



Vaasan yliopisto
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**Consumer Preferences for Western and Chinese
Battery Electric Vehicles (BEVs) From the perspective
of Strategic Business Development in Finland**

School of Management
Master's Thesis in Strategic
Business Development

Vaasa 2025

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Year of Completing the Master's Thesis:	2025
Pages:	92

ABSTRACT

Sähköautot valtaavat jatkuvasti markkina-alaa ja niitä kehittävien länsimaisten sekä kiinalaisten autovalmistajien kilpailu syvenee. Kuluttajat ovat tässä avainasemassa, sillä heidän mieltymystensä ymmärtäminen on tärkeää optimaalisen myyntistrategian luomiseksi. Tutkimuksen tavoitteena on ymmärtää kuluttajamieltymyksiä länsimaisiin ja kiinalaisiin sähköautoihin liittyen suomalaisessa markkinaympäristössä sekä miten kilpailukykyisinä tuotteet näyttäytyvät suomalaiselle kuluttajalle. Tutkimuskysymysten kautta tarkastellaan, kuinka suomalaiset kuluttajat kokevat läntiset ja kiinalaiset sähköautot sekä kuinka tämä mielikuva vaikuttaa sähköautojen käyttöönottoon ja kilpailukykyyn Suomessa. Tämän lisäksi kuluttajien mielikuvaan vaikuttavat tekijät ovat tutkimuksen keskiössä.

Tutkimuksen viitekehys perustuu pääteorian toimivaan sosioteknisten siirtymien teoriaan sekä pohjoismaisten sähköautojen esteiden ja muiden kuluttajien aikomuksiin vaikuttavien viitekehysten sosiotekniseen verkostoon. Sosioteknisten siirtymien teoriaa käsitellään sähköautojen sosioteknisten siirtymien, kuluttajien roolin sekä kuluttajien aikomuksiin vaikuttavien muuttajien kautta. Pohjoismaisten sähköautojen esteiden ja muiden kuluttajien aikomuksiin vaikuttavien viitekehysten sosiotekniseen verkostoon sisältyvät liikenteen sosiotekninen järjestelmä, suunnitellun käyttäytymisen teoria (TPB), innovaatioiden leviämisen teoria (DOI) sekä teknologian hyväksymismalli (TAM). Tutkimusteemat ja -kysymykset pohjautuvat pohjoismaisten sähköautojen esteiden ja

muiden kuluttajien aikomuksiin vaikuttavien viitekehysten sosiotekniseen verkostoon sekä tieteellisiin ja muihin lähteisiin. Tutkimusaineisto kerättiin avoimilla haastatteluilta ja suljetuilla kysymyksillä täydennettiin vastauksia. Aineisto analysoitiin temaattisella analyysillä.

Tutkimus osoittaa, että suomalaiset kuluttajat kokevat läntiset ja kiinalaiset sähköautot positiivisesti. Läntisiä sähköautoja pidetään luotettavimpina, teknologisesti edistyneimpinä ja laadukkaampina. Kiinalaiset sähköautot nähdään mielenkiintoisina, mutta tuntemattomina. Positiivinen mielikuva lisää sähköautojen käyttöönottoa ja kilpailukykyä. Eniten mielikuvaan vaikuttavia tekijöitä ovat demografia (sähköautoystävällinen sijainti), olosuhteet (latausinfrastruktuurin saatavuus), psykologia, kokemus ja hedoniset motivaatiot (miellyttävä kuva sähköisestä ajamisesta), talous (ostohinta, sähkön hinta ja huollot), politiikka (hankintatuki ja sähköautomyönteinen politiikka), sosiaaliset ja symboliset kannustimet (muiden mielipide), teknologia (kiinnostus uutuuksiin) sekä ympäristötekijät ja toiminnan havaittu kollektiivinen tehokkuus (ympäristöystävällisyys).

KEYWORDS: Battery electric vehicle, consumer preference, Western and Chinese, competition, strategic business development, Finland

1. INTRODUCTION

1.1. Motivation for the study

Battery electric vehicles (BEVs) are completely electric means of transport that utilize large-capacity batteries to operate the electromotor and electronic components with chemical energy. An internal combustion engine (ICE) is not needed. The mitigation of CO₂ emissions of light-duty vehicles (LDVs) and the reliance on non-renewable energy transportation is achieved through battery electric vehicles (BEVs) (Andwari, Pesiridis, Rajoo, Martinez-Botas, and Esfahanian, 2017; Goel, Sharma, and Rathore, 2021). Herrmann and Rothfuss (2015) state that BEVs have a forceful electromotor and appropriately sized battery system without an ICE, petrol tank, or exhaust. Charging is conducted via the electrical grid or recuperation. In addition, it is claimed that the technical features of the electromotor or the battery capacity can noticeably differ as there are many vehicle concepts for fully electric vehicles. The authors allege that the battery capacity of the latest compact cars is approximately 15–25 kWh, while premium vehicles can include a battery system of 60 kWh or more (Herrmann & Rothfuss, 2015).

Meanwhile, Friel (2014) defines BEVs as having a battery for driving force without the help of an ICE, whilst being the opposite of hybrid vehicles. However, the author highlights that BEVs share many of the characteristics of the plug-in hybrid vehicle battery, which is the need to accept regenerative braking as a charging mechanism while also charging from a stationary power line. The BEV battery management system is described as comparable with the hybrid vehicle except for its larger capacity and voltage. These add complexity to the design and safety considerations while necessitating the basics of supervision, measurement, calculation, conversing, and commanding (Friel, 2014).

What we know about the topic is that, at least in Europe, the electric vehicle market continues to grow while customer expectations evolve, which makes electric vehicles no longer a niche business. However, Chinese brands have a low recognition in Europe, while domestic products are the most preferred option, according to McKinsey and Company (Venus, Schaufuss, & Möller, 2024). In turn, the Finnish charging operator Virta Global (2024) highlights in their report that the number of BEVs is growing consistently in most of Europe (besides Germany after eliminating government incentives). It is noted that for the year 2023, of the worldwide BEV sales, the European market represented 2.4 million sales at 25%, while China had 3.2 million sales (Virta Global, 2024). It is highlighted that the rising numbers indicate rigorous European carbon dioxide criteria, including new cars and vans having zero emissions in 2035, government incentives, and tax perks in larger markets. Virta Global (2024) mentions The 2024 Global EV Outlook report (International Energy Agency, 2024), where Norway (BEVs constituted 95% of automobiles vented), Sweden (60%), and the Netherlands (30%) are listed as the greatest European BEV locations (Virta Global, 2024). Meanwhile, in the acquisition of BEVs, Fuels Institute/Ricardo Strategic Consulting (2021) states that businesses evaluate the “Total cost of ownership (TCO)” and “payback period” (Fuels Institute/Ricardo Strategic Consulting, 2021, p. 2) as primary decision-making tools, while knowledge of the product, supply, and cost have a definitive impact on the acquisition process and the probability of its success in business applications. In the consumer context, the author claims that the purchase of BEVs is affected by many factors, including the quantity of offspring, family salary, journey length, area, housing style, and age factors (Fuels Institute/Ricardo Strategic Consulting, 2021).

However, the topic must be explored in this thesis because the availability of studies conducted, especially in Finland, on consumer opinion of Western and Chinese battery electric vehicles (BEVs) is low. The factors influencing the choice of the Finnish customer may differ from other Nordic countries due to differences in culture, climate, battery electric vehicle (BEV) policy, purchasing power, infrastructure, and many other factors. In

addition, Chinese battery electric vehicles (BEVs) are still in new and unknown territory for most Finns, and thus, exploring the consumer opinion relating to these products is especially interesting. It can be compared whether the factors influencing the adoption of battery electric vehicles (BEV) are similar to those of other markets. The report by Deloitte (2024) could be an essential basis for this comparison, as it presents various consumer factors. The report's key findings are that the BEV industry is challenged by a collection of difficulties, including the lack of chargers, slow charging, and the fear of sufficient battery capacity, all hindering BEV adoption. In some geographical regions, purchase intention is impeded by the unfavorable vehicle market and financing environment. Authorities and the vehicle manufacturing industry have noted the situation but have failed to respond effectively, as the effect of national BEV consumer stimulus packages and discounts from manufacturers have been insufficient compared to the difficulties in BEV adoption (Deloitte, 2024).

In addition, it is stated in the report that consumers might consider moving between different manufacturers, while geography impacts the factors for customer choice. The writer asserts that cost is the key attribute in developed economies, such as Japan, the US, and Germany. Meanwhile, in India, quality is highlighted. In South Korea and China, performance is stated to be paramount. It is claimed that connectivity features are risks for automakers due to the chance of not being profitable despite increased consumer interest. The writer notes that these features include maintenance updates, road accident prevention, and recommendations for safer journeys. Nevertheless, the writer claims that consumers in developed economies are reluctant to make additional payments when facing connected technologies. The authors highlight additional education's role in mitigating these worries while indicating that vehicle subscriptions attract younger clients (Deloitte, 2024).

Economic concerns affect younger consumers in many markets, where they prefer a subscription model over vehicle ownership. Still, concerns about vehicle availability, total ownership cost (TCO), and the perception of higher monthly fees are maintained (Deloitte, 2024). The factors contributing to the mainstream adoption of battery electric vehicles (BEVs) have also been addressed in multiple academic papers (e.g., Bryła, Chatterjee, & Ciabiada-Bryła, 2023; Li, Long, Chen, and Geng, 2017; Liao, Molin, & van Wee, 2017).

Especially the competition between Western and Chinese battery electric vehicles (BEVs) and their market dynamics in Finland can be an essential topic to research since Chinese battery electric vehicles (BEVs) and vehicle manufacturing have evolved significantly recently, which changes market dynamics as Western manufacturers are forced to re-evaluate their business strategies (Paba, 2022). Also, the role of battery electric vehicles (BEVs) or electric vehicles (EVs) as the vital alternative to internal combustion engine (ICE) vehicles for the transition towards a carbon-free world is a significant theme (Noel, Zarazua de Rubens, Kester, & Sovacool, 2020), while their role in the realm of socio-technical transitions is also recognized (Noel et al., 2020; Geels, 2019; Corradi, Sica, and Morone, 2023). The research context is the consumer opinion, uptake of BEVs, and competition between Western and Chinese battery electric vehicles in Finland. Academic articles are the primary source of information in this thesis, as these can be considered scientific and reliable sources. Qualitative research methods or interviews will be used as the primary research tools as these will provide the most meaningful, relevant, and latest data available. The benefits and theory of qualitative research and interviews have been discussed by other authors as well (e.g., Britten, 1995; Kallio, Pietilä, Johnson, & Kangasniemi, 2016).

The topic is justified as it is a recent and essential topic that requires further research in the future. It can be stated that electric mobility and its changing market dynamics affect everyone, and electrification is a megatrend.

There are significant research gaps that are based on research by Li et al. (2017), Mandys (2021), Wicki, Brückmann, Quoss, and Bernauer (2023), Noel et al. (2020), and Paba (2022). First, the papers have a geographical bias, which justifies the study conducted in Finland to see if the factors also work here. Only Noel et al. (2020) focus on the Nordics; thus, we require more research on this geographical area, especially Finland, as it might differ from other Nordic markets. There are multiple studies in the US, Germany, Australia, China, Korea, and China, but the works focusing on Finland and the Nordics are limited. Therefore, we need more data and research for this geographical area to see if consumer behavior toward adopting battery-electric vehicles is similar in Finland and other Nordic countries or markets. Each study focuses on different geographical areas, as Li et al. (2017) focus on the US, Germany, Australia, China, and Korea. Mandys (2021) focuses on the UK market, Noel et al. (2020) emphasize Nordic countries, Wicki et al. (2023) have a global perspective but focus only on English-language studies, and Paba (2022) highlights China and the Western market. Secondly, only Paba (2022) considers the Chinese battery electric vehicles (BEVs) and their competition with Western alternatives. He only highlights the rapid pace of Chinese innovation and the shift in market dynamics, which the other research papers do not address. Thirdly, most sources are from previous years, which might have some outdated content due to the swiftly changing nature of the battery electric vehicle (BEV) field and consumer preferences. Therefore, gathering and analyzing the latest information to match the pace in this constant innovation continuum can be considered critical.

1.2. Research gap

This study aims to better understand the consumer preferences for Western and Chinese battery electric vehicles (BEVs) in the Finnish market and how competitive the products are for the Finnish consumer. This research opportunity will be reached by answering the following research questions:

1. How do Finnish customers perceive Western and Chinese battery electric vehicles (BEVs), and how does this perception impact the adoption and competitiveness of these products in the Finnish market?
2. What factors influence Finnish customers' perception of Western and Chinese battery electric vehicles (BEVs)?

The challenges for this academic work are ethics in the production process of BEVs, geopolitical tensions affecting the availability of raw materials and swiftly evolving technology, which can make inventions outdated.

1.3. Research problem and theoretical contribution

The research question is answered via qualitative research methods or interviews which are justified by Villiers, Faroog, and Molinari (2022), Britten (1995), Hammarberg, Kirkman, and de Lacey (2016), DiCicco-Bloom and Crabtree (2006), Fossey, Harvey, McDermott, and Davidson, (2002), Adhabi and Anozie (2017), and Minhat (2015). The aim of the study will be reached by conducting interviews or qualitative research to produce high-quality and relevant data.

Similarly to Villiers et al. (2022), wealthy, in-depth data is collected. This happens via face-to-face and telephone interviews (Gillham, 2005; Shuy, 2003; Villiers et al., 2022).

Meanwhile, Britten (1995) states that interviewing is used due to its flexibility and role as a powerful tool that can open many new areas for research and enable the investigation of relevant research questions (Britten, 1995).

In turn, the research of Hammarberg et al. (2016) is harnessed in this thesis. The author employs qualitative techniques to address inquiries from the speaker's viewpoint on attitude, encounters, and significance, which are deemed unsuitable for measurement or quantification. The author uses procedures such as “analysis of texts and documents” (Hammarberg et al., 2016, p. 499) (such as internet pages, official documents, journals, or media articles to absorb shared or confidential information) and thorough interviews (for comprehending an incident from a personal perspective) (Hammarberg et al., 2016).

Qualitative techniques are harnessed in this thesis, similar to Fossey et al. (2002), to examine inquiries focused on comprehending the significance and knowledge of human existence and social environments. Likewise, in qualitative studies, quality standards link to ethical principles (Fossey et al., 2002). In addition, extensive and pedantic interviews can offer profound and wealthy data from personal experiences due to being more appreciated, ordered, and applied more conspicuously in the professional setting (Adhabi & Anozie, 2017; DiCicco-Bloom & Crabtree, 2006).

Structured interviews are applied similarly to the research of Adhabi and Anozie (2017), as it is claimed that qualitative interviews are not devoid of organization (Jamshed, 2014), which the interviewer completely controls, allowing the interviewee less flexibility and freedom (Stuckey, 2013). Equivalent to employment interviews, structured interviews are used in this study with brief questions and direct answers. The interviewees are expected to provide short and frank answers, while the researcher has to follow specific rules (Stuckey, 2013). This thesis's author will follow the inquiries' format and order. When clarifying their answer, it is guaranteed that no one can respond to others' inquiries. Stuckey

(2013) stresses that the role of the interviewer is not to imply, conform, or argue with the interviewee (Adhabi & Anozie, 2017). Minhat (2015) underscores the ability to process the purpose and intention of the study for open-ended questions. Also, the writer highlights collecting the maximum amount of information about the phenomenon under research via effective queries (Gill et al. 2008). It is noted that during the interview, open-ended (specifically, necessitating beyond a yes or no reply), comprehensible, personal, and unbiased inquiries are to be applied (Minhat, 2015).

The theoretical contribution of this thesis is that this academic work will gather the most up-to-date data from the Finnish battery electric vehicle (BEV) consumer preferences that have not been researched widely. In addition, consumer preferences for Chinese BEVs present interesting research phenomena, as these are new to the global and Finnish markets alike. Additionally, the managerial implications are that the whole battery electric vehicle (BEV) industry and policymakers can gain relevant and latest information for the field of battery electric vehicles (BEVs) and consumer preferences in the Finnish market. Therefore, all the stakeholders can inform their decisions based on reliable data directly from consumers and experts in the industry.

1.4. Thesis structure

The thesis will be structured based on five main chapters. After the introduction, Chapter 2 presents the conceptual framework based on a literature review. Next, Chapter 3 introduces the methodology of this thesis. The methodology will act as the basis for the interview process by presenting the overall research strategy and method, case selection, data collection, and data analysis methods. Meanwhile, in Chapter 4, the study's findings are introduced and summarized. Finally, Chapter 5 reviews and compares the findings and their theoretical and managerial implications and presents suggestions for future research and limitations of the study.

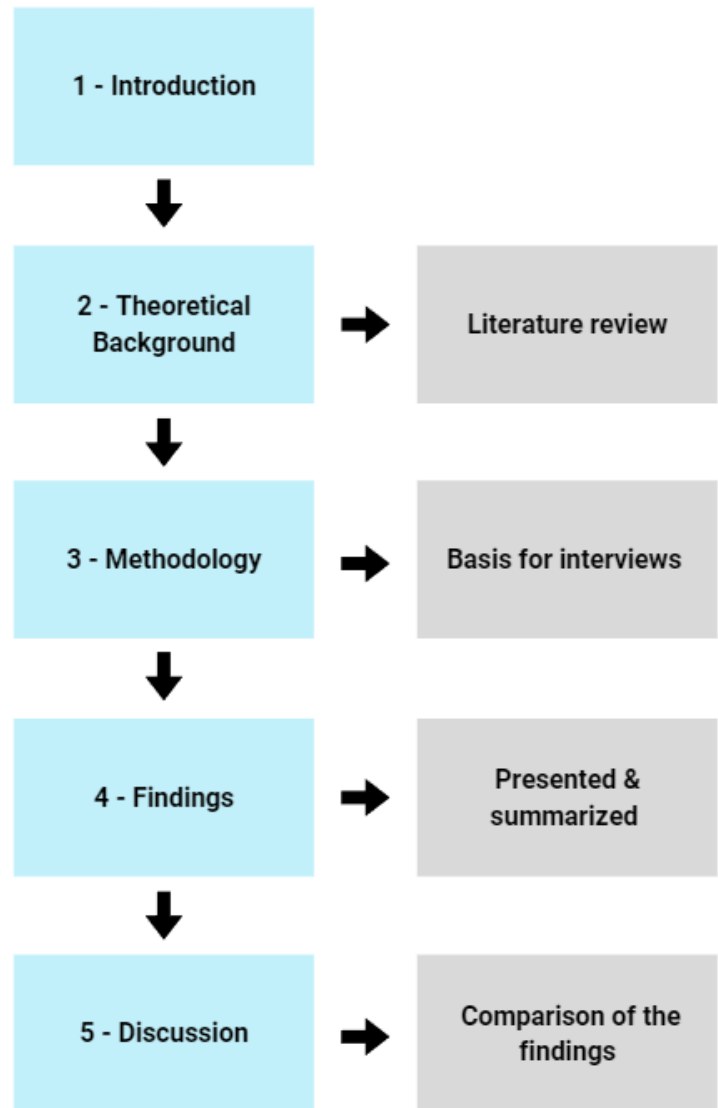


Fig 1. The visualization of the thesis structure.

2. THEORETICAL BACKGROUND

2.1. Socio-technical transitions of battery electric vehicles (BEVs)

The term socio-technical transitions relates to the studies of innovation research at the beginning of the 21st century. Various historical case studies of transitions (in the areas of agro-food, hygiene, music, heating, power, and water) have tested and polished the theory which has been used in the studies focused on current and forthcoming sustainability transitions (for example, city transportation, green electricity, biomass-based district heating, battery electric vehicles, agro-ecology, and plant-based milk) (Geels, 2019). Meanwhile, the author also defines transitions as sustainability transitions, which are relevant due to the systematic environmental challenges with multiple causes. Within an organized perspective, the theory is inspected through three core structures: “the socio-ecological”, “the socio-economic”, and “the socio-technical” (Corradi, Sica, and Morone, 2023, p. 2). The socio-technical approach is highlighted as the current research approaches the topic from that viewpoint (where the “socio-technical system” is conceived as an organization of factors containing regulation, culture, technology research, infrastructure, customer habits, and business). It is stated that these processes aid society through energy, transportation, heating, agri-food, garbage disposal, housing, electricity, and water. These are influenced by the manufacturers and consumers in the economic system and by the interplay between organizations, infrastructures, expertise, collaboration of involved parties, and artifacts. It is noted that the “socio-technical” approach sees transitions as multifaceted, sustained, and essential transition mechanisms. Adopting eco-friendly creation and consumption is achieved via accustomed socio-technical systems (Corradi et al., 2023).

However, in the setting of BEVs, Geels (2019) states that socio-technical transitions can be inspected via the Multi-Level Perspective (MLP), which examines the significant

transformations (within accommodation, transportation, energy, and agro-food) required in handling enduring environmental issues. It is claimed that the viewpoint may be included in the comprehensive scholar argument about ecological transitions, with critiques and seven latest developments of the MLP in seven types (government policy and authority, social climate deliberation and definition of difficulties, community-based creativity, several adaptation routes, incumbent firm resistance and change of direction, disorganization, and deterioration, and policy assessment).

In understanding the more extensive social studies, the author highlights that these elaborations have refined and diversified the comprehension of socio-technical transformations to eco-friendliness and developed the MLP into the core element of a versatile, progressive study initiative besides an extensive evidence-based foundation (Geels, 2019). Furthermore, Corradi et al. (2023) harness the MLP standpoint, investigating the actions of the road-based transport industry participants by exploring obstructions to the move regarding electrical transportation. The writers emphasize “regime actors” (Corradi et al. 2023, p. 1) or every customer (motorists), field participants (automakers and distributors), legislators, and civilian population (residents, non-profit organizations, employees, labor unions, and ecological groups) at the position of governance. The researchers underline these partakers as steadiness enforcers of the socio-technical system while open to change. The authors claim that these partakers can promote the transformation by advocating for a change strategy that aligns with their preferences, and reassessing their actions is critical to enable an administration transition (Corradi et al., 2023).

Overall, it is claimed to be possible to perceive that socio-technical transformations of BEVs include the “Radical technical innovation” and “Mobility” (Corradi et al., 2023, p. 190) groups beside hydrogen (plug-in) hybrid and biofuel road vehicles (Geels, 2019). This declaration is promoted by Corradi et al. (2023) on the topic of BEV transformation, with

four classifications of regime participants in the road transportation network: (i) customers (f.e., motorists), (ii) field partakers (f.e., automakers and vendors), (iii) lawmakers, and (iv) civilian communities (i.e., civilians, laborers, and employee associations of the motor vehicle sector, ecological and customer associations, and nonprofit organizations). Such groups depict the background conditions, demand and supply aspects, and policy formulation in the automobile industry. Through key elements, the research explores the BEV usage patterns of all sections of participants. It is stated that multiple research papers analyze personal populations, mental determinants, individual standards, and societal rules that can affect buying patterns (Corradi et al., 2023).

Likewise, in the academic work of Corradi et al. (2023), Rezvani, Jansson, and Bodin (2015) recognize five elements that are “contextual”, “technical”, “social”, and “individual” factors, and “financial dis/incentives” (Corradi et al., 2023, p. 3; Rezvani et al., 2015). “Contextual factors” include “charging infrastructures and financial and nonfinancial incentives provided by public policies” (Corradi et al. 2023, p. 3; Rezvani et al., 2015). “Technical factors” encompass “charging time, battery range, low noise, acceleration, low environmental pollution, safety, and vehicle-to-grid integration” (Corradi et al. 2023, p. 3; Rezvani et al., 2015). “Social factors” contain “conformity to social norms within descriptive norms (i.e., what a person believes a member of the reference group does)” (Corradi et al. 2023, p. 3; Rezvani et al., 2015), “injunctive norms (i.e., what is approved and disapproved in a group)” (Corradi et al. 2023, p. 3; Rezvani et al., 2015), and “subjective norms (i.e., perceived expectations of others)” (Corradi et al. 2023, p. 3; Barth, Jugert, and Fritsche, 2016; Rezvani et al., 2015); “personal norms and moral obligations” (Corradi et al. 2023, p. 3; Jansson, Nordlund, and Westin, 2017; Rezvani et al., 2015); “perceived collective efficacy of a certain action (i.e., when an action performed collectively has a significant general effect)” (Corradi et al., 2023, p. 3-4; Rezvani et al., 2015); “information conformity and the influence of opinion leaders” (Cherchi, 2017; Corradi et al., 2023, p. 4; Rezvani et al., 2015), and “status-seeking and symbolic motivations” (Corradi et al., 2023, p. 4; Rezvani et al.,

2015). Meanwhile, “individual factors” entail “psychological traits such as openness, responsibility, environmental concern, innovativeness, lifestyle, and self-perception” (Corradi et al., 2023, p. 4; Morton, Anable, and Nelson, 2016; Rezvani et al., 2015); “socio-demographic characteristics” (Corradi et al., 2023, p. 4; Rezvani et al., 2015; Sovacool, Kester, Noel, and de Rubens, 2018); “level and kind of EV experience” (Corradi et al., 2023, p. 4; Rezvani et al., 2015; Schmalfuß, Mühl, and Krems, 2017), and “hedonic motivations (i.e., pleasure experienced when driving an EV)” (Corradi et al., 2023, p. 4; Rezvani, Jansson, and Bengtsson, 2018; Rezvani et al., 2015). Lastly, “financial dis/incentives” comprise “purchase price”, “life cycle costs”, and “recharging costs” (Corradi et al., 2023, p. 3, Rezvani et al., 2015, p. 3).

In their academic work, the factors identified by Rezvani et al. (2015) are observed in the interviews which are contextual (conversations about charging infrastructure and government economic and non-economic benefits), technical (time spent charging, battery distance, quietness, rapidness, environmental friendliness, and road protection), social [compliance with societal standards in depictive (influence of the cohort), directive (endorsement of the cohort), perceived social standards (assumed beliefs of others) (Barth, Jugert, and Fritsche, 2016), individual standards and ethical commitments (Jansson, Nordlund, and Westin, 2017); assumed group impact of an activity (for example, as a cooperative activity produces a meaningful result); prestige and emblematic reasons) as BEVs are viewed positively due to their environmental benefits and modern technology], personal elements [such as accountability, ecological awareness, ingenuity, living style, and self-image (Morton, Anable, and Nelson, 2016) (BEVs being considered as trendy and possibly a reflection of their persona and lifestyle), familiarity with BEVs (Schmalfuß, Mühl, and Krems, 2017), and pleasure-driven incentives (BEV driving delight)], and monetary benefits (acquisition and total cost of ownership and servicing, charging, and repair costs) (Corradi et al., 2023; Rezvani et al., 2015).

2.2. The role of consumers in socio-technical transitions

Predominantly, the influence of customers in socio-technical transformations refers to the circumstances of cultural purpose, including technologies, customer habits, attitudes of culture, government policy-making, infrastructures, market strategies, and exchanges (Geels, 2019). In addition, the writer highlights that invention may occur in buyer inclination as customers cultivate breakthroughs and change them from uncommon to common items rooted in the customs and exercises of daily life (Lie and Sørensen, 1996). Positive cultural attitudes are also essential to aid valid inventions and increase assistance. It is stated that inventions could be challenged by cultural groups encountering negative ramifications or considered inadequately advised in the decision process. It is noted that such disagreement may cause arguments and deadlocks, impeding future advancements in the form of biofuels, land-based wind generators, and CO₂ capture and containment (for a few countries) (Devine-Wright, Aas, Sovacool, Labelle, and Batel, 2017; Geels, 2019).

Geels (2019) declares that solving constant and deteriorating ecological issues (such as global warming, decline of resources, and ecosystem degradation) demands essential alterations of these structures, which are conceptualized as socio-technical since the completion of civic duties includes positioned customer habits, technologies, cultural significance, infrastructures, government regulations, operational strategies, and marketplaces (Elzen, Geels, and Green, 2004). The MLP emphasizes breakthroughs and comprehending socio-technical transformations by various social groups (e.g., companies, customers, media, public campaigns, financiers, legislators, and scholars), participating in different undertakings (for example, investigation, education, objective planning, discussion, bargaining, the battle for control, dispute, funding, and alliance formation) within the boundaries of guidelines and establishments (containing philosophies and standards) via merging thoughts from economic evolution, innovation sociology, and new institutionalism (Geels, 2019; Geels, 2004; Farla, Markard, Raven, and Coenen, 2012;

Fuenfschilling and Truffer, 2016). Interim, Verhees, and Verbong (2015) consumers' contribution in sustainability transformations. They state that the varied structures and models in transition research render it exceedingly difficult to arrive at some comprehensive and unifying declaration for participant, customer, and resident engagement methods and interactions. The authors' second goal is less ambitious as they aim to synthesize a typology of user, consumer, and citizen roles. The (partly) automated content analysis tools offered by T-LAB are stated to provide significant assistance in uncovering 'hidden dimensions' (i.e., axes) and 'themes' (i.e., clusters of abstracts or sentences characterized by frequently co-occurring keywords) underlying the abstracts in the dataset. It is stated that the systemization of these insights leads to constructing a typology based on two dimensions (Figure 2) (Verhees & Verbong, 2015).

The writers seek to categorize the responsibilities of clients, civilians, and users, making their second objective not as aspiring. In revealing the "hidden dimensions" (also known as axes) and "themes" (Verhees & Verbong, 2015, p. 32) (groups of abstracts or clauses based on regularly coexisting main phrases) sustaining the abstracts in the set of data, it is claimed that the moderately automated T-LAB content analysis toolkit offers notable support. The author states that the classification characterized by two dimensions (Figure 2) is built by arranging the insights (Verhees & Verbong, 2015).

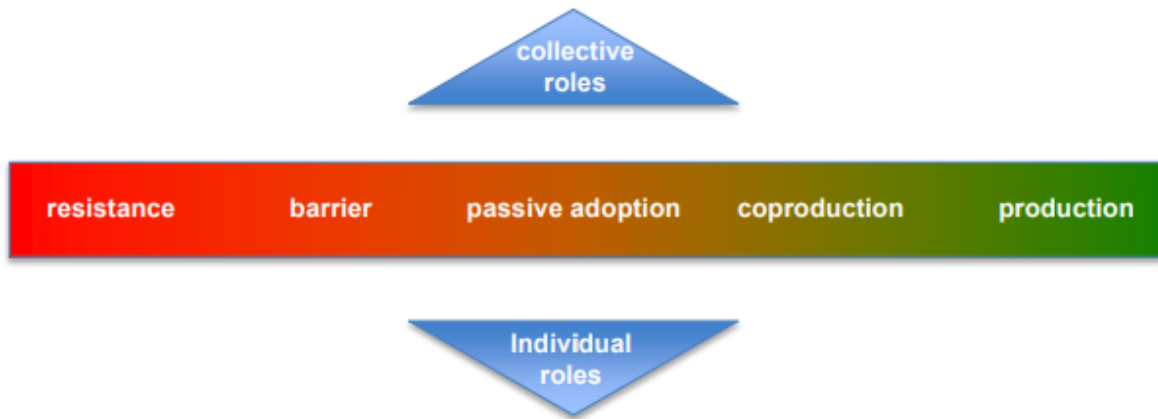


Fig 2. User roles in sustainability transitions (Verhees & Verbong, 2015).

Hansen, Liu, and Morrison (2019) approach usage trends or customer decision-making as one of the six key matters related to battery electric vehicles (BEVs), which are connected to the “socio-technical” transitions as energy transformations. The authors use technical and economic effects as the lens through which BEVs are viewed (Hansen et al., 2019). Meanwhile, Noel et al. (2020) examine BEVs, the “socio-technical system” framework, its customer obstacles with BEVs, and the clients’ purpose in “socio-technical” transitions. The authors examine electrical power and transportation infrastructure, a part of BEVs, as a “socio-technical system” with more than just the technical features. These include the effect on society and the ways of participating in it. Alternatively, it is claimed that the “socio-technical” framework uncovers that the distinct norms of leaders, makers, financiers, customers, leaders, and authorities mold technological advances. In addition, it is stated that the framework requires a societal perspective for comprehending technologies (such as BEVs and electrical networks). Fig. 3 demonstrates every element influencing “socio-technical” transitions, clients, and the transformation of the “socio-technical” system in automotive, established, and contemporary ground transportation (Noel et al., 2020).

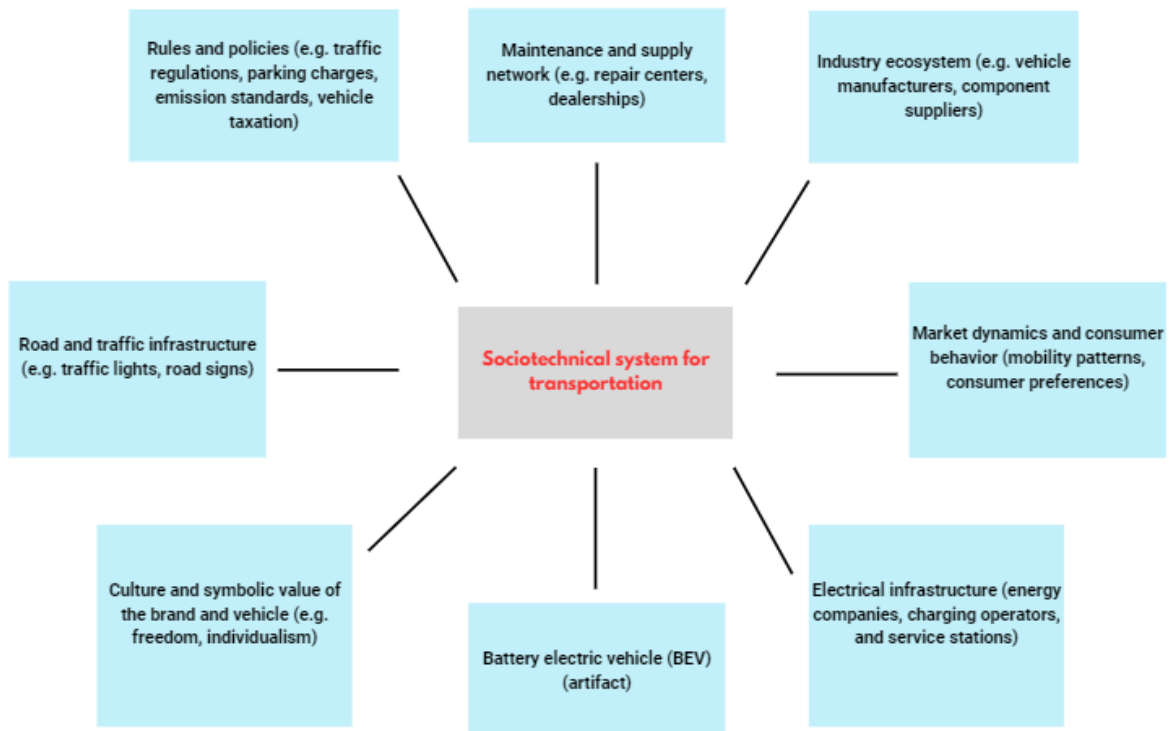


Fig 3. The adaptation of the socio-technical system for transportation by Sovacool et al. (2018a,b) in the work of Noel et al. (2020).

2.3. Factors influencing consumer intentions to adopt battery electric vehicles (BEVs)

The factors influencing consumer intentions to adopt battery electric vehicles (BEVs) are highlighted by Li et al. (2017, p. 326) in their paper, where they create three categories for BEV adoption intentions: “(1) demographic factors including individual variables (e.g., gender, age, education, income, and occupation) and family variables (e.g., vehicle ownership, accessibility to plug-in vehicles at home, population, and the number of driving licenses); (2) situational factors such as technical features, cost, environmental attributes,

and government policy; and (3) psychological factors such as experience, attitudes, emotions, perceived behavioral control, societal influence, and symbolic value.”

Meanwhile, Bryła et al. (2023) feature multiple authors and their consumer adoption factors, including socioeconomic factors contributing to the selection of EVs (Ahmadi, Croiset, Elkamel, Douglas, Entchev, Abdul-Wahab, and Yazdanpanah, 2015), sustainability perspective (Almansour, 2022), the role of technology (Carley, Siddiki, and Nicholson-Crotty, 2019; Lim, Jahromi, Anderson, and Tudorie, 2015), and minimized operations cost and usage satisfaction (Bryła et al., 2023; Chu, Im, Song, and Park, 2019).

Also, battery range is mentioned (Lebeau, Macharis, and Van Mierlo, 2016) and charging infrastructure, transparent and easier-to-adopt policy (Dong, 2022; Wang, Wang, Li, Wang, and Liang, 2018; Dua, Hardman, Bhatt, and Suneja, 2021; Fazeli, Davidsdottir, Shafiei, Stefansson, and Asgeirsson, 2017; Seminar, Calandra, Lanzalonga, and Ferraris, 2022), recommendations from governments encouraging customers (Srivastava, Kumar, Chakraborty, Mateen, and Narayanamurthy, 2022), purchase price, financial incentives, and lack of charging infrastructure (Abotalebi, Scott, and Ferguson, 2019), poor air quality index (Nichols, Kockelman, and Reiter, 2015; Abotalebi et al., 2019), consumer benefit appetite and willingness to buy (Featherman, Jia, Califf, and Hajli, 2021) when facing new technology (Irfan and Ahmad, 2021; Nazari, Rahimi, and Mohammadian, 2019; Featherman et al., 2021), consumer perception (Zhang, Wang, Wan, Zhang, and Zhao, 2022; Junquera, Moreno, and Alvarez, 2016), and attitude (Bryła et al., 2023, Wu, Liao, and Wang, 2020; Junquera, 2016).

Still, Bryła et al. (2023) continue to list factors such as motivation (Zhou, Long, Kong, Zhao, Jia, and Campy, 2021; Junquera, 2016) on the price of the EV and longer charging time acted as a deterrent for considering EV purchase, consumers’ self-image (Jansson, Nordlund, and Westin, 2017; Li, Wang, Gong, and Liu, 2022) interpersonal influence, and attitudinal

factors, various consumer psychological factors (such as car ownership symbols and risk aversions) (Huang and Qian, 2018), government subsidies vehicles (Helveston, Liu, Feit, Fuchs, Klampfl, and Michalek, 2015), renting their own EV for a better and clearer attitude towards their ownership (Langbroek, Cebecauer, Malmsten, Franklin, Susilo, and Georén, 2019), attitude and perceived behavior (Mohamed, Higgins, Ferguson, and Kanaroglou, 2016), behavioral characteristics of consumers (Ouyang, Zhang, and Ou, 2018), cognitive consumer behavior with seeking a co-adoption policy for solar charging (Shakeel, 2022; Liang, Qiu, and Xing, 2022; Moon, Lee, Choi, and Woo, 2022), and the spatial effect (Bryła et al., 2023; Liu, Roberts, and Sioshansi, 2017; Shakeel, 2022).

2.4. Synthesis

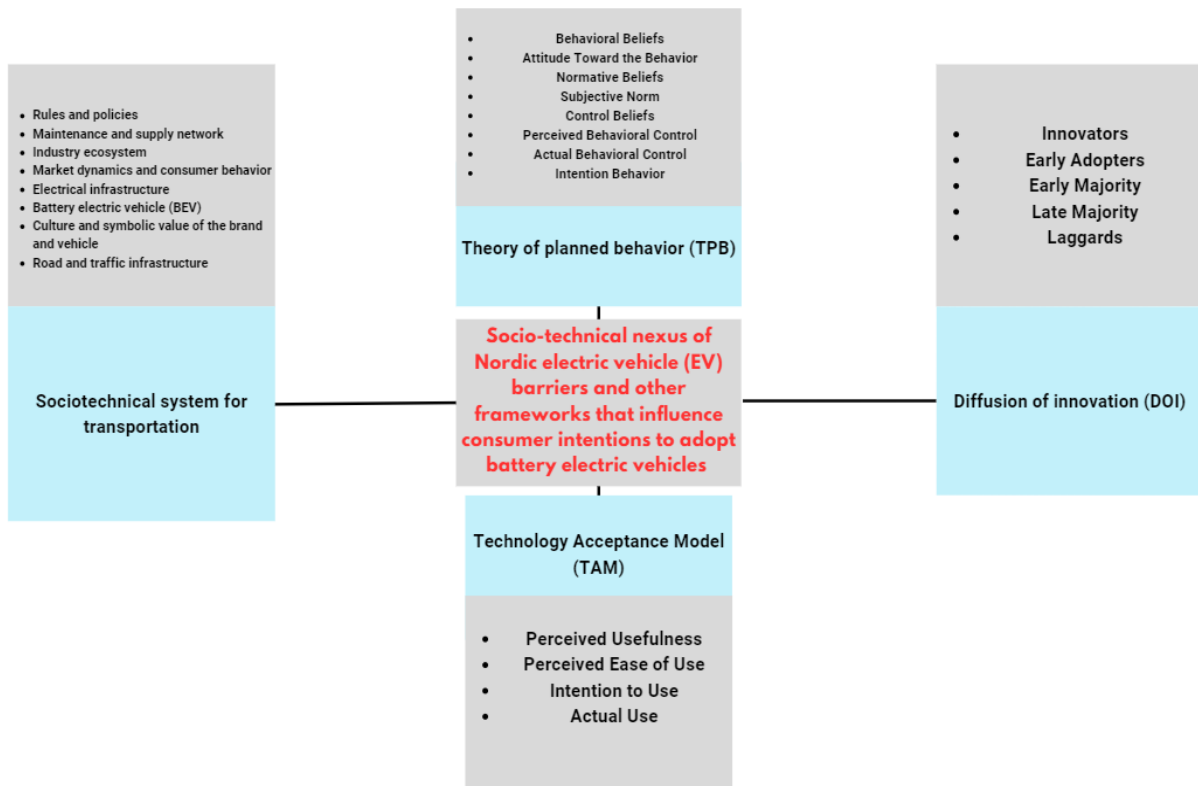


Fig 4. The socio-technical nexus of Nordic electric vehicle (EV) barriers and other frameworks influencing consumer intentions to adopt battery electric vehicles.

This proposition combines all of the main theories and their contents in this academic work including the Theory of Planned Behavior (TPB) and the Diffusion of Innovation (DOI) research model presented by the Boston University School of Public Health (2022), the Technology Acceptance Model (TAM) in the work of Li et al. (2017) and Marikyan and Papagiannidis (2024), and the Socio-technical system for transportation inspired by the work of Sovacool et al. (2018a,b) in the paper of Noel et al. (2020). Figure 4 is an essential conceptual framework of this thesis as it combines all the necessary theories to produce a comprehensive and holistic approach to the scientific research of the topic. All the theories support each other in creating a basis for the interview themes and questions.

3. METHODOLOGY

3.1. Research strategy and method

Mills and Birks (2014) claim that the trustworthiness in recent decades for investigating human experience and its multiple facets makes qualitative research the best option for this thesis. Similarly to their work, knowledge of the logic of the research plan is demanded in this study. It is stated that the research will successfully formulate a question that mirrors the research objective and guides the execution. Mills and Birks (2014) delineate typical procedures while exploring the preparation and application of research formulated on a firm research question with theories regarding qualitative review. When crafting the research proposal, the writers see a possibility to elucidate and coagulate an ambitious mindset into a plausible strategy. The authors note that multiple scholars propose vital approaches when producing a qualitative research proposal (Sandelowski and Barroso, 2003; Penrod, 2003; Padgett and Henwood, 2009), whose satisfactory implementations demonstrate specific issues. In Figure 5, guidelines for the research proposal are presented as the summarization of the strategies: “1. Front material, 2. Background, 3. Research plan (methods and techniques), 4. Outcomes and significance, and 5. Budget and timeline.” (Mills and Birks, 2014, p. 202). In generating a qualitative research proposal, the authors state that Figure 5 presents additional information about the segments requiring consideration (Mills & Birks, 2014). This thesis is built upon a qualitative research proposal that follows clear and detailed instructions to produce well-rounded academic work.

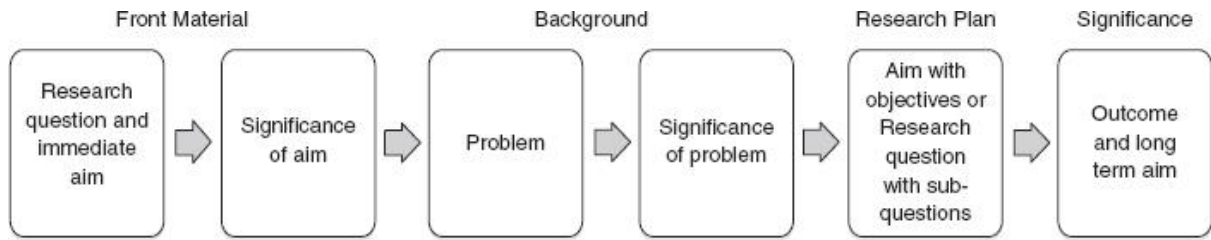


Fig 5. Constructing a qualitative research proposal (Mills & Birks, 2014).

Meanwhile, McIlvennan, Morris, Guetterman, Matlock, and Curry (2019) state that qualitative tools offer extraordinary possibilities for supporting research. It is claimed that in implementing qualitative methods, the imagination and refinement of scientists have increased, resulting in the progress of qualitative methodology. The writers note that there are many options for expanding modern and flexible means for directing and using qualitative methods. In their view, with advanced data collection techniques harnessing digital patient files, mobile messaging, online forum text data, and visual media, there are endless possibilities with technology. The writers highlight that present data collection methods and use are developing effectuation assessment, client-centric planning, prior to execution review, policy consideration, and efficacy inspection. The authors highlight more influential cardiovascular journals being published (with the method remaining underused), harnessing more qualitative research studies than previously. To handle challenging scientific inquiries, the writers advocate for assessing the feasibility of qualitative approaches by increasing qualitative proficiency in research groups (McIlvennan et al., 2019). Following their work, the latest technology and data sources are utilized in the making of this thesis to produce comprehensive academic work. Lastly, Tracy (2010) introduces an extensive and adaptable framework for standards in qualitative research where the mechanisms of qualitative research (techniques and implementations) and goals

are separated. It is stated that the conception is given logic and detailed background via academic work (Tracy, 2010).

For qualitative research, Tracy (2010, p. 839) outlines and evaluates eight main quality criteria: “(a) worthy topic, (b) rich rigor, (c) sincerity, (d) credibility, (e) resonance, (f) significant contribution, (g) ethics, and (h) meaningful coherence.”

It is claimed that the interpretation consisting of eight items yields a standard language of essential qualitative guiding principles and a functional educational paradigm. The author claims that these quality markers verify the quality of this thesis. The academic work enables discussion, creativity, progress, and extemporization while advocating for these quality benchmarks, which are harnessed in this thesis. Also, Mills and Birks (2014) highlight the factors influencing the quality of qualitative research in Figure 6, an adaptation from Birks and Mills (2011, p. 34), which guides this thesis.

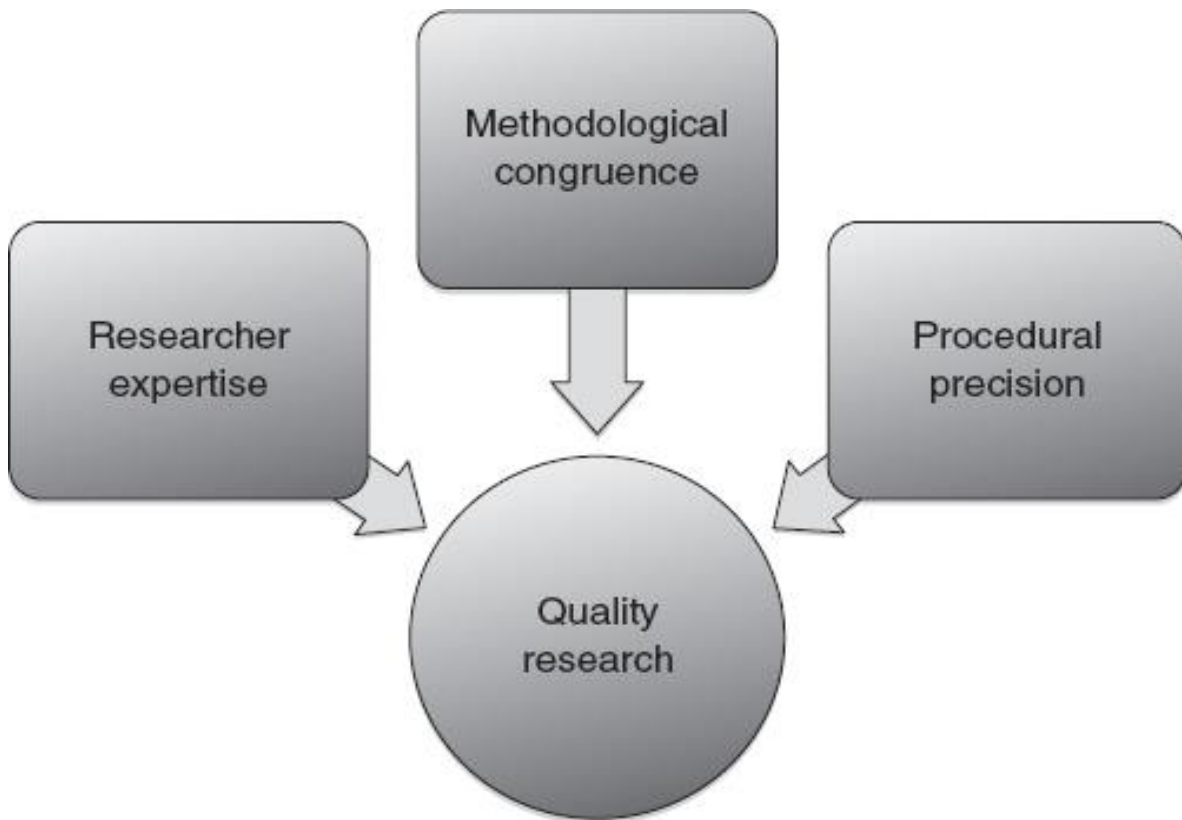


Fig 6. Factors influencing quality in qualitative research (Mills and Birks, 2014; Adaptation from Birks and Mills, 2011, p. 34).

Within the figure, Mills and Birks (2014) explain that researcher expertise refers to the possible confusion of amateur scholars during research (also commonly during the next phases) caused by the early writings and intricacies of qualitative research nomenclature. The writers emphasize the empirical expertise of most researchers despite their possible restricted knowledge of qualitative implementation. The authors claim that novice scientists have various core abilities for their studies, which include utilizing assets, directing an initiative, and crafting academic papers (Mills & Birks, 2014), which are harnessed in this thesis.

On the other hand, the consistency of the framework refers to the agreement of the declared study objectives, the methodological strategy for reaching these aspirations, and the individual reflective situation (Mills & Birks, 2014). The authors refer to “meaningful coherence” (Mills & Birks, 2014, p. 848), where the execution of the research alongside the fundamental structure and aims and the arrangement of the research design are guaranteed. Furthermore, Tracy (2010) proclaims that despite lending from lending from different models, the unity of this arrangement is possible. The author claims that irrespective of the reflective extent where the research is placed, or the methodological structure, the consistency of the framework is the groundwork of conceivable research. The writer affirms that her work empowers imagination, innovation, and bravery (Mills & Birks, 2014).

Finally, Mills and Birks (2014) introduce systemic accuracy, which they claim encompasses intentional, constant, and calculated utilization of methodological academic strategies. Burns (1989) is mentioned in qualitative studies, who converses “procedural rigor” (p. 49). It is noted that nearly all procedures affiliated with information gathering and production are emphasized, where the limitation of the theory is that qualitative research, including multifaceted proceedings exceeding and prefacing data collection, is not considered. Mills and Birks (2014) note that focus should be directed to overseeing information and assets, displaying structured rationale to secure structured fidelity of the research, and sustaining an audit trail, which is important to ensure the quality of this thesis (Mills and Birks, 2014).

3.2. Sample selection

DeLuca (2023) declares that qualitative research is considered for responses to our utmost critical social matters while being observed growingly by the general population, media, and legislators. Therefore, the discipline still lacks well-defined principles for analyzing qualitative research, while academic work considers the standard of qualitative research

superior. It is stated that Mario Luis Small and Jessica McCrory Calarco strive to eliminate this void with their recent publication (DeLuca, 2023). The author argues that their book presents effective rules to evaluate the adequacy of the time devoted to the domain and the detailed interviews used in this thesis. Meanwhile, the writer notes that fundamental standards can be dismissed without employing organized, lucid, and reasoned sampling methods. The author claims that this diminishes the offering of qualitative research to a more accumulative production of academic information (DeLuca, 2023). In turn, Suri (2011) claims that conscious choices in sampling are vital to enhancing the standards of research synthesis, which are considered in this academic work. The writer states that numerous qualitative researchers endorse purposeful sampling when combining qualitative studies. It is claimed that scholarly work discusses ways of supporting research synthesis through varying techniques of purposeful sampling (Suri, 2011).

In primary research and purposeful sampling, Suri (2011) claims that Patton is constantly referred to as being in a position of power. It is stated that in the first works of Patton he does not advise to combine the research synthesis and purposeful sampling. The author highlights the unmatched ways this academic work contributes to the publications by exploring the procedure of qualitative research synthesis and the versatility of all 16 purposeful sampling strategies from Patton. This enlightens the ways for distinct purposeful sampling techniques in forming unfettering, holistic, dismantling, and facultative meanings of released studies (Suri, 2011), which are harnessed in this academic work. Lastly, Stratton (2024) weighs the benefits and downsides of purposeful sampling, which have been harnessed in choosing the suitable sampling method for this thesis (Stratton, 2024).

In his view, purposeful sampling is generally met in qualitative writing. Comparably with the publication, purposive sampling is used in this thesis as a population sampling procedure, where the interviewees are selected depending on their qualities, background, being in the target group, or additional metrics. Next, to portray people or a cohort that is the

examination's focus, research participants are harnessed as the deliberate sample. It is noted that purposeful sampling studies are harnessed to detect contemporary theories, social challenges, and norms. In addition, the writer highlights that purposeful sampling investigations are often intended to evolve perception as research inquiries. Sequentially, purposeful sampling is described as less resource-intensive and more time-efficient than most conventional scholarly techniques, making it beneficial and optimal for this thesis. The authors claim that most comprehensive evaluations as a type of synthesis research mention purposeful sampling publications. Also, purposeful sampling analysis is ordinarily harnessed in assessing inquiries or focus areas to teachers, financial institutions, medical staff, and political figures. The author claims that purposeful sampling can demonstrate variations in results by contrasting various samples (including group samples formulated on gender) (Stratton, 2024). Also, an essential feature of academic work based on purposeful sampling is considered in this thesis, which is described as having specified self-reliant and reliant factors with a limited and succinct research goal. It is stated that with expanding the danger of perplexing and complication in evaluation metrics, academic works with several research outcomes must be averted. The author claims that identifying an approach for determining the attendees for purposeful sampling is the aim of the research (Stratton, 2024).

3.3. Data collection

The data is collected via interviews. The interviews are structured with open-ended questions and thus without yes or no questions as the main questions to produce long-form answers. Only follow-up questions might contain closed-ended questions to clarify the question at hand. The questions aim to provide extensive information about consumer feedback about the current state of the battery electric vehicle market, its dynamics, customer preferences, and possible future developments where the battery electric vehicle (BEV) market and the products should evolve.

The planned qualitative research methods are justified by Kallio et al. (2016), Britten (1995), Hammarberg et al. (2016), DiCicco-Bloom and Crabtree (2006), Fossey et al. (2002), and Adhabi and Anozie (2017).

Kallio et al. (2016) intend to create a structure for a qualitative semi-structured interview guide while highlighting the context or strict information-gathering processes affecting the research findings. It is stated that methodological research about crafting a semi-structured interview guide is uncommon, but the semi-structured interview is a standard information-gathering process. The authors use a rigorous methodology-based examination with PubMed, CINAHL, Scopus, and Web of Science knowledge bases. The writers pursue methodological scholarly works about semi-structured interview guides between October 2004 and September 2014, reviewing 2,703 titles, abstracts, and 21 complete works, choosing ten. The information assessment techniques or analysis contain the qualitative content analysis procedure. The outcomes comprise recently combined expertise of the evolution of a semi-structured interview guide, including five stages (Kallio et al., 2016, p. 2959): “(1) identifying the prerequisites for using semi-structured interviews; (2) retrieving and using previous knowledge; (3) formulating the preliminary semi-structured interview guide; (4) pilot testing the interview guide; and (5) presenting the complete semi-structured interview guide.”

In summary, the writers state that the strict advancement of a qualitative semi-structured interview guide forms more believable findings and supports the neutrality and reliability of studies. It is advised that academics utilize five phrases to produce a semi-structured interview guide and rationalize its choices (Kallio et al., 2016).

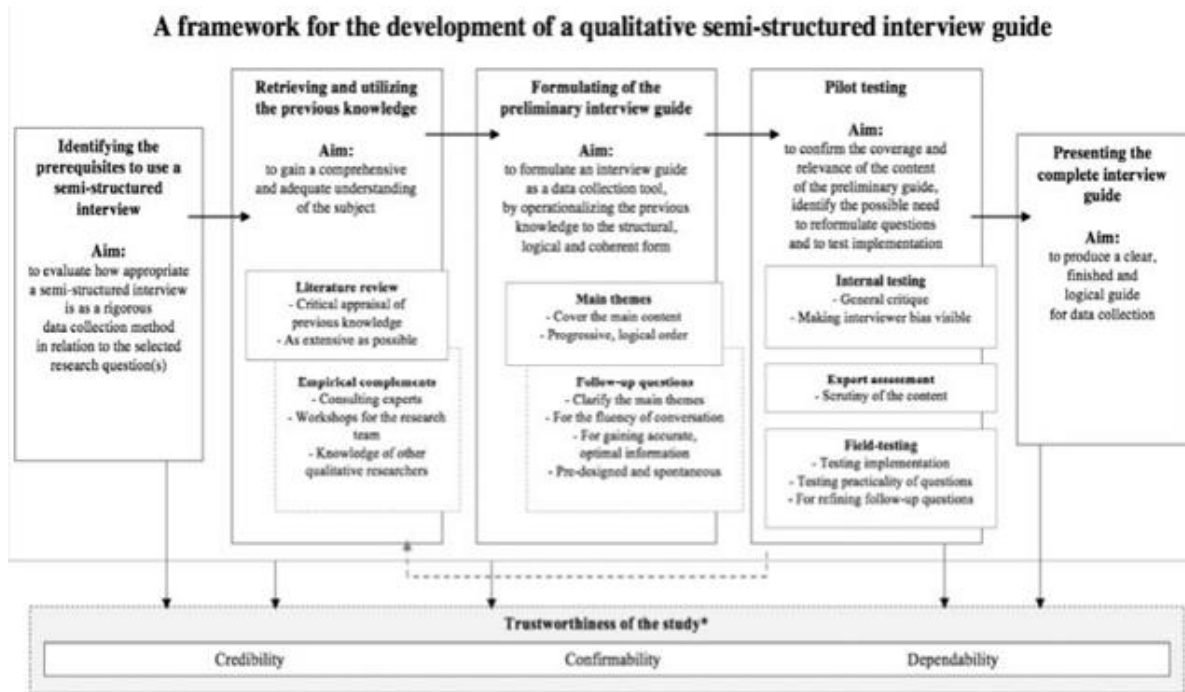


Fig 7. A framework for developing a qualitative semi-structured interview guide (Kallio et al., 2016).

Britten (1995) claims that qualitative interviewing is a versatile and forceful instrument for uncovering multiple recent study territories while facilitating the study of direct impact research inquiries to daily working life, which would alternatively be challenging to examine. The writer notes that while lacking instruction, some scholars would commence using a new study technique, where universities and specialist research organizations offer coaching in research interviewing skills (Britten, 1995). In addition, Hammarberg et al. (2016) state that these techniques respond to inquiries about the background, significance, and viewpoint of the test according to the attendee. It is claimed that the information is usually not quantifiable or countable. It is explained that qualitative methods contain “small-group discussions” for mindsets, researching convictions, and theories of normative actions; “semi-structured interviews” for input on a concentrated subject with primary

respondents or for the viewpoint of institutions or data; “in-depth interviews” for comprehending an occasion, situation, or background from an individual position; and “exploration of writings and records”, such as media articles, official documents, daybooks, or webpages for shared or personal information (Hammarberg et al., 2016, p. 499).

Furthermore, Hammarberg et al. (2016) note that qualitative works consistently gather, arrange, depict, and comprehend vocal, graphic, or word-based information with guidelines for evaluating the report standards. Concurrently, the academics highlight that it is possible to rate studies employing qualitative approaches (Dixon-Woods et al., 2006; Young et al., 2014) with a few standard principles for evaluating qualitative papers (Hammarberg et al., 2016; Kitto et al., 2008; Kirkman et al., 2016).

On the other hand, Fossey et al. (2002) state that queries involving social environments and existence are linked to the perception of the implication and expertise elements that are approached via qualitative studies. The authors claim that worthy qualitative research refers to the perspective of others on the subjective meanings, actions, and social contexts of the partakers of the research. The writers note that the research aims to offer amateur scholars (and those inexperienced in qualitative study) positioning to guidelines instructing the review of qualitative studies' management, planning, definition, and results.

It is noted that this guides the audience to two philosophical views (the illustrative and vital study designs), supporting the qualitative techniques and assessment of qualitative studies. The writers state that the benchmarks for assessing standards are linked with qualitative principles for integrity. Elements are incorporated to create effective methods for the reliability of analyzing qualitative information and the practice of qualitative studies. The authors examine these standards and discourse and how they can be harnessed to assess qualitative studies. The authors claim that for the novice qualitative scholar, these guidelines provide instructions for a reasonable qualitative study (Fossey et al., 2002).

DiCicco-Bloom and Crabtree (2006) claim that comprehensive data about personal experiences can be produced via detailed interviews (nevertheless, there are multiple variations of qualitative interviews and alternative variations of qualitative techniques for medical researchers). The writers indicate that the multifarious types of qualitative research are honored in the most recent Handbook of Qualitative Research and discussed in other academic journals. In addition, the authors note that researchers should analyze all suitable approaches for responding to a study query while highlighting that multiple medical inquiries are complex. It is claimed that mixed-method techniques (combining qualitative and quantitative methods) are needed for holistic and detailed research. The writers highlight that combining research techniques, including interviews, can deliver scientifically valid and meticulous research structures with qualitative techniques. The authors allege that these support evolving discoveries while functioning as an essential part of a developing investigation method (DiCicco-Bloom & Crabtree, 2006).

In turn, Adhabi and Anozie (2017) state that interviews underpin core information gathering in qualitative research plans where the framework of investigating and rationalizing a specific occurrence complements the scope of a qualitative study (Stewart, Gill, Chadwick, & Treasure, 2008). The authors emphasize productive primary information-gathering techniques utilizing interviews. It is claimed that interviews may be classified according to their quality of execution and optimal motivations in qualitative research (Edwards & Holland, 2013). It is stated that interviews might be official or unofficial, according to their characteristics. Unofficial interviews are described as a segment of everyday life or life stories, complementing qualitative research. Still, rooted in the magnitude of most researched subjects, their utilization is constrained (besides, data obtained is applied principally for illustrative reasons) (Adhabi & Anozie, 2017).

Conversely, formal interviews are stated to be more appreciated, better organized, and harnessed occupationally more evidently. The authors claim that it is not accentuated in

unofficial interviews that chief analysts conduct professional or official interviews. Meanwhile, thematic analysis is harnessed in this thesis, which is justified by Castleberry and Nolen (2018). The authors are concerned that qualitative research methods are gaining popularity. Differently, it is claimed that the term “thematic analysis” (Castleberry & Nolen, 2018, p. 1) is classified as qualitative investigation and harnessed in academic projects, where meticulous qualitative research does not inherently correspond to conducting this analysis form. With their methodology investigation, the writers specify how to conduct precise theme-based investigations about qualitative information to form conclusions. The authors highlight the typical phases for guaranteeing the consistency and detail of the thematic analysis in their methodological literature review, even though there is no evaluation manual for all study scenarios.

The authors state that a framework of qualitative data examination can be planned in five actions: collecting, dismantling, regrouping, analyzing, and summarizing. The writers make pragmatic suggestions for aiding scholars in their stringent theme-based studies, reassuring qualitative investigators, and uplifting the publishing criteria. It is noted that harnessing the rigid principles for theme-based studies and clearly expressing them in the information procedure enhances the value of the results (Castleberry & Nolen, 2018).

The structure of the interview questionnaire is based on the works by Kallio et al. (2016), Taherdoost (2022), Staller (2022), and *Fuels Institute/Ricardo Strategic Consulting* (2021). Meanwhile, the content of the interview questions is inspired by the works of Lee and Clark (2018), Kantar (2023), Cardell and Batra (2023), Durmuş Şenyapar and Akıl (2023), and Shivaraman (2024).

Taherdoost (2022) claims that in structured interviews, the phrasing and sequence of inquiries are comparable for every respondent. Therefore, an exact method is harnessed in planned interviews. These methods provide various advantages as they can reduce time

commitment and prejudices. The interviewer can oversee the procedure competently, and the findings can be processed and investigated easily. Nevertheless, the technique limits elaboration as they function as verbal surveys. As a result, some scholars advocate for this structure solely once social and demographic data are separated (Doody, 2013). Therefore, the author does not suggest these structures for qualitative studies. The writer states that interview questions can be split into three key sections. Taherdoost (2022) asserts that key inquiries emphasize the study's main objective and are mostly presented directly after the introduction. Prepared subsequent inquiries, also called probes, which are harnessed for thorough replies about more distinct topics. These inquiries can also support the interviewees and guide the core problems of the study. Lastly, alternative subsequent inquiries that are unscripted come after the researcher hears the initial responses. These are employed for further legitimacy as the researchers are supported to organize additional explanations for the significance of the matters or inquiries for the participants (Bolderston, 2012; Taherdoost, 2022).

In turn, Staller (2022) states that accomplished scripts contain verbalized research inquiry worthy of a response, substituting tentative and basic inquiries with complicated variations from the procedure of research, inquiries linked to present publications (experiential, abstract, and analytical), inquiries structured for the methodology (for example, phenomenology, ethnomethodology, and spoken records), revealing inquiries in the language of the researchers and science that validate having queries for building novel insights (conversely being alternatively significant), illustrating their dialogue with current writings, and the participation in the research work. It is explained that robust manuscript contributions express the research inquiry and exhibit a comprehension of its objective and role. The author claims that the inquiry has consequences for the literature review, inspection, results, and research outcomes, which should be clear across the manuscript's structure (Staller, 2022).

In the report by Fuels Institute/Ricardo Strategic Consulting (2021), it is mentioned that a literature review is performed to increasingly recognize the way and place customers drive and charge their electric vehicles (EVs) and their optimal experience when charging concerning site structure, services, features, and hospitality. In addition, the author studies academic works to comprehend customer habits and predict their development in the following 10 years when additional BEVs are acquired. Emphasis is placed on responding to five matters: “1. Who is the customer? 2. When and where does the customer recharge? 3. Why does a customer choose a particular recharging facility? 4. How do customers interact with charging equipment? 5. What do customers do at facilities while charging?.” (Fuels Institute/Ricardo Strategic Consulting, 2021, p. 1). The literature review comprises generally accessible references, including the works of Ricardo about buyer choices, released questionnaires, official records, multidisciplinary organizational documents, academic papers, national laboratory reports and regulations, and media releases. It is stated that personal interviews complement these (Fuels Institute/Ricardo Strategic Consulting, 2021).

Meanwhile, the content of the interview questions is derived from the work by Lee and Clark (2018), encompassing topics such as charging infrastructure (challenges, financials of charging, and load distribution), total BEV expenditure analysis, and battery technology (difficulties, incentives, and total expenditure) (Lee & Clark, 2018). Finally, Kantar (2023) considers the current adoption of BEVs in four locations and topics in the setting: rising demand for BEVs, essential elements for people considering a BEV, drivers for BEV acquisition, obstacles to BEV acceptance (range anxiety, expenses, and rivalry with hybrid vehicles), customer perception about the outlook of BEVs, and traditional vehicle manufacturers versus specialty BEV firms (Kantar, 2023). Cardell and Batra (2023) also harness the EY Mobility Consumer Index report by recognizing five buyer groups (EV skeptics, reluctants, persuadables, considerers, and enthusiasts). The authors state that the sections include a range of characteristics and mindsets, from cynics to passionates. It is mentioned that the largest groups include individuals more likely to acquire a BEV in the

future and most receptive to evolving into a BEV fan (Cardell and Batra, 2023). Notably, Durmuş Şenyapar and Akıl (2023) examine the regulations and rewards in various nations when acquiring a BEV, assess customer worries prior to adopting a BEV, and customer aspirations of acquiring BEVs with theories including “reasoned action theory, planned behavior theory, and technology acceptance model” (Durmuş Şenyapar and Akıl, 2023, p. 1) harnessing bibliometric evaluation (Durmuş Şenyapar and Akıl, 2023). Lastly, Shivaraman (2024) highlights the dominance of China over BEVs and notes that Chinese vehicle manufacturers comprise more than half of BEVs internationally. The author claims that the study indicates that Chinese firms can utilize their price competitiveness against Western manufacturers due to the increasing customer interest in BEVs due to pricing (Shivaraman, 2024).

The interview questions for the consumers and managers belong to the following themes:

1. Consumer preferences for battery electric vehicles (BEVs) (attitudes, pros and cons, development targets, preferred features, and government incentives and policies) (questions 1-3)
2. Optimal sales system for battery electric vehicles (BEVs) (sales process or dealerships versus online sales, pricing, after-sales, and resale and maintenance network) (questions 4-6)
3. Battery electric vehicles (BEVs) charging (charging infrastructure, charging operators and technology, pricing, and functionality) (questions 7-9)
4. Western and Chinese battery electric vehicles (BEVs) (global competition, brands, technologies, current market dynamics, and future market outlook) (questions 10-12)

3.4. Data analysis

The data quality and reliability of the planned project will be assured by following the instructions in the research paper by Minhat (2015), Batini, Cappiello, Francalanci, and Maurino (2009), Walsh and Downe (2006), and Easton, McComish, and Greenberg (2000).

According to Minhat (2015), interviews could be advantageous for investigating encounters, observations, all delicate matters, views, and perceptions not uncovered and depicted by only responding to a series of inquiries in a methodical survey. The author claims it to be most fitting with limited available information about the study phenomenon or where comprehensive observations are needed from interviewees while being especially appropriate for investigating personal subjects that interviewees may wish to keep private instead of discussing in a group setting (Gill, Stewart, Treasure, & Chadwick, 2008). The writer notes that a precise depiction of the emotions, face, and enthusiasm of the participant can be obtained through two categories of qualitative approach interviews (person-to-person interviews termed as the “in-depth interview” and group interviews (widely recognized as “focus group discussion”) (Minhat, 2015, p. 211). Minhat (2015) claims that the compatibility of information-gathering techniques relies on the topic and the focus group. In addition, the writer asserts that in creating an interview plan, inquiries considering the purposes and goals of the study, which can generate maximum data about the research subject, are needed (Gill et al., 2008). In the same academic work, Patton and Cochran (2000) state that prior to the following interview, every session must be transcribed and recorded word-for-word (Minhat, 2015).

Patton and Cochran (2000) recommend creating observations about participants' milieu, articulation, thought process, insights, and feelings during or after the interview to alleviate the information analysis. It is claimed that it might be time-consuming to build the correct inquiry for the exact information the interviewer is fascinated by. The authors give the

following guidance: [1. Beginning with a common inquiry for directing the interview to the subject, 2. Evaluating the degree of communication language needed for the interviewees for comprehension while not fearing intricate glossary or being minimized by a basic one, 3. Using daily words devoid of jargon or obscure language, 4. Increasing personal inquiries when nearing the conclusion, 5. Soliciting detailed responses (necessitating further than yes/no reactions), 6. Posing neutral queries (e.g., how rather than why questions), 7. Harnessing practical instead of theoretical inquiries (such as candid questions and not vague), and 8. Specific memories aiding people recall (for example, the date of a seismic event or following the birth of the youngest offspring) (Minhat, 2015; Patton & Cochran, 2000).

Meanwhile, Minhat (2015) depicts detailed interviews as open-ended, rigorous, and investigative techniques to gather thorough data from an interviewee. The core objective is to extensively investigate the interviewee's emotions, perspectives, memories, and attitudes. It is claimed that detailed interviews are primarily executed in the initial phase of a greater study process with inquiries about defining the demanded inquiries to be examined in the study or restricting the emphasis of the research. The author states that surveying requirements, individual stories, anticipations, problem detection, ideas, emotions, enhancement of programs, and views can be examined with detailed interviews. Additionally, Minhat (2015) emphasizes the scenarios where detailed interviews can be more desirable than focus groups [1. With profoundly personal themes, interviewees can be distressed when expressing genuine emotions in groups; 2. Being the initial preferred approach during logistical difficulties arising from assembling multiple interviewees in the same space, including location difference; 3, when personal (also not group views) are prominent concerning a topic; 4, when the interviewees might not be relaxed discussing honestly with others; and 5. Including exclusive categories of individuals/scarcely available groups of the society (top executives and so on)] (Minhat, 2015).

In turn, the academic work by Batini et al. (2009) will be considered in this thesis when assessing information about relevance, standards, and volume. The authors highlight the relative viewpoints for assessing and contrasting “data quality (DQ)” (Batini et al., 2009, p. 2) approaches. It is declared that these include the stages and procedures forming the methodology, the tactics and procedures in the methodology for evaluating and bettering standards of data, the variables and measures of the methodology to evaluate data quality grades, fees with data quality problems (including expenses from low-quality data or faults and opportunity costs from overlooked financial opportunities or overhead expenses, and expenses of evaluation and enhancement proceedings or costs of goods sold), data categories of the methodology, types of data structures that harness, adjust, and direct the information in the methodology, the institutions in the procedures building or upgrading data in the methodology (with their layout and practices), the procedures producing or upgrading data to develop solutions needed by customers in the methodology, and the solutions of the proceedings in the methodology (Batini et al., 2009).

Simultaneously, Walsh and Downe (2006) note that they confronted numerous unaddressed problems in building a meta-synthesis of qualitative research of free-standing midwife-led units relating to methodology and epistemology. The authors claim that one of these concerns is evaluating qualitative research quality. The authors harness a repetitive process with eight roadmaps and overview structures to define the problem. They state that several texts are perspective-driven, while some combine established designs. It is claimed that none of the texts overviews the guidelines in their every evaluated publication and their similarities and contrasts. The authors rigorously analyze these structures and summarize that they are overly meticulous for most uses while being intricate from epistemological and theoretical perspectives (Walsh & Downe, 2006).

Walsh and Downe (2006) state that the discoveries from these structures and checklists are connected to arrive at a practical resolution to the difficulty of evaluating standards in

qualitative studies. The authors use the “redundancy approach” (Walsh & Downe, 2006, p. 108) method to remove unnecessary guidelines or the conclusion model. The authors formulate the final synthesis via evaluative arguments and dialogue, and elements of this conversation are listed here. It is stated that the synthesis is based on an epistemology of subjectivist nature, which sees the purpose of expertise as created and hermeneutic (containing culture-based, personal, and systemic illustrations of truth) (Walsh & Downe, 2006). Finally, Easton et al. (2000) state in their paper that the interpretative character of qualitative studies requires stringent scientific techniques for credible findings. While qualitative techniques produce extensive information, the writers state that users must be confident in their discoveries. Therefore, academics are liable for the reliability of qualitative studies. Obstacles in the industry jeopardize information reliability, which can reduce the risk of errors during research, and scholars can enhance the credibility of the analysis. The writers aim to introduce three hazards that can arise in qualitative research during transcription and information gathering (faults in transcription, environmental risks, and instrument malfunction). Also, to lessen preventable mistakes, the authors consider explicit approaches (Easton et al., 2000), which are also considered in this thesis.

4. FINDINGS

Overall, eight consumers and two managers were interviewed for this thesis. There were four themes with the same number of questions in each theme where the participants gave detailed answers.

4.1. Consumer preferences for battery electric vehicles (BEVs)

The first theme evaluates consumer preferences for battery electric vehicles (BEVs) from the perspective of attitudes, pros and cons, development targets and preferred features, and government incentives and policies with questions 1-3.

The questions addressed the way, reasons, steps, and milestones in purchasing a BEV, the perception of BEVs and their pros and cons, features to be added or removed, and the effect of government incentives or policies on preferences for BEVs.

Overall, consumers noted that the reasons for their battery electric vehicle purchase are environmental, economic, and ease-of-use—a typical customer decision-making process involves comparing different alternatives, resulting in an informed purchase.

“Generally speaking, I followed the media and looked at multiple cars. I think I visited the dealership once to ask and familiarize myself with the product and see how the vehicles are sold. At some point, I chose a Skoda Enyaq by seeing where I could find a showcase car. I found one, and we made the purchase. So, the final purchase decision was made online.” (Interviewee 6, consumer)

Customers perceive the pros of BEVs to be that they are environmentally friendly, cheaper to operate than their internal combustion engine (ICE) counterparts, noiseless, and easier

and more affordable to maintain. However, the cons are their high purchase cost, battery capacity, charging requirements, shorter winter range, and uncertain resale value.

“The pros are definitely the features of the electric motor which make driving smooth. Another matter is environmental friendliness and, of course, economic efficiency. A battery electric vehicle does not really need maintenance. The cons are that appropriate charging infrastructure must be in place, and if there is no possibility of charging the vehicle at home, it is going to be more difficult. Of course, the range can affect it, but for me personally, it is not so much as it is adequate for 400 kilometers. I do not really drive longer trips.” (Interviewee 3, consumer)

“The cons are the purchase price and the possibility of large price drops after the release of new models coming to the market. That is surely one of the cons.” (Interviewee 4, consumer)

Meanwhile, managers see that customers usually weigh different options and ponder which suits their situation. Managers state that usual considerations involve the range in Finnish winter, how much the vehicle should be charged, and the resale value (which has been disturbed by Tesla). The key questions are the range, charging infrastructure, and how BEVs maintain their resale value.

The pros include the electric drivetrain, environmental values, ease-of-use, great user experience, and more space. The preferred features include charging speed and more range, especially during winter. Economic incentives are noted to increase BEV demand substantially, especially within company vehicles.

“When purchasing a BEV, customers usually think about how they will manage in the Finnish winter and how much it should be charged. Also, resale value is a

current topic, and Tesla, for example, has caused havoc in pricing with its actions. Those are probably the largest question marks. Range, charging infrastructure, and how BEVs maintain their resale value are key questions for consumers. Regarding pros and cons, one upside is definitely the powertrain—also, environmental values, not in manufacturing but with minimizing emissions to zero. Ease-of-use is one pro, especially in warming the car or with user experience that has been taken afar, such as pre-air conditioning during the winter and heating during the summer. The additional space for families with children is also a plus. There are many pros. The largest wish for additional features is a larger range and charging speed. Economic incentives have a clear effect, especially with company drivers as BEVs are expensive.” (Interviewee 9, manager)

“In the modern era, many go through hybrid vehicles or through the combination of internal combustion engine (ICE) and electric cars. Firstly, consumers purchase one and find out that electric driving is sufficient with a modern range. Many are afraid of electric driving, its adequacy, and how the vehicle behaves. This is the most common way, but there are also those who go straight from an internal combustion engine (ICE) to an electric car. Consumer attitudes are constantly shifting. Earlier, the attitudes were very much against battery electric vehicles, and there were a lot of arguments for why they could not purchase a BEV. These attitudes are rare nowadays.” (Interviewee 10, manager)

Battery electric vehicles (BEVs) are described as a new addition to the dealership catalog and have become increasingly common. Managers note that some doubts still exist around the most common development targets. Additionally, government incentives are seen in a positive light.

“Electricity is still a little bit of a new propulsion force, so the most common doubts are associated with the durability of batteries, the functionality of the technology, and the effect of weather. The media has highlighted the negative side, which invokes uncertainty in consumers. Most central development targets are battery, range, and charging speed. I see charging speed as the most beneficial because there are differences between vehicles. Certainly, government incentives for BEVs lower the bar to test a BEV because the price difference to an ICE vehicle is smaller. Overall, it has narrowed down due to the tax benefit. Surely, it encourages consumers to try BEVs when you are incentivized.” (Interviewee 10, manager)

Briefly, consumers see that their reasons for buying a BEV or the pros of BEVs include environmental, economic, and ease-of-use reasons. A typical decision-making process includes comparing alternatives. The cons are the need for charging infrastructure, especially at home, purchase price, and ambiguous pricing of used BEVs. Features to be added are faster charging speed and winter range. Government incentives or policies affect preference for BEVs by adding to the willingness of consumers to try a BEV.

Meanwhile, managers perceive the typical consumer decision-making process to include thoughts about the viability of BEVs and, most of the time, choosing a hybrid vehicle first and seeing that the electric range is sufficient for their needs, resulting in purchasing a fully electric vehicle. The pros of BEVs are seen as additional space compared to internal combustion engine vehicles and powertrains. Cons are listed as the charging infrastructure, range, and unknown resale value. The desired features include better batteries, a longer range, and faster charging speed. Managers state that government incentives positively affect consumer preferences by making purchasing a BEV easier.

4.2. Optimal sales system for battery electric vehicles (BEVs)

The second theme evaluates the optimal sales system for battery electric vehicles (BEVs) by presenting questions about the sales process or dealerships versus online sales, pricing, after-sales, and resale and maintenance network of BEVs with questions 4-6.

The questions focused on the optimal sales channel for BEVs, pricing of BEVs, and after-sales, resale, and maintenance network of BEVs.

According to the interviews, most customers see physical dealerships as the optimal sales channel for BEVs, while some customers prefer online sales only to their convenience to the car manufacturers, cutting the middleman or the dealership. Meanwhile, the pricing of BEVs is seen as high, but their mainstream adoption is viable.

“I support products that are bought from physical dealerships. When buying from a physical dealership, I can test drive the car and see if the vehicle suits me. Online stores probably have a stricter price competition, but they are less reliable than physical dealerships.” (Interviewee 1, consumer)

“With older car brands, each middleman takes their part in the sales process. For example, Tesla has implemented a brand-new sales process, which makes it special. In my opinion, all cars can be sold directly from the manufacturer, especially Tesla. Many brands are dependent on the middlemen or dealerships as these have sales agreements with them. They provide maintenance but affect the sales margin, which makes profitability more difficult in the long term. If they sell directly to the customers, like Tesla does, it improves profitability. However, this requires a completely new sales process.” (Interviewee 8, consumer)

Customers are skeptical about used BEVs and some about after-sales, even if the features can be purchased conveniently online. The maintenance networks are seen as functional and identical to networks for ICE vehicles, with lower costs and a smaller need for maintenance.

“I feel that purchasing a used battery electric vehicle (BEV) that has been used longer includes a larger risk. The risk is quite high as it introduces the same feeling as buying a used smartphone. It might function, but it might not as well.” (Interviewee 6, consumer)

“I would not purchase features afterward as I have been told that this includes major risks, such as not functioning as claimed. For example, some have been offered new chargers to increase the charging power, but they did not function as intended. I am very skeptical about this. In addition, I would not purchase options online as these are exceptionally complicated interconnected systems. I believe a customer should be very well-informed about what he is doing and purchasing.” (Interviewee 5, consumer)

“I think the maintenance services have functioned well as they have been affordable. The need for service has been fewer than with an internal combustion engine (ICE) vehicle, and maintenance prices have been low due to the lack of an ICE.” (Interviewee 4, consumer)

Due to product knowledge, managers perceive dealerships as the optimal sales process. However, online sales are described as a great additional process combined with the expertise provided in the physical dealership. The managers see alternatives to ownership as quite challenging to implement in Finland as ownership is the preferred method, but

these could function in larger cities, such as ride-sharing. After-sales are seen as positive as these add consumer choice and add to the vehicle's lifespan.

“The optimal sales process is the dealership due to product knowledge. For example, when comparing Chinese and European BEVs, their features, and what electrification brings. Personal service in everything. Surely, when we purchase pricier products or technology, if we are not experts, we like that a specialist can justify why the specific model with the specific features is the right one for you. With artificial intelligence, it is possible to tailor the experience to the customer, but in more technological products, one person's impact is larger in selecting the right product for the consumer. When it comes to alternatives to ownership, you can read what happened to the Mobility-as-a-service (MaaS) trial in Finland. It is not easy to imagine that the modern generation would share their car. Certainly, it grows slowly, but Finland is a country that travels long distances. Ride- and car-sharing work in the areas of larger cities. Moreover, in a certain way while moving between cities. But not further north, especially from the Finnish ownership mentality. Over-the-air (OTA) updates are fantastic in after-sales. They function similarly to a smart TV, where you select the extent of your channel pack. This is unquestionably a hit product in BEVs. It is also great in used BEVs, where you can choose features according to the customer (e.g., Apple CarPlay, navigation, or seat heating) from a cloud service and include them in the car. This all comes with endless possibilities.” (Interviewee 9, manager)

Another manager notes that he does not perceive a difference in sales between battery electric vehicles (BEVs) and internal combustion engines (ICEs). In his view, a multi-channel sales approach is the best choice for consumers and managers. Alternatives to ownership are not seen as realistic options in Finland.

“I do not see a propulsion difference. The most important is what people are used to trying. When buying a new car, it is good to test drive the vehicle to ensure its features match what you require. However, gathering the same essential information from an online store that is available in a physical dealership is possible. Both have their sides, so I believe in multi-channel sales as these support each other. Car sharing was introduced a few years back, about five to ten years ago, quite radically, and it has been discussed a lot. In Finland, it does not work in practice in areas other than the Helsinki Metropolitan Area, where it functions moderately. We are so used to owning a car that preference is not easy to change. If we consider the future, these will be more common.” (Interviewee 10, manager)

The manager highlights the changing role of the after-sales system with service packages and features from the cloud services that can upgrade older models. The price level is also noted to be lower.

“Overall, flexibility between vehicle needs will change, so we will not purchase one car and drive five years with it. Instead, we will purchase a service package with different choices for your needs. You can change the vehicle if you have different needs during different seasons. When it comes to pricing, BEVs are approaching the price with an adequate range. There are products in the 20-30,000 euro range already available to a larger consumer cohort, which is positive as prices go down with age. One aspect consumers see negatively is when battery guarantees end or the reusability of the vehicle thereafter. I do not see a difference in choosing features for a BEV. When you have a BEV and need an additional feature, you will purchase it. If you do not see the point, you will not buy. I do not believe there are any differences between a BEV vehicle and an ICE vehicle. With BEVs, it is possible to load features from the cloud, but this is available in ICE vehicles where features are also sold afterward to be downloaded.” (Interviewee 10, manager)

Some consumers see that the optimal sales channel for BEVs is a physical dealership, while some do not mind purchasing a new BEV exclusively from an online store. BEVs are considered pricey. Their view on after-sales, resale, and maintenance networks is that some like after-sales, primarily online, and some do not. Also, some view used BEVs as risky options. The maintenance network is the same as that of ICE vehicles, with less maintenance and, thus, more affordable maintenance.

Meanwhile, managers perceive the optimal sales channel for BEVs as a dealership or mixed-method strategy with online and physical stores. BEVs are seen as expensive. After-sales is an amazing option that enables consumers to customize used vehicles according to their needs. The resale and maintenance networks are seen as functional, as the same network can be used with ICE offerings.

4.3. Battery electric vehicle (BEV) charging

The third theme consists of battery electric vehicles (BEVs) charging, which presents questions about charging infrastructure, charging operators and technology, pricing, and functionality with questions 7-9.

The questions were based on the perception of the current state of charging infrastructure, charging technology, operators and their ease of use, and the pricing and functionality of charging.

The current charging infrastructure in Finland is considered good, while all interviewees see that it could be better, especially outside Southern, Central, and Western Finland.

“At least the situation is good in Southern and Central Finland. I do not have experience further up north than Central Ostrobothnia.” (Interviewee 5, consumer)

“This year, new chargers were built in Southern Ostrobothnia. The situation is probably not adequate even still, but there should be upcoming EU legislation that obligates chargers for every 60 kilometers or so.” (Interviewee 4, consumer)

The charging technology itself and the operators are seen positively, while the charging process is noted to be too complicated due to the different apps, RFID tags, and pricing by each charging operator.

“Certainly, it is tedious that every charging operator has their app and tag. Improvements are coming, such as charging to be paid directly via credit card, which is great. The pricing varies a lot as it is sometimes really expensive and sometimes reasonably priced.” (Interviewee 3, consumer)

Thus, the consumers see that one unified app or billing ID with a clear pricing model could be a viable solution to this problem. The pricing and functionality of the charging are perceived as cheaper to fuel but are uncertain due to the ambiguous pricing and the possibility of choosing the wrong app or tag for the operator in question, resulting in significantly higher prices.

“Price roaming should be fixed with a unified pricing model. For example, a unified billing ID where you could charge at all places even if the price would be different. Charging operators should make charging easy.” (Interviewee 6, consumer)

However, managers note that charging is inadequate as there are still not enough chargers, and the fees are high, similar to roaming costs with telephones in the past. Also, the number of apps and tags required for charging, especially for commercial clients, is claimed to be ambiguous and difficult. However, the functionality of the charging network

is described to be in a good state, but managers wish that pricing would be kilowatt hour (kWh)- and not time-based, as with fuel in internal combustion engine (ICE) vehicles.

“The current charging infrastructure in Finland is not adequate in any way. The consumer is angry that we are in the old roaming world of old telephones. It is the same with charging possibilities when you go to a charging station, as every operator will take a cut. The situation should be similar to modern phone subscriptions with the same data pack. The network is currently laughable. Let’s say that you drive for work and must charge in stations from different operators; you will need ten different apps that will give you invoices in ten different ways, which you will send to your company. The infrastructure functions well in Finland, but the broken chargers might make the situation difficult. When it comes to pricing, it should be kilowatt-hour (kWh) and not time-based similar to internal combustion engine (ICE) cars and fuel, as you pay for liters and not the time used.”

(Interviewee 9, manager)

“In my opinion, the charging infrastructure is adequate for traveling. The problems I see are the large city and population centers, which, as far as I understand, have quite bad charging opportunities in the city. Housing cooperatives have not yet been warmed for the thought, even though there are instructions. I understand that a lack of a proficient charging place is an obstacle to purchasing a BEV, which requires you to go to a public charging station. I see charging operators as functional, especially after these support payment cards, which makes them even better. These function well at the moment, and I use them myself. Pricing cannot be seen elsewhere besides the app, so you cannot see the price of electricity beforehand, which is surprising. The price of electricity is not shown similarly to other propulsion forces. I think that there will be a change. You can find out from the app, but not if you do not have the app installed. Subsequently, it is confusing that you can have a service provider with

different pricing between apps. With the generalization of public charging places, the problem leaves where problems are random after all.” (Interviewee 10, manager)

Briefly, consumers see that the state of charging infrastructure in Finland is inadequate but already in a reasonable state in Southern, Central, and Western Finland. The charging technology and operators are considered ambiguous due to pricing (price roaming) and app differences between different charging operators. The pricing and functionality of charging are viewed as costly but functional.

Meanwhile, managers perceive the state of charging infrastructure to be adequate. The charging technology and operators are considered challenging to use due to the sheer number of apps required for people who drive longer distances frequently. According to operators, the varying pricing is confusing, but functionality is favorable.

4.4. Western and Chinese battery electric vehicles (BEVs)

Meanwhile, the last and fourth theme ponders Western and Chinese battery electric vehicles (BEVs) by examining their global competition, brands, technologies, current market dynamics, and future market outlook with questions 10-12.

The questions highlight the reasons for purchasing a BEV and preferences for other brands, the perception of Western and Chinese BEVs and their differences, the competitiveness of Western BEVs compared to their Chinese counterparts, and the current and future market situation from the consumer perspective.

Multiple customers compare alternatives before purchasing, while some are loyal to their favorite car brand. Most interviewees see Western and Chinese BEVs as different and

consider Western BEVs safer and still more technologically advanced alternatives for nearly the same price. However, interviewees are interested in Chinese BEVs' future and technological potential.

“I see that vehicles from the VW conglomerate, which I have sat in the most, are quality vehicles, and you can feel from everything that they are well-built. In my view, purchasing from a manufacturer with a long-standing presence in the market is still different. Nevertheless, I believe that the Chinese can produce vehicles efficiently.”

(Interviewee 6, consumer)

The interviewees still see Western BEVs as more competitive than their Chinese counterparts but are primarily excited about more options in the market. It is perceived that the current market situation could change rapidly as Chinese firms are pushing more and more products to the vehicle market, while many European and Japanese vehicle manufacturers have been late in realizing the potential that the electric future can hold. Heavy government subsidies and tariffs for Chinese firms are highlighted as these can potentially change the playing field. However, consumers see that heavy tariffs imposed by Western countries can shield their production and companies from the landslide of cheaper Chinese alternatives.

“They have a large capacity to mass produce and lower prices with government incentives, especially as there is not as much development as with internal combustion engines (ICEs). Tariffs are going to be especially critical, and these will probably affect the market situation.” (Interviewee 7, consumer)

On the other hand, managers see Chinese vehicles as a welcome addition to their brand selection. Managers note that European vehicles have realized that Chinese vehicles are competitive and are here to challenge them in their home market. Managers note that

Chinese vehicle manufacturing has evolved significantly, and large brands in China are in Europe as well. Managers see that tariffs will have an effect on the competition and pricing of BEVs.

“Every manufacturer is welcome. However, as long as there are only two battery cell suppliers worldwide and no individual powertrains, the technical differences between vehicles are minimal. BYD and MG are among the largest brands in China and Europe. Unfortunately, Finnish customers might be skeptical and search for European alternatives. Tariffs will, of course, affect the market.” (Interviewee 9, manager)

“I see the global competition in that way that Chinese BEVs are completely comparable to Western BEVs and even ahead in multiple matters, as they have been able to make only BEVs, similarly to Tesla. The electric features are better than those of traditional brands. When you go forward in time, the lead will certainly flatten. I predict that the price range under 30,000 euros and under BEVs will come from East Asia, and generally, products will be from the affordable end. The brand products would come from the West, similar to internal combustion engine (ICE) vehicles with premium brands. I believe that the manufacturing of affordable end products will continue in Asia. I consider BYD the most essential Chinese brand, and it is globally the largest BEV manufacturer. I believe it will also be a strong player in the future. There will be other strong brands from China, which will probably segment themselves differently. BYD is involved in every size class and model. Probably specific brands will be in different size segments.” (Interviewee 10, manager)

In addition, consumers' attitudes concerning Chinese BEVs, reasons for the favorability of BEVs, and the role of tariffs in global competition are described.

“In the big picture, consumers doubt a little bit as the thought of Chinese quality is of a certain type. Those who have adopted Chinese BEVs have noticed that these do not have differences in quality. I dare to recommend a Chinese BEV as well as a Western one. From some features, they are better, but some features required in this market are not found. So, it depends on which features you emphasize. There have been talks about alternative propulsion solutions such as hydrogen or biofuels, so there will be challenges. However, in the global picture, the investment in electric mobility comes from nations and other entities. I believe that electric mobility will be a megatrend for some time. Electric mobility's overall ease of functionality attracts, which demands a charging place at home. The factors relating to maintenance are more temporary maintenance, where there is no certain kilometer count to be fulfilled, but yearly maintenance. The ease of maintenance and the number of components are smaller than in a comparable ICE vehicle. These are the central reasons why, after one becomes familiar with a BEV, it is difficult to quit due to easiness. Through trust and experience, Chinese BEVs will become general when people can use them. These will take more market share than earlier, especially in the affordable BEV segment. Tariffs will surely impact, but continuity is more important for how long these would last.” (Interviewee 10, manager)

Consumers choose the purchased vehicle by comparing alternatives or staying loyal to their favorite brand. The most popular alternatives to their choice were Western BEVs. Due to unknown brands and technology, western and Chinese BEVs are seen as different. However, Chinese BEVs are seen as competitive. The current market situation from the consumer perspective is still favorable for Western BEVs, but their Chinese counterparts are reaching them quickly. In the future, it is noted to be highly likely that the competition will be even fiercer, with tariffs having a definitive impact.

Meanwhile, managers perceive consumers to choose the purchased vehicle by comparing alternatives. The most popular alternatives to their choice were Western BEVs or hybrid vehicles. Western and Chinese BEVs are seen as different due to new manufacturers. Chinese BEVs are already considered competitive. The current market situation from the managerial perspective makes Western and Chinese BEVs similar. The future scenario includes Chinese manufacturing evolving and challenging Western BEVs in new ways while tariffs favor Western brands.

5. DISCUSSION

The empirical evidence agrees with Corradi et al. (2023) that socio-technical transitions are relevant in sustainability transitions due to systematic environmental challenges with multiple causes. The three conceptual frameworks with a systemic view to transitions which are 'socio-ecological', the 'socio-economic', and the 'socio-technical' (Corradi et al., 2023), are represented in the interviews. The socio-ecological framework manifests as the highlighted environmental benefits of BEVs, while socio-economic factors are present in the noted cost-effectiveness of electric driving. The socio-technical framework appears in the interviews as the preference for modern technology, namely electric drivetrain and new features found in BEVs.

In addition, the interviews agree with Geels (2019) about regimes, landscape pressures, and niche-innovations, while for Corradi et al. (2023), those are economic, social, technological, and environmental concern factors.

In the interviews, the theory of Geels (2019) is examined as the current regimes, which are the fossil-fuel and internal combustion engine (ICE) industries, where the interviewees see BEVs as realistic challengers already, and even so in the future as technology develops. In addition, landscape pressures emerge in the interviews as macro-level trends. The interviewees stated that the most notable are climate change, trade or tariff changes, favorable BEV adoption policies, and competition between Western and Chinese manufacturers, pushing innovation and research and development of new innovative technologies.

In the interviews, the work of Corradi et al. (2023) is seen as economic factors that are the preference for low-cost driving, social factors such as the positive image of BEVs, technological as the preference for new technology, and environmental concern factors as

environmental reasons being one of the key motivators for the purchase of a battery electric vehicle. Meanwhile, the effects of Geels (2019) include sustainability transitions and regime transformation, while Corradi et al. (2023) emphasize economic implications, environmental benefits, and market transformation.

In the interviews, sustainability transitions refer to the shift from internal combustion engine (ICE) vehicles to BEVs, where the participants see the shift positively and see the electric future as a viable and the most likely outcome. Meanwhile, in the interviews, regime transformation refers to the shift from the current energy and automotive systems favoring fossil fuels to the utterly electric era where BEVs have a key role. Here, the interviewees highlight the importance of efficient marketing of BEVs, government incentives and suitable policies, and the need for a large and effortless charging network supporting the growing electric mobility need.

The economic implications of Corradi et al. (2023) in the interviews are cost-effectiveness, environmental benefits are the benefits of carbon-free driving, and market transformation symbolizes excitement and preparedness towards the shift to the electrification of the vehicle market.

In their academic work, the factors identified by Rezvani et al. (2015) are observed in the interviews which are contextual (conversations about charging infrastructure and government economic and non-economic benefits), technical (time spent charging, battery distance, quietness, rapidness, environmental friendliness, and road protection), social [compliance with societal standards in depictive (influence of the cohort), directive (endorsement of the cohort), perceived social standards (assumed beliefs of others) (Barth, Jugert, and Fritsche, 2016), individual standards and ethical commitments (Jansson, Nordlund, and Westin, 2017); assumed group impact of an activity (for example, as a cooperative activity produces a meaningful result); prestige and emblematic reasons) as

BEVs are viewed positively due to their environmental benefits and modern technology], personal elements [such as accountability, ecological awareness, ingenuity, living style, and self-image (Morton, Anable, and Nelson, 2016) (BEVs being considered as trendy and possibly a reflection of their persona and lifestyle), familiarity with BEVs (Schmalfuß, Mühl, and Krems, 2017), and pleasure-driven incentives (BEV driving delight)], and monetary benefits (acquisition and total cost of ownership and servicing, charging, and repair costs) (Corradi et al., 2023; Rezvani et al., 2015). However, the interviews do not discuss personal norms and moral duties (Corradi et al., 2023; Jansson, Nordlund, and Westin, 2017; Rezvani et al., 2015).

Predominantly, the position of social purposes is the customers' function in socio-technical transitions, including infrastructures, technologies, buyer patterns, cultural attitudes, legislative measures, market strategies, and markets (Geels, 2019) that are found in the interviews as the preference for new technologies, familiarity with the use of a BEV, cultural acceptance of battery electric vehicles, favorable BEV policies and business models, high market demand for BEVs, and functional and sufficient infrastructure for the electrification of traffic. Additionally, the author notes that when clients naturalize groundbreaking ideas, the invention can occur inside customer habits, which are converted from unaccustomed to accustomed normal items based on daily habits and ordinaries (Lie and Sørensen, 1996), which can be seen in the interviews as positive attitude for battery electric vehicles as the owners have experienced them and are very aware of their features.

Meanwhile, Verhees and Verbong (2015) examine the role of consumers in sustainability transitions. Their theory is harnessed in the interview process by examining the user, consumer, and citizen behaviors to sustainable innovations with resistance on the one end and production on the other, including the roles of active resistance, less active resistance, passive adopters, sustainable co-producers, and user-led sustainable innovation. According to the interviews, most BEV owners are passive adopters (who buy sustainable products

without active involvement) and sustainable co-producers (who actively participate in sustainable practices). The individual roles include early adopters, resisters, rejecters, and socially constructed users, whereas active roles include user innovation and user entrepreneurs. Meanwhile, collective roles include large-scale social movements, represented users, collaborative consumption, and collective buying power. In the case of BEVs, the roles are mainly individual, with most consumers being early adopters and socially constructed users. Meanwhile, the BEV community can play a collective role.

The results support the work by Li et al. (2017, p. 326), where they create three categories for BEV adoption intentions: “(1) demographic factors including individual variables (e.g., gender, age, education, income, and occupation) and family variables (e.g., vehicle ownership, accessibility to plug-in vehicles at home, population, and the number of driving licenses); (2) situational factors such as technical features, cost, environmental attributes, and government policy; and (3) psychological factors such as experience, attitudes, emotions, perceived behavioral control, societal influence, and symbolic value.”

Also, the interviews agree with the work of Bryła, et al. (2023) as their consumer adoption factors include socioeconomic factors contributing to the selection of EVs (Ahmadi, Croiset, Elkamel, Douglas, Entchev, Abdul-Wahab, and Yazdanpanah, 2015), sustainability perspective (Almansour, 2022), the role of technology (Carley, Siddiki, and Nicholson-Crotty, 2019; Lim, Jahromi, Anderson, and Tudorie, 2015), and minimized operations cost and usage satisfaction (Bryła et al., 2023; Chu, Im, Song, and Park, 2019).

Moreover, battery range (Lebeau, Macharis, and Van Mierlo, 2016) and charging infrastructure, transparent and easier-to-adopt policy (Dong, 2022; Wang, Wang, Li, Wang, and Liang, 2018; Dua, Hardman, Bhatt, and Suneja, 2021; Fazeli, Davidsdottir, Shafiei, Stefansson, and Asgeirsson, 2017; Seminar, Calandra, Lanzalunga, and Ferraris, 2022), recommendations from governments encouraging customers (Srivastava, Kumar,

Chakraborty, Mateen, and Narayanamurthy, 2022), purchase price, financial incentives, and lack of charging infrastructure (Abotalebi, Scott, and Ferguson, 2019), consumer benefit appetite and willingness to buy (Featherman, Jia, Califf, and Hajli, 2021) when facing new technology (Irfan and Ahmad, 2021; Nazari, Rahimi, and Mohammadian, 2019; Featherman et al., 2021), consumer perception (Zhang, Wang, Wan, Zhang, and Zhao, 2022; Junquera, Moreno, and Alvarez, 2016), and attitude (Bryła et al., 2023; Wu, Liao, and Wang, 2020; Junquera, 2016).

In addition, the interviews concur with Bryła et al. (2023) with factors such as motivation (Zhou, Long, Kong, Zhao, Jia, and Campy, 2021; Junquera, 2016) on the price of the EV and longer charging time acted as a deterrent for considering EV purchase, interpersonal influence, and attitudinal factors, various consumer psychological factors (such as car ownership symbols and risk aversions) (Huang and Qian, 2018), government subsidies vehicles (Helveston, Liu, Feit, Fuchs, Klampfl, and Michalek, 2015), attitude and perceived behavior (Mohamed, Higgins, Ferguson, and Kanaroglou, 2016), and behavioral characteristics of consumers (Bryła et al., 2023; Ouyang, Zhang, and Ou, 2018).

Factors that are not mentioned in the interviews are poor air quality index (Nichols, Kockelman, and Reiter, 2015; Abotalebi et al., 2019), consumers' self-image (Jansson, Nordlund, and Westin, 2017; Li, Wang, Gong, and Liu, 2022), renting their own EV for a better and clearer attitude towards their ownership (Langbroek, Cebecauer, Malmsten, Franklin, Susilo, and Georén, 2019), cognitive consumer behavior with seeking a co-adoption policy for solar charging (Shakeel, 2022; Liang, Qiu, and Xing, 2022; Moon, Lee, Choi, and Woo, 2022), and the spatial effect (Bryła et al., 2023; Liu, Roberts, and Sioshansi, 2017; Shakeel, 2022).

The Technology Acceptance Model (TAM), the Theory of Planned Behavior (TPB), and the Diffusion of Innovation (DOI) model are harnessed in Theme 1. From the results, it is

possible to note that the Technology Acceptance Model (TAM) is related to the answers as perceived usefulness includes environmental and economic factors, while perceived ease of use is mentioned as a positive and, in the case of charging, which can be done conveniently at home. The intention to use is based on effortless driving and cutting emissions, while actual use is similar.

In the case of the Theory of Planned Behavior (TPB), behavioral beliefs can be that BEVs are seen as environmentally friendly and technological but costly products, attitude toward the behavior can be positive behavior towards BEVs due to the environmental benefits, lower usage costs, and new technology while cons such as the difficulty of charging outside home and high cost can hinder BEV adoption, normative beliefs are beliefs about the expectations of others, such as that people see BEVs as environmentally friendly options, subjective norm is the social pressure to drive a BEV due to the environmental and technological viewpoints, control beliefs are government incentives, ease-of-use, smaller maintenance, and availability of charging, perceived behavioral control include having enough resources for the purchase of a BEV, adequate charging opportunities, financial incentives, and technical knowledge, actual behavioral control includes the availability and amount of charging stations and charging options at home, government policies supporting BEVs, pricing of the vehicles, and intention behavior, positive attitudes towards BEVs lead to a purchase of a BEV. In the Diffusion of Innovation (DOI) theory, we can see that the interviewees are included in the innovators, early adopters, and early majority categories, while laggards are not presented in the answers.

The Technology Acceptance Model (TAM) and the Diffusion of Innovation (DOI) research model are utilized in Theme 2. Optimal sales system for battery electric vehicles (BEVs) (sales process or dealerships versus online sales, pricing, after-sales, and resale and maintenance network) (questions 4-6).

From the results, it is possible to note that the Technology Acceptance Model (TAM) includes perceived usefulness or time-savings by using online shopping, effortless shopping experience, and customer service in the physical dealership, perceived ease of use as the convenience of online shopping, the intention to use which is to make shopping faster and more convenient, and actual use which includes consumers harnessing websites to inspect a variety of options before choosing their favorite which is seen in person and test-driven before the purchase decision.

During the interviews of theme 2, it was revealed from the Diffusion of Innovation (DOI) perspective that there was a more laggard mindset than during theme one, as some interviewees trusted only physical dealerships. Nevertheless, most people shared the mindsets of innovators, early adopters, and early majority by cherishing the possibilities of either complete online sales or mixed-method sales with dealerships present.

The Sociotechnical system for transportation is harnessed in Theme 3. Battery electric vehicles (BEVs) charging (charging infrastructure, charging operators and technology, pricing, and functionality) (questions 7-9), the Technology Acceptance Model (TAM), the Theory of Planned Behavior (TPB), and the Diffusion of Innovation (DOI) theory as well.

From the results, it is possible to note that the Technology Acceptance Model (TAM) for Theme 3 includes perceived usefulness, which is fast charging; perceived ease of use or convenient charging solutions; intention to use, which is fast charging when on the road and home charging for overnight charging, and actual use which is fast charging with ambiguous pricing and apps when on the road, and affordable and convenient home charging for overnight charging.

The Theory of Planned Behavior (TPB) includes behavioral beliefs, attitudes toward the behavior, normative beliefs, subjective norms, control beliefs, perceived behavioral control,

actual behavioral control, and intentional behavior. The behavioral beliefs include charging seen as a must for travelers and environmentally friendly and less costly than fueling vehicles, attitude toward the behavior as primarily positive attitudes towards charging, normative beliefs as the beliefs of others which are mostly positive but also opposing viewpoints are highlighted, a subjective norm which is the pressure to charge BEV during longer trips. These control beliefs are the factors in favor and against BEV charging, primarily positive, but charging infrastructure is seen as lacking and the number of apps too large, perceived behavioral control, which is the ease and difficulty of charging BEVs, actual behavioral control or the cost of electricity, availability of charging, and technological know-how, and intention behavior which is the positive attitude towards BEVs and charging hindered by the negatives of charging (not enough chargers, lower charging speeds, broken chargers, etc.).

Most share the innovator, early adopter, and early majority mindsets from the Diffusion of Innovation (DOI) theory in charging. However, as opposed to previous themes, there is also a laggard mindset present as the shortcomings of the current state of the charging network are highlighted by the interviewees. However, as opposed to previous themes, there is also a laggard mindset present as the shortcomings of the current state of the charging network are highlighted by the interviewees.

Consumers see that Finland's charging infrastructure is inadequate but already in a reasonable state in Southern, Central, and Western Finland. The charging technology and operators are considered ambiguous due to pricing (price roaming) and app differences between different charging operators. The pricing and functionality of charging are viewed as costly but functional.

Meanwhile, managers perceive the charging infrastructure to be good. Charging technology and operators are seen as challenging due to the numerous apps required for people who

drive longer distances frequently. According to operators, the varying pricing is confusing, but functionality is satisfactory.

The Sociotechnical system for transportation, the Technology Acceptance Model (TAM), the Theory of Planned Behavior (TPB), and the Diffusion of Innovation (DOI) research model are handled in Theme 4. Western and Chinese battery electric vehicles (BEVs) (global competition, brands, technologies, current market dynamics, and future market outlook) (questions 10-12).

From the results, it is possible to note that the Technology Acceptance Model (TAM) includes perceived usefulness as fast charging, perceived ease of use as convenient charging solutions, intention to use as fast charging when on the road, and home charging for overnight charging, and actual use as fast charging with ambiguous pricing and apps when on the road, and affordable and convenient home charging for overnight charging.

The Theory of Planned Behavior (TPB) includes behavioral beliefs where Western BEVs are seen as quality, reliable, more expensive, and environmentally friendly products while Chinese vehicles are perceived to be more affordable, attitude toward the behavior as Western BEVs being trusted more due to more extended history in the market and brand value while Chinese are considered good value for the money, normative beliefs as beliefs of others are seen as favoring more Western BEVs in Finland, subjective norm as social pressure to choose a Western BEV, control beliefs as factors in favor and against Western and Chinese BEVs where Western BEVs are seen as quality products from known brands and Chinese as lesser known but likely to offer technology for the money, perceived behavioral control as the resources for owning a BEV and availability of vehicles and dealerships, actual behavioral control as resources, technology, dealerships, maintenance networks, brand value, reliability, and resale value, and intention behavior which is affected by the perceived behavioral control, attitude toward the behavior, and the subjective norm.

Positive attitudes and social pressure towards Western BEVs lead to purchasing one, while the same is true for Chinese BEVs.

The Sociotechnical system for transportation for Theme 4 includes rules and policies (governments making favorable policies for BEVs and tariffs), maintenance and supply network (either the same companies for Western and Chinese brands or unique shops for Western or Chinese brands only), industry ecosystem (raw materials and mining companies, research and development, vehicle, part, technology and battery, and charging manufacturers and providers, and sales networks through dealerships or manufacturer online sales, and recycling solutions), market dynamics and consumer behavior (favorable for Western brands but change is very likely), electrical infrastructure (mostly universal for all brands), battery electric vehicle (BEV) (difference between Western and Chinese manufacturing), culture and symbolic value of the brand and vehicle (the quality-image of Western BEVs and lesser-known Chinese BEVs), and road and traffic infrastructure (universal for all brands but more advanced vehicles could become a part of the infrastructure).

The theory of Diffusion of Innovation (DOI) can be perceived via the mindsets of innovators, early adopters, and early majority when considering Western BEVs. At the same time, laggard views are present when discussing Chinese BEVs as consumers can be skeptical about unknown technology and brands, especially if they are brand loyal to their familiar options.

6. CONCLUSION

The research reveals that Finnish customers perceive Western and Chinese battery electric vehicles (BEVs) positively, while Western BEVs are often considered more reliable, technologically advanced, and high-quality. However, customers see Chinese BEVs as interesting options with the need for development. This perception impacts the adoption and competitiveness of these products in the Finnish market as a positive image of the products increases adoption and competitiveness and encourages new customers to try the products and purchase them. The image of Western BEVs is currently better than that of Chinese BEVs because Chinese brands are still unknown to the majority, but there are clear efforts to improve the situation.

The research indicates that the factors influencing Finnish customers' perception of Western and Chinese battery electric vehicles (BEVs) the most are demographic (BEV-friendly location), situational (availability of charging infrastructure), and psychological factors, experience, and hedonic motivations (positive and comfortable image of electric driving and new technology), economic (purchase price, electricity costs, and maintenance), political (government incentives and BEV-friendly policies), social and symbolic motivations (the perception of others of BEVs and their owners), technological (interest for new technology), and environmental concern factors and perceived collective efficacy of an action (understanding the benefits of carbon-free driving) which affect customer perception by shaping consumer behavior and preferences.

6.1. Conceptual implications

The conceptual implications of this thesis are that it provides a current literature review and methodology of the latest academic works about the consumer opinion of battery electric vehicles (BEVs) in Finland. The theory can be a basis for mapping consumer opinion and

targeting the most interested consumer segments. Conceptually, the results add to existing research and provide valuable data to the BEV field. The socio-technical transitions theory, the role of consumers in socio-technical transitions, and factors influencing consumer intentions are utilized in the BEV framework to view the perceptions of Finnish customers for Western and Chinese battery electric vehicles (BEVs), the impact on adoption and competitiveness in the Finnish market, and to examine the factors influencing customer perception of these products.

Geels (2019) claims that socio-technical transitions link with studies in the first years of the new millennium within the subject of research about innovation, proven and enhanced by numerous historical investigations about transitions (in transportation, warmth generation, energy, agriculture and food production, sound arts, aquatic systems, and hygiene), and has later been extensively utilized in evaluations of ongoing and upcoming sustainability transitions (Geels, 2019). The study bolsters the social-technical transitions theory by examining it from the BEV viewpoint. It is possible to characterize these transitions as sustainability transitions, which are essential because of the systematic environmental adversities with diverse reasons. There are three theoretical structures with a holistic transition approach: “the socio-ecological, the socio-economic, and the socio-technical” (Corradi et al., 2023, p. 2), as seen in the interviews. The socio-technical approach is highlighted as the present studies address the subject from that perspective (where the socio-technical system is considered as a combination of factors such as research findings, technology, economy, regulations, infrastructure, purchasing patterns, cultural significance, and technology) (Corradi et al., 2023).

Corradi et al. 's (2023) antecedents are economic, political, social, demographic, technological, and environmental concern factors mentioned in the interview process. Meanwhile, the effects of Geels (2019) include sustainability transitions and regime transformation, while Corradi et al. (2023) emphasize economic implications,

environmental benefits, and market transformation, also found in the interview data. However, in the context of BEVs, socio-technical transitions can be viewed through the Multi-Level Perspective (MLP), which explores essential solutions to overcome continuous ecological challenges. It is argued that scholars can place the perspective into the wider discussion of sustainability transformations, where objections and seven of the latest elaborations of the MLP are discussed. Through awareness from the wider social sciences, it is noted that these developments have refined and diversified the comprehension of socio-technical transitions to sustainability and established the MLP as the foundation of a versatile and evolving research project with extensive empirical support. A perception of socio-technical transformations from several communities participating in different actions and revolutionary developments is accentuated by the MLP (Geels, 2019). Similarly, Corradi et al. (2023) also take the MLP viewpoint with the research of the stakeholder activities within the field of road passenger transportation and the examination of obstacles in the transition towards electric transportation. At the regime level, every customer or regime actor is emphasized. The authors do not resist transformation in all cases while stressing the participants as stabilizers of the socio-technical system. The writers state that these actors can effectively assist the transformation with a restructuring plan aligning with their priorities, and reshaping their actions is necessary for the regime to switch to happen (Corradi et al., 2023). This thesis contributes to the MLP perspective by focusing primarily on consumers, but other stakeholders are also mentioned in the interviews. The data gathered can benefit them as well.

Corradi et al. (2023) identify four groups of regime actors in the “road passenger system” (Corradi et al., 2023, p. 3) (customers, industry stakeholders, legislators, and community organizations), advocating for the dimensions of demand and supply, the situational conditions, and formulation of policies in the passenger vehicle sector. The research examines the BEV choices of each category of actors via influential factors. It is stated that multiple papers analyze personal traits of a socio-demographic and psychological nature

and individual and cultural standards affecting customer activity (Corradi et al., 2023). In their academic work, the factors identified by Rezvani et al. (2015) are observed in the interviews which are contextual (conversations about charging infrastructure and government economic and non-economic benefits), technical (time spent charging, battery distance, quietness, rapidness, environmental friendliness, and road protection), social [compliance with societal standards in depictive (influence of the cohort), directive (endorsement of the cohort), perceived social standards (assumed beliefs of others) (Barth, Jugert, and Fritsche, 2016), individual standards and ethical commitments (Jansson, Nordlund, and Westin, 2017); assumed group impact of an activity (for example, as a cooperative activity produces a meaningful result); prestige and emblematic reasons) as BEVs are viewed positively due to their environmental benefits and modern technology], personal elements [such as accountability, ecological awareness, ingenuity, living style, and self-image (Morton, Anable, and Nelson, 2016) (BEVs being considered as trendy and possibly a reflection of their persona and lifestyle), familiarity with BEVs (Schmalfuß, Mühl, and Krems, 2017), and pleasure-driven incentives (BEV driving delight)], and monetary benefits (acquisition and total cost of ownership and servicing, charging, and repair costs) (Corradi et al., 2023; Rezvani et al., 2015).

Consumers' function in socio-technical variations is described as the condition of social operations, including technologies, customer habits, cultural interpretations, government initiatives, commercial strategies, business environments, and facilities (Geels, 2019). This thesis contributes to the consumer perspective by examining consumer opinion and preferences. The research adds to the paper of Verhees and Verbong (2015) as the sustainability perspective can be found in the interviews as sustainability transitions. They state that structural and conceptual variety in transition research renders it nearly unachievable to form a comprehensive, unified declaration of civilian, customer, and end-user engagement (Verhees & Verbong, 2015).

Hansen et al. (2019) see the socio-technical transformations from the viewpoint of energy developments, where customer habits or purchasing trends are one of the six key subject factors related to BEVs. Also, the authors research BEVs from the standpoint of techno-economic implications (Hansen et al., 2019), which can be found in the interviews. Meanwhile, Noel et al. (2020, p. 2-3) ponder buyers' contribution to socio-technical developments by viewing BEVs and the “socio-technical system” framework, in which customers encounter the obstacles of BEVs. The opinions of researchers link to transit and energy infrastructure, which means the “socio-technical system” associated with BEVs. It examines further than the technical elements, including the societal impact and their position in it. Namely, it is stated that the notion of a “socio-technical system” assists in uncovering those technologies (for example, power distribution networks and BEVs) should be comprehended in their social setting and that the ideals of builders, innovators, directors, lawmakers, and customers influence the transformation of technology (Noel et al., 2020, p. 2-3). This study adds to the research of Noel et al. (2020) and Sovacool et al. (2018 a,b) by making an adaptation of the theory by Sovacool et al. (2018a,b) used in the research by Noel et al. (2020) better to suit the battery electric vehicle (BEV) landscape.

Conceptually, the research adds to the work of Li et al. (2017), where aspects affecting customer willingness for BEV acceptance are highlighted. In their view, there are three categories for BEV adoption intentions: “demographic, situational, and psychological factors” (Li et al., 2017, p. 326). Also, the research by Bryła et al. (2023) is complemented, where multiple consumer adoption factors are mentioned in the interviews.

Meanwhile, the socio-technical nexus of Nordic electric vehicle (EV) barriers and other frameworks affecting customer motives for BEVs combines all the main theories in this thesis and contributes to them by forming this comprehensive framework for the Nordic market. These include the Theory of Planned Behavior (TPB) and the Diffusion of Innovation (DOI) research model presented by the Boston University School of Public Health (2022),

the Technology Acceptance Model (TAM) in the work of Li et al. (2017) and Marikyan and Papagiannidis (2024), and the Socio-technical system for transportation inspired by the work of Sovacool et al. (2018a,b) in the paper of Noel et al. (2020).

6.2. Managerial implications

For managers, the results show that BEV owners have positive experiences owning a battery electric vehicle and enjoy the benefits electric driving offers. The managerial implications of this thesis are that it provides the latest and most meaningful information for the consumer opinion of the battery electric vehicle (BEV) market in Finland. Managers in the field can gain up-to-date information about the market situation in the Finnish context to develop their business strategies.

Managers can harness the theory of socio-technical transitions of battery electric vehicles, the role of customers in them, the factors influencing consumer intentions, and the Socio-technical nexus of Nordic electric vehicle (EV) barriers and other frameworks that influence consumer intentions to adopt battery electric vehicles by having a deep understanding of the consumer willingness for BEV adoption and what are the most efficient ways to introduce potential customers to the world of battery electric vehicles. For managers, special attention should focus on the perceived positives and negatives of BEVs by consumers, thus tailoring the way of presenting BEVs to customers in a welcoming way that emphasizes meeting customers' exact needs. The theories are utilized to view Finnish customers' perceptions of Western and Chinese battery electric vehicles (BEVs), the impact on adoption and competitiveness in the Finnish market, and to examine the factors influencing customer perception of these products.

6.3. Limitations

The limitations of this thesis are that while being an in-depth study into the battery electric vehicle (BEV) market, it only covers the Finnish market. Therefore, the cultural emphasis limits this thesis to the Finnish market, but it could serve as a basis for Nordic research. In addition, the researcher does not have professional experience in the battery electric vehicle (BEV) industry, thus relying on the feedback, expertise, and latest information from the consumers and the experts in the field.

Furthermore, one limitation is the rapid development of the battery electric vehicle (BEV) field and technology, where innovation is constant, and the whole industry can change rapidly. Thus, the information presented in this thesis can become outdated quickly. Also, the broad topic of battery electric vehicles is approached only from the standpoint of consumer opinion.

6.4. Suggestions for future research

The suggestions for future research include expanding the research horizon by including consumer opinion research in other countries and cultural areas to produce well-rounded sampling and research for advancing the mainstream adoption of battery electric vehicles (BEVs) globally. Future research should focus on other viewpoints, such as the technological perspective.

In addition, future research could update this research topic after technological advancements and other significant developments in the battery-electric vehicle environment. The topic of brand influence and how these compare between different brands and Western and Chinese BEVs could also be a welcome addition to reveal the most in-depth insights into consumer opinion.

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APPENDICES

Appendix 1. Interview guide

The interview themes and questions are based on consumer behavior and preferences for battery electric cars in Finland. The semi-structured interview framework will be based on the Theoretical Background and Methodology chapters, or more specifically, the questions are based on Figure 4 (The socio-technical nexus of Nordic electric vehicle (EV) barriers and other frameworks influencing consumer intentions to adopt battery electric vehicles) presented in the Theoretical Background chapter. The structure is from work by Kallio et al. (2016), Taherdoost (2022), Staller (2022), *Fuels Institute/Ricardo Strategic Consulting* (2021), and inspired by Lee and Clark (2018), Kantar (2023), Cardell and Batra (2023), Durmuş Şenyapar and Akıl (2023). (2023), and Shivaraman (2024). These current, highly relevant academic works validly address the research purpose.

The interview questions for the consumers and managers belong to the following themes:

1. Consumer preferences for battery electric vehicles (BEVs) (attitudes, pros and cons, development targets, preferred features, and government incentives and policies) (questions 1-3) (Based on the Technology Acceptance Model, TAM, the Theory of Planned Behavior, TPB, and the Diffusion of Innovation, DOI)
2. Optimal sales system for battery electric vehicles (BEVs) (sales process or dealerships versus online sales, pricing, after-sales, and resale and maintenance network) (questions 4-6) (Based on the Technology Acceptance Model, TAM, and the Sociotechnical system for transportation)

3. Battery electric vehicles (BEVs) charging (charging infrastructure, charging operators and technology, pricing, and functionality) (questions 7-9) (Based on the Sociotechnical system for transportation)
4. Western and Chinese battery electric vehicles (BEVs) (global competition, brands, technologies, current market dynamics, and future market outlook) (questions 10-12/13) (Based on the Technology Acceptance Model, TAM, the Theory of Planned Behavior, TPB, the Diffusion of Innovation, DOI, and the Sociotechnical system for transportation)

Questions for consumers

The interview questions for the consumers and managers belong to the following themes:

Theme 1. Consumer preferences for battery electric vehicles (BEVs) (attitudes, pros and cons, development targets and preferred features, and government incentives and policies) (questions 1-3)

- 1) How and why did you buy a battery electric vehicle (BEV)? Tell me about the decision-making process (e.g., steps and milestones).
- 2) How do you see battery electric vehicles (BEVs)? What are their pros and cons, in your opinion?
- 3) Which features should be added or removed? How do government incentives or policies affect your preference for a battery electric vehicle (BEV)?

Theme 2. Optimal sales system for battery electric vehicles (BEVs) (sales process or dealerships versus online sales, pricing, after-sales, and resale and maintenance network) (questions 4-6)

- 4) What is the optimal sales channel (and process) for a battery electric vehicle (BEV), a physical dealership, or an online retailer? Why?
- 5) How do you see the pricing of battery electric vehicles (BEVs)?
- 6) What is your view on battery electric vehicles' after-sales, resale, and maintenance network (BEVs)?

Theme 3. Battery electric vehicles (BEVs) charging (charging infrastructure, charging operators and technology, pricing, and functionality) (questions 7-9)

- 7) What is the state of charging infrastructure in Finland, in your opinion?
- 8) How do you see the charging technology and operators? Are these easy to use?
- 9) What is the pricing and functionality of charging?

Theme 4. Western and Chinese battery electric vehicles (BEVs) (global competition, brands, technologies, current market dynamics, and future market outlook) (questions 10-13)

- 10) Why did you choose the vehicle you bought? Did you consider other vehicles? If yes, which ones?

- 11) How do you see Western and Chinese battery electric vehicles (BEVs)? Are there any differences?
- 12) How competitive are Western battery electric vehicles (BEVs) compared to their Chinese counterparts? Why is this?
- 13) How do you see the current market situation from the consumer perspective? How about in the future?

Questions for managers

Theme 1. Consumer preferences for battery electric vehicles (BEVs) (attitudes, pros and cons, development targets, preferred features, and government incentives and policies) (questions 1-3)

- 1) What are consumers' most common steps and milestones when buying a battery electric vehicle?
- 2) What are consumers' most common attitudes and pros and cons concerning BEVs?
- 3) What are the most required development targets and preferred features for BEVs by customers? How about managers? How do government incentives and policies affect consumer preferences for BEVs?

Theme 2. Optimal sales system for battery electric vehicles (BEVs) (sales process or dealerships versus online sales, pricing, after-sales, and resale and maintenance network) (questions 4-6)

- 4) What is the optimal sales system for a battery electric vehicle (BEV) (dealership or online sales)?
- 5) How are the demand for ownership and consumer preferences predicted to change (e.g., car sharing, private and company leasing, and renting)?
- 6) How do pricing, after-sales, resale, and maintenance networks affect consumer choice?

Theme 3. Battery electric vehicles (BEVs) charging (charging infrastructure, charging operators and technology, pricing, and functionality) (questions 7-9)

- 7) How do you see the current state of the charging network in Finland? Is it adequate? What could be better?
- 8) How about charging operators? Do you consider them functional?
- 9) What is the pricing and functionality of the charging infrastructure?

Theme 4. Western and Chinese battery electric vehicles (BEVs) (global competition, brands, technologies, current market dynamics, and future market outlook) (questions 10-12)

- 10) How is the global competition between Western and Chinese battery electric vehicles (BEVs)? Which brands are the most significant? Why?
- 11) What are the current market dynamics? Why is this?

12) How about the future outlook? How so?