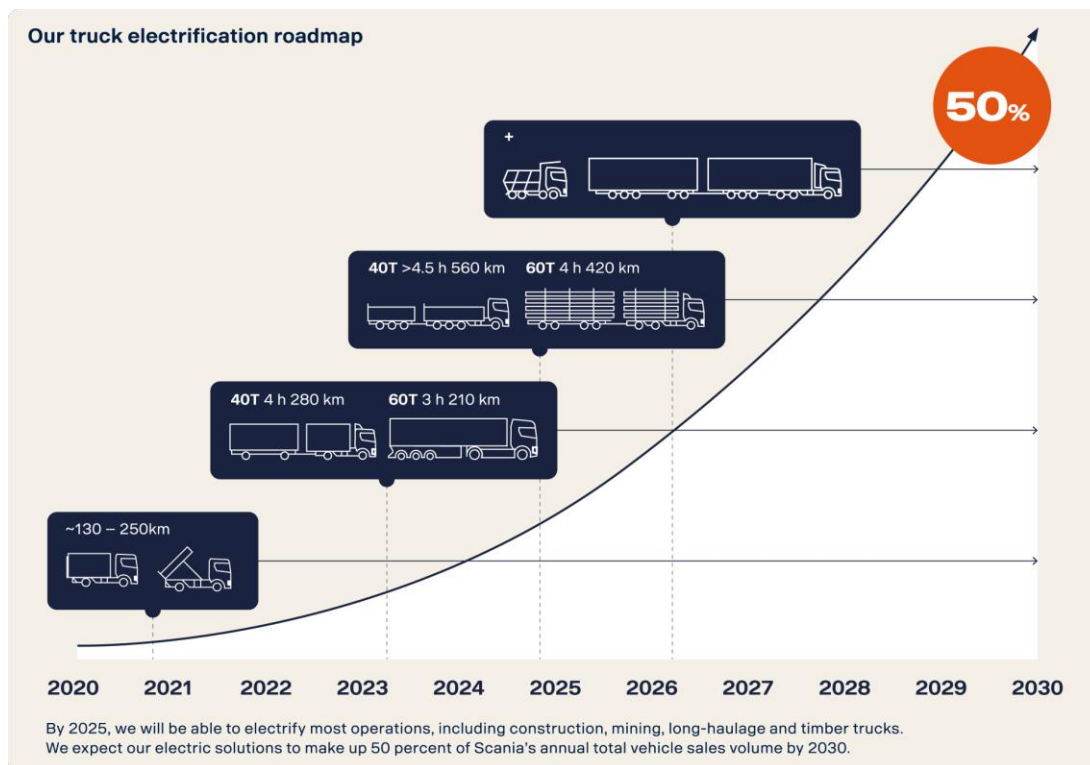


Figure 1: Scania trucks electrification roadmap (Scania, 2023)

2.2 Infrastructure and charging

One of the biggest obstacles to the widespread use of electric vehicles is the need for charging infrastructure. This applies especially to electric trucks, which require higher charging capacity and longer charging times than passenger cars. A study by the European Automobile Manufacturers' Association (ACEA) found that there aren't many public charging stations for electric trucks in Europe. Only 200 electric truck charging stations existed in Europe in 2020, compared to 200,000 charging stations for cars. This is because electric trucks have a higher power capacity than passenger cars, making it difficult to supply adequate energy on the current networks (ACEA, 2020).

The most common type of charging is through cable where the truck stands still, meaning you have to plug in the truck. There are many different types of plugs depending on the region, but

the EU has Type 2 as the standard. Europe has its own standard for fast charging called CCS (Combined Charging System). Vehicles with CCS can apply both fast charging and normal speed charging (Triplef, 2021).

Another crucial element is the requirement for cooperation among various market participants, like car manufacturers, charging station operators, and authorities. In order for all stakeholders to work together to offer customers high-quality and reasonably priced charging services, it is critical to establish an open and competitive market for charging infrastructure, according to a report by Transport & Environment (T&E) from 2020.

2.3 Battery life and usage recommendations

The charging capacity can be affected by various factors, and the charging time will depend partly on how big the battery is, the temperature of the surroundings where the battery should be used, and which effect it should have. When charging a battery (not limited to trucks), the optimal is to only charge up to 80 percent in order to not damage the battery. The power will reduce when the battery reaches 80 percent, meaning that the charging between 80 to 100 percent will be significantly slower (Sweco, 2020). According to (Hayes, 2018) batteries used in cars are typically designed to last around 10 years. Depending on how you use and handle the battery, the lifespan might be affected. Such as too high voltage, frequency of charging, and varying temperatures are such factors.

When dimensioning or designing a battery used for trucks, the daily energy usage should be analyzed to get an accurate capacity in relation to the average consumption. This is to be able to maximize the usage of the battery and should limit the need for frequent support charging. Another very important thing to consider when designing a battery is the weight. The weight of the battery and the capacity increases in relation to each other. If you want high capacity it will be heavy. And if the battery is big and heavy, the loading capacity will reduce to make room for the battery, both in terms of weight loading and storage loading (Triplef, 2021).

2.4 Politics and regulations

Electric trucks have become a viable option recently for cutting greenhouse gas emissions from freight transportation and achieving the Paris Agreement's climate targets. However, in order to overcome the difficulties of high initial prices, a constrained operating range, and inadequate charging infrastructure, the deployment of electric trucks on a broad scale requires major legislative and regulatory support (Helmreich, 2020).

To encourage the use of electric trucks, the European Union (EU) and its member states have put in place a number of policy initiatives. A major push to speed up the purchase of clean and energy-efficient vehicles, particularly electric trucks, for public fleets is the Clean Vehicles Directive, which was implemented in 2019. By 2025 and 2030, the directive establishes legally enforceable targets for the proportion of low- and zero-emission cars in public procurement, with minimum requirements of 25% and 50%, respectively (EU, 2019a).

A number of EU nations have also introduced national incentives and rules to promote the use of electric trucks. For instance, businesses can deduct up to 50% of the cost of electric trucks from their taxes in Germany (BMW, 2020). For heavy-duty vehicles, France has implemented a bonus-malus system that imposes a tax penalty on high-emission trucks and a tax credit on low-emission trucks, including electric trucks (ADEME, 2021). Sweden has set a national goal to transition to fossil-free road freight transportation by 2030. This goal involves providing incentives for electric vehicles and infrastructure for charging them (Trafikverket, 2021).

The EU has modified its type approval regulations to include specific specifications for electric drivetrains, battery safety, and noise emissions in order to assure the safety and environmental performance of electric trucks (EU, 2018). A new CO₂ emission norm for heavy-duty vehicles has also been proposed by the European Commission, which would call for a reduction of at least 30% by 2030 and 100% by 2040 compared to 2019 levels. The proposed legislation intends to level the playing field for all manufacturers in the EU market and encourage the use of zero-emission trucks (EU, 2021).

There are still issues that need to be resolved even while policy and regulatory support for electric trucks are expanding. Lack of infrastructure for charging, particularly on long-haul and cross-border journeys, is one of the major issues (European Court of Auditors, 2021). The high initial cost of electric vehicles is another issue, which may dissuade some fleet operators from utilizing this technology (Helmreich, 2020). Also, the COVID-19 outbreak has delayed production and affected the supply chain for electric trucks, creating market uncertainty (Transport & Environment, 2021).

2.5 Investors

A major factor in encouraging the use of electric last-mile logistics vehicles is investors. Investors of many types, including institutional, private, and government investors, participate in the market in Europe. With laws and incentives, government investors like the federal, state, and local governments significantly contribute to the adoption of electric last-mile logistics vehicles. Startups for electric last-mile logistics vehicles receive funding from private investors such as venture capital firms and angel investors. Institutional investors put money into well-established businesses that make electric last-mile logistics vehicles or related infrastructure, such as pension funds and insurance organizations. (Enevoldsen & Friis, 2021)

Investment in electric last-mile logistics vehicles and related infrastructure has been expanding in recent years. Brinkman et al. (2020) examined investment plans for electric trucks in the European freight industry. According to the survey, interest in investing in electric trucks is expanding, and investment quantities have been rising recently. A number of changes in investment strategies were also noted by the survey, including a concentration on niche industries and the formation of alliances with well-established businesses.

The locations where investments in infrastructure and last-mile electric logistics vehicles have been made vary. National investment plans for electric freight vehicles in Europe were examined in a study by Enevoldsen and Friis (2021). The study found that Nordic countries, such as Norway, Sweden, and Denmark, have invested the most in electric freight vehicles, followed by the Netherlands, Germany, and the United Kingdom. According to the study, the ambitious climate policies and adoption incentives in these nations are to blame for the high investment levels.

Each country has different infrastructure requirements and investment opportunities for electric last-mile logistics vehicles. For instance, Alanne's et al. (2021) review of electric last-mile logistics in European cities in 2021, revealed that while the Nordic region has seen a number of successful initiatives, there are still problems in Southern European nations due to insufficient charging infrastructure and a lack of financial incentives. The regulatory environment, consumer demand, and the availability of resources are additional elements that influence investment opportunities and challenges.

2.6 Trucks in the Spotlight: Fuel vs. Electric

Fuel trucks, which are primarily powered by diesel engines, have long dominated the transportation sector. Long-range capabilities and the accessibility of refueling facilities are two of the main benefits of gasoline trucks. Additionally, compared to the time needed to charge for electric trucks, fuel trucks typically require less time to refuel (Helmus et al., 2018). However, fuel trucks have a number of significant drawbacks, including their role in air pollution and greenhouse gas emissions. Trucks and other heavy-duty vehicles accounted for over 22% of the world's oil consumption in 2019, according to the International Council on Clean Transportation (ICCT, 2019). Furthermore, in the same year, heavy-duty vehicles in the European Union were accountable for 41% of all transport-related CO₂ emissions (European Environment Agency, 2020).

Over their counterparts powered by fuel, electric trucks have a number of benefits. They don't release any pollutants from the exhaust, since they don't have any, which can greatly reduce air pollution and greenhouse gas emissions, especially in metropolitan areas (Ambrose et al., 2020). Due to cheaper fuel costs and less frequent maintenance needs as compared to internal combustion engines, electric trucks also have lower operational costs (Lajunen, 2018). However, there are some drawbacks to electric trucks, including a shorter driving range and longer charging times than for fuel trucks (ACEA, 2020). Additionally, there is currently a lack of adequate charging infrastructure for electric trucks, which can create operational challenges for long-haul transportation (Transport & Environment, 2020).

The type of electricity utilized for charging has a significant impact on the environmental advantages of electric trucks. Electric vehicles can have a significantly reduced carbon footprint than fuel-powered trucks in areas where renewable energy sources make up a large portion of the electricity mix. However, the overall emissions reduction may be less significant in regions where electricity is primarily produced from fossil fuels (Ambrose et al., 2020).

3. METHODS

In this chapter, the report's methodology and implementation are presented, with a focus on how interviews have been conducted and the information gathered from them. The chapter also describes the process of literature search, including how sources have been identified and how relevant information has been extracted to support the report's analysis and conclusions.

3.1 Literature search

In this report, a literature search has been performed by compiling relevant articles. The data collection is carried out through a selection of published studies related to the electric vehicle market through digital articles, as well as through tools such as Google Scholar and Chalmers library databases. Then the information from the sources will be compared and compiled to

present the whole picture of the current research on this topic in the results section. Our approach is carried out with the help of relevant keywords in Chalmers Library's databases, such as; *Ellastbil*, *electric trucks*, *EV*, *road transportation*, *logistics*, and *sustainability*. Various methods have been used to conduct this report. Searches on the web have also enabled more results of interest, partly from third-person actors that have given their views on the market. And not only the professional view frequently provided through scientific articles which at times can be very biased towards a certain company. A future forecast will be examined taking into account potential new restrictions or legislation as well as what is on the horizon for the electric truck market to visualize the growth of electric trucks in Europe and identify relevant trends and factors.

3.2 Interviews

In order to better understand the driving forces behind the development and uptake of electric trucks in the market, this study will look at obstacles relating to infrastructure, battery technology, and regulations. To accomplish this, we spoke with people working in various positions across the sector, including sales reps, engineers, and logistics specialists. We managed to interview 4 people within relevant companies. Using these interviews, we sought to pinpoint the elements that affect the uptake of electric trucks and investigate the issues that must be resolved for more widespread uptake.

The interview questions we asked were the following:

1. What challenges do you see within your company to increase the use of electric trucks, especially in terms of infrastructure, charging time, and range?
2. What role do you think politics, regulations, and investors play in the development of electric trucks?
3. What have previous technical forecasts said about the future of electric trucks, and have the forecasts been accurate over time within your company? For example, you have reached your goals with the number of trucks produced in recent years.
4. What are the latest innovations that your company has developed in the automotive industry, and how do you think they will affect the market?
5. How has battery technology developed over the years, and what impact has this had on the development of electric trucks?
6. What steps are being taken to address concerns about the safety of electric trucks?
7. How do you think charging time for electric trucks affects their adoption, and what solutions are being developed to address this challenge?
8. Which competitors do you see as the biggest challenges for your company, and how do you work to meet their threats and strengthen your position in the market?
9. Finally, how do you see the future of electric trucks in the industry, and what developments do you think we can expect to see in the coming years, and what are your company's visions?

4. RESULTS

In this chapter, the results of interviews with representatives from two leading truck manufacturers are presented. The interviews were conducted to investigate their views on electric trucks and the challenges and opportunities they see with this technology.

4.1 - Interview nr. 1

Interviewee number 1 started working in the business in 1998 and has since worked on various vehicles, from cars to buses, trucks, and excavators. He initially focused on climate control for cars and later worked on energy management and Complete Vehicle management. In 2016, he became involved in the Swedish Electromobility Center, where he is currently researching how weather affects energy consumption for different vehicles, particularly trucks. He has found

that crosswinds significantly impact energy consumption for large vehicles with a significant cross-sectional area.

Challenges within the company in terms of infrastructure, charging time, battery technology, and range

He has identified several challenges in the transition to electric vehicles. These include issues with the charging infrastructure, long charging times, and a limited range of the batteries. The weather can also pose a problem, as it can cause a large variation in energy consumption and result in the need for an extra charge during bad weather. This can lead to nationwide chaos if all-electric vehicles need to charge at the same time, particularly during worst-case scenarios like snowstorms.

While there are many challenges, he also sees the advantages of electric vehicles, including better driving characteristics and faster production times. However, he acknowledges that building an electric vehicle from scratch and taking full advantage of all improvements can be difficult. Nonetheless, he believes that the effort is worth it.

Politics, regulations, and investors' role in the development of electric trucks

If we consider Volvo, he states that their motivation to make changes primarily stems from the legislation. Legislation measures the amount of CO₂ that vehicles emit, which led the company to consider hybrid options as a means of complying with the regulations. However, after recognizing the potential for reducing emissions, the focus shifted toward pure electric vehicles. This approach allows them to continue manufacturing diesel vehicles while simultaneously increasing the number of pure electric vehicles, resulting in no need for diesel engines to be criticized. He emphasizes the significance of legislation for their fleet, as reducing energy consumption and CO₂ emissions from a traditional diesel engine is very expensive. Enhancing diesel engines to reduce energy consumption by just 1% is costly and challenging, even with years of development. Consequently, building electric vehicles has been their chosen path, as it is the most straightforward and efficient approach to comply with legislation.

Previous forecasts about the future of electric trucks, have the goals been reached in recent years

He states that their company has a bonus system that incorporates the number of electric vehicles produced, and it appears that they have not yet achieved their objectives. To the best of their knowledge, they estimate that they have reached roughly 60% of their target, but the target is still expanding and expected to increase at a rapid pace. However, he acknowledges that this is just a personal estimation.

New innovations that have been developed in the industry, and how will they affect the market

He finds it challenging to identify any single innovation that has revolutionized the industry. He believes that progress has been made gradually, with battery technology improving incrementally over time. However, he also acknowledges the potential for a game-changing innovation, such as a smart solution for quickly replacing batteries. This could address the issue

of lengthy charging times and the bottleneck of limited charging stations. He considers this an innovative idea, although he is unaware of any entity that has put it into production.

Steps Taken to Address Safety Concerns of Electric Trucks

He is not equipped to provide recommendations on how to address concerns regarding the safety of electric trucks, as it falls beyond his area of expertise. The technical nature of the subject and the varying perspectives of experts make it challenging to offer an authoritative answer. Nonetheless, he affirms that his company has obtained numerous certifications regarding electric vehicle operation. The certifications are categorized by levels of involvement, and all engineers must undertake a course to work in the workshop. The required courses vary depending on one's level of responsibility. Thus, the company prioritizes safety by ensuring that all engineers are adequately trained to handle electric trucks.

Competitors, and how to meet their threats and maintain in the market

He believes that Tesla is revolutionizing the market in many ways, although some people may not feel the need to worry about them. He recently attended their investor day and was impressed with the numerous plans they presented for the future, including the ability to build a new car in just an hour. This achievement was made possible by their unique approach to building electric vehicles from scratch and rethinking traditional manufacturing processes.

While he is impressed with Tesla, he is also somewhat apprehensive about its potential as a competitor, particularly in the trucking industry. He believes that the industry needs to make significant changes in order to meet Tesla's level of innovation. Simply building on existing technologies and processes will no longer suffice, and he advocates for a complete rethinking of the production chain.

Moreover, he points out that the danger of Tesla as a competitor is not just limited to traditional companies like Scania and Daimler. New challengers from China are also emerging, and it is essential to stay vigilant and proactive in order to remain competitive. He emphasizes that it is crucial to reevaluate every aspect of the industry to ensure that it is capable of meeting the challenges posed by Tesla and other emerging competitors.

He also mentions that there are other companies like Scania and Daimler, who are traditional players in the market, and they will also have good trucks in a few years. However, he believes that Tesla is a dangerous competitor on paper and the industry needs to change its production and rethink the whole supply chain to keep up with the competition. He thinks that they really need to look at everything now to remain competitive.

The Future of Electric Trucks in the Industry: Expectations and Company Visions

He mentions that the company has visions for all vehicles to transition to zero-emission vehicles by a certain year. He believes that this could change everything if legislation begins to change. Currently, there is a lot of focus on emissions from exhaust pipes, but with zero-emission

vehicles, more attention would be paid to life cycle analysis, which would open up alternative fuel options. However, he believes that the focus is mainly on electric vehicles at the moment.

He emphasizes that it is highly politically driven, and legislation plays a significant role in the industry. If it continues in the same direction as now, he believes that electric vehicles will increase exponentially, but there is a risk of problems with charging infrastructure and charging if the industry does not keep up with developments. He is also concerned about the range of electric vehicles on cold and windy winter days.

He also mentions that trucks are more sensitive to poor road conditions and that it could be problematic if they need to charge on the roads during harsh winter days. He believes that fuel-cell technology could become an option in the longer term, but it depends on how good the batteries become and whether there is a need for fuel-cell vehicles in the future.

4.2 - Interview nr. 2

Interviewee number 2 is a salesman and is currently responsible for sales of electric trucks within Sweden, Norway, Finland, Denmark, the Netherlands, Belgium, Austria, and Switzerland. These markets together stand for around 65% of their sales.

Challenges within the company in terms of infrastructure, charging time, and range

He started by saying that selling electric trucks is a completely different thing compared to selling electric vehicles for personal use. Many people are very keen on the design when choosing a personal vehicle, and something you would enjoy driving. He means that very most people purchase these based on their feelings towards them. A truck is a vehicle used for work and is typically bought by various companies whose main mission is to make money. You don't earn money from the trucks itself, you rather earn on what you transport. You want to transport the cargo as cost-efficiently as possible. The cockpit should be good for the operator with all necessities you should want or need. The driver will be spending a large amount of time in the truck.

Some challenges are the batteries, which are very expensive. It is the main part that decides the cost of the trucks. A thing you usually look for is the so-called TCO (Total Cost of Ownership), which includes the cost of the truck along with interest, service costs as well as the fuel to power the vehicle. A big challenge is to get this together without losing too much money. Sweden has a subsidy of 20% from the state for the total cost of the truck, along with relatively low electric costs. This means you can make the calculation go around if you manage to get a high utilization rate. There are other countries, such as Denmark, which have a high price for electricity and rather low for diesel. He means that in such countries it is very difficult to manage the calculation and make it positive. Therein the swift from diesel to electric does not have an economic background. Out of all goods that are transported within Europe, 45% are transported in shorter distances than 300 km. You need to plan the route so that you have time to stop and charge the vehicle which connects to the infrastructure of the placement of charging stations.

Their initial thought was to charge fully when the trucks “are home”, and then to charge publicly when needed. Many logistics companies do not have enough effect in the chargers stations in their area. When the number of electric trucks increases, you will also need further public charging stations, since it simply is not enough to charge all the vehicles on sight overnight. Therefore the infrastructure for public charging is very important. Currently, there are very few such stations for heavy trucks in Europe. 140 new charging stations will be built around Sweden. It is a good start, but there is more needed.

Politics, regulations, and investors' role in the development of electric trucks

The state in Sweden contributes 20% of the purchase of an electric truck. Out of the previously mentioned charging stations, the state also paid for 140 out of 140. To compare, in Germany the state covered the cost of up to 80% of such charging infrastructure. For instance in Denmark, which had a very short period with support for purchase, later had an election. Another party won that had not decided how to go around regarding such support. Long-time customers had seen the potential of support from the previous party. Many buyers are therefore waiting in hopes that there will be support in the future. Usually where there is support for something, there is more being sold.

Previous forecasts about the future of electric trucks, have the goals been reached in recent years

He said that according to the prognosis, they are currently up to date. The number of electric trucks increases a lot year by year. Last year they produced somewhere around 1000 electric trucks out of 147 000 trucks produced in total. There is still a relatively low percentage of electric trucks if you look at the total amount of trucks produced. For 2021 they produced around 100 trucks, and for 2022 they produced several 100 trucks. Likewise, for the year 2023, they plan to produce around 1000 trucks, and for 2024 the vision is to produce several 1000 trucks. They have the vision to increase the number of electric trucks much and fast in the coming years. It is a very steep incline which means that there is a high demand for these vehicles. The company has a goal for the year 2030, where the total amount of trucks globally should be electric-powered. So far they have kept up with their goals and targets.

New innovations that have been developed in the industry, and how will they affect the market

To power an electric truck is nothing new in itself, therefore it is not an innovation. The innovation will rather be on the systems or certain details. An example of new innovation is a thing called “Active Grip”. To spin the tires on a truck is bad for various reasons. For instance, it takes longer to accelerate to a certain speed, which means the truck will have higher emissions. The tires get worn out and you will get worse traction. Diesel trucks generally have slow regulations. You need a lot of throttles to rev up the engine and heat it up for it to start combustion. The electric motor is more or less instant when it comes to revving it up and start accelerating. Their new innovation measures the wheel slip which in turn directly regulates the electric motor. Therein you get much better accessibility with an electric motor compared to combustion engines. This is not an innovation that will drive the development or change toward electric trucks. An innovation would rather be to lower the total cost of production so that it will be closer to the cost for diesel trucks. As well as to bring more energy into the batteries. It is currently possible to drive major lengths with electric power, but it is not enough to fully rely

on it. The main innovations that will truly change how the market looks are therefore to come up with solutions or technology that enables the batteries to pack more energy, as well as to lower the cost of production for the batteries as well as the trucks.

Battery technology development over the years, impact on the development of electric trucks

The company in question showcased its first version of an electric battery in the year 2019. The weight of the first battery they produced was around 500kg and had 50 kWh. The second generation battery released in 2021 had around the same weight but increased the energy to 60 kWh. The current generation released in 2022 had again around the same weight but had a huge increase in energy, 90 kWh. The kWh per kg increase shows that the energy density has increased a lot, and that means you can drive longer. Not only longer distances but also in time. Think of a garbage truck that rather uses its energy to lift up the garbage cans and compress its contents. Since you have more kWh per kg, you can access bigger parts of the market.

Effect of charging time of electric trucks, solutions to develop even further

It does not necessarily get better the faster you can charge a truck forever. But the time it takes today is in most cases considered too slow. You usually earn more by shortening the charging time, but eventually you will reach a point where it is typically unnecessary to shorten even further because you barely make more profit out of it. There are several rules about driving time when driving a truck. A driving shift must be at most 4 and a half hours, followed by a 45-minute break, and then another 4.5 hours of driving. The initial idea is to be able to charge the truck fully during the break between the two shifts. Today the fastest charging times are closer to 2 hours, which is too slow compared to diesel-powered trucks. So there is still a profit to be made if you can shorten it even further. There is not much point in having a faster charging time than 45 minutes since the driver, according to law, must take a 45-minute break where the truck will be standing still.

Competitors, and how to meet their threats and maintain in the market

Their biggest competitors are the same as in the diesel market. Namely, Scania, Mercedes and DAF. There are a lot of new manufacturers coming from China, and we have Tesla in the American market. He says that they try to strengthen their position by offering as good of a product as possible, and for a price that the customers are willing to pay for the vehicles. They also consider customer relations to be of utmost importance in order to be successful within the market. According to him, neither of these will make it big in Europe in the coming years. Tesla trucks for example are not built after the standard and regulations that European-made trucks follow. They don't fit the drivers' needs in Europe. They simply aren't made according to European specifications and standards. Furthermore, there is currently a lack of retailers of Tesla trucks, and if a company were to buy one, there would also be a lack of service points for these trucks.

The future of electric trucks in the industry, what developments to expect, company's visions?

Their future is difficult to determine, however, they have a few visions or goals. As said earlier, their vision is to have 50% of the produced vehicles to be CO2 neutral by the year 2030. This

can be achieved in various ways. For instance electrification, but it can also be hydrogen-powered, or other alternatives. For now though, battery-powered is the most efficient. He said this will likely be a challenge to go for this change in production, but it is something that is much needed, and they will proceed to go through the change necessary. He finished by saying that there will happen a lot in the near future within the company.

4.3 - Interview nr. 3

The interviewee has acquired four years of professional experience as a technical engineer at a company, where they have gained extensive knowledge and expertise in the development of technical components for vehicles.

Challenges within the company in terms of infrastructure, charging time, and range

The interviewee said that as the company moves towards electrification in the transportation industry, one of the biggest challenges we face is infrastructure. We need to ensure that there are enough charging stations available to support the growing number of electric trucks on the road. Moreover, it is necessary to make sure that the charging infrastructure is reliable and efficient, which is crucial for our customers to achieve the necessary productivity. Another challenge we face is the limited range of electric trucks, especially when it comes to long-haul applications. We need to develop and implement better battery technology that can provide longer range and faster charging times. In addition, we need to work with our customers to help them plan their routes and optimize their operations.

Politics, regulations, and investors' role in the development of electric trucks

Regulations, politics, and investors play a significant role in the development of electric trucks. Governments around the world are setting ambitious targets for reducing greenhouse gas emissions, and electric trucks are a crucial part of achieving these targets. Therefore, policies and regulations that encourage the adoption of electric trucks, such as tax levels, grants, and subsidies, are essential. Investors also play a crucial role in the development of electric trucks. Without sufficient funding, it is challenging to develop the necessary technology to make electric trucks a viable option for the industry. Therefore, investors who are willing to fund the development of electric trucks and battery technology are essential to the success of the industry.

Previous forecasts about the future of electric trucks, have the goals been reached in recent years

Previous technical forecasts have predicted significant growth in the electric truck market, and we have seen this prediction come true in recent years. The company has reached our goals in terms of the number of electric trucks produced in recent years, and we are continuing to see increasing demand for our electric trucks. However, there is still much work to be done to achieve our long-term goals of fully electrifying the transportation industry. As battery technology continues to evolve, and charging infrastructure expands, we expect to see even greater demand for electric trucks in the coming years.

New innovations that have been developed in the industry, and how will they affect the market

They are continually innovating to stay ahead of the curve in the automotive industry. We have developed a hybrid truck that combines electric and combustion engines to provide more

flexibility and range for our customers. We believe that our innovations will help to drive the market towards electrification and reduce the industry's impact on the environment. Moreover, we are always looking for new ways to improve our products and services, and we believe that our innovation will help us to maintain our position as one of the main players in the industry.

Battery technology development over the years, impact on the development of electric trucks

Battery technology has developed rapidly in recent years, and this has had a significant impact on the development of electric trucks. As battery technology has improved, electric trucks have become more practical for a wide range of applications, including long-haul transportation. Moreover, advancements in battery technology have led to improvements in range and charging times, which are critical factors for electric truck adoption. We expect that continued innovation in battery technology will lead to even more significant improvements in electric trucks' range and charging times.

Steps Taken to Address Safety Concerns of Electric Trucks

Safety is a top priority for the company, and we take a comprehensive approach to address safety concerns in our electric trucks. Our battery systems are designed to meet the highest safety standards, and we have implemented a number of safety features, such as redundant battery management systems, thermal management systems, and emergency shutdown systems. We also provide extensive training for our technicians and customers to ensure that they are aware of the risks and how to handle them.

Effect of charging time of electric trucks, solutions to develop even further

Charging time is a critical factor in the adoption of electric trucks. The company is working on several solutions to address this challenge, including fast-charging infrastructure, battery-swapping technology, and improved battery management systems. We believe that a combination of these technologies will be required to provide a seamless charging experience for our customers.

Competitors, and how to meet their threats and maintain in the market

The company faces competition from several established players in the trucking industry, as well as new entrants who are focusing on electric and autonomous trucks. We work to meet these threats by continuing to innovate and invest in research and development. The interviewee says that focus on sustainability and customer value is what sets us apart from our competitors, and we believe that this will continue to be a key differentiator in the market.

The future of electric trucks in the industry, what developments to expect, company's visions

The future of electric trucks looks promising, and we expect to see continued growth in the coming years. Advances in battery technology, charging infrastructure, and regulatory frameworks are driving the adoption of electric trucks, and we are confident that this trend will continue. Our vision is to be a leader in sustainable transport solutions, and we will continue to invest in research and development to achieve this goal. We believe that electric trucks will play a key role in achieving our vision, and we are committed to making this a reality.

4.4 - Interview nr. 4

The interviewee has been working in the sales department for several years and has gained valuable insights into the industry. Their expertise lies in the area of electric trucks, and they have seen significant changes in this field during their time at work.

Challenges within the company in terms of infrastructure, charging time, and range

Infrastructure poses a significant challenge to the widespread adoption of electric trucks. The availability of a well-established charging network, particularly along frequently traveled trucking routes, is crucial. Improving charging time and range is also essential. To address these challenges, the company is actively investing in research and development to enhance battery technology. Additionally, the company is collaborating with strategic partners, such as Siemens, to develop innovative infrastructure solutions. A notable example is their ongoing testing of electric road systems in Germany, demonstrating the commitment to finding practical and efficient solutions for the future of electric trucks.

Politics, regulations, and investors' role in the development of electric trucks

The interviewee highlights that the development of electric trucks is heavily influenced by politics, regulations, and investors. Governments worldwide are setting targets to reduce carbon emissions, which is driving the shift towards electric trucks. Regulations around emissions and vehicle standards are also pushing the industry in this direction. Investors are also interested in supporting companies that are working towards sustainability goals. These factors are seen as important drivers for the development of electric trucks.

Previous forecasts about the future of electric trucks, have the goals been reached in recent years

According to the interviewee, the technical forecasts for the growth of the electric truck market have been accurate. They have observed an increase in demand for electric trucks and has been able to meet their production goals. They have made significant investments in the research and development of electric trucks and is confident in its ability to continue meeting the market demand in the future.

New innovations that have been developed in the industry, and how will they affect the market

They have developed several innovations in the automotive industry. For example, the company has recently launched a new generation of trucks equipped with advanced safety features, improved fuel efficiency, and driver comfort. In addition to this, they have also developed hybrid and electric models of their trucks, which are gaining popularity in the market. These innovations are aimed at meeting the evolving demands of the market and promoting sustainability.

Battery technology development over the years, impact on the development of electric trucks

Battery technology has had a significant impact on the development of electric trucks in recent years. With the advancement of battery technology, electric trucks can now achieve longer ranges and faster charging times, making them a more competitive option in the market. This evolution has reduced the reliance on fossil fuels and lowered emissions, providing sustainable solutions for customers who are increasingly conscious of their environmental impact. The company is committed to investing in research and development to improve battery technology

and explore new ways to make their electric trucks even more efficient and environmentally friendly.

Steps taken to address safety concerns of electric trucks

Safety is a crucial factor when it comes to electric trucks. Extensive research and development have been conducted to enhance the safety features of their electric trucks. A new feature has been introduced that allows the driver to monitor the battery level and temperature, which helps prevent any potential risks during the charging process.

Moreover, they have invested in the development of a sophisticated battery management system, which regulates the temperature and power flow within the battery pack, minimizing the risk of overheating and potential fires. The company has also partnered with leading safety organizations to ensure that their electric trucks meet the highest safety standards and are tested rigorously before they are put into operation.

Effect of charging time of electric trucks, solutions to develop even further

Reducing charging times is considered crucial to the widespread adoption of electric trucks. The company understands the importance of practicality for its customers, and they are constantly exploring new and innovative solutions. He says that one such solution is the development of smart charging infrastructure that allows for more efficient charging of multiple trucks simultaneously.

Furthermore, the company is collaborating with other companies and organizations to develop a comprehensive charging network across the regions where their electric trucks operate. This network will include public charging stations, as well as private charging facilities for their customers. The aim is to provide customers with a seamless charging experience, regardless of their location or the size of their fleet.

Competitors, and how to meet their threats and maintain in the market

Innovation is considered crucial to staying ahead in the market. The company is not only focused on electric trucks but also on developing other alternative fuels and powertrains, such as hydrogen and biofuels. They believe that a range of solutions will be necessary to meet the diverse needs of its customers.

In addition to established truck manufacturers, they also keep an eye on new entrants in the market, such as Tesla, who have announced plans to enter the electric truck market. However, they are confident that their years of experience and focus on customer needs will help them maintain their position as a leader in the industry.

The future of electric trucks in the industry, what developments to expect, company's visions

Electric trucks are viewed as the future of the transportation industry. Due to the increasing focus on sustainability and reducing carbon emissions, there is an ever-growing demand for zero-emission vehicles. The company is dedicated to taking a leading role in the transition to sustainable transport solutions and is continuously investing in research and development to improve the technology behind electric trucks.

With the continuous evolution of battery technology, it is expected that electric trucks will soon have even greater ranges and faster charging times, making them even more competitive with

diesel trucks. The development of infrastructure, such as charging stations and battery swapping stations, is also expected to accelerate, making it easier and more convenient for customers to adopt electric trucks.

Furthermore, government regulations and incentives are expected to push the industry towards more sustainable transportation solutions. With the ongoing transition towards a greener economy, there is optimism about the future of electric trucks. They are committed to taking a leading role in the development of sustainable transport solutions and being a part of this transition.

4.5 - Sales and Prognosis

In this study, the market for electric trucks was examined and how different companies are performing in terms of sales, deliveries, and forecasts for future growth. Data was collected from several different sources, including interviews with industry experts and analysis of the companies' financial reports.

The results show that the market for electric trucks has seen significant growth in recent years and that this is expected to continue in the future. Several companies have made significant investments in this technology and have seen increased sales and deliveries of electric trucks. Some of these companies are major players and include Tesla, BYD, Daimler, and Volvo Group. The forecasts for future growth in the market for electric trucks are very positive. According to a report by Research and Markets, the market is expected to grow at an annual growth rate of 18.7% between 2021 and 2028 (Research and Markets, 2021).

5. DISCUSSION

In this chapter, we will discuss and comment on the theory, methodology, and findings from our study on the factors influencing the development and adoption of electric trucks in the logistics industry. The research questions focused on identifying the key factors that affect the creation and adoption of electric trucks, the challenges associated with expanding usage, infrastructure, and battery technology, and the role of politics, regulations, and investors in the advancement of electric trucks. Additionally, the study explored the accuracy of previous technical prognoses about the future of electric trucks.

5.1 Challenges in the Transition to Electric Trucks

During our interviews, one of the primary challenges identified by industry experts is the lack of adequate charging infrastructure for electric trucks. This issue severely hampers the widespread adoption of electric trucks for long-haul transportation. Several companies expressed concerns about the limited availability of charging stations along major transportation routes, which affects the feasibility of incorporating electric trucks into their fleets. This challenge aligns with the findings of ACEA (2020), which emphasizes the need for a robust charging network to support the growing number of electric trucks on the roads.

Another significant challenge highlighted by the interviewees is the relatively long charging times for electric truck batteries. The extended charging duration reduces the operational efficiency of logistics companies, leading to potential productivity losses. Ambrose et al. (2020) also stress the importance of fast-charging technology to minimize downtime and improve the competitiveness of electric trucks in comparison to traditional diesel-powered trucks.

The driving range of electric trucks emerged as another crucial challenge in the transition to electrification. Companies reported concerns about the limited range of electric trucks, particularly when navigating long distances or adverse weather conditions. To address this limitation, further advancements in battery technology are necessary to extend the driving range and improve the overall performance of electric trucks. Sahoo & Ko (2019) echo this sentiment, underscoring the significance of continued research and development in battery technology.

Moreover, financial constraints have been cited as a challenge for some companies looking to transition to electric trucks. The higher upfront costs of electric trucks, particularly for long-haul applications, can be a barrier to adoption. Additionally, the uncertainty surrounding the return on investment for electric trucks poses challenges for decision-makers in the logistics industry. Government incentives and financial support can play a vital role in addressing these challenges and encouraging greater adoption of electric trucks.

5.2 Opportunities and Progress

Despite the challenges faced during the transition to electric trucks, there are substantial opportunities and encouraging progress in this domain. Technological advancements have played a pivotal role in enhancing the capabilities of electric truck batteries. Our interviewees praised the developments in battery technology that have led to higher energy density, resulting in longer driving ranges and improved performance of electric trucks. Brinkman et al. (2020) also acknowledge the positive impact of technological breakthroughs on the attractiveness of electric trucks to companies and investors.

Government policies and support have been instrumental in driving the adoption of electric trucks. Many companies highlighted the importance of financial incentives and subsidies provided by governments to promote the purchase and operation of electric trucks. ACEA (2020) further emphasizes that a supportive policy framework is essential to accelerate the integration of electric trucks into the transportation sector and achieve sustainability goals.

Private sector investments have also fueled the progress of electric trucks. Our interviewees expressed gratitude for the substantial investments made by private stakeholders to fund research and innovation within the electric truck industry. This financial support has facilitated technological advancements and increased the availability of electric trucks in the market. Helmreich (2020) reinforces the role of investors in driving the growth of electric trucks through financial backing.

Additionally, technological innovation has extended beyond battery improvements. Companies are exploring advancements in autonomous driving technology, which could enhance the efficiency and safety of electric trucks. The integration of autonomous features into electric trucks has the potential to revolutionize the logistics industry and further drive the adoption of electric trucks.

5.3 Sustainability Aspects

A critical aspect that emerged from our interviews and previous research is the sustainability of electric trucks. On one hand, electric trucks offer significant environmental benefits by reducing greenhouse gas emissions and air pollution compared to conventional diesel trucks (ACEA, 2020). The potential to mitigate the environmental impact of the transportation sector is a compelling reason to embrace electric trucks.

However, there are also sustainability challenges associated with the production and disposal of electric vehicle batteries. The extraction of rare and valuable minerals required for battery production can have adverse environmental and social implications. Proper recycling and sustainable sourcing practices are essential to address these concerns. Bertling & Ciftci (2021) highlight the importance of adopting environmentally responsible practices throughout the entire lifecycle of electric truck batteries.

To enhance the sustainability of electric trucks, companies are exploring innovative ways to reduce the carbon footprint associated with electric truck operations. Many companies are exploring the use of renewable energy sources to power charging stations, further reducing the environmental impact of electric trucks. By combining the advantages of electric trucks with renewable energy, the logistics industry can take significant strides towards achieving sustainability goals.

5.4 The Future of Electric Trucks

Looking ahead, the future of electric trucks appears promising as the industry continues to advance. The ongoing efforts to improve battery technology, charging infrastructure, and government support are expected to propel the widespread adoption of electric trucks in the logistics sector. Technological advancements will likely lead to more efficient and cost-effective electric trucks, driving their integration into fleets across various industries.

However, to achieve a successful transition to electric trucks, addressing the remaining challenges is critical. Governments and industry stakeholders must work together to expand the charging infrastructure and establish standardized charging protocols to facilitate seamless adoption. Moreover, continued investments in research and development are essential to enhance battery performance and overcome the current limitations in driving range.

To support the widespread adoption of electric trucks, collaboration among key stakeholders is essential. Public-private partnerships can accelerate the development of charging infrastructure and provide the necessary financial incentives to encourage companies to transition to electric trucks. Additionally, collaborations between governments, logistics companies, and technology providers can foster innovation and accelerate the deployment of electric trucks.

5.5 Concluding Thoughts

In conclusion, our interviews have provided valuable insights into the challenges and opportunities associated with the transition to electric trucks in the logistics industry. The identified challenges, such as charging infrastructure, charging times, driving range, and financial constraints, underscore the importance of collaborative efforts among governments, private companies, and research institutions to advance electric truck technology.

At the same time, the opportunities for electric trucks, including technological advancements, government support, private investments, and advancements in autonomous driving technology, offer promising prospects for a sustainable and greener future for the logistics sector. By leveraging the existing knowledge and building on the progress made so far, we can drive the successful integration of electric trucks into the transportation ecosystem and pave the way for a more environmentally friendly and efficient logistics industry.

5.6 Method discussion

The method discussion gives us the opportunity to review and discuss our study method. A strength of our study is that we conducted both a literature review and interviews with leading companies in electric trucks. This gave us a broad understanding of the subject and the ability to gather information from various sources. A weakness may be that our study did not include quantitative calculations, which may have limited our analysis of some aspects.

An important point to mention is that our study is limited to the logistics industry in Europe and does not include estimations. This means that our results may be specific to the geographical and industry context and may need to be considered when generalizing the results to other areas.

In terms of reliability, it is important to acknowledge that our study is based on existing research and interviews with selected companies. We have endeavored to use credible sources and have relied on information from reliable and well-established companies in the industry. We have also endeavored to provide a balanced view of the results and discuss potential biases or limitations that may have affected our findings. However, as with any research study, there may be other factors or variables that we have not accounted for, and our results should be interpreted with caution.

6. CONCLUSION

In this final chapter, we summarize the findings and conclusions drawn from our study, verify the purpose and research questions, and discuss the implications of our results. We also provide recommendations for further research and development in the field of electric trucks in the logistics industry.

6.1 Summary of findings

Our study aimed to identify the factors influencing the development and adoption of electric trucks in the logistics industry. Through a combination of a literature review and interviews with leading companies, we identified several challenges and opportunities associated with the electric truck technology. However, advancements in battery technology, charging infrastructure, and supportive policy measures and investments are creating opportunities to overcome these challenges.

We also found several critical factors influencing the development and adoption of electric trucks. These include the cost of electric trucks compared to traditional trucks, the availability and accessibility of charging infrastructure, and the limitations of battery technology, such as charging time, safety, and range. Furthermore, the study revealed that politics, regulations, and investors have a significant role in the advancement of electric trucks.

Our study has also highlighted the importance of considering ethical and environmental factors when introducing electric trucks. While electric trucks offer significant environmental benefits, the production and disposal of batteries and infrastructure can have negative environmental impacts. Therefore, it is crucial to prioritize the use of renewable energy and streamline the production and recycling of batteries and infrastructure.

The research also investigated previous technical prognoses and found that most predictions have been relatively accurate. However, advancements in technology have accelerated faster than anticipated, resulting in a more rapid uptake of electric trucks.

6.2 Implications for future research

Based on the findings of this study, the thesis concludes that there is a significant potential for electric trucks in the market, and further research is needed to address the challenges associated with their adoption. The study recommends future research to explore ways to improve charging infrastructure and battery technology while considering the role of politics, regulations, and investors in advancing the industry. Furthermore, efforts to reduce the cost of electric trucks must be prioritized to encourage greater uptake.

One area for future research is the economic feasibility of electric trucks. While electric trucks offer cost-saving benefits in the long run, the initial investment can be significant. Further analysis of the economic viability of electric trucks in different contexts and markets could provide valuable information for decision-makers and investors.

Another area for future research is the impact of electric trucks on the logistics industry and supply chains. As electric trucks become more prevalent, their impact on logistics operations, such as route planning and delivery times, needs to be understood. The integration of electric trucks with other transportation modes, such as rail and maritime, also warrants further investigation.

Finally, future research should also focus on the environmental and ethical implications of electric trucks beyond the production and disposal of batteries and infrastructure. For example, the impact of electric truck use on local air quality and noise pollution and the effects on the livelihoods of truck drivers need to be considered.

Overall, our study contributes to the growing body of research on the development and adoption of electric trucks in the logistics industry. By identifying the significant barriers and opportunities associated with this emerging technology, our study provides a foundation for further research and informed decision-making by stakeholders in the logistics industry and policymakers.

Overall, this research provides valuable insights into the critical factors affecting the development and adoption of electric trucks and highlights the need for continued research and development to drive the industry forward.

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