Revising Technology Strategies In The High-Tech Electric Vehicle Industry

A Case Study into the new Stationary charging station (SCS)
Case Company: Elonroad

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2023

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Abstract

Title	Revising Technology Strategies In The High-Tech Electric Vehicle Industry
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Keywords	*Electric Road System, ERS, Case study, Electrification, Electric Cars, Stationary charging station, Dynamic charging station, Evaluation, Technology, Elonroad.*
Background and problem	The master thesis background focuses on the growing demand for effective charging infrastructure in the EV sector and highlights the challenges faced by startups like Elonroad in launching new technologies. The problem addressed is navigating the complexities of introducing Stationary Charging Stations (SCS) technology in the EV charging market, particularly for startups.
Purpose	The purpose of this master thesis is to develop and suggest a model for adapting and revising the technology strategies concerning SCS based upon insights from relevant market and stakeholders.
Methodology	The research methodology involved an exploration approach, resulting in qualitative data collection. This included conducting interviews with main stakeholders, including Elonroads management and industry experts, to gain insights into the practical and strategic aspects of introducing SCS technology. The study also involved a thorough review

of academic articles, academic literature, and internal documents to support and enrich the empirical findings.

Results The research identified several Critical Success Factors (CSFs) for Elonroad's new SCS technology, categorized as technological innovation, strategic management, customer relations, compliance, certification, and operational efficiency. The SCS framework, providing a strategic guide for example startups and established companies in high-technology solutions in the EV charging industry and helping them identify their own CSFs

Introduction

In recent times, the shift towards electric vehicles (EVs) has gained remarkable momentum. This transformation is driven by the urgent need to reduce carbon emissions and combat climate change. As electric vehicles become more common, the focus has shifted towards developing effective and efficient charging solutions. This article delves into the intricate landscape of the electric vehicle charging industry, particularly examining the challenges and opportunities in stationary charging station technology.

Background

The electric vehicle (EV) industry is experiencing a surge in demand, largely due to increasing environmental concerns and advancements in technology. One critical aspect of this growth is the development of efficient charging infrastructure. It is recognized that for electric vehicles to be a viable alternative to traditional combustion engines, accessible and effective charging solutions are essential. The focus is increasingly turning towards innovative charging technologies, which promise to revolutionize how electric vehicles are powered.

Problem Discussion

Despite the excitement around electric vehicle technology, there are significant challenges, especially for startups entering this field. The primary issue lies in launching new and high-tech charging solutions, like Dynamic Charging Station (DCS) (Charging while driving). These technologies are complex and require careful navigation through technical, regulatory, and market challenges. Startups and established companies, such as the case company (Elonroad) in this study, face hurdles in establishing and expand their technologies due to these complexities. Understanding these challenges is crucial for the successful implementation and acceptance of such innovative charging solutions.

Sweden's commitment to reducing greenhouse gas emissions and advancing sustainable transportation is emphasized. By 2030, the nation targets a 70% reduction in transport emissions from 2010 levels and net-zero emissions by 2045 (Trafikverket, 2017). Electric vehicles (EVs) are crucial in achieving these goals.

The current infrastructure includes over 4,200 charging stations and 27,000 charging points (Energimyndigheten, 2020). To support the growing EV fleet, the Swedish government has allocated SEK 1.2 billion (approximately USD 130 million) for 2021-2030 to expand charging infrastructure (Government Offices of Sweden, 2020).

Furthermore, the master thesis discusses Sweden's exploration of electric roads, including the suspension of a planned first permanent electric road in the world due to cost overruns (Trafikverket, 2023). It underscores the market's uncertainty in adopting advanced technologies like Elonroad's dynamic charging stations (DCS). Elonroad's development of Stationary Charging Stations (SCS) is also mentioned as part of a strategy to prepare the market for DCS technology, secure financial stability, and demonstrate viability through a pilot project with Bring, aiming for broader adoption.

Main Purpose

Develop and suggest a model for adapting and revising the technology strategies concerning SCS based upon insights from relevant market and stakeholders.

This involves a detailed investigation into the requirements and conditions that enable the successful introduction and implementation of this technology in the market. The focus is on understanding the nuances of the EV charging industry and providing a clear guide for startups and other companies navigating this challenging yet promising industry.

Methodology

This master thesis adopts a methodology tailored to Elonroad's Stationary Charging Station (SCS) technology, combining interpretivist philosophy, exploratory research, and a case study strategy. These choices are based on the study's qualitative nature, focusing on sorting and categorizing qualitative data (Höst et al., 2006, p. 30-33).

Interpretivism is chosen to deeply understand the personal views related to SCS technology. It's ideal for examining social and human aspects of technology adoption, like stakeholder perceptions and decision-making processes.

The exploratory approach allows flexibility in researching the new and developing SCS technology, enabling the discovery of complex phenomena and contributing new insights in this evolving field.

The case study method provides a detailed examination of Elonroad’s SCS technology, offering a comprehensive view of its functionality, perception, and interaction with business and technological elements. This method helps to deeply understand the operational challenges and market responses to the SCS technology.

Interviews form the cornerstone of this exploration. A mix of internal and external interviews were conducted to gather diverse perspectives. Main stakeholders within Elonroad, including the CEO and CTO, shared their insights, while external voices like investors, customer and industry partners (Bring) added depth to the understanding of the market dynamics. These

conversations were designed to be open-ended, allowing a natural flow of information and minimizing bias.

The gathered data underwent a thematic analysis. By coding the interviews into categories like Technology, Business, and Partnerships, a clear picture emerged of the interconnected dynamics at play. This method helped in identifying the technical nuances, business strategies, and the importance of partnerships in the realm of SCS technology.

Together, these methods ensure the research comprehensively addresses the unique aspects of Elonroad's SCS technology, providing the depth and flexibility needed to develop a strategic roadmap for high-tech solutions in the EV charging industry.

Building the Theoretical Framework

The theoretical framework is a vital component, guiding the research towards meaningful conclusions. It's built upon a multidimensional understanding of innovation and commercialization in the high-tech industry. This framework is not just a collection of theories but a cohesive map that aligns with the study's main purpose and research questions.

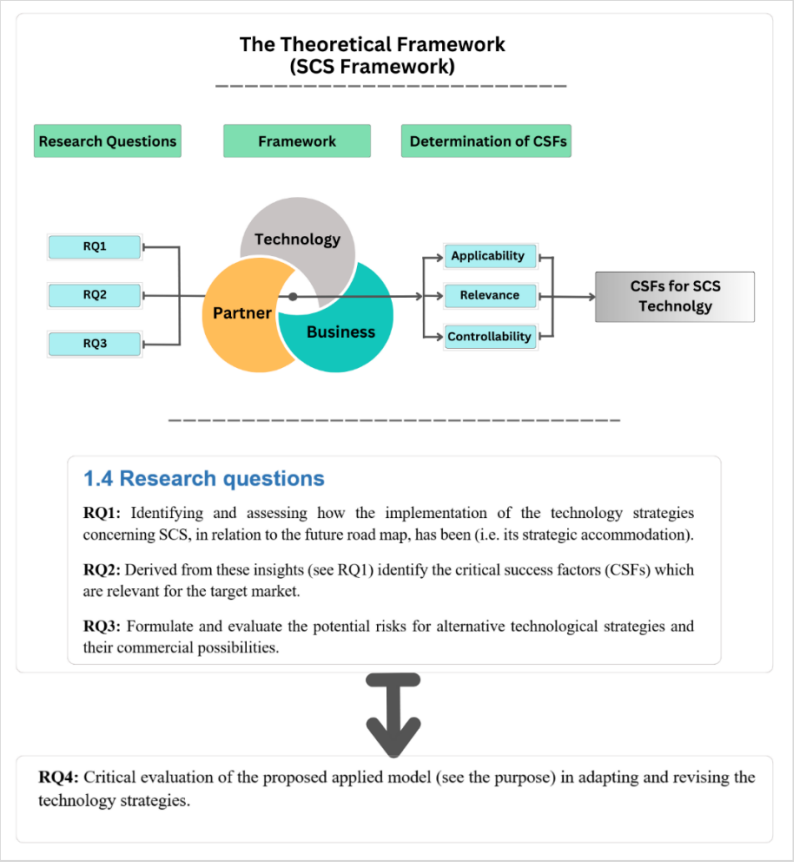

Figure 1: The SCS framework. This framework is to identify CSFs of a new high technology for startup companies within EV charging industry.

This SCS framework in Figure 1 starts with the research questions RQ1-RQ4 which are connected to the main purpose questions. These questions provide a structured pathway for exploring for example Elonroad's strategy and potential in the EV charging market.

The second step is that the framework categorizes critical success factors into three main areas: Technology, Business, and Partner. These categories represent the core aspects of Elonroad's journey, from technological innovation and business model viability to the significance of strategic partnerships.

Technology: This segment delves into Elonroad's technological prowess and future roadmap. It integrates theories like Technology Strategy and the Technology Acceptance Model, focusing on early adopters of SCS technology.

Business: Here, the study examines Elonroad's market strategy, customer relations, and overall business health using models like the Value-Proposition and SWOT analysis.

Partner: Recognizing the importance of collaborative efforts, this section explores Elonroad's external relations, emphasizing how partnerships contribute to the success of their SCS technology.

This last step for this SCS framework is to identify the critical success factor with help of three criteria: Applicability, Relevance and controllability for identification of CSFs as suggested by Rodrigues and Dorrego (2008).

Discussion and Conclusion

Critical success factors (CSFs) for Elonroad's Stationary Charging Systems (SCS) technology were found and discussed through the master thesis with help of the SCS framework. In the last step of the SCS framework was to identify the CSFs, based on Rodrigues and Dorrego's criteria: Applicability, Relevance, and Controllability. CSFs are the following (See Figure 2):

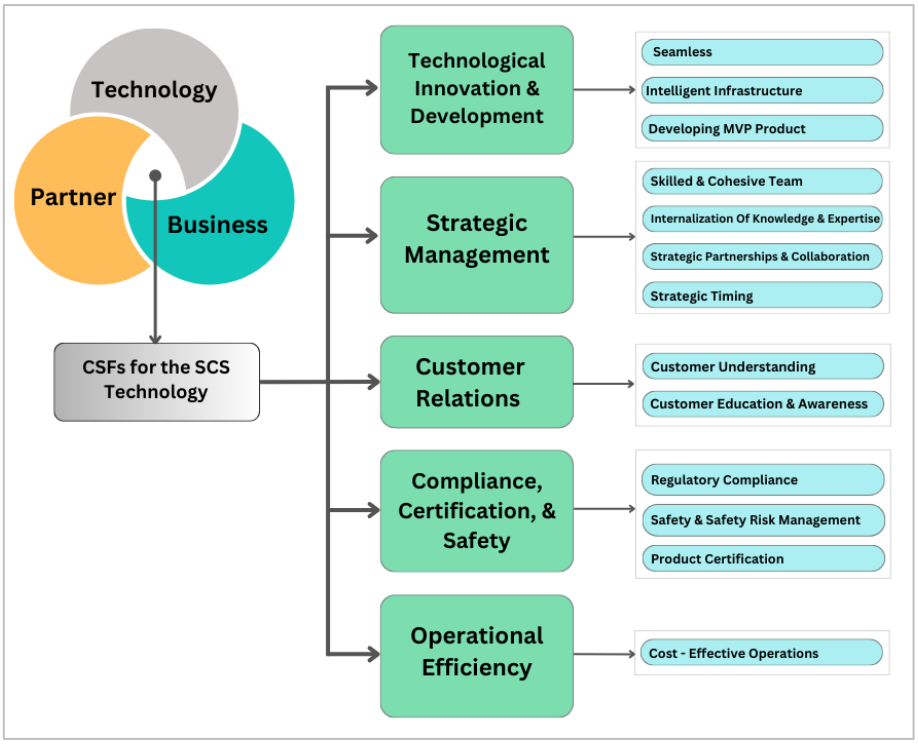

Figure 2: The critical success factors for Elonroad's new SCS technology.

- **Technological Innovation and Development:** The CSFs theory by Rodrigues and Dorrego (2008), emphasizes the importance of leveraging core competencies to meet market CSFs. Elonroad's focus on seamless integration, intelligent infrastructure, and developing a Minimum Viable Product (MVP) with customer feedback underlines its commitment to technological excellence, which is central to its core competencies and addresses the market's need for innovative charging solutions.

- **Strategic Management:** Organizations should develop strategies that leverage their strengths to meet market needs. Elonroad's strategic management approach, forming strategic partnerships, timing their market entry, and building a skilled team, are aligned with this premise. Moreover, internalizing knowledge and expertise is critical to maintaining the distinctive competencies required for competitive advantage.

- **Customer Relations:** Rodrigues' theory suggests that customer satisfaction is a key component of success. Thus, understanding customer needs and educating them about the product is imperative. Elonroad's emphasis on customer understanding and education addresses this requirement directly, aiming to satisfy and even anticipate customer needs.

- **Compliance, Certification, and Safety:** The CSF framework also indicates the necessity for regulatory compliance and safety management, which are applicable to all competitors in the industry and control possibilities for the company. Elonroad's focus on these areas ensures adherence to industry standards, which is essential for gaining customer trust and securing a competitive position.

- **Operational Efficiency:** Finally, the significance of distinctive strategies based on the critical functional areas. Operational efficiency and cost-effectiveness are essential to Elonroad's strategy, ensuring that it can deliver value to customers and stakeholders more effectively than its competitors.

Two factors, Standardization and Consumer Perception, are excluded from criticality due to their lack of controllability, as they are influenced by external forces. Overall, the success of Elonroad's technology hinges on these strategically chosen and controlled factors.

Effectiveness for Customers:

The SCS technology potentially offers an effective solution for both existing and potential customers. It addresses limitations of conventional charging methods and integrates seamlessly with existing EV infrastructure, making it an attractive option. However, continuous optimization and alignment with industry standards and customer preferences are necessary.

SWOT Analysis:

Strengths of Elonroad's technology include innovative design, strategic team expertise, and a commitment to sustainability. Weaknesses involve its small size and limited resources, among others. Opportunities arise from the global shift toward electric roads and the demand for automated charging solutions, while threats include competition and regulatory uncertainties.

Strategic Partnerships:

Partnerships with vehicle manufacturers, logistic companies, government agencies, and research institutions are crucial for the development and scaling of the SCS technology.

Risk Areas:

Significant risks include safety concerns, the need for synergy between electric roads and SCS, attracting investors, standardization of another technology, and uncertain market trends. A strategic approach addressing these risks is essential for the long-term success of the SCS technology.

Contribution to the Academia and Industry

This master thesis significantly contributes to both academic research and the EV industry, especially in developing a model for adapting and revising technology strategies for startups with Stationary Charging Station (SCS) technology.

1. Adaptable Model for Technology Strategy - SCS Framework (Figure 1)

The creation of the SCS Framework marks a key academic contribution. Illustrated in Figure 1, this framework is designed to assist startups and established companies in adapting and

revising their technology strategies, particularly for high-tech solutions like SCS. It acts as a comprehensive guide, helping both academics and industry practitioners to understand and implement effective technology strategies within the EV charging domain. Furthermore, the adaptability of this framework allows for its application to other high-tech startups in the same industry, provided the research context is appropriately adjusted.

2. Flexible Approach to Identifying CSFs for SCS Technology (Figure 2)

Another major contribution is the identification of adaptable Critical Success Factors (CSFs) for SCS technology, as detailed in Figure 2. These factors, being dynamic and modifiable, are pertinent to any startup employing similar high-tech solutions in the EV charging sector. Startups can use this framework to choose and evaluate their own CSFs, based on the criteria outlined by Rodrigues and Dorrego (2008), as shown in the final part of Figure 1 and Section 4.2.1. This flexible method of pinpointing CSFs allows for a wider applicability among various startups in the EV charging industry, increasing their chances of success in a competitive environment.

In summary, these contributions not only add valuable insights to academic literature but also offer practical tools and frameworks that can aid startups and other companies in the EV charging industry. They provide a foundation for further research and application in the field, emphasizing the importance of aligning technology development with business models and strategic partnerships for successful implementation.

Suggestions for Further Research and Practices

1. **Exploring Market Adaptability:** Future studies could explore how the SCS framework applies to other high-tech startups and established companies outside the EV charging industry, testing its adaptability in different technological contexts. Startups could use these insights to modify their business models for various market segments.

2. **Long-Term Studies on CSFs:** Researching how critical success factors evolve over time would provide insights into their dynamic nature in fast-changing high-tech markets. This information could help startups in the EV sector update their strategies and operational models as market needs and technology change.

3. **Technological Standardization:** Investigating the challenges and opportunities in standardizing technologies like SCS within regulatory frameworks would be beneficial. Businesses can use these insights to effectively navigate regulatory industry.

4. **Customer Behaviour and Preferences:** Studies on customer behaviour in relation to new EV charging technologies would improve understanding of market demands. These studies can inform customer-focused product development and marketing strategies.

These recommendations aim to extend the thesis's findings, bridging the gap between theoretical research and practical application, and providing actionable insights for startups in the high-tech EV industry.

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