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Strategic Business Model Innovation in the Electric Vehicle Charging Industry: An Analysis of Charge Point Operators in Europe – Assessing Concepts of Business Model Innovation

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Abstract

This thesis investigates the strategic business models of Charge Point Operators in the European Electric Vehicle Charging industry, with a particular focus on oil and gas companies transitioning to e-mobility. By leveraging frameworks such as the Business Model Canvas and Ecosystem Pie Model, the study explores how legacy assets, such as fueling networks, shape business model strategies and their ability to scale during the industry's shift toward mass market adoption. Through a mixed-methods approach incorporating secondary data and expert interviews, the research provides actionable insights for sustainable growth, innovation, and ecosystem collaboration in the evolving EV charging landscape.

Keywords

Strategic Business Model, Business Model Innovation, Strategic Industry Analysis, E-Mobility, Electric Vehicle Charging, Charge Point Operators, Public Charging

Preface

We extend our sincere gratitude to Professor Ilya Okhmatovskiy for his guidance and support throughout this thesis. We would also like to give special thanks to all interview participants and peers from the "Strategic Business Model Innovation" field lab for their insights and thoughts, which greatly enriched our work. Finally, we are grateful to NOVA SBE for fostering a supportive and stimulating academic environment.

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1 Introduction (Individual Part)

1.1 Relevance and Trends

Road transportation is a major contributor to worldwide CO_2 emissions, coming in second after electricity and heating. In total, the mobility sector accounts for nearly 15% of global energy-related emissions (GridX 2024a). Driven by the ambition to lower emissions and mitigate climate change, a surge in electric vehicle (EV) sales can be observed across the world. In 2023, 13.6 million EVs were sold globally, constituting an increase of 31% compared to the prior year (IEA 2024). In the next decade, the transformation towards e-mobility is prognosed to accelerate, mainly driven by the increased cost competitiveness of EVs compared to conventional vehicles, as well as ambitious decarbonization targets (Maisonnier, Longstaff, and Vilchez 2022). For instance, the 2019 European Green Deal targets carbon neutrality by 2050 and a 55% reduction in emissions by 2030. The CO_2 regulation states that from 2035, only electric cars and vans will be allowed to be sold in the EU (ACEA 2024a). However, there are strong headwinds that currently hinder widespread EV adoption: high electricity costs, inflation, reduced government subsidies, and a perceived lack of charging infrastructure (Vilchez et al. 2024). To accommodate the increasing number of EVs, an accessible and affordable charging infrastructure is of critical importance. Range anxiety is described as a major concern for potential EV buyers, and insufficient charging infrastructure can substantially deteriorate the EV user experience and reinforce adoption barriers (Mildner 2023). Currently, 70% of EV charging in Europe happens at home or work, but the availability of public charge points (PCPs) is crucial to provide flexibility, alleviate range anxiety, and enable seamless journeys. Studies suggest that in ten years, 40 to 50% of energy for EVs will be supplied by public chargers (Hagenmaier et al. 2021). By 2023, there were 630k PCPs in the EU, and based on the exponential EV growth, significant growth in infrastructure is needed (GridX 2024a). The projected needs and estimates for 2030 vary considerably, highlighting the uncertainty still present in the market (figure 1). For example, the IEA estimates 2.7 million charging points (IEA 2024), the European Federation for Transport and Environment (T&E) projects 3 million (European Federation for Transport and Environment 2020), McKinsey forecasts 3.4 million (Conzade et al. 2022), and the European Commission predicts 3.5 million (ACEA 2024b). Overall, resulting in an annual growth rate between 23% and 28% through 2030.

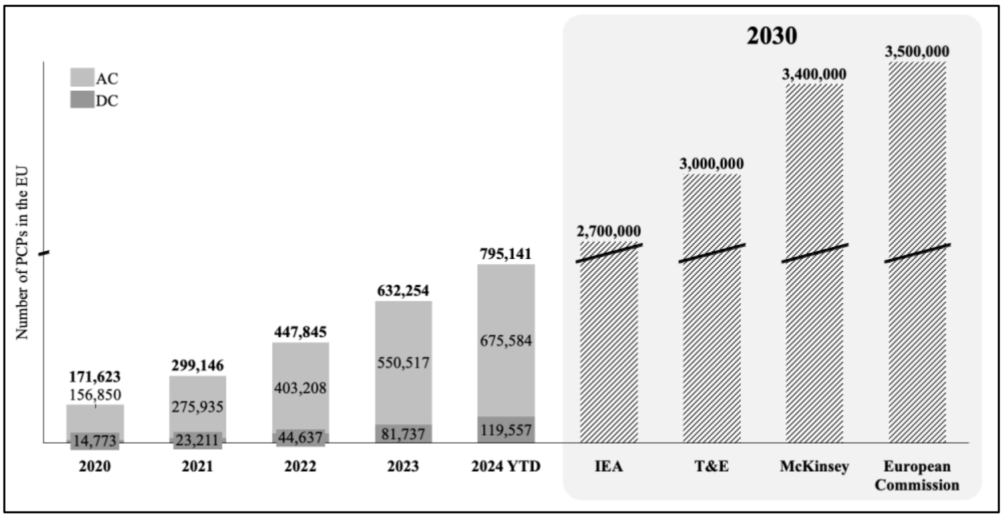

Figure 1: PCPs in EU, own depiction based on European Commission (2024a)

Various players have recognized the growth potential and strategic importance of EV charging and are pursuing diverse strategies to achieve profitability in this industry, leading to a highly fragmented market. The industry landscape is expected to change significantly as it matures, with projections indicating three to four players per market that can sustain an above-average market share of 15% or more (Kane et al. 2021).

The Electric Vehicle Charging Industry (EVCI) was selected for business model (BM) analysis because of the highly competitive, dynamic, and rapidly evolving environment. The market is currently highly fragmented, with consolidation anticipated in the coming years. Only companies with robust, future-proof BMs capable of rapidly scaling infrastructure are likely to achieve long-term success. Furthermore, the EVCI can be described as an interface between the automotive and energy sectors, two industries that are undergoing substantial transformation towards more sustainable products and services. As the EV industry and, therefore, EV charging is relatively new, numerous developments have the potential to disrupt and shape the industry in the future, making it an interesting ecosystem to analyze.

1.2 Structure of Work and Methodology

This thesis explores the EVCI regarding key industry developments, different players, and the business models they deploy in the industry. The primary objective is to conduct an in-depth analysis of the BM of a Charge Point Operator (CPO) and provide actionable insights and recommendations.

The research is conducted in two main phases. First, secondary data is collected from industry reports and academic journals to establish a foundational understanding of the industry. This preliminary analysis lays the groundwork for the second phase, where industry experts are interviewed to assess BMs currently implemented in the EVCI.

The thesis is structured to progress logically from theoretical foundations to industry-specific applications. This structure ensures a clear understanding of academic concepts and frameworks, which then inform the analysis of industry dynamics and trends. Chapter 2 introduces essential definitions and theoretical models, such as the Business Model Canvas (BMC) and Ecosystem Pie Model (EPM), which guide the subsequent practical analysis.

The research adopts a qualitative approach, employing a combination of literature review and expert interviews. The literature review, covered in Chapters 2 and 4, follows an integrative approach as recommended by Snyder (2019). This approach is particularly suitable given the emerging nature of the EVCI field and allows for a more flexible synthesis of insights from both academic and industry sources. Instead of relying solely on systematic, quantitative methods, this thesis incorporates recent data and perspectives from industry stakeholders and related sectors to fill gaps in the academic literature.

The goal of this research is to conceptualize the current state of strategic BMs within the EVCI and to develop actionable recommendations for optimizing the selected BM. By combining academic theory with practical insights, this thesis provides a comprehensive analysis that reflects the evolving nature of the EVCI.

2 Literature Review: Business Models (Individual Part)

Before delving into specific BMs utilized within the EVCI, it is essential to establish a thorough understanding of the concepts of "business model" and "business model innovation" (BMI). To this end, a review of relevant theoretical literature was conducted, focusing on the definitions, core components, and evolving frameworks associated with these terms. Insights from this literature review form the foundation for the subsequent analysis of BMs.

2.1 Definition

Although businesses existed for centuries, the concept of "business models" did not gain prominence in academic literature until the mid-1990s, when web-based businesses emerged (Zott, Amit, and Massa 2011). BMs are frequently conceptualized as defining the architecture or framework of a business (Teece 2010), and early definitions surfaced quickly as scholars sought to delineate this structure. Timmers (1998, 4), for instance, offers a concrete definition, describing a BM as follows:

> "An architecture of the product, service and information flows, including a description of the various business actors and their roles; a description of the potential benefits for the various business actors; a description of the sources of revenues."

In contrast, other definitions are more abstract. Magretta (2002) conceptualizes a BM as a narrative or story explaining how enterprises work. Some scholars attempt to break down BMs into specific yet abstract components. Alt and Zimmerman (2001), for example, categorize a BM into six elements: Mission, Structure, Processes, Revenues, Legal Issues, and Technology.

In recent literature, a convergence in the conceptualization of business models has emerged, characterizing them as “design or architecture of the value creation, delivery, and capture mechanisms” within an enterprise (Teece 2010). Despite diverse definitions, certain recurring themes have become evident in defining business models, such as a system-level perspective, a “holistic” perspective on how firms “do business” (Zott, Amit, and Massa 2011). Comprehensive literature reviews have identified shared components across definitions. Shafer, Smith and Linder (2005) categorize these components into four clusters: **strategic choices** (Customer, Value Proposition, Capabilities/Competencies, Revenue/Pricing, Competitors, Output, Strategy, Branding, Differentiation, Mission), **value network** (Suppliers, Customer Information, Customer Relationship, Information Flows, Product/Service Flows), **capture value** (Cost, Financial Aspects, Profit), and **create value** (Resources/Assets, Processes/Activities). Alternatively, Burkhart et al. (2011) propose key components, including **offering** (value creation for stakeholders), **market** (who is the value created for), **internal capability** (internal activities and competencies), and **economic** (all economic-related aspects) components.

Nonetheless, despite the development of numerous frameworks and a common general understanding, there is no standardized and universally accepted analytical concept for defining BMs in the literature (Zott, Amit, and Massa 2011; Li 2020). Frameworks are often developed from different analytical perspectives and objectives, which complicates efforts to synthesize them effectively (Li 2020). This results in continued research regardless of the lack of an explicit concept definition (Foss and Saebi 2018). Appendix 1 provides a summary of prevalent BM definitions.

While closely related, BMs and strategy are distinct concepts. BMs can serve as an “abstraction of a firm’s strategy that can be applied to various companies” (Burkhart et al. 2011) or as “a reflection of the firm’s realized strategy” (Casadesus-Masanell and Ricart 2010). Notably, the same BM may support firms with differing strategic goals (Burkhart et al. 2011) and be a potential source of competitive advantage (Christensen 2001).

2.2 Prominent Business Model Frameworks

Despite the lack of a uniform BM definition in literature, several frameworks or ontologies try to sum up and combine elements that make up a BM. In academic papers, these elements are also referred to as building blocks (Osterwalder and Pigneur 2011), components (Pateli and Giaglis 2004), or questions (Morris, Schindehutte, and Allen 2005). BM frameworks and ontologies, therefore, do not only describe the elements but also define relationships between them and often introduce a hierarchal structure (Gordijn, Osterwalder, and Pigneur 2005). This hierarchal structure is often introduced as a two-layered model with higher-level and lower-level elements (Fielt 2013). This chapter presents a selection of the most important frameworks, including two frameworks that examine the BM isolated on a company level and one framework that evaluates multiple BMs from a broader market perspective.

2.2.1 The Business Model Canvas

The most popular BM framework is the Business Model Canvas (Osterwalder and Pigneur 2010), which is a follow-up of the BM Ontology (Osterwalder 2004). Osterwalder and Pigneur (2010) define a BM as "[…] the rationale of how an organization creates, delivers, and captures value". Moreover, the BMC is a tool for describing, analyzing, designing, and adjusting BMs, with nine basic building blocks that show the logic of how a company intends to make money (figure 2). The nine building blocks are explained in more detail in the following section:

The first one is **"Customer Segments"**, which describes the different groups of people or organizations an enterprise aims to reach and serve. These groups have common needs, common behaviors, or different attributes. It, therefore, involves a two-part process in which a segmentation (grouping of different people) is carried out before a targeting decision is made. Osterwalder and Pigneur (2010) distinguish between different types of customer segments, including the “mass market” (not differentiating between different customer segments and targeting the market as a whole), “niche market” (serving specific, specialized customer segments), “segmented” (distinguishing between market segments with slightly different needs and problems); “diversified” (targeting two unrelated customer segments with very different needs and problems) and “multi-sided platforms or multi-sided markets” (addressing two or more interdependent customer segments).

Secondly, the block **“Value Propositions”** defines a collection of products/services that create value for a specific customer segment, therefore solving a problem or satisfying a customer need. Customers choose one business over another because of its value proposition. These values can be quantitative (e.g., price, service speed) or qualitative (e.g., design, customer experience). Osterwalder and Pigneur (2010) present examples of contributions to customer value creation, including need creation, improvement of product or service performance, adaptation to customer needs, advertisement of the brand/status, or price advantage.

Thirdly, the block **“Channels”** outlines a company's approach to reaching and communicating with its customer segments to transfer a value proposition. Osterwalder and Pigneur (2010) distinguish between five different phases that are essential for reaching out to customers: raising awareness, evaluation phase of the value proposition, purchase phase, delivery of the value proposition, and after-sales. A channel can cover some or all of these phases. The channel can also be owned, provided by partners, or a mix of both, as well as direct or indirect.

“Customer Relationships”, the fourth building block, explains the kind of relationships a business makes with particular customer segments that range from personal to automated ones. Relationships can be driven by motivations, including customer acquisition, retention, and upselling. Literature differentiates between multiple categories of customer relationships that are not mutually exclusive and may co-exist. Examples are personal assistance (based on human interaction), self-service (no direct relationship with the customer), or communities (facilitating connections between community members).

The cash a business generates from each customer segment is represented by the **"Revenue Streams"** building block by addressing the value each segment is willing to pay. There are two types of revenue streams: transaction revenues (from one-time customer payments) and recurring revenues (from ongoing payments). Osterwalder and Pigneur (2010) define multiple ways to generate revenue streams, including asset sales (from selling ownership rights to physical product), usage fees (from using a specific service), subscription fees (from selling ongoing access to service), lending/renting/leasing (from temporarily granting exclusive asset usage right), and licensing (permitting intellectual property usage). Other options are brokerage fees (from intermediation services performed on behalf of two or more parties) or advertising (from fees for advertising a particular product, service, or brand). The revenue streams mainly have two pricing mechanisms: fixed and dynamic pricing.

The sixth building block, **"Key Resources"**, summarizes the most important assets required to enable the aforementioned building blocks of the BM. They can be physical (such as vehicles or machines), financial (e.g., cash, lines of credit, or a stock option pool for hiring purposes), intellectual (e.g., brand, knowledge, patents), or human. Resources can be owned or leased by the company or acquired from key partners (Osterwalder and Pigneur 2010).

The **"Key Activities"** underline the most crucial actions a business must do to ensure the success of its BM. Osterwalder and Pigneur (2010) categorize key activities in production (designing, making, and delivering a product with a unique selling proposition), problem-solving (developing innovative solutions for specific consumer issues), and platform/network (e.g., related to platform management, service provisioning, and platform promotion).

The network of suppliers and partners that support the BM is defined as the **"Key Partnerships"** building block for optimizing their practices, reducing risk, or acquiring resources. The literature differentiates between four types of partnerships: strategic alliances between non-competitors, partnerships between competitors, joint ventures for developing new businesses, and buyer-supplier relationships. Additionally, there are three motivations for the creation of partnerships: optimization and economy of scale, reduction of risk and uncertainty (especially in competitive environments), as well as the acquisition of specific resources and activities (Osterwalder and Pigneur 2010).

The most important expenses that arise from the BM are summarized in the last building block, the **"Cost Structure"**. The literature distinguishes between two classes: cost-driven (focus on minimizing costs) and value-driven BM (focus on value creation). However, these classes are not mutually exclusive. Cost structures can have different characteristics, including fixed costs (independent from the volume), variable costs (dependent on the volume), economies of scale (cost advantage driven by higher output), and economies of scope (cost advantage driven by the larger scope of operations) (Osterwalder and Pigneur 2010).

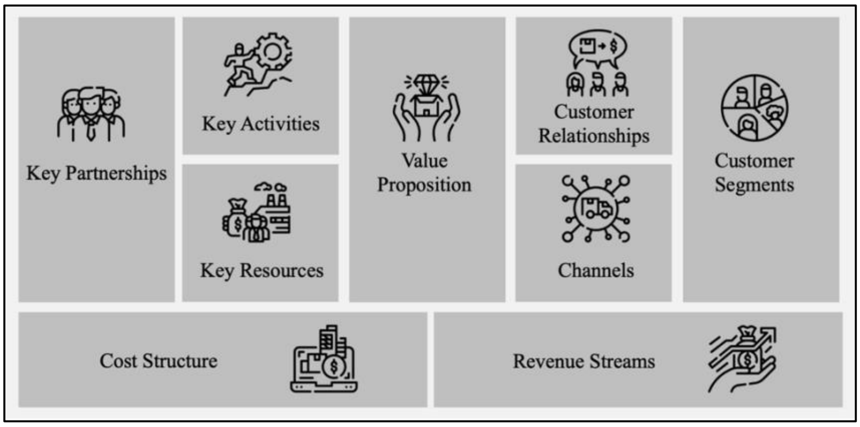

Figure 2: The elements of the Business Model Canvas, own depiction based on Osterwalder and Pigneur (2010)

2.2.2. Afuah's Business Model Framework

An alternative, on five components build framework, is Afuah's (2014) BM framework (figure 3). The first component is the **customer value proposition**, i.e., activities, products, or services that are carried out to satisfy customer needs, especially unique benefits compared to competitors. The products/services offered also depend on the reputation/image and the other assets that a company controls, such as customer relationships. Secondly, the **market segment** component describes the customer groups to whom a value proposition is offered, how many customers there are in each group, their attractiveness, and willingness to pay. Additionally, the component represents the quality and quantity of the coopetitors (incl. suppliers, complementors, and competitors) with which the firm needs to cooperate to capture value. Thirdly, **the revenue model** component addresses how, when, for what, and how much customers have to pay for products/services. The companies' pricing model is also a critical part. A unique component, in comparison to other BM frameworks, is the **growth model** component, as it covers how a business can expand successfully and what steps it must take to attract additional customers, raise their willingness to pay, and maintain low expenses while keeping prices close to customers' reservation prices. The last component represents the **capabilities** that consist of resources and activities, the tools a business employs to develop and/or convert resources into value that is created and captured (Afuah 2014).

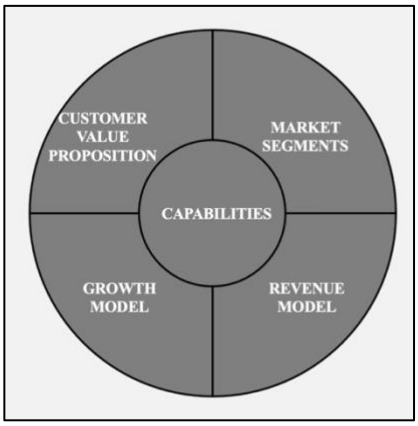

Figure 3: Afuah's Business Model Framework, own depiction based on Afuah (2014)

Appendix 2 presents a selection of further BM frameworks, including the magic triangle framework depicted in appendix 3 with their related elements, that are not specified further. However, they are largely consistent with the components of the aforementioned.

2.2.3 The Ecosystem Pie Model

In addition to the concepts above, which can be used to analyze a specific BM, there are also approaches for representing the interaction of several BMs in an ecosystem. Companies frequently depend on other ecosystem players to accomplish their value proposition. The EPM is a tool to map, analyze, and design innovation ecosystems, as depicted in appendix 4 (Talmara et al. 2020).

The framework differentiates between ecosystem-level constructs (value proposition, user segments, and actors) as well as actor-level constructs (resources, activities, value addition & capture, dependence, and risk). In the center of the pie is the **ecosystem's value proposition**, which can be described as a system-level goal or an overarching offer by the supply-side agents in the ecosystem (Slater 1997). Additionally, **user segments** specify the target market for the value created in the ecosystem (Talmara et al. 2020). The main **actors** involved in the value creation of the ecosystem are visualized as "slices" of the EPM. They are defined as legally independent but economically interdependent entities that carry out different productive activities within the modular architecture of the ecosystem (Jacobides, Cennamo, and Gawer 2018). When applying the framework, the following constructs must be defined for each actor: **Resources** (can also be obtained from other actors in the ecosystem) (Lubik and Garnsey 2016), **activities** (how resources are converted into value) (Zott and Amit 2010), **value addition** (outcome of the activities the actor contributes to the ecosystem) (Rothaermel 2001) and **value capture** (how, what kind, and how much value is captured by a particular actor). The latter does not necessarily entail financial gains but also non-monetary benefits such as reputation, greater efficiency, or additional resources (Lepak, Smith, and Taylor 2007). Furthermore, the framework includes the construct **dependence**, which is defined as the extent to which the success of the actor is related to that of the ecosystem. In addition, the construct **risk** includes actor-specific uncertainty, particularly concerning the construct's dependency and value capture. The unwillingness of certain actors to contribute to the ecosystem is an exemplary source of risk (Talmara et al. 2020).

2.3 Business Model Innovation

Business Model Innovation is a relatively underexplored area compared to the study of BMs, but interest by scholars has surged in recent years (Foss and Saebi 2017). This growth is attributed to BMI's role in enhancing performance (Zott, Amit, and Massa 2011) and its potential as a pathway to achieving competitive advantage (Teece 2010). Similar to the development of BM definitions, BMI has been approached from diverse perspectives, resulting in a variety of definitions offered by scholars, reflecting differing research objectives and theoretical orientations (Foss and Saebi 2018; appendix 5). For instance, Teece (2010) defines BMI as the process of finding novel ways to generate revenue and deliver unique value propositions for customers, suppliers, and partners. Foss and Saebi (2017) categorize BMI by examining two key dimensions: **scope** (modular vs. architectural) and **novelty** (new to firm vs. new to industry). There are different perspectives in literature debating on whether a single modification to a BM component qualifies as innovation or if BMI requires changes to multiple components or novel reconfiguration. Based on these dimensions, Foss and Saebi (2017) propose four different types of BMI: (1) **Evolutionary BMI**: This involves gradual and incremental modifications to existing BMs, typically in response to external pressures or influences. (2) **Adaptive BMI**: This represents comprehensive changes to the BM architecture that are novel for the firm but not new within the industry. (3) **Focused BMI**: This entails innovating a specific BM component, disrupting the industry while the remaining structure of the BM remains intact. (4) **Complex BMI**: Involves a complete redesign of the BM that is entirely new to the industry, potentially leading to the creation of new industries (Teece 2010). Drivers of BMI are typically grouped into internal and external factors. **External drivers** include shifts in the competitive landscape (de Reuver, Bouwman, and Haaker 2009), changing stakeholder demands (Ferreira et al. 2013), and the advent of new information and communication technologies (Wirtz, Schilke, and Ullrich 2010). **Internal drivers** are often associated with dynamic capabilities, such as the firm’s ability to respond to significant shifts in the environment (Teece 2007), the adoption of open innovation processes (Chesbrough 2010), factor conditions and conflicts (Chung, Yam, and Chan 2004), changes such as new product and service offerings, or changed revenue models (Giesen et al. 2010).

Despite its potential, BMI faces notable **barriers** within established companies, including challenges related to existing asset configurations, ingrained processes, and limited understanding among key employees of the value potential of BMI initiatives (Bouchikhi and Kimberly 2003). This underscores the crucial role of leadership in facilitating BMI. Effective leadership is often essential for navigating these challenges and may involve establishing a targeted leadership agenda (Svejenova, Planellas, and Vives 2010) or fostering engagement and collaboration within an informal organizational structure (Santos, Spector, and Van der Heyden 2009). Similarly, Chesbrough (2010) identifies two major barriers to BMI: obstruction (resistance to change) and confusion (lack of clarity around BMI initiatives). He suggests that change-oriented leadership, along with experimentation, are essential strategies for overcoming these barriers. Giesen et al. (2010) identify three key requirements for successful BMI: strong alignment with both internal and external stakeholders, ongoing monitoring and analytical assessment, and a flexible design allowing for new model adaption.

3 Methodology of Assessing the EV Charging Industry (Group Part)

3.1 General Approach

The analysis of the EVCI follows a qualitative mixed methods approach, relying on primary and secondary data sources to address the prevalent multi-faceted research problem (Doyle, Brady, and Byrne 2009). As an initial step, secondary research was conducted to understand industry dynamics and identify the key topics shaping the EVCI. Reports from consultancies and organizations such as Vilchez et al. (2024) or the International Energy Agency (IEA) (2024) provided a foundational overview of the EVCI, including the identification of industry player types, major trends, and prevailing challenges. However, this research revealed that secondary data was insufficient for an in-depth examination of individual BMs, their interrelationships, and the most pressing challenges and opportunities faced by companies operating within the EVCI. To address this gap and develop a more comprehensive understanding, industry experts from diverse backgrounds were consulted to provide first-hand insights. Their perspectives were particularly valuable given the fragmentation of the EVCI, with multiple industries converging on this market. These experts offered critical insights into the resources companies leverage, the activities driving business scaling, and the mechanisms by which firms capture value through their BMs. The integration of secondary research and expert interviews thus forms a robust foundation for understanding BM variations, selecting a model for detailed analysis, and ultimately deriving actionable recommendations.

It is essential to recognize that qualitative research is inherently subject to certain limitations, such as selection bias (Collier and Mahoney 1996). Additionally, maintaining transparency and consistency throughout the research process is critical for ensuring the reliability of the findings. Regarding validity, one needs to emphasize the significant influence of the selection and quality of the data, particularly in the case of primary sources (Dorussen, Lenz, and Blavoukos 2005). To overcome these methodological constraints, the field lab group leveraged the advantage of collaboration dynamics, which resulted in three joint workshops: EPM application on the EVCI (appendix 4), BMC application on the oil & gas (O&G) CPO BM (appendix 6), and recommendation workshop (appendix 7). Additionally, scheduled meetings twice per week further leveraged the group effect within several co-working sessions to drive a collaborative and iterative research process.

3.2 Secondary Data

Firstly, secondary data research was conducted to maximize information density and gain an initial overview of industry dynamics. Sources were categorized into peer-reviewed journal articles, academic literature, market participants, thought leaders, and reports from organizations like the IEA, ensuring a structured and holistic industry view. Secondly, while this broad access to data helped establish foundational knowledge, the need for greater detail and transparency prompted the collection of primary data.

3.3 Primary Data

The secondary research was complemented by incorporating primary data through the analysis of expert interviews. The interviewed experts represent various key stakeholders in the industry, as well as consultants and other outside experts. The aim is to capture diverse perspectives, considering the industry and BM background of each expert's company. Bearing in mind the long history of researching interview structures (Pawson 1996) and considering the expertise of the stakeholders involved, a semi-structured approach is used, balancing a set structure with open discussion (Brinkmann 2014). It is important to note that interviewer bias can influence respondents' answers, potentially reducing reliability (May 1991). This issue was partially mitigated by having two interviewers from the field lab group conduct each interview together. The issue of data protection plays a significant role as participants might be reluctant to share sensitive data, such as drivers of competitive advantage, regardless of potential confidentiality agreements (Knott et al. 2022).

To ensure the reliability of the interviews, guides leveraging BMC and industry dimensions were created, resulting in three different guides for BM understanding, industry insights, and recommendation validation (appendix 8). The questions for each dimension are open-ended, with detailed sub-topics tailored to each stakeholder to maximize value (Gill et al. 2008).

The **outreach approach** followed a three-step process, primarily targeting the European market and CPOs with strategic assets in the O&G sector. Additionally, it incorporated perspectives from the U.S. and China, as well as CPOs with backgrounds in various industries, to ensure a comprehensive understanding. Firstly, candidates were identified based on screened reports, industry contacts, conferences, news articles, and related industries collaborating with or serving the EVCI, such as consultancies or news agencies. Senior employees were identified to access high-quality insights and gain expert-level understanding. Candidates were approached via cold outreach with a standardized LinkedIn message or professional networks of this field lab group. Secondly, interview guides were tailored to the expert before the interview. Thirdly, interviews were conducted by two field lab group members at all times to ensure reliability and address research gaps of secondary research with new key insights (appendix 10). In total, 199 potential interviewees were contacted, of which 22 were interviewed (appendix 9), resulting in a conversion rate of 11%. The insights gathered from these interviews serve as a key source of information for the BM analysis and derivation of recommendations.

Due to the high sensitivity of the insights shared by the interviewed experts and the critical market dynamics, transcripts and direct quotations are not shared within this thesis. Only a list of the interviewees containing role and industry details as reference (appendix 9) and the key insights of each interview (appendix 10) are shared in this thesis. Lastly, the interviews were mainly conducted virtually to facilitate engagement with stakeholders globally (Musselwhite et al. 2007), resulting in an increased pool of potential interviewees (Khan and MacEachen 2022).

3.4 Frameworks for Analysis and Recommendation

Given the fragmented and complex nature of the EVCI, the EPM (Talmara et al. 2020), introduced in chapter 2.2.3, is applied to achieve a holistic understanding of the ecosystem consisting of participants with backgrounds from various industries and different BMs with, in parts, high variation (appendix 4). For this thesis, one prominent BM within the EVCI is selected for detailed analysis, with specific recommendations based on a comprehensive examination. Following the discussion in chapter 4.5, the focus is set on the BM of CPOs due to their critical role in the value chain and the changing requirements while moving toward a more mature market. More specifically, the BM of CPOs utilized by O&G companies is being examined. This specification is necessary as the strong variation within the CPO BM is mainly driven by strategic assets, capabilities, objectives, and challenges companies are equipped with. Therefore, legacy O&G players are selected due to their significant presence across most European markets and asset-related challenges. Consequently, O&G CPO experts were specifically targeted in our interview outreach process, ensuring high coverage.

The analysis of this BM is structured around the BMC framework, which also serves as the guiding structure for interviews with stakeholders active in the industry. As discussed in chapter 2.2.1, the BMC's nine building blocks provide a clear and organized approach to analyzing the BM chosen within the scope of this thesis, enabling a comprehensive evaluation of their components and effectiveness. Due to the emerging and quickly evolving nature of the industry, this thesis extends the BMC, adding the dimension "growth," borrowed from the Afuah model (2014), as a dynamic component to the model.

The recommendations discussed in chapter 6 of this thesis are structured around two key components. First, a thorough analysis based on BM theory, industry overview, and BM deep dive is conducted, leveraging both secondary research and expert interviews to derive recommendations. The field lab group leveraged the concept of a workshop to jointly identify potential recommendations based on a guiding framework. As innovation benefits from a consistent methodological approach, the workshop was structured by the **"ten types of innovation"** framework, which consists of ten innovation buckets structured in three development areas: **configuration**, focusing on the business system; **offering**, focusing on the product or service offered; and **experience**, comprised of customer-facing elements such as customer engagement (Deloitte 2024). As a result of this workshop, a long list of recommendations, BM-related and of a general nature, emerged.

Additionally, based on conducted interviews, another framework emerged against which the recommendation long list was mapped. This framework consists of **five key pillars**, namely “Real Estate,” “Capital Access,” “Grid Connection, “Customer Access,” and “Technology,” which contribute toward being a successful CPO. Each recommendation is individually related to these metrics, linking them to building on strengths, e.g., customer access for O&G CPOs and mitigating vulnerabilities such as historical technological disadvantages. Consequently, this framework supports a more differentiated discussion of the recommendations.

Next, the recommendations related to the O&G CPO BM were mapped based on a **New-Useful-Feasible analysis** (NUF) (Alexandorsson 2019) to identify the key recommendations that will significantly impact the existing BM. In detail, this was achieved by every group member assigning each recommendation a score from 0-10 for the respective three dimensions of the NUF concept and then deriving the mean. Based on the sum of mean scores, the three key recommendations identified are discussed in detail, and the remaining ones, discussed more briefly, can be found in chapter 6.1. This structure was validated by three expert interviews (appendix 10: CON4; CON5; HSP3).

4 The EV Charging Industry (Group Part)

4.1 Scope of this Thesis

To provide a comprehensive report, this thesis has a clearly defined scope. Firstly, it focuses on the European market due to the different nature of market environments underpinned by varied geographical EV adoption, market composition as well as market maturity, compared to, e.g., the U.S. Looking at 2017, China already invested more than 2$ billion annually compared to 1$ billion in the U.S. and decentralized, lower investments within EU countries (Hall and

Lutsey 2017). Secondly, a distinction is made between passenger and commercial vehicles. Given that commercial charging is a more recent development (appendix 10: CPO5) with unique technological requirements compared to the charging of passenger vehicles, this thesis primarily focuses on passenger vehicles. However, relevant connections to the commercial EV sector business-purpose vehicles, typically fleet-focused, e.g., delivery service fleets, are touched upon. Thirdly, the industry is divided into private and public charging solutions, described in detail in chapter 4.2.1, each posing unique challenges for BMs. This thesis emphasizes public charging infrastructure, an area known for its complexity (appendix 10: CPO5) while considering the relevance of private charging infrastructure within the BM when necessary. As a result, the insights derived from the chosen BM will be more targeted, yet impactful for companies following the analyzed BM.

4.2 Underlying Concepts

A comprehensive understanding of the various concepts, technologies, and terminologies used in the EVCI is essential for analyzing the industry and the BMs employed by market participants. Accordingly, this section aims to introduce foundational technologies, concepts, and terminologies, along with their characteristics and limitations.

4.2.1 Charging Location

EV users have various charging options, including private and public charging. Private charging can be further categorized into home charging and privately-owned facility charging.

In detail, **home charging** means charging an EV at the user's residence using either a standard outlet (120V) or a dedicated EV charging station, also called a wallbox (240V). Home charging is currently the most common means of charging EVs as it is very convenient and takes advantage of lower electricity prices while charging overnight (IEA 2024). According to BCG, more than 80% of EV drivers have access to home charging and prefer to use this option over public charging (Hagenmaier et al. 2023). However, the access to home charging varies significantly between different regions and depends on the density of the population, differences in urban, suburban, and rural areas, as well as income brackets (IEA 2024). Private charging further includes **privately owned facility charging**, which additionally includes charging stations installed at workplaces, apartment complexes, or other privately owned facilities where access is limited to a specific group of users. In Europe, there are over 250k such private non-home chargers (IEA 2024).

Public charging points are available for general use and can be found in various locations such as shopping malls, parking garages, public spaces, and highways. They are typically faster than home charging points, with moderate charging speeds deployed in most urban locations and fast charging usually found along highways or at dedicated fast-charging stations. Within public charging, **destination charging** refers to charging stations located at venues like supermarkets, shopping malls, and sports arenas. These stations aim to provide EV drivers with convenient charging opportunities while they engage in other activities. For drivers, charging is a secondary benefit, complementing their primary purpose of visiting these facilities or using the services offered. **En-route charging** is commonly found near highways or urban areas, with the primary objective of providing customers with a seamless, fast-charging experience so they can quickly resume their journey. Thus, en-route charging is mainly conducted through ultra-fast, high power stations, minimizing wait times. Broad and reliable network coverage and simple payment mechanisms are key success factors (Hagenmaier et al. 2021).

The availability of public chargers is considered crucial for enabling the widespread adoption of EVs, as it supports long-distance travel, combats range anxiety, and promotes more equitable access to EVs (IEA 2024), supported by industry experts arguing that the ratio of home charging will significantly decrease within the next adoption phase (appendix 10: CPO6; CPO8).

4.2.2 Technologies

Before delving into charging technologies, a brief analysis of EV technologies needs to be conducted. Generally, EVs can be categorized into five different types based on their engine technologies: (1) **Battery Electric Vehicles** (BEVs) are powered solely by electricity. They operate without an Internal Combustion Engine (ICE) or liquid fuel, utilizing large, chargeable battery packs instead. Furthermore, BEVs utilize regenerative braking, a process in which kinetic energy released during the braking process is converted back into electrical energy that can be retained by the battery, which makes them suitable for city driving. (2) **Plug-In Hybrid Electric Vehicles** (PHEVs) combine an ICE with an electric motor, which is powered by an external electricity source. Under normal driving circumstances, PHEVs can substantially lower fuel consumption by utilizing electric drive. They also feature regenerative braking. (3) **Hybrid Electric Vehicles** (HEVs) are also equipped with an electric motor and a gasoline engine, however, as opposed to PHEVs, regenerative braking provides all energy for the battery. Hybrid electric vehicles cannot connect to the power grid for battery charging. (4) **Fuel Cell Electric Vehicles** (FCEVs) have an electric motor that is not powered by a large battery but by a fuel cell stack in which hydrogen is combined with oxygen taken from the air, with water vapor being the only byproduct. (5) **Extended-Range EVs** (ER-EVs) operate using an electric motor with an additional power source that extends the driving range of the vehicle. This range extender is a small gasoline engine that supplies power to the battery. CO_2 is only emitted when the range-extending engine is running, making ER-EVs significantly more environmentally friendly than traditional ICEs (Shahed and Rashid 2024). For the scope of this thesis, only BEVs, PHEVs, and ER-EVs are relevant because they have a battery that can be charged using an external electric power source.

Furthermore, a distinction is to be made between passenger, light-duty, and heavy-duty vehicles. While passenger cars are primarily designed for transporting people, duty vehicles are used to transport goods. **Light-duty vehicles** (LDV) include small vans, trucks, and light commercial vehicles and have a gross weight rating of up to 3.5 tons. **Heavy-duty vehicles** (HDV) are defined as freight vehicles over 3.5 tons and include large trucks, buses, and construction vehicles (European Commission 2014).

Batteries of EVs can be charged using **conductive** or **inductive charging**. Inductive charging is wireless and can be divided into stationary and dynamic charging systems. While stationary charging can only be utilized when the car is parked, dynamic charging also works when the vehicle is in motion. However, due to their limitations regarding efficiency, costs, range, and electromagnetic compatibility, inductive charging systems are not as widely commercialized as conductive systems (Brenna et al. 2020). There are two modes in conductive charging systems, namely **alternating current** (AC) and **direct current** (DC) charging. EV batteries can only store DC energy. When using an AC charging point, the electric energy needs to be converted into DC inside the vehicle as the power grid provides AC electricity, but the vehicle battery requires DC electricity. This is done by an on-board charger, which supplies the battery using either single-phase slow charging or three-phase fast charging systems. This additional unit not only adds weight to the entire system, but the conversion also slows down the charging process. However, the on-board charger also improves the efficiency of EV charging while reducing fluctuations and interference with other devices (Kumar 2023).

In contrast, energy from DC charging points does not need to be converted, typically making it the faster charging mode. Moreover, the conversion unit is installed distinctly from the vehicle at a charging station and feeds the battery directly (off-board charger), possibly resulting in a reduction in the weight and size of the vehicle. However, DC charging is more expensive due to higher installation and maintenance costs, can negatively impact the battery's lifespan, and is not accessible to all EVs (BP pulse 2023). AC charging is usually deployed for home charging and regular public charging stations, whereas DC charging is utilized for public fast-charging stations (Sadeghian et al. 2022). According to their power levels and charging speed, EV chargers can be categorized into six charging speeds, which are illustrated in table 1.

Category	Sub-category	Reverter location	Typical use	Typical power	Charging time
Category 1 (AC)	Slow AC, single-phase	On-board	Home charging	2-7 kW	4-11 h
	Medium-speed AC, triple-phase	On-board	Home charging	7-22 kW	2-4 h
	Fast AC, triple-phase	On-board	Public charging	> 22 kW	1-2 h
Category 2 (DC)	Fast DC	Off-board	Public charging	50-150 kW	30-40 min
	Ultra-fast DC (Level 1)	Off-board	Public charging	150-350 kW	20-30 min
	Ultra-fast DC (Level 2)	Off-board	Public charging	>350 kW	10-20 min

Table 1: EV Charger Categories, own depiction based on European Commission (n.d.) and Brenna et al. (2020)

At all power levels, the power flow can be **unidirectional** or **bidirectional**. While unidirectional charging only allows grid-to-vehicle (G2V) interaction, bidirectional systems additionally enable various vehicle-to-everything (V2X) technologies, which recently have gained attention within research and practice as EV batteries offer additional value when not being used (Rehman et al. 2023). There are different use cases of V2X, depending on charger location, scope, and level of connectivity. Firstly, vehicle-to-home (V2H) and vehicle-to-building (V2B) technologies utilize EVs to supply power to individual households or apartments, as well as industrial and commercial buildings. In case of high energy demand or power failures, EVs can serve as backup power sources and help manage electricity costs for homeowners and residential energy management systems (Leippi et al. 2024). Secondly, the most prominent example of V2X technologies is called vehicle-to-grid (V2G). Within V2G, EVs can supply energy back to the grid in case of peak demand or system failure and thereby improve overall reliability, stability, and efficiency (Dar et al. 2024). V2G technologies are also an essential part of smart charging, which experts claim to be crucial in the future of EV charging (Sadeghian et al. 2022; appendix 10: CPO8). Smart charging refers to intelligent charging of EVs, which includes using EVs as power storage units in the charging ecosystem, as well as peak load management, which describes regulating charging times according to demand peaks in the grid (Vattenfall InCharge 2023).

An alternative to EV charging is the battery-swapping model. First introduced by an Israeli start-up founded in 2007 (Noel and Sovacool 2016), later launched and scaled by Chinese original equipment manufacturer (OEM) Nio (2020), users rent the battery through a subscription model, also called battery-as-a-service. When entering a swapping station, the depleted battery is dropped out from the bottom of the vehicle and replaced with a charged battery in a fully automated process within three minutes. This provides many advantages for the users: lower risk of owning a default battery, reduced price of the initial purchase, guaranteed quality of the regularly inspected batteries, and no end-of-life issues (Lin 2024). However, the high cost of storing the batteries, as well as users' anxiety that their batteries might be swapped for a faulty one, have prevented battery-swapping from becoming a mainstream solution in the EV market so far (Winton 2022).

4.2.3 Value Chain

EV charging is a complex industry with a wide range of stakeholders active along the entire value chain, starting from the supply of energy, continuing with the EVCI itself, and ending with add-on services (Hagenmaier et al. 2021). Overall, it can be seen as an interface between the energy and automotive sectors. Each value chain stage calls for different BMs, with numerous players from different industries exploiting their core assets and capabilities to compete in the industry. A detailed view of the EV charging value chain is depicted below (figure 4).

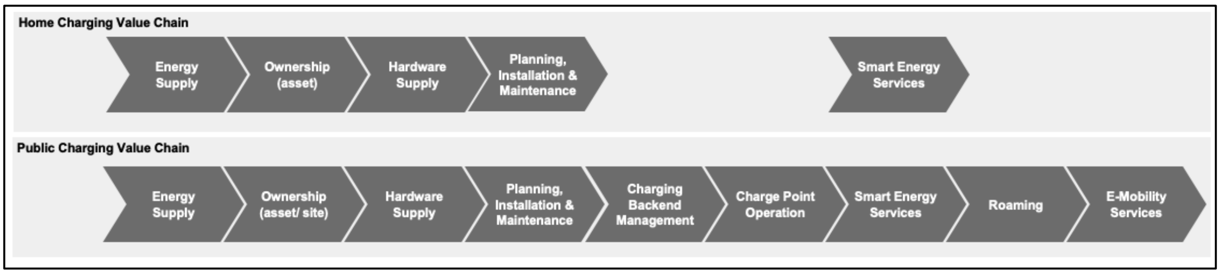

Figure 4: The Value Chain of the EV Charging Industry, own depiction based on Hagenmaier et al. (2023) and Zayer et al. (2022)

In line with the scope of this thesis, the primary focus is on the public charging value chain, which shares several similarities with the home charging value chain but differs in certain key aspects. The initial stage in the EV charging value chain is the **provision** of the necessary **energy** to charge EVs. This step entails the generation, storage, and distribution of electricity to homeowners, businesses, and CPOs via the power grid. The transition to unstable renewable energies, old infrastructure, and rising EV adoption has made it challenging to ensure a sufficient energy supply during peak times to guarantee charging speeds (appendix 10: CPO10). Power plants do not necessarily need to be operated by the value chain step owner but can also be solved by using power purchase agreements (PPA) to acquire renewable energy. Nevertheless, the energy source and infrastructure to connect stations to the grid, including substations and transformers, are essential and challenging for many players.

The second stage evolves around the physical location, which can vary based on a site or asset **ownership model**. Site owners can invest in charging sites, including securing permits and planning the associated infrastructure to commercialize charging services and other offerings. Alternatively, sites may be leased from property owners. The asset ownership model refers to the investment in and ownership of the actual charging infrastructure located at these sites (Hagenmaier et al. 2021). Regardless of the ownership model, selecting optimal sites is crucial, as location directly impacts charger utilization rates and public acceptance of EVs and, consequently, profitability (Hosseini and Sarder 2019).

The third stage entails the **supply of charging point hardware**, including the design, engineering, manufacturing, and sale of charging equipment. Charging technology varies by use case, with options such as AC or DC chargers providing different charging speeds. Modular charging station designs are gaining popularity as they facilitate scalability in expanding charging infrastructure (Hagenmaier et al. 2024).

Following this, the **planning, installation, and maintenance** of the charging systems are carried out at the selected location. Project planning and consulting services ensure an adequate energy supply to meet the anticipated demand at each charging site. Installation and setup differ between home-based and public charging stations, with variations in technology and charging speeds. Ongoing maintenance is critical to ensure operational reliability, especially since power electronics are prone to frequent failures and require regular inspections and replacements (appendix 10: CPO10).

In the subsequent stage, **charging backend** management systems are deployed to enable optimized charging process management, which includes, e.g., the handling of driver authentication and billing. Firms operating in this domain specialize in providing B2B software solutions with minimal direct interaction with end users. However, some CPOs have developed their backend in-house (appendix 10: CPO1). Operations include data management for charging stations, monitoring charger status, maintaining charging records, coordinating maintenance, evaluating feedback, and integrating additional mobility services.

An essential component for optimizing charging efficiency is the integration of **Smart Energy Services** (SES). SES solutions address supply and demand issues through advanced energy services and load management technologies, including load shifting, V2X capabilities, peak load management, and electricity trading. End users, whether private individuals or fleet operators, are increasingly engaged in SES, for instance, by offering public access to their charging points for a fee or making their vehicles available for energy management purposes (Wangsness and Figenbaum 2022).

Roaming enables drivers to use charging stations from various CPOs without requiring multiple subscriptions. This can be implemented by using roaming hubs, which offers different charging networks on its platform. This platform, with its charging points, can be included by the mobility service provider (MSP) and prevents the tedious work of negotiating each CPO contract separately. Still, peer-to-peer roaming enables the inclusion of several charging networks through separate contract negotiations with CPOs. The largest roaming hub Hubject includes over one million charging points across 63 countries on its platform (Hubject GmbH n.d.).

The final step in the charging value chain is the provision of **mobility services**, which serve to connect customers with CPOs by offering a centralized platform, typically via an app, web portal, or RFID card, including the aggregation of charging points in one platform for convenient charging services. These services streamline processes such as contracting, billing, payment, customer support, and network management (GridX 2024b). Optionally, additional services, such as car wash services, can also be integrated to enhance the value offered.

4.4 Evolution of Business Models (Group Part)

The evolution of BMs within the EVCI has deep historical roots, though it has seen unprecedented acceleration in the past ten to fifteen years. This transformation of BMs is largely driven by three interrelated factors: Advancements in **EV technology**, breakthroughs in **battery and charging technology**, and the influence of **regulatory frameworks and policies**. As a technology-centered BM, EV charging is inherently tied to the progress of electric mobility. Without the growth in EV adoption, there is no intrinsic demand for charging infrastructure. Consequently, the development of EV charging solutions is symbiotically linked to the advancements in EV capabilities and market penetration, with charging networks and the variety of BMs expanding as EVs become more mainstream. Furthermore, BMs evolve in direct response to the technical limitations of batteries and charging speeds, as well as shifts in policy mandates that encourage widespread EV adoption and infrastructure development.

Early EV charging BMs emerged in the early 1900s, coinciding with a period when EVs held over 30% of the U.S. automotive market share (Matulka 2014). Early charging solutions were highly manual, and power was sold as a service where vehicles were sold without a battery and electricity was bought through an exchangeable battery from dedicated battery companies (Cutcliffe and Kirsch 2001). Skilled workers would remove vehicle batteries and carefully recharge them in designated “battery rooms” to prevent overcharging and damage to the batteries (Reddy 2024). Vehicle owners would pay a per-mile charge and an additional service fee (Daly 2019). Technological breakthroughs in charging technology in the 1950s enabled OBCs that introduced convenient overnight home charging, reducing the need for extensive manual intervention (Reddy 2024). However, the limited range and high cost compared to cheap and abundant gasoline of EVs led to a sharp decline in EV vehicles during the next decades (Matulka 2014).

The oil crisis and oil embargo in 1973, alongside advancements in power electronics, revived interest in EVs and charging infrastructure (Matulka 2014). This resurgence was bolstered by policies such as the Hybrid Vehicle Research, Development, and Demonstration Act of 1976, which promoted research and development for electric transportation solutions (Matulka 2014). Despite these developments and further policy support like the Zero Emission Vehicle mandates instituted by the California Air Resources Board Electric in 1990 (Gustavo and Sperling 2008), mass-produced EVs, like GM’s EV1 in 1996 or Toyota’s Prius in 1997, did not appear until the late 1990s. Until then, home chargers remained the main way to charge vehicles, which typically consisted of slow AC chargers, which were slow but compatible with standard home outlets (Reddy 2024). During the 1990s, the absence of unified standards led to efforts to standardize charging technology (Reddy 2024). Consequently, the first companies started to focus on BMs around pure charging points and sell them on a very small scale to utilities, municipalities, and private companies, e.g., ChargePoint in 2007 (Callander, Richman, and Makinen 2018). BMs around public charging solutions were still very limited, with only a few experimental PCPs, e.g., in the U.S., there existed less than 1,000 public and private electric charging stations until 2011 (Department of Energy 2024).

Improvements in battery technology during the 2000s, particularly the advent of lithium-ion batteries, facilitated the introduction of fast DC chargers and consequently Level 1 & 2 ultra-fast DC chargers, which became the new industry standard due to their faster charging speeds (Reddy 2024). These faster charging speeds enabled new BMs around "destination charging," allowing users to charge their vehicles within a few minutes while parking at various locations such as supermarkets, shopping centers, gyms, and cinemas (Dixon, Elders, and Bell 2020). Consequently, this period experienced the rise of the first big public charging networks, most notably Tesla's Supercharger network in 2012 (Tesla 2012). Tesla's Supercharger network was one of the first network-based models, offering an exclusive charging network at various locations for Tesla vehicle owners (Qian and Zhang 2023). In addition to Tesla, other industry participants have developed public charging networks while differentiating their BMs. These models are often based on subscription services, pay-as-you-go systems, or vertical integration by automotive OEMs to support their initial EV offerings. Furthermore, some charging network operators, frequently managed by utilities or automakers, provide exclusive solutions to distinguish themselves from competitors (Chen et al. 2024). The Paris Agreement of 2015, along with government subsidies and incentives, further fueled market growth. During the next years, the amount and diversity of EV charging solutions and players increased significantly.

By the end of 2019, there were approximately 900k PCPs worldwide (IEA 2022), signaling the maturation of EV charging from a novel technology into a commercially viable business

(Jennings, Parkin, and Del Maestro 2018). In recent years, various innovative BMs have emerged within the EVCI, ranging from comprehensive approaches that cover multiple steps in the value chain to specialized solutions focusing on specific hardware or software offerings. These include, among others, turnkey providers, charge point operators, hardware manufacturers, mobility service providers, and roaming platform operators (see chapter 4.5). Additionally, established players from industries such as utilities, O&G, retail, and technology have entered the market, either by integrating EV charging into their existing BM or by developing bespoke solutions. As the market matures and expands, EV charging is increasingly transitioning into a commodity service (Krug 2020; appendix 10: CPO9), prompting firms to explore pathways to profitability. While a few niche players have retained market presence with innovative offerings, others have diversified their BMs by either expanding across the value chain or venturing into areas beyond traditional charging infrastructure (Krug 2020). European countries exhibit varying levels of development in the EVCI. Norway stands out as a leader, with advanced BMs that have begun to generate returns while simultaneously optimizing value-added products and services. In contrast, countries such as Germany and the Netherlands remain primarily focused on the large-scale rollout of charging infrastructure to support the growing adoption of EVs (Brickenstein, Rennert, and Bartosek 2023). Over the coming years, the EVCI in Europe is expected to consolidate significantly, reaching a new phase of maturity (appendix 10: CPO9).

Recent trends and changes in BMs cover the integration of new technology solutions for commercial vehicles, the integration of grid services, redeploying energy into electricity grids or contactless charging (IEA 2024). These developments aim to enhance customer experience, reduce operational costs, and generate new revenue streams beyond direct EV charging services. Industry players operating charging stations currently face the challenge of transitioning their BMs from serving a niche market of early adopters and tech enthusiasts to addressing the demands of mainstream, mass-market consumers (appendix 10: HSP3). This evolutionary step in defining the right BM is critical for the success of market participants and is referred to as the "chasm," or the adoption gap of new products or technologies (Moore 2014). By 2023, over two million PCPs were operational globally (IEA 2024), with more than 600k in Europe alone (European Commission 2024b). This exponential growth is expected to continue, particularly in the public charging sector, as large gaps in infrastructure needs present lucrative opportunities (European Court of Auditors 2021). The commitment of legacy automakers to shift toward all-electric lineups, along with impending bans on internal combustion engine (ICE) vehicles in regions like Europe, underscores the lasting demand for charging infrastructure (Zamanov 2023). Additional recent policy interest in the EU with the Alternative Fuel Infrastructure Regulation (AFIR) in 2024 mandating the deployment of charging infrastructure in the EU member states (Haghani et al. 2023) further supports the industry's growth trajectory.

5 Deep Dive in Business Model "CPO from Oil & Gas Industry" (Group Part)

5.1 Charge Point Operator Business Models

As outlined in the methodology in chapter 3.4, the analysis of this thesis focuses on CPOs. As further detailed in chapter 4.5, CPOs are highly varied in strategizing their BM, which leads to a clear focus on a narrower view that captures a BM archetype within the CPO environment.

In this thesis, CPOs with an industry background in O&G are selected for detailed analysis due to several **key reasons**. First, from a strategic asset perspective, O&G companies hold a unique position due to their extensive ICE filling station infrastructure at strategic locations. This allows for an investigation into whether these assets provide long-term strategic advantages or act as barriers to innovation by hindering adaptation to EV charging. Second, these assets have historically enabled O&G companies to be a key factor in the public network expansion, supported by experts (appendix 10: CPO4), positioning them as key players in the EVCI. Consequently, the industry's role underpins the choice of CPOs with a background in O&G. Table 3 provides a selection of O&G companies acting as CPOs in Europe.

Company	PCP 2024	PCP Targets (Year)	Active Markets
Total Energies	67,000	150,000 (2025)	Belgium, France, Germany, Netherlands, U.K.
Shell Recharge	60,000	200,000 (2030)	China, Germany, Netherlands, Singapore, Switzerland, U.K., U.S.
BP Pulse	37,500	100,000 (2030)	China, Germany, U.K., U.S.
Plenitude - Be Charge	21,000	40,000 (2030)	Austria, Croatia, France, Germany, Greece, Hervatska, Italy, Portugal, Serbia, Slovakia, Spain, Switzerland
Galp	4,800	10,000 (2025)	Portugal, Spain
OMV	3,000	5,000 (2030)	Austria, Hungary, Romania, Slovakia

Table 3: O&G CPOs Europe examples, own depiction

5.2 Business Model Canvas Analysis

5.2.1 Customer Segments

According to the interviewed industry experts, the EV charging customer base is segmented into B2C and B2B customers (appendix 10: CPO1; CPO4; CPO7). Given the primary scope of this thesis, the B2C segment is most relevant for the analysis, however, as the B2B segment will gain importance in the future, it cannot be neglected as the share of new registrations of corporate cars increased from 50% in 2015 to 60% in 2023 in Europe (T&E 2024).

Looking at the **B2C segment**, customers can be classified as EV drivers with heterogeneous socio-demographics, preferences, values, and habits. As explained in chapter 4.2.1, current EV drivers are wealthy early adopters with single-family homes and access to **home charging** (Mosele and Neri 2020). In the analysis, it was found that most O&G CPOs do not operate in the home charging market except Shell (n.d.b.). However, there are O&G CPOs such as Aral that offer home charging possibilities through fleet solutions to charge company cars at home (Aral 2024a).

Today's **public charging** customers are mostly frequent travelers primarily utilizing en-route charging and city dwellers, who may have access to a charging point at home or at work but leverage the time of running errands to charge their EVs. According to CPO1, en-route charging along highways is considered a core offering for CPOs with a background in O&G (appendix 10). In addition to equipping existing gas stations with EV charging points, the experts state that dedicated EV charging hubs are being built to increase network coverage, tap into new customer segments, and enhance the overall customer experience (appendix 10: CPO1; CPO2). With more widespread EV adoption, particularly in cities, however, destination charging will gain importance. Thus, O&G CPOs do not rely solely on their filling station network and charging hubs but also invest in destination charging sites and partnerships to attract city dwellers (appendix 10: CPO2; CPO7).

A further distinction can be made between direct and indirect customers. **Direct customers** are EV users without an MSP subscription that charge directly on PCPs managed by the CPO or, if the CPO is also an MSP, with the respective MSP subscription. **Indirect customers** are EV drivers paying a subscription fee to an external MSP, which in turn pays a fee to the O&G CPO (outbound roaming) (Goncearuc et al. 2022). CPO1 remarks that direct customers are more valuable because the company can collect valuable customer usage data, provide tailored offers through direct touchpoints to increase customer loyalty and retain a larger share of the revenue (appendix 10).

In the **B2B segment**, there are two different customer groups. Firstly, companies commission O&G CPOs to install charging stations at their premises for employees to charge their EVs (workplace charging), as a means to improve employee satisfaction and employer attractiveness (Office of Energy Efficiency & Renewable Energy n.d.). Secondly, fleet and depot customers are a key customer group for O&G CPOs (appendix 10: CPO1). Fleet customers operate a dispersed group of EVs, which requires charging at different locations, such as homes, depots, and public charging. To enable fueling and charging with one consolidated solution, O&G CPOs offer fleet cards, allowing fleets to charge and fuel publicly while offering reporting capabilities for fleet managers and add-on payment options for services like tolls and car washes (appendix 10: CPO7). For instance, ride-hailing companies, corporate car fleets, and car rentals fall under this category (Bland, Gao, and Noffsinger 2020). Depot customers manage centralized charging stations at one specific location, the depot, where vehicles are parked and charged, often overnight or during downtime. Depot charging is often used by logistics and last-mile delivery companies, as well as public transit authorities and municipal services, with an increased focus on commercial charging (Swallow 2023).

Experts confirm that fleet and depot customers are of strategic importance for the profitability of their BM (appendix 10: CPO1; CPO3). Although margins are lowered by discounts, fleet and depot contracts provide CPOs with better plannability and reliability of sales volume, payment streams, and charger utilization (appendix 10. CPO10). Furthermore, industry experts see high growth potential in commercial charging for trucks and buses, which is growing at a significantly faster pace than passenger cars (appendix 10: CPO1; CPO2; CPO3).

5.2.2 Value Proposition

The value proposition of CPOs owned by O&G companies reflects their strategic transition from traditional fuel providers to leaders in e-mobility solutions. By leveraging decades of expertise in energy and transportation, these companies aim to simplify and enhance the charging experience for EV users. Their offerings are built on key pillars: reliability, convenience, integrated services, and clean energy, tailored to meet the diverse needs of both individual and business customers.

Reliability is a fundamental aspect of the value proposition for O&G CPOs. Based on their existing and long-lasting gas station networks, the charging networks are designed to provide reliable and accessible charging options, featuring fast and ultra-fast chargers at strategically located sites (appendix 10: CON2). Companies like BP Pulse, ShellRecharge, Total Energies, and Plenitude emphasize the ease of finding, using, and paying for services through their digital platforms. Mobile apps such as the BP Pulse and ShellRecharge apps offer real-time updates on charger availability, pricing transparency, and detailed charging history, ensuring a seamless and user-friendly experience. BP highlights its vision of making EV charging as effortless as charging a phone, encapsulating its commitment to simplicity (BP pulse 2024).

Convenience plays a central role in the value propositions of these operators, reflecting their legacy of operating customer-focused service stations (appendix 10: CON1; CON4). O&G CPOs have adapted this expertise to the EV domain by situating charging points at their serviced stations. To enhance the experience, many sites include complimentary amenities like cafes, Wi-Fi, and waiting areas, making the charging process more rewarding for users. Companies like ShellRecharge also integrate home, work, and public charging options into their offerings, providing a comprehensive and flexible charging ecosystem (appendix 10: CON1). This ensures customers have reliable solutions tailored to their daily lives, whether they are commuting, following daily activities, or traveling long distances.

Integrated services further distinguish O&G CPOs in the EVCI. These companies offer one-stop app-based solutions, including offerings to enhance the easiness and convenience for every customer. Offerings might be flexible payment systems, including contactless payments, subscription models, and charge cards, catering to various customer preferences. For instance, ShellRecharge combines pay-as-you-go options with subscription plans, offering detailed billing and live updates through its app. Similarly, roaming agreements enable users to access partner networks, thereby extending the reach and usability of their charging solutions.

Although the core activities of O&G companies are in the field of traditional energy sources, companies position their charging services as pivotal enablers of the global energy transition (Kienzler et al. 2023). By integrating **renewable energy** into their charging networks, they align with the growing demand for sustainable mobility solutions and support their portfolio diversification and transition efforts. Brands like ShellRecharge and Total Energies emphasize their commitment to using renewable energy sources, appealing to environmentally conscious consumers. Additionally, these operators support businesses in transitioning to electric fleets through tailored fleet management solutions (appendix 10: CPO7). BP Pulse, for example, combines charging infrastructure with operational support to help corporate clients electrify their fleets while maintaining efficiency and reliability.

Accessibility and scalability are additional aspects that define the value proposition of O&G CPOs. These companies leverage their extensive infrastructure and operational expertise to ensure that EV charging is available to a broad audience. BP Pulse, for instance, draws on its century-long history in mobility services to support the shift toward electrification. Similarly, Total Energies and Plenitude emphasize their network scalability through continuous expansion and roaming agreements, reducing range anxiety and ensuring broad coverage.

5.2.3 Channels

When analyzing the channels that O&G CPOs utilize to reach their customers, a categorization into direct and indirect sales can be applied. **Direct sales** refer to a method of selling products and services directly to consumers with company-owned channels and without involving intermediaries. Different customer segments are addressed via different channels according to their behaviors and preferences. According to CPO1 (appendix 10), current EV drivers are tech-driven early adopters and, therefore, very susceptible to digital channels like social media. Most of the experts interviewed view their own apps and websites as valuable tools to attract and retain customers (appendix 10: CPO1; CPO3; CPO7). O&G CPOs leverage their existing infrastructure of gas stations with convenience stores attached to offer customers discounts on in-store purchases (appendix 10: CPO1). Experts see the collection of customer data as a key objective of apps, enabling them to address customers directly via e-mail campaigns (appendix 10: CPO7). One expert underlines the significance of image campaigns via radio and television for a broader audience to position the company as an innovation and sustainability leader in e-mobility instead of the traditional image of an O&G company (appendix 10: CPO1). In addition to digital channels, charging sites in strategic locations are important to attract customers.

Looking briefly at B2B sales, experts agree that individual customer support via key account managers is crucial. In contrast to private end users, depot and fleet customers conclude multi-year contracts for large volumes and, therefore, require special attention and dedicated contact partners (appendix 10: CPO1; CPO7).

Indirect sales via strategic partnerships are the second pillar for CPOs to expand their reach to customers. All interviewed experts agree that in the complex EVCI, partnerships with other industry players are a key success factor. Through roaming partners, CPOs can expand their network and increase their charge point utilization. Furthermore, partnering with OEMs and car dealerships enables seamless integration of EV driving and charging (appendix 10: CPO7). For destination charging, CPOs often collaborate with site owners such as retailers, restaurants, or shopping malls to install their charge points. There is great potential for cross-selling, with CPOs offering discounts to EV drivers in shops and restaurants or vice versa (appendix 10: CPO1; CPO7). One example is Aral, having formed demand partnerships with the largest German automobile service provider, ADAC, as well as major loyalty program provider Payback, underlining the importance of exclusivity (Aral 2024c; Payback n.d.).

5.2.4 Customer Relationships

In a competitive market with difficulties for companies to reach profitability, acquiring new customers and retaining existing ones is critical for utilization and success (appendix 10: CON1) Companies must establish trustful and engaging customer relationships by leveraging various channels and touchpoints to stand out.

The core interaction of the CPO BM is **transactional**, characterized by minimal interaction between customers and CPOs during the charging process. Charging stations are designed for **self-service** and equipped with integrated payment systems that allow customers to independently operate them. Interactions with CPOs primarily occur in a **service-oriented** capacity, addressing customer support, maintenance, or troubleshooting issues. These interactions are usually managed through digital platforms, such as mobile apps (e.g., ShellRecharge, BP Pulse, Plenitude) or traditional service hotlines. On average, users use between three to four EV-related apps regularly (figure 11).

Unlike other CPOs, O&G companies operate physical convenience stores at many of their en-route charging locations. This creates an opportunity to offer **in-person assistance** and additional services that enhance the customer experience (appendix 10: CON2). On-site amenities, such as cafes, Wi-Fi, and comfortable waiting areas, transform the charging session into a more pleasant and engaging activity.

Digital platforms remain the backbone of CPO customer relationships, facilitating interactions and ensuring a seamless user experience. Mobile apps and websites are critical tools for real-time charger availability, transparent pricing, integrated payment systems, and personalized services such as energy consumption tracking. These platforms also enable proactive communication, such as sending reminders, notifications about promotions, and updates on new station openings.

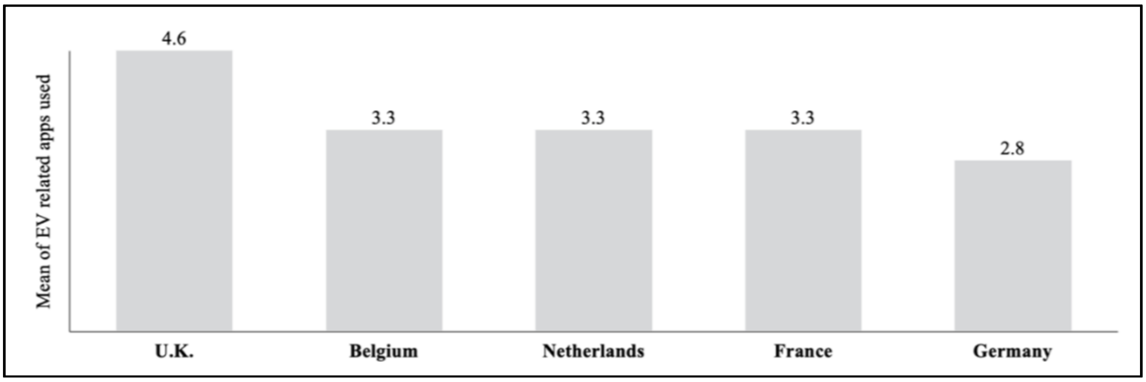

Figure 11: Mean-Number of EV-related apps used by respondents, own depiction based on ShellRecharge (2024b)

Loyalty programs are a cornerstone of customer retention strategies for most CPOs (appendix 10: CON2; CPO1). These programs aim to reward repeat customers and encourage brand loyalty by offering various benefits. Customers can collect points for charging sessions, which can be redeemed at the company’s convenience stores (e.g., Shell ClubSmart), applied to discounts on future charging sessions, or used through cross-industry partnerships, such as Aral with Payback, as described in chapter 5.2.2. By leveraging these partnerships, O&G companies extend the value proposition of their loyalty programs, allowing customers to enjoy perks beyond charging alone (appendix 10: CON5). Additionally, as O&G companies continue to offer traditional fuel services alongside EV charging, they can create combined offerings catering to customers in a transitional phase who might own cars with different technologies. This seamless integration supports customers transitioning from conventional vehicles to EVs, fostering long-term loyalty during a pivotal period of change. Another strategy for retaining customers is to offer a subscription model that provides access to lower charging rates. This approach creates a lock-in effect by incentivizing customers to prioritize charging stations included in the subscription, fostering loyalty and repeat usage.

Cross-industry collaborations aim to reach a targeted customer group, for instance, automotive OEMs (e.g., BYD with ShellRecharge (BYD 2023)), retail stores (e.g., Wild Bean Café with BP Pulse (BP plc. 2023b)), or automobile clubs (e.g., ADAC, Norway). These allow O&G companies to establish deeper connections with specific customers by offering exclusive benefits, such as discounted tariffs or other perks. For example, Shell’s collaboration with BYD includes special tariffs for drivers of BYD, effectively lowering charging rates by €0.15 for every kwH (BYD n.d.). In addition, these collaborations often include integration with in-car systems, enabling drivers to locate and interact with O&G CPO services directly from their vehicle's navigation system. Through these digital channels, O&G companies can build a stronger connection with customers, even outside the charging session.

For **B2B customers**, including corporate clients and fleet operators, O&G companies adopt a more personalized approach to relationship management. These clients are assigned dedicated key account managers who oversee the entire relationship and ensure seamless service delivery (appendix 10: CPO3; CPO7). These managers provide tailored solutions, which may include full-service packages for both traditional and electric fleets, covering charging needs, infrastructure installation, and ongoing maintenance. The ability to leverage their expertise in servicing large traditional fleets while incorporating new, EV-focused services enhances the overall customer experience and positions these companies as comprehensive mobility partners. For example, the Shell Card offers a one-stop solution for business customers, integrating services such as fuel and EV charging access, site management, billing integration, tariff payments, and more (Shell plc. 2024a). This holistic approach makes O&G companies an attractive choice for businesses seeking streamlined fleet management solutions.

5.2.5 Revenue Streams

O&G CPOs distinguish between revenue streams based on established customer segments B2B and B2C in chapter 5.2.1. B2B revenues are split into project and fleet card revenues. Project revenues are created within closed systems, such as establishing and managing charging networks at production sites and offices, which are not within the primary scope, this thesis provides only a brief overview of B2B project revenue. These projects offer inherent advantages, including existing infrastructure, predictable charging behavior, and fewer stakeholders, leading experts to emphasize that operating closed systems is crucial for scaling the overall CPO business (appendix 10: CPO10; CPO7). Fleet card revenues can be bundled with project sales but also sold independently. As corporate cars drive twice as much as private cars, fleet card revenues account for a significant share (T&E 2024). Still, fleet card revenues follow a similar structure as B2C revenues. Consequently, **B2C revenue** streams are analyzed in detail. These can be further differentiated based on direct or indirect sales, as done in chapter 5.2.3. Firstly, **direct revenue** streams are driven by immediate, peer-to-peer roaming and roaming hub energy sales. Straight energy sales can be considered the fundamental revenue stream that determines the profitability of the charging station, neglecting additional sources of revenue. Due to the high fragmentation of the dynamic market, price competition for the price per kWh is fierce (appendix 10: CPO3). EBIT calculations for a public charging station, purely selling energy, conducted by experts in the U.S. market, based on an assumed utilization rate of 15% and a market price of $0.45 per kWh, indicate annual revenues ranging from $265k to $285k. These figures result in a negative EBIT of $40k to $50k (Fröde, Lee, and Sahdev 2023). However, a combination of higher utilization rates and increased ancillary revenue have the potential to boost revenue and achieve breakeven.

Besides the straight energy sales, additional revenues can be generated from peer-to-peer roaming and roaming hub energy sales. Peer-to-peer roaming energy sales occur when a customer from a different CPO, who is a partner, charges at the own CPO's stations, generating fees for each charging session within the partnership, either as a fee per charge or as part of an annual partnership financial agreement. In contrast, hub roaming fees can be generated when a customer is neither part of one's own customer network nor the partner's network but still intends to charge their car at the CPO's stations through a roaming hub like Hubject or Gireve. In this case, the price per kWh is increased by 2-3 cents (E-Flux by road 2024). Roaming hub energy sales are considered highly relevant within the O&G CPO landscape due to the leverage of the strategic locations of their PCPs (appendix 10: CPO7). The above transactions need to be facilitated within a software ecosystem, part of the MSP offering, which can either be insourced (appendix 10: CPO1) or outsourced (appendix 10: CPO4) to a selected service partner.

If charging sites are not owned, the above revenues can be split between the site owner and CPO, including the real estate owner as a partner, by negotiating a shared cost/shared revenue model based on leasing (appendix 10: CPO6; CPO8).

Besides direct revenues, **indirect revenues** are of high strategic relevance for O&G CPOs, considering the convenience-based BM of their fueling network. Due to the existing infrastructure of convenience stores and other ancillary services at the charging locations that have always been a cornerstone for O&G (BP plc. 2023c), O&G CPOs can leverage the customer's idle time during the charging session to generate additional revenue. To be exact, a full charging session takes at least 10 minutes if level 2 ultra-fast DC technology is installed (see chapter 4.2.2). Data from the U.S. indicates that the turn-in rate for EV drivers can be nearly 45% higher compared to ICE drivers, with EV drivers also spending an average of 25% more on food (Adams et al. 2023). However, experts argue that the more advanced the infotainment system of the EV, the worse the cross-selling effect for the customer, as the in-car experience competes with the convenience store (appendix 10: CPO7). Overall, the overarching relevance of ancillary services plays a key role for O&G CPOs besides owning the charging locations. Augmenting the charging session with experience-based services such as integrated promotions not only contributes to store revenue but fosters customer loyalty among users of one's own EV charging network (appendix 10: CON2). Nonetheless, past innovations in charging technology have reduced the idle time to be leveraged by O&G CPOs significantly, and pivotal innovations such as solid-state batteries or wireless EV charging will affect the current BM of O&G CPOs.

Additionally, O&G CPOs can monetize customer behavior data. While charging data itself holds significant relevance, OEMs have better access to these datasets already, limiting its value. EU regulations further restrict monetization by requiring EVCI stakeholders to provide access to charging data to enhance ecosystem interoperability (European Parliament and the Council of European Union 2023). However, beyond charging data, insights derived from consumer behavior during idle time, such as product preferences, offer valuable monetization opportunities not captured by the EV itself.

Lastly, as a side effect of operating a charging network, CPOs can generate additional revenue by trading issued CO_2 certificates based on the greenhouse gas quota. When being verified by the respective federal environment agency, a CPO can receive 15 cents per kWh charged (Reev 2024). According to experts working in the industry, this revenue functions as an indirect governmental subsidization (appendix 10: CPO5).

From a pricing perspective, O&G CPOs can leverage subscription or membership-based pricing to increase customer retention and obtain detailed data insights. For example, premium tariffs to app customers may be offered to drive customer relations. Nonetheless, pay-per-use remains possible to increase the customer base while demanding a slightly higher price per kWh as customers are charged the roaming price (appendix 10: CPO7). Table 4 below highlights the price differentiation among competitors in Germany (Shell, Aral) and Austria (OMV), pointing toward variation within both pricing categories as well as mark-ups for roaming up to 32% compared to member prices.

Oil & Gas CPO	**Member price per kWh (€)**	**Roaming price per kWh (€)**	**Markup for roaming in %**
Shell (n.d.a.)	0.6	0.79	13%
Aral Pulse (2024a)	0.57	0.75	32%
OMV (2024a)	0.59	0.69	17%

Table 4: Price comparison of oil & gas CPOs in DACH, own depiction

Additionally, roaming prices are negotiated between CPOs and vary quite significantly. Due to the early stage of the EVCI, dynamic pricing is often not yet implemented to avoid irritating new customers (appendix 10: CPO1). Early adopters, such as “EVgo” and “Spirii,” have already introduced dynamic pricing models based on pricing windows or specific hours of the day (Haller, Daus, and Zapletal 2024). In the long-term, however, route-based pricing will likely be implemented to drive profitability (appendix 10: CON1).

5.2.6 Key Resources

“Key Resources” can be physical, intellectual, human, or financial and do not need to be owned by the company but can be leased or acquired (Osterwalder and Pigneur 2011).

Physical key resources of O&G CPOs consist primarily of fuel stations, charging and energy hardware, and power plants, as mentioned in the EPM in chapter 4.3.2. Fuel stations provide a key strategic asset to O&G CPOs as they can lower their CAPEX by preventing expensive site acquisition. Property prices, particularly at locations in urban areas such as city centers or near high-traffic roads, are notably high (Linhart et al. 2024). Fuel stations can be redesigned for charging services by building pure charging hubs or a combination of the fuel station and charging while also offering the potentially existing infrastructure like lighting and restrooms. Still, charging services have different requirements in comparison to fuel stations. Firstly, some EV users value the charging experience and prefer not to smell fuel fumes and exhaust fumes (appendix 10: CPO2). Secondly, the site requires more space as cars are charging for longer periods in comparison to other fueling. Therefore, larger parking areas are required to make the charging site construction profitable. This is part of the reason for the divestment of fuel stations by TotalEnergies and Shell (Shell plc. 2024a; Perkins 2023). Changing charging use cases contribute, as typical city charging events may move from en-route charging at gas stations to destination charging at retailers, shopping centers, or other destinations.

Ancillary products and services, such as convenience goods, sanitary facilities, car additives, and cleaning services, represent key resources in the fuel station ecosystem. Convenience stores are often operated in partnership with external providers, such as Rewe Go at Aral stations, rather than being directly owned by O&G companies. TotalEnergies recently sold over 2k retail fuel stations across Germany, the Netherlands, Belgium, and Luxembourg to Circle K, a convenience store and fuel station operator. Following this transaction, Circle K will manage the convenience store operations in-house (McIntyre 2024).

Additionally, O&G companies own charging hardware, which is essential for the operation of charging services to enable plug-in charging. Charging hardware varies based on the use case and may include slow, fast, and ultra-fast chargers, with fast and ultra-fast chargers predominantly utilized at en-route locations. Fast and ultra-fast charging stations are expensive as they include a power transformation unit. Additionally, transformers need to be acquired to deliver the amount of energy needed to the charging station (appendix 10: CPO7). As part of the transition to renewable energy sources, some O&G CPOs own power plants to produce clean energy for charging operations through photovoltaic and wind parks. O&G CPOs who are currently not producing renewable energy may integrate into this area, but this varies depending on the chosen strategy for the country, as stated in chapter 4.3.2 (appendix 10: CPO2; CPO7).

To cover the demand for energy from charging stations with enough renewable energy, O&G CPOs focus on PPAs, which are categorized as **intellectual key resources**. PPAs are used to hedge energy price risks but primarily to meet sustainability goals by origin certification (Trepte and Miroslau n.d.). Another intellectual key resource are the applied IT systems. These may be owned by developing them in-house (appendix 10: CPO2; CPO7) or leased by software specialists like Spirii and Circle K (Spirii 2024b). The main IT systems are the charging backend and the MSP solution, as described in chapter 4.2.3, but also energy management systems can be considered as a key resource. The development of an in-house backend and MSP solution is expensive but enables high flexibility and intellectual property ownership (appendix 10: CPO3). Clear trends of O&G CPOs of in-house or white-label solutions could not be identified. Some companies wanted to ensure fast market entry and, therefore, used white-label solutions and are currently developing their in-house solution (appendix 10: CPO7). Moreover, industry relationships play a vital role as key resources for O&G CPOs. Connections to hardware manufacturers, software providers, but most importantly to OEMs and regulators. Industry relationships have proven to be vital for the BM, e.g., by offering charging offers through OEMs to end customers (appendix 10: OEM1). Future regulations greatly influence the success of the BMs as the break-even in the fast and ultra-fast charging industry is high (appendix 10: CPO7) and takes around three years for payback, as shown in the analysis by Strategy& (Brickenstein, Rennert, and Bartosek 2023).

Looking towards end customers, two main key resources exist. On the one side, the brand identification and reputation. O&G CPOs built popular brands in respective countries and a high level of recognition with a mobility image (appendix 10: CPO2) On the other side, existing customer relationships, especially in the B2B business, offer great resources when it comes to transforming B2B fleets into electric fleets. Relationships and trust between O&G companies and customers are key resources, as well as collected customer data (appendix 10: CPO7).

The third key resource category is the **skilled workforce**, which can be divided into technical and management workforce. Software developers and IT administrators are essential for the in-house development of IT systems (appendix 10: CPO1), as well as the integration of white-label solutions in existing systems like enterprise resource planning. Connected to IT are data analysts who help to make location decisions and conduct customer analytics. Although usually covered by hardware manufacturers, an installation & maintenance workforce is needed to ensure the reliable functioning of charging hardware at all times.

Effective managerial practices are essential to ensure successful operations. Project management plays a pivotal role in expanding the charging network while maintaining cost efficiency during the planning, permitting, and installation phases; leveraging their expertise in infrastructure projects. Marketing is crucial for communicating the unique value proposition of the company's EV charging services, positioning them as sustainable and innovative. Store management is key to enhancing the customer experience, ensuring seamless integration of EV charging services with convenience offerings. Lastly, strategic management drives critical decisions, such as identifying ideal charging site locations, managing M&A activities, and defining the strategic focus on high-priority use cases like fleet charging or highway corridors.

Lastly, the large cash amounts and **cross-financing opportunities** between the fuel business and the charging business offer a tremendous financial key resource (appendix 10: CPO2). As the EV adoption is not as expected, O&G CPOs can survive the industry consolidation (appendix 10: CPO1) and gain market share by subsidizing the EV charging business. Moreover, the EV adoption challenges can be leveraged by performing M&A activities to gain market share (Brickenstein, Rennert, and Bartosek 2023).

5.2.7 Key Activities

Osterwalder (2011) describes key activities as required activities for BM success (see chapter 2.2.1). The key activities of O&G CPOs revolve around expansion and operations.

Expansion of the charging network is critical and requires planning and installation of charging sites and hardware (appendix 10: CPO1; CPO2). This applies to public charging facilities but also to the business of depot solutions and B2B offerings. Part of the planning of charging sites is the analysis and identification of potential charging sites to reach the necessary utilization to be profitable (appendix 10: CPO7). Furthermore, the decision on which charging powers, charging hardware, and how many charging stations should be installed is essential for the success of the business. Depending on the use case, slow, fast, and ultra-fast chargers may be required. Data gathering and analysis are valuable as they give knowledge about the frequency of a charging location but can also be used in the future for optimization of the dynamic load and energy management at the location. After charging sites are set up, pricing activities influence the success of a charging site and network (appendix 10: CON1; CPO7). Pricing needs to be in line with competitors with similar offerings, as well as the integration of dynamic pricing needs to be set up properly to not run into risks of over- and underpricing. More strategic activities include the scanning and scouting of new technologies, as can be seen in the acquisition of Ubitricity by Shell (Reuters 2021). Ubitricity offers charging in cities by redesigning streetlamps to also enable charging points. The observation of changing customer needs and behaviors is also critical in the fast-changing EVCI. Customers may move partly from ultra-fast charging at gas stations to destination charging (appendix 10: CPO2). The market for ultra-fast charging at designated charging stations will probably be most relevant for travelers who want to be back on the road as fast as possible. To provide high network coverage with owned chargers, O&G CPOs can build their own charging sites organically. However, many big O&G CPOs take an active role in M&A activities to acquire smaller networks (appendix 10: CPO9). Examples of this are the acquisition of Renovatio with 400 charging points in Romania by OMV (2024c) and Galp acquiring 280 charging points from Mobilelectric (Galp 2021). To sell charging services, marketing for MSP offerings, fleet and depot solutions, charging sites, and the charging network integration in other networks through roaming are indispensable. Further up the value chain, the investment into renewable energy production gains importance as 100% renewable energy at the charging stations is requested by customers, but regulations also pressure companies to reduce their carbon footprint (appendix 10: CPO1). Looking at the **operations of the charging network**, charger operations, including the functionality of the charging hardware, are essential. Observation of key performance indicators like successful charging sessions is important to deliver the value proposition stated in chapter 5.2.2. The operation of power electronics requires continuous maintenance, as chargers are prone to errors. Predictive maintenance describes the use of data to lower the need for physical maintenance and helps to enhance the maintenance activity. In case charging services are not available and cannot be prevented in advance, customer service through hotline or chat is available to assist customers at charging locations. To provide advanced hardware diagnostics and a reliable and integrated backend, O&G CPOs tend to develop their own backend software, making it a key activity since, without a charging backend, energy sales are impossible. In addition, the store operations located at charging sites should satisfy customer needs (BP plc. 2023c) by safeguarding the availability of the right products and the possibility of shopping during usual charging times. Some players in this category emphasize the availability of great lighting and security cameras to create a safe environment for customers (appendix 10: CPO1). The network coverage acts as a value proposition to customers and is, at the current industry, stage delivered through other CPO networks. Hence, partner management, including the negotiation of prices and offerings and the alignment of IT interfaces, is necessary to provide customers with large charging networks. Partners of O&G CPOs include not only but also other CPOs like Fastned and Allego, IT specialists like Spirii, OEMs for in-car integrations, TSOs, and DSOs to plan future grid expansions.

5.2.8 Key Partnerships

As discussed in section 4.5.2, the steps in the value chain in which an O&G CPO operates vary from company to company using this BM. Based on this, the key partnerships that are established naturally differ. Nevertheless, there are common patterns. This chapter mainly distinguishes between key suppliers (typical buyer-supplier relationship) and key alliance partners (specific output is generated in collaboration with a partner). Firstly, **key suppliers** of this BM include companies that supply the CPOs with hardware, as most players offer a white-label solution, i.e., they establish a buyer-supplier relationship for the hardware and brand the chargers with their logos (appendix 10: CPO4). For example, the O&G CPO BP Pulse/Aral pulse acquires ultra-fast charging hardware units from Tesla and brands them in their own look and feel (BP plc. 2023a). CPOs typically either develop their charging backend software in-house from scratch or rely on white-label solutions from software providers like Spirii and customize it as needed. Although some of the interviewed BM operators confirmed that they are integrating the energy supply for the charging stations (through offshore wind turbines, solar plants, and corporate transactions such as M&As) (appendix 10: CPO1; CPO4), the required quantities are not sufficient to cover the entire energy demand. Energy is, therefore, often purchased from utility companies, making them an important supplier. In this context, PPAs are playing an increasingly important role in the purchase of renewable energy for charging stations. By definition, a PPA is a long-term agreement between an off-taker (CPO) and asset owner (usually power developers or suppliers) to purchase power on a long-term basis for an agreed price. It is used as a vehicle to reduce carbon emissions while procuring energy at lower costs (Trepte and Miroslau n.d.). O&G CPOs not only build charging stations on their own properties (mostly used for petrol stations) but also increasingly at locations enabling destination charging, e.g., at supermarkets, parking garages, gyms, hotels, or restaurants. Therefore, they are important key suppliers as site providers, but they also contribute to the customer flow and usually receive rental fees as well as a profit share from energy sales (appendix 10: CPO6; CPO8). For example, Galp has partnered with IKEA to install 278 PCPs on their retail store parking lots for customers, employees, and delivery vans (Galp 2023).

Additionally, subcontractors are deemed to be key suppliers for the O&G CPOs who support them in the core activities, including planning, installation & maintenance, and operation, with, for example, groundwork as part of the installation process.

The following part introduces the typical **key alliance partners**: Operators of this BM typically outsource the grid operation, driven by high regulatory entry barriers, and don't have ambitions to change this (appendix 10: CPO1). Accordingly, these players rely on Transmission System Operators (TSOs) to transport energy on a national or regional level, as well as Distribution System Operators (DSOs) responsible for distributing and managing energy to the final consumers to ensure reliable charging power. These are also considered relevant because they can delay the commissioning of the systems due to slow grid connection procedures (appendix 10: CPO8). Accordingly, well-formed alliance partnerships with these players are considered crucial to quickly offset the investments with the charging revenues.

Additionally, O&G CPOs are also in close contact with automotive OEMs to coordinate emerging charging technologies. Thus, one player mentioned in an expert interview that they are currently collaborating with an automotive firm to test wireless charging technologies (appendix 10: CPO4). Also, automotive OEMs play an important role in achieving a high utilization rate for the CPOs by suggesting the respective chargers in the cars' route planning. One example of this is the partnership between ShellRecharge and BMW, which facilitates the integration of their charging network into the MyBMW MSP app (DiIanni 2024). In addition, these BM operators enter partnerships with car manufacturers to offer more attractive charging conditions. For example, ShellRecharge partners with BYD in the UK and allows BYD drivers to charge for a discounted £0.15 per kWh off DC charging in the ShellRecharge network (BYD 2023). This also involves dealership training collaborations, e.g., preparing staff for EV charging conversations and providing dummy chargers for showrooms.

In contrast, the importance of MSP partnerships varies between the companies practicing this BM. Some players, including the Portuguese O&G CPO Galp, do not act as independent MSP and enter partnerships with external ones like Mobi-E to promote their charging network (Galp 2022). However, there are also O&G CPOs that act independently as MSPs but generally remain compatible with external MSPs (Aral 2024a). However, this is also linked to market characteristics, as in Portugal, for example, CPOs make extensive use of the Mobi-E MSP, which explains Galp's actions. In the CPO BM, government institutions are key for obtaining building permits for PCPs. In addition, CPOs are entering into key alliance partnerships with roaming providers, such as OMV with its partner Smatrics**.** This leads to higher utilization rates for CPOs because external customers have easier access to OMV chargers and give OMV users comprehensive access to PCPs outside of their own network (OMV 2024b).

5.2.9 Cost Structure

As discussed in chapter 4.5.1, managing costs is essential for CPOs aiming to scale profitably. The complexity of cost structures, combined with the fragmented and competitive nature of the market, puts further pressure on profitability. This chapter delves into the fixed and variable cost structure specific to O&G CPOs.

Firstly, it is pivotal to understand the structure of **fixed costs**, primarily driven by capital investments in infrastructure and software. Infrastructure investments, a key part of upstream CAPEX for O&G CPOs owning their site locations, are especially significant during the initial stages of scaling an EV charging network. Despite the advantage of owning ICE charging infrastructure already, Shell reported $8 billion in 2022 for site acquisition, planning, and preparation of gas stations, covering both EVCI and ICE infrastructure, underpinning the substantial upfront investments required for infrastructure (Shell plc. 2023). This further resonates with experts arguing that it costs about €100k to install one charging station, excluding grid and site equipment (appendix 10: CON2), while a 150-350 kW charging unit can cost an additional $100k (Fröde, Lee, and Sahdev 2023). Another major infrastructure cost component is hardware acquisition to power PCPs, including transformers and cables that must be purchased and installed. Additionally, "missing technical standardization, especially for transformers" (appendix 10: CPO2), creates further complexities for scaling the business. Given the industry's nascent stage, continuous innovation is advancing technology, resulting in high depreciation rates for charging points. Their value is closely tied to improvements in charging speed and capacity, which evolve rapidly (appendix 10: CPO1). Investments in proprietary software development also significantly impact the cost structure, as building an in-house backend is essential for creating a competitive advantage and potentially monetizing insights from structured consumer data. These software development costs are closely linked to personnel expenses, primarily driven by the need to expand the development workforce to keep pace in a rapidly evolving industry. However, fixed software costs are also driven by partnership costs as part of outsourced services such as end-to-end MSP offerings toward CPOs (appendix 10: CSP1). Overall, significant fixed costs required for operating a PCP network create an entry barrier for other companies scaling within the CPO market and provide a competitive cost advantage for O&G companies.

Secondly, **variable costs** are critical to consider when analyzing the cost structure of O&G CPOs. Key cost drivers in this area include energy, software, and maintenance expenses, which are closely linked to operational activities. Specifically, energy supply costs encompass not only the electricity itself but also grid-associated fees, which are incurred to ensure a stable grid connection during peak demand periods. According to the World Economic Forum, renewable energy sources are increasingly undercutting fossil fuels (Masterson 2021), rendering them both more attractive and integral to the strategic transition efforts of many O&G companies (BP plc. 2023c). In contrast, service-related fees and taxes now exceed the cost of electricity alone, amounting to approximately 8-9 cents per kWh (appendix 10: CPO1), while pure energy production equals 3-7 cents per kWh (appendix 10: CPO2).

While substantial initial infrastructure investments are required, it is energy costs, rather than these upfront investments, that will ultimately govern the profitability of a CPO BM (appendix 10: CPO7). This dynamic particularly highlights the competitive advantage of CPOs with a strong footing in the energy sector (appendix 10: CPO3). Nevertheless, it is also important to acknowledge that as a CPO's EV charging network expands, maintenance costs are likely to rise proportionately.

Lastly, software leased from third-party providers, mainly backend and MSPs, drives variable costs as well as services such as payment processing scale with growth. From the MSP’s perspective, strategic reimbursement models allow both parties to benefit equally from this growth, creating a partnership that ultimately drives down costs (appendix 10: SWS1).

5.2.10 Growth Model

The majority of O&G CPOs have very ambitious expansion plans. One example is Total Energies, which has 67k charging points in operation in 2024 and plans to have 150k by 2025 (table 3). In addition, BP has installed around 29k charging points by 2023 (BP plc. 2023c) and plans to install another 11.7k chargers by 2030 across Iberia in a joint venture with Iberdrola (Iberdrola 2023). Accordingly, creating the basis for the realization of these plans is important for the BM. As already mentioned in chapters 2.2.2 and 3.4, the Growth Model component by Afuah (2014) is used to also take into account non-static aspects of the O&G CPO BM and to tailor the analysis to the characteristics of the industry. Afuah (2014) states that part of this growth dimension is "how a firm can grow profitably." The structure of the chapter is fundamentally based on the differentiation that BMs should find ways to maintain and increase revenues while keeping costs low or even reducing them in relation to competitors.

Focusing on the **revenue side**, players practicing this BM commonly expand their operations in different ways. They also exploit synergy effects and utilize cross-selling potential by earning additional revenue with sales from non-CPO divisions, as detailed in chapter 5.2.5. Aiming for increased sales from adjacent services like convenience stores is therefore relevant for O&G companies. This can be achieved by linking CPO and convenience sales businesses more closely, e.g., through special promotions for items such as coffee that are offered in the company's own MSP apps. In fact, daily customer transactions in connection with fuel or just in-store purchases are around 200 times higher than charging transactions (appendix 10: CPO1), indicating a currently still limited relevance.

Furthermore, the BMs of O&G CPOs have the potential to tap into underrepresented customer segments like commercial vehicles with LDV and HDV. However, it should be noted that opinions in the interviews differed as to how easily this implementation is. One of the interviewees stated that, apart from minor adjustments, the charging concept can be adopted by LDV. For example, the compatibility of the roof heights at the charging stations and the technical integration of queuing tools should be implemented (appendix 10: CPO6). However, in a consultancy expert interview, it was stated that it would be difficult to design the charging station infrastructure to meet the needs of both customer segments. This would mainly be due to the increased space requirements for commercial vehicles and the need for lower kWh prices. Accordingly, it would be unsuitable to target both segments at the same charging station. Setting up separate infrastructures would lead to better results (appendix 10: CON2). However, CPO experts outside the O&G industry have shown that integration is possible and mentioned that they attract commercial vehicles with its ultra-fast charging stations, although not mainly targeted (appendix 10: CPO5).

As O&G companies are increasingly expanding beyond the CPO business into the energy generation business, the sale of private energy contracts could also play a role in the future (appendix 10: CPO4), although this seems rather unlikely due to the significant complexity and distance from O&Gs core business.

O&G CPOs address more customers with their offerings by extending the compatibility with external MSPs and roaming partners. In connection with this, it was mentioned in a CPO expert interview that the majority of CPOs aim to be placed in the cars's navigation systems and apps through cooperation with Cirrantic (appendix 10: CPO6). Cirrantic is an e-mobility information service provider and the market leader that supplies live data for apps such as Google Maps.

Additionally, CPOs increase the total number of charge points offered, leading to an improvement in the top and bottom-line revenue. CPOs looking to expand abroad often undertake M&As, acquiring providers to operate their charging station portfolio to ensure faster market entry (appendix 10: CPO6). However, it was emphasized that for CPOs, it is not the sheer number of charging points offered that leads to greater success but rather their operational efficiency and profitability. Additionally, the increase in offered charging points can also have a negative impact on the cost structure because it may lead to lower utilization rates if expansion is pursued too fast and not matched properly to the demand. Moreover, this only works if a corresponding grid infrastructure is ensured that allows expansion (appendix 10: CPO10).

On the **cost side**, there are significant saving potentials that O&G CPOs are increasingly making use of. These are linked to the expansion aspects mentioned above (directly and indirectly related to the CPOs business division). A primary factor in cost reduction is business scaling, which exploits cost efficiencies as output increases (Corden 1972). Additionally, economies of scope may be achieved by leveraging existing energy resources, providing a distinct cost advantage. By optimizing value chain coverage, O&G CPOs can unlock substantial cost-saving potential relative to their competitors, which is critical for achieving profitability. Cost reduction opportunities exist in selectively outsourcing non-essential functions like invoicing and insourcing key processes aligned with O&G CPO BMs core competencies, e.g., site and project management, thereby reducing both costs and external dependencies over time. For instance, BP targets a portfolio-level return of 15% on its EV charging business (BP plc. 2023c), whereas competitors report challenges with scaling profitably across the industry (appendix 10: CPO3). Finally, the complex value chain within the EVCI requires lean operations to enhance both cost efficiency and operational effectiveness (appendix 10: CPO7). The latter is related to a continuous adaptation of technical innovations, which plays a major role in making charging operations more profitable and efficient. This includes dynamic load management software that is embedded in the backend software. The integration of AI also plays an important role (appendix 10: CSP1). One example is the AI technology used to quickly diagnose and resolve station problems. This solution is based on drivers' reports of hardware problems using their app. The AI analyzes images to identify the problem, often without the need for an on-site visit. This leads to lower maintenance costs (appendix 10: CSP1). Although CSPs use a different BM, this serves as an indicator of market trends for also O&G CPOs. It should also be noted that European CPOs are the majority of the CSP customers who are likely to adopt their technologies (appendix 10: CSP1).

Nevertheless, it is assumed that the growth model should provide solutions for growth barriers. Considering that the financial resources required for the stations, where one charging unit often exceeds €100k (appendix 10: CON2), is a drastic barrier to the expansion of operations. And this already excludes the site costs. In addition, increasing competition between CPOs for customers and attractive sites can be observed. This has led to the dilution of one of their value propositions, namely single ownership in some markets (appendix 10: CPO8). According to the CEO of Powerdot at the Intercharge Network Conference (ICNC), this would be the reason not to enter specific markets. The German market would be too populated with CPOs, and it would be too hard to become a market leader, which is one of their three criteria to enter a market (ICNC24 2024). Another growth barrier is the cost pressure that is directly linked to the issue of competitive pressure, which is further exacerbated by ever-better price comparability for end customers with apps such as Chargeprice (Chargeprice 2024). Moreover, the EV adoption uncertainty makes CPOs insecure about the amortization of the investment made in the past (appendix 10: CPO1) and in further scaling (appendix 10: CPO8). Regulatory uncertainty is also a major barrier to growth and is a hindrance to further investment (appendix 10: CPO6).
A summary of all dimensions used to analyze the O&G CPO BM can be found in appendix 6.

6 Oil & Gas CPO Business Model – Recommendations (Group Part)

This chapter provides two types of recommendations: First, recommendations modifying major components of the O&G CPO BM by leveraging BM advantages and mitigating vulnerabilities, i.e., targeting the aspect of BM innovation described in chapter 2.3. Secondly, general recommendations are proposed that do not change the BM components themselves. They build on the activities currently undertaken by BM owners and seek to capitalize on advantages and mitigate vulnerabilities by identifying potential areas of focus for O&G CPOs. As the EVCI is relatively young, there is considerable potential for improving operational effectiveness. As described in chapter 3.4, recommendations are derived leveraging the framework "Ten Types of Innovation" (Deloitte 2024) during a field lab group recommendations workshop. This framework allows to identify new BM opportunities and develop viable innovations by distinguishing between 10 different types of innovation. These can be mapped to three overarching dimensions: "configuration," "offering," and "experience." One change to the original framework is that the sub-dimension of the profit model focuses on the revenue side and excludes the cost side, as this is covered by the other dimensions. A more detailed explanation of the framework components can be found in table 9. Accordingly, attempts were made to apply a mutually exclusive and collectively exhaustive approach to consider all relevant perspectives in the recommendations. After identifying recommendations for all ten innovation types, they were grouped into the BM innovation recommendations (presented in chapter 6.1) and the general recommendations (presented in chapter 6.2).

Overarching Dimension	Dimension	Definition
Configuration: Enterprise's innermost workings and business system	Profit (Revenue) Model	How you make money.
	Network	How you connect with others to create value.
	Structure	How you organize and align your talent and assets.
	Process	How you use signature or superior methods to do your work.
Offering: Enterprise's core product or service, or a collection of its products and	Product Performance	How you develop distinguishing features and functionality.
	Product System	How you create complementary products and services.
Experience: Customer-facing elements of an enterprise and its business system.	Service	How you support and amplify the value of your offerings.
	Channel	How you deliver your offerings to customers and users.
	Brand	How you represent your offerings and business.
	Customer Engagement	How you foster compelling interactions.

Table 9: Ten Types of Innovation Framework, own depiction based on Deloitte (2024)

6.1 Business Model Innovation Recommendations

This work presents a total of seven BM innovation recommendations. The recommendations were evaluated using the New-Useful-Feasible framework (Alexandorsson 2019), whereby each recommendation was rated in the three dimensions on a numerical 10-Likert scale by all field lab members individually to then derive an average which included the experts interviewed to validate the order (appendix 10: CON4; CON5; HSP3). Overall, only slight deviations were found among raters, underpinning the order depicted in table 11. This approach ensures a balanced assessment of the recommendations, aligning innovation with practicability and impact, reducing the risk of measurement errors, thus positively impacting inter-rater reliability (Hallgreen 2012). An explanation of the dimensions and scales can be found in table 10.

Framework Dimension	Definition	Score 0 Meaning	Score 10 Meaning
New	Does this idea already exist on the market, or has it been done before?	Has already been implemented numerous times before.	Has never been implemented before.
Useful	Does the idea actually solve the problem, without creating new problems?	Does not solve the problem concerned and creates new ones.	Completely solves the problem concerned withour creating new Problems.
Feasible	Can it be done and how many resources and effort is needed?	Requires great effort to put into practice	Very easy to put into practice.

Table 10: Explanation of the NUF Evaluation Method and related Scale, own depiction based on Alexandorsson (2019)

Business Model Recommendations:	New	Useful	Feasible	Sum
Standardizing Customer Experience	6	9	10	25
Introducing Battery Energy Storage Systems	7	10	7	24
Enhancing Utilization and Site Selection Capabilities using Data Analytics	7	10	6	23
Establishing Modular Charger Architecture	5	8	8	21
Introducing Reservation Feature	6	6	8	20
Implementing Investment Reduction Initiatives	3	7	9	19
Demand-Based Dynamic Pricing	10	7	2	19

Table 11: Application of NUF to the Business Model Recommendations, own depiction

Additionally, appendix 7 depicts which dimensions of the Ten Types of Innovation framework are addressed by the recommendations. In addition to this categorization, the interview process identified key success pillars for CPOs, which were subsequently used to validate the proposed recommendations. It seems to be a more structured approach to differentiate the dimensions targeted by the recommendations. These primarily address the BMC dimension key resources (see chapter 5.2.6), whereby a CPO must perform superior in two of these five dimensions to be successful (appendix 10: HSP3). Details of this matrix can be found in Table 12.

			The 5 CPO Success Pillars				
Rank	NUF Score	Business Model Recommendations:	CAPEX	Real Estate	Technology	Customer Access	Grid Connnection
1	25	Standardizing Customer Experience	✓	✓		✓	
2	24	Introducing Battery Energy Storage Systems			✓		✓
3	23	Enhancing Utilization and Selection Capabilities using Data Analytics		✓	✓		
4	21	Establishing Modular Charger Architecture	✓		✓		
5	20	Introducing Reservation Feature				✓	
6	19	Implementing Investment Reduction Initiatives	✓				
7	19	Demand-based Dynamic Pricing				✓	

Table 12: Business Model Recommendations and the 5 CPO Success Pillars Matrix, own depiction based on appendix 10: HSP3

The three highest-ranked recommendations are discussed in detail in the following subchapters, 6.1.1 until 6.1.3, while this chapter discusses all eight recommendations superficially in chronological order: Firstly, companies using the O&G CPO BM should **standardize the**

customer experience. This recommendation attempts to utilize the brand-related BM advantage and mitigate CAPEX vulnerability through offering uniform service offerings, including for commercial vehicle drivers, where customers know what to expect, just like with the legacy gas stations. To tackle underutilization and increase profitability, the services offered for each charging station should be promoted through engaging app interfaces embedded with promotional convenience offers and integrated loyalty programs. To reduce cannibalization effects (appendix 10: HSP3), surrounding partners that do not compete directly with the in-store offer of O&G CPOs should be increasingly promoted. Examples are clothing retailers, coffee stores, and fine restaurants, but for instance, no other supermarkets should be targeted by this recommendation if the station provides a convenience offering.

Additionally, to address challenges like grid capacity limitations and fluctuating energy supply, it is recommended to consider the integration of **Battery Energy Storage Systems (BESS)** into EV charging stations, ensuring reliable, stable charging speeds and enhancing operational efficiency (appendix 10: CON4; CON5).

Thirdly, **data analytics capabilities should be enhanced** in the BM by deploying digital twin technology and predictive models to optimize network performance and increase utilization, as well as improve site selection (appendix 10: HSP3).

Another recommendation to mitigate the vulnerabilities of high CAPEX and charging technology uncertainty (but also to further reduce OPEX) relates to the implementation of **Modular Charger Architecture** at charging stations, i.e., with at least four to six chargers (appendix 10: HSP3). Additionally, this recommendation has a use case for en-route but also destination charging sites. This involves centralizing power electronics (including precise power electronics, thermal management, and switching matrix) in one unit, the power unit, instead of installing them in each charging station (appendix 13). This would lead to a potential reduction in investment costs of up to 30-40%, easier adaptability of the charging solution, and a shorter time-to-market (Hagenmaier et al. 2024).

In addition, the considerable advantage of locations and growth potential, which is primarily attributable to the key capability of financial resources, should be leveraged to **introduce a charger reservation feature** to especially meet the needs of the heavy-duty vehicle customer segment, as validated in one of the last expert interviews (appendix 10: HSP3). This function also indirectly requires the introduction of waiting time/capacity availability prediction functions and must take traffic congestion into account for dynamic reservations. In-house software development is potentially required but opens up the potential for new revenue streams and differentiation from other CPO BM variations.

Although more relevant for other CPO BM variations than for the O&G CPO BM, operators should look for ways to reduce one of the main vulnerabilities of high CAPEX by **reducing the investment volume**. An important lever could be increased cooperation with infrastructure funds and private equity firms to also reduce their vulnerability to regulatory and technological uncertainty by sharing the risk with other firms. Recent examples are the Antin Infrastructure Partners and Arié Group investing in Powerdot (Powerdot 2024b) or PGGM, Bpifrance, and Eurazeo in Electra (Lawrence 2024). This recommendation is expected to be particularly applicable to the European market, as the aggregate transaction volume in Europe is about 5x higher than in the USA/Canada (appendix 14). However, the vulnerability of the O&G CPOs' brand perception could be a limitation. Other options could include increased partnerships with WhiteLabel DC manufacturers based in Asia, as seen with ShellRecharge and Chinese manufacturer Electrly (Electrly 2024), to reduce procurement costs and exploit the growth advantage that comes with greater negotiating power. Despite the financial resources of the O&G CPOs, innovative leasing (e.g., usage-based) options can be considered (Bertoldi 2019).

O&G CPO BM operators should consider **introducing advanced demand-based dynamic pricing** by collecting customer preferences for desired charging speed in addition to the simple dynamic pricing, based on which the price is calculated. Experts could confirm that dynamic pricing can be highly beneficial and possibly deployed on a large scale in the future (appendix 10: HSP2). This enables capturing the customers' willingness to pay and artificially influences the vulnerability of capacity utilization. This could also have an impact on the profit model, as more willingness to pay can be skimmed off the customer's side**.**

6.1.3 Key Recommendation – Enhancing Data Analytics Capabilities

The underlying **problem statement** related to the third key recommendation revolves around the inefficient utilization of charging stations and the challenging alignment of site locations with changing customer demand. Underutilized stations challenge charging station profitability and hinder further expansion, while sites chosen beyond the existing O&G infrastructure are difficult to assess, which contributes to inefficiencies and lower profitability. Beyond site selection, O&G CPOs struggle to leverage insights into customer behavior, leaving room for potential within the convenience strategy. Addressing these issues requires a capability building and strategic shift (appendix 10: CON5) toward data-driven decision-making impacting several dimensions within the framework applied in chapter 6.1. In detail, this shift elevates the internal processes driving operational excellence and improves both product performance due to higher utilization and product system due to tailored ancillary offerings to customers.

The proposed **solution** centers on the integration of advanced data analytics tools, particularly through the deployment of digital twins and predictive models. This approach improves data-driven network optimization and enables O&G CPOs to identify and eliminate potential bottlenecks or inefficiencies before they occur. Current research has introduced the thought of implementing digital twins into the EVCI by highlighting digital twins as transformative for the industry, addressing efficiency, sustainability, and scalability challenges in the shift to smart, user-focused, and renewable-integrated systems (Yu et al. 2024). Focusing on O&G CPOs, our field lab group advocates that this new capability elevates owned operations in four distinct ways: demand-based load management, guiding the site selection process, customer price sensitivity, and predictive station maintenance.

First, load management can be optimized based on demand (appendix 10: CON4), impacting both revenue and cost, but also customer experience. By accurately predicting and balancing demand, operators can reduce energy costs by utilizing off-peak rates and incorporating demand forecasts into dynamic pricing strategies. This approach also helps avoid expensive grid upgrades and reduces maintenance requirements through more efficient power distribution. From a revenue side, load management with digital twin technology mitigates revenue loss by dynamically balancing energy demand. Lastly, customers may benefit from lower charging costs during off-peak times.

Regarding site selection, scaling the network beyond legacy infrastructure is essential for O&G companies' success, but competition is already advanced due to no respective existing sites (appendix 10: CON4). Additionally, the site selection process is very complex, as discussed in chapter 5.2.4. Thus, leveraging digital twin technology can support evaluating environmental, technical, economic, social, and engineering factors comprehensively. Furthermore, this recommendation supports the emerging technological capability by creating virtual models of potential sites, integrating real-time data, and enabling scenario simulations, which help forecast different variables (Ali et al. 2023) impacting an O&G charging network. These models facilitate the optimization of locations based on predictive analytics and assessments of grid capacity, traffic patterns, and environmental impact (Harshil and Nagababu 2024), providing a structured approach to improving a key CPO competence (appendix 10: HSP3).

Thirdly, digital twin technology elevates the operational status quo by enabling O&G CPOs to analyze real-time pricing elasticity and customer behavior. This allows for precise pricing strategy adjustments, addressing customers with tailored offers. Lastly, continuous performance monitoring and failure simulation using digital twins can enhance predictive maintenance strategies for O&G CPOs. This data-driven approach mitigates unexpected operational disruptions, optimizes maintenance intervals, and reduces associated costs.

Incorporating this recommendation into the CPO BM has profound implications on several dimensions of the BMC analyzed in chapter 5. Enhanced data analytics capabilities directly affect several key elements of the BMC. Regarding key resources, the implementation of digital twin platforms and predictive analytics tools requires substantial investment in IT infrastructure and skilled personnel such as data analysts and software engineers. These resources are crucial to the advancement of the proposed capabilities and critical to their successful deployment. Continued monitoring of charging station performance and proactive maintenance planning is similarly aligned with the analytical approach. Equally transformative is the impact on the value proposition. Improved reliability and operational efficiency elevate the customer experience and eliminate issues such as station unavailability and waiting times. By optimizing the location and performance of charging stations, CPOs can better align their offerings with customer needs, driving trust and satisfaction. In addition, revenue streams are positively impacted by higher utilization, which translates into higher energy sales and potentially higher ancillary revenue. In terms of cost structure, while initial investments in analytics tools and infrastructure may be substantial, the long-term operational savings achieved through predictive maintenance and optimized resource allocation are expected to offset initial investments.

The **implementation** of this recommendation benefits from a phased approach, dividing measures within a “now, next, later” framework. In the short term, O&G CPOs should conduct feasibility studies to identify data gaps and performance metrics. Detailed analyses need to indicate whether these capabilities should be developed in-house or outsourced to an established partner in predictive analytics. Consequently, pilot digital twin solutions at select high-traffic sites provide opportunities for testing and refinement before scaling the solution across the network. Secondly, the established capabilities can be deployed more broadly, with predictive maintenance models integrated into operations. Developing dashboards for assessing different scenarios within the model is key to deriving structured insights into topics such as site utilization and customer behaviour. In the long term, advanced systems can shift the focus toward automated integrating network adjustments, enabling dynamic pricing strategies, optimized energy flow management, and real-time tailoring of ancillary in-app offerings.

Nonetheless, this recommendation is not without **limitations**. Technical barriers, such as the high upfront costs of upgrading digital infrastructure and acquiring or developing analytics tools, require significant commitment. Data collection, particularly in fragmented ecosystems, may be incomplete or inconsistent, affecting the reliability of predictive models. Additionally, as O&G CPOs expand beyond their legacy network, competitors have already developed EV charging site selection capabilities over a couple of years, potentially having secured some of the most attractive sites already (appendix 10: CON4). Consequently, securing new locations has become not only a matter of cost but also of timing, resulting in O&G CPOs heavily relying on M&A activities to drive their network growth inorganically. Lastly, O&G CPOs may be advised to focus only on using digital twins to elevate their core operations, which exclude maintenance, which can also be handled through service level agreements with hardware providers (appendix 10: HSP3).

These limitations highlight the need for a dedicated, well-implemented network optimization strategy driven by this recommendation.

6.2 General Recommendations

General recommendations do not directly modify the BM components and rather focus on creating further enhanced advantages as well as mitigating the vulnerabilities caused by the BM. Especially for O&G companies transitioning into this space, their BM adaptation requires a forward-looking and strategic approach due to their BM vulnerabilities. Following the group recommendations workshop, four general recommendations were proposed: **Technology foresight, branding, feedback mechanism, and partnerships with OEMs**.

Technology foresight emerges as a critical tool in this context, allowing companies to anticipate and integrate key innovations while maintaining their competitive edge. This helps to potentially mitigate vulnerabilities like CAPEX, energy supply & infrastructure, and charging technology. Historically, the O&G industry has operated in a relatively stable environment, with minimal disruption to its core BM (Bau et al. 2021). However, the transition to EVs demands a proactive stance on identifying and leveraging technological advancements. To effectively monitor and integrate these advancements, O&G companies who use this should implement a structured technology foresight process, such as the one proposed by Rohrbeck (2010) in "Harnessing a Network of Experts." This involves engaging a diverse network of experts, including engineers, scientists, and industry specialists, by installing 'scouts' to identify and evaluate emerging technologies. Additionally, deploying data-mining tools and AI can automate the identification of new developments in patents, academic publications, and industrial research (Rohrbeck 2010). Insights can be gathered from a range of sources, including social media, industry-focused publications, bloggers, and thought leaders, to maintain an up-to-date understanding of market trends. Global perspectives are equally crucial, with regions like China and South Korea leading in battery swapping (Kang 2024) and automated charging technologies (Hyundai Motor Group 2023), Europe advancing in standardization practices, and the U.S. pioneering AI tools and BESS innovation through Tesla. Scouts identify and evaluate innovative technologies according to the criteria: industry novelty and novelty to the organization of the technology. Rohrbeck (2010) further describes that in technology scouting, as depicted in figure 16, the actors' Technology Foresight, Technology Scouting, and Technology Management need to work together. These actors are needed to assess, often in a workshop, the market potential, e.g., potential market size, cost savings and disruptive potential, and technological realization complexity, e.g., complexity, implementation risk, and development cost. Lastly, technologies that are assessed as relevant are disseminated to internal stakeholders to launch a gap analysis and new R&D projects.

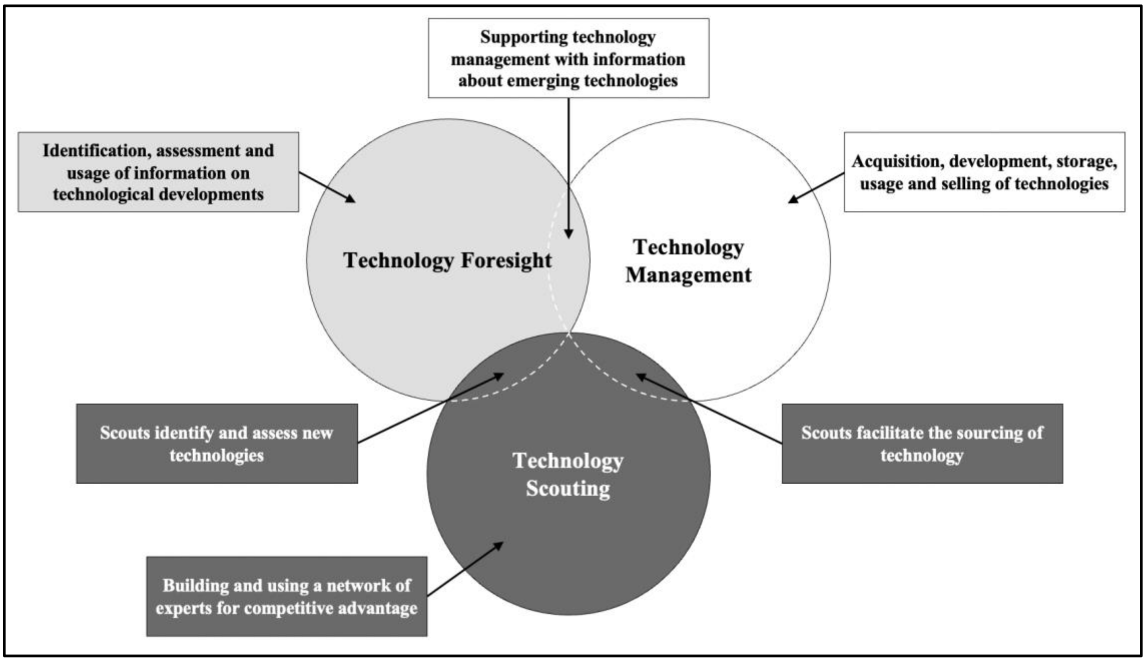

Figure 16: Contributions of Technology Scouting to Technology Foresight and Technology Management, own depiction based on Rohrbeck (2010)

Branding is another critical element that requires thoughtful consideration as it serves as an advantage and vulnerability of the BM (see chapter 5.4). Effective brand architecture can help O&G BM companies appeal to the growing EV market while maintaining the credibility of their existing operations. Several approaches are viable, including an endorsed brand, house of brands, sub-brands, and branded house strategy (Aaker and Joachimsthaler 2000). To leverage both the existing endorser-brand of O&G BM companies with its mobility image and the image of a sustainability-oriented company, the **endorsed brand strategy** is recommended. It can be argued that the recognizability is not as high as with other brand strategies, and additional overhead costs are created due to separate entities. Still, the renewable and sustainable image is important in the field of EV charging to private and business customers (appendix 10: CPO6). Moreover, establishing a distinct entity dedicated to sustainable EV charging may facilitate greater access to green financing, as certain investors, such as the Swiss infrastructure fund Energy Infrastructure Partners, demonstrate a reluctance to invest in diversified O&G companies (Energy Infrastructure Partners n.d.).

To further advance operations and reduce underutilization by uncovering customer experience blind spots, robust **feedback mechanisms** should be integrated into the customer journey. Feedback can be gathered via mobile apps or websites, allowing customers to share their experiences effortlessly. On-site interactive kiosks offer another avenue for real-time input, while QR codes placed on charging stations can redirect users to brief surveys. Post-charging follow-ups through email or push notifications provide additional opportunities for feedback, ensuring companies remain attuned to customer needs. Social media platforms facilitate direct engagement and the opportunity to address issues or gather insights publicly, while customer support lines provide a personal touch for resolving more complex concerns. Integration of AI can enhance customer support efficiency and experience by implementing chatbots and a knowledge base (appendix 10: CSP1).

To mitigate vulnerabilities in charging technology and underutilization, **partnerships with OEMs** present a strategic opportunity for O&G companies to enhance security, reliability, and user convenience (appendix 10: CPO2; CPO7). By integrating route planning, authentication, and billing directly through vehicles using plug-and-charge technology, these collaborations minimize risks associated with manual input and third-party interface. For O&G companies transitioning to EV charging, co-branded partnerships allow them to leverage their established trust and mobility image. Especially, partnerships with Asian OEMs who gain market share in the European market should be fostered.

7 Limitations and Suggestions for further Research (Group Part)

Research limitations are an inherent part of any study, helping to clarify the scope and context of the findings. While this research aimed to provide valuable insights into the EVCI, certain theoretical, methodological, and analytical constraints should be acknowledged to situate the results appropriately and guide future research.

One **theoretical limitation** arises from the use of flexible research methods, which allowed for adaptability to emerging trends but led to some variability in focus and depth. Time constraints, coupled with the need to address diverse aspects of the EVCI, meant that not all dimensions could be explored equally. Additionally, the study's findings were influenced by regional market characteristics, with a primary focus on the European market. Differences in adoption rates and market maturity across regions, and especially within European countries (see chapter 4.3.2) where countries' regulators follow different EV charging strategies, e.g., Netherlands or Norway, limiting the generalizability of some insights. Lastly, the rapid pace of innovation in the EV sector means that some findings could become less relevant as new technologies and policies emerge. These limitations reflect practical decisions made during the research process. The flexibility of the methodology allowed for the exploration of nuanced, market-specific insights but inevitably led to trade-offs in standardization. Similarly, focusing on Europe leveraged the availability of relevant data and expertise but narrowed the geographic scope of the findings. While the dynamic nature of the EVCI underscores the timeliness of the study, it also introduces challenges in maintaining its long-term relevance. Future research could mitigate these issues by using standardized methods to ensure consistency across topics and regions. Expanding the analysis to our study of underrepresented markets, China and the U.S., and adopting longitudinal approaches could further enhance the applicability and durability of the findings, especially in terms of assessing country-specific variation within the defined scope.

In terms of **methodological limitations**, access to primary data and generalization of insights posed some challenges. With respect to primary data, the total number of interviews conducted was limited by candidate availability and the time available for outreach, with low response rates from cold LinkedIn outreach. Additionally, the sensitive nature of BM insights meant that some participants were unable to share detailed data due to confidentiality concerns. Lastly, the lack of direct consumer surveys left customer perspectives untouched, though this was not the primary focus of the research. Regarding the generalization of interview insights, the nonrandom selection of interview partners and different variations of the interview focuses due to different roles, industries, and company BMs of interviewees making generalization and drawing of comparable insights difficult. These methodological constraints reflect the inherent challenges of conducting research in a competitive and rapidly evolving industry. The reliance on professional networks constrained the diversity of perspectives, while confidential considerations around data sensitivity limited the level of detail available. However, the insights gathered still provided a valuable foundation for analysis. To address these challenges, future studies could adopt broader outreach strategies, such as collaborations with industry groups or research firms, to improve participation rates and allow for more standardized interviews, improving comparability. Data anonymization methods, rather than pseudonymization, could alleviate concerns around confidentiality, and integrating customer surveys would add valuable insights into consumer preferences to complement strategic findings.

Concerning **analytical limitations**, the complexity inherent in the technical aspects of the industry, its BMs, and their interrelations posed challenges to the accuracy and depth of the analysis and recommendations, particularly given the academic backgrounds of the authors in business and economics. However, this limitation was mitigated through abstraction, targeted research, and consultations with industry experts. To achieve a more comprehensive understanding of specific aspects of the BM and to develop more precise recommendations and implementation plans, closer collaboration with technology and industry experts well-versed in these technologies would be essential, as well as a more detailed and in-depth analysis of financial statements from multiple companies representing a CPO BM variant. Given the access to business unit-level financial data, further analyses regarding the financial perspective of transitioning from legacy BMs to scaling a CPO BM are of high interest to understand the complexity of this transition from another angle.

Additionally, future research should delve deeper into the potential benefits and synergies of BMs serving diverse customer segments – such as commercial vehicles, fleets, and private passenger vehicles – across various locations, including en-route, destination, workplace, and residential settings at the same time. Alternatively, studies should explore whether market specialization and competition might yield more effective solutions.

8 Conclusion (Group Part)

This thesis explored the European EVCI, analyzing its evolution, challenges, and opportunities, with a particular focus on the CPO BM as adopted by O&G companies. Leveraging secondary data and expert interviews, the study examined the critical dynamics of BMs within the EVCI, detailing advantages, vulnerabilities, and potential innovations that drive the industry's growth. One core observation was the EVCI ecosystem complexity, which bridges energy and automotive sectors. The study underscored how O&G companies, through their legacy assets such as fueling stations and customer networks, possess unique strategic advantages in transitioning to e-mobility solutions. However, the research also identified key vulnerabilities, including the need for substantial capital investments, the challenges of rapid technological advancements, and ambiguous consumer expectations.

This thesis offers significant **theoretical implications**. First, it introduces a comprehensive framework for categorizing BMs within the EVCI by origin industries, e.g., utilities or O&G.

By linking legacy assets to industry-specific dynamics, this framework offers scholars a perspective on how firms leverage their own resources to adapt in evolving sectors, enhancing cross-industry understanding and encouraging further research into adaptations in markets such as decentralized finance, bridging technology and finance sectors (Chen and Bellavitis 2020).

Second, the study highlights the dual role of strategic assets, e.g., petrol stations, as both enablers and barriers to innovation. This finding reveals tensions firms face in balancing the benefits of existing resources with the need for transformative changes in rapidly evolving industries. For scholars, this research contributes to the prominent research stream on reconfiguration and repurposing of resources, e.g., telecom competing streaming platforms on connectivity services (Mohr and Meffert 2017). Furthermore, this thesis offers a new perspective on differences between legacy players and pure players following a "de-novo" approach (York and Lenox 2014), similarly observed in other industries such as disk drives (Khessina and Carroll 2007). Thirdly, it positions technology, such as BESS and smart grids, as a central driver of BM evolution rather than a supporting factor. This perspective encourages scholars to view technology as foundational in reshaping BM elements, deepening the understanding of how technological advancements redefine firm strategies in dynamic ecosystems, seen in other industries as well (Khrais 2020).

Besides theoretical implications, this thesis is highly relevant from a **practical implications** point of view. To address all stakeholders involved in the research process, implications are structured into O&G CPOs, Non-O&G CPOs, and broader EVCI stakeholders.

Firstly, this research provides a deeper understanding of the industry dynamics for **O&G CPOs** by highlighting the critical need to develop new capabilities essential for navigating the transition toward mass EV adoption. The primary challenge lies in balancing impactful investments in the emerging EV industry with sustaining profitability in the legacy O&G sector. Additionally, the research motivation posed for selecting the O&G CPO BM (see chapter 5.1) is validated through an analysis of the strategic role of legacy infrastructure. As the industry transitions from early adoption to mass adoption, referred to as the "chasm" in chapter 4.4, it becomes evident that scaling a charging network will increasingly require O&G CPOs to expand beyond their existing infrastructure. Consequently, their legacy assets, while valuable, may diminish in strategic relevance, requiring a broader approach to scaling operations to maintain industry leadership. Nonetheless, the findings suggest that O&G CPOs possess a competitive advantage in driving the EV transition. Their established networks enable them to strategically leverage a customer-centric, convenience-based approach, differentiating them from competitors and providing a strong foundation for continued innovation.

Secondly, the findings suggest that **non-O&G CPOs** are challenged and may differentiate from O&G CPOs by focusing on unique value propositions such as low-cost solutions, technological leadership, or sustainability-driven premium offerings. While O&G CPOs benefit from legacy infrastructure and retail partnerships, non-O&G players are more agile to address specific market needs. For example, Milence's focus on heavy-duty vehicle charging underpins how segment specialization can drive differentiation (Milence 2024). Additionally, projected consolidation and increasing PCP density underscore the importance of capitalizing on individual strategic assets, such as grid connection capabilities for utility-based CPOs. Another implication for non-O&G CPOs is that destination charging networks present a viable opportunity, as current partnerships with municipalities and parking space providers offer a clear edge over O&G players, still largely focused on en-route charging. Consequently, enhanced capabilities in site selection and urban scalability position non-O&G CPOs as leaders in destination and workplace charging, segments critical to supporting widespread EV adoption.

Thirdly, this thesis offers implications for **broader EVCI stakeholders**. Looking at hardware and software providers, the shift toward customer-centric charging stations requires continuous innovation in customization, seamless user experiences, and charging speeds. Flexible backend software is essential for integrating CPOs and OEMs, with adaptable communication platforms and energy management systems as key enablers. Providers prioritizing R&D to meet these demands will secure competitive advantages in a rapidly evolving market. Diversifying CPO portfolios may lead to hardware providers tailoring their portfolios to address diverse CPO needs. CPOs focusing on heavy-duty vehicles, modular station designs or urban scalability, and versatile hardware offerings, like Kempower's portfolio (2024), demonstrate the value of addressing varying site requirements. Lastly, MSPs face growing challenges as CPOs consolidate and merge into larger individual players with integrated proprietary app solutions to reduce external dependencies. To remain relevant, MSPs may evaluate targeting smaller CPOs with bundled solutions like integrated energy management, advanced user engagement platforms, and strengthening their role in underrepresented value chain segments.

In conclusion, while O&G CPOs are uniquely positioned to drive the transition to sustainable mobility by leveraging their legacy infrastructure and integrating innovative solutions, the broader EVCI must embrace collaboration, technological advancement, and customer-centric strategies to create a seamless and scalable future for EV adoption.

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List of Abbreviations

Term	Abbreviation
Alternating Current	AC
Alternative Fuel Infrastructure Regulation	AFIR
Battery Electric Vehicle	BEV
Battery Energy Storage Systems	BESS
Business Model	BM
Business Model Canvas	BMC
Business Model Innovation	BMI
Charge Point Operator	CPO
Charging Solution Provider	CSP
Direct Current	DC
Ecosystem Pie Model	EPM
Electric Vehicle	EV
Electric Vehicle Charging Industry	EVCI
Extended-Range Electric Vehicle	ER-EV
Heavy-duty vehicles	HDV
Internal Combustion Engine	ICE
Light-Duty Vehicles	LDV
Mobility Service Provider	MSP
New, Useful, Feasible	NUF
Original Equipment Manufacturer	OEM
Oil & Gas	O&G
Plug-In Hybrid Electric Vehicle	PHEV
Public Charge Point	PCP
Smart Energy Services	SES
Vehicle-to-building	V2B
Vehicle-to-everything	V2X
Vehicle-to-grid	V2G

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Industry Glossary

Term	Definition
Mobility Service Provider	A company that offers access to EV charging networks for drivers, often through apps or RFID cards.
(Ultra-)Fast charging	High-power charging (typically 150 kW and above), using direct current, that provides a quick charge, often within 30 minutes or less.
AC charging	A slower charging method using alternating current, usually for home or workplace charging, with power levels typically up to 22 kW.
Charge-at-work	Charging infrastructure provided at workplaces for employees to charge their EVs during working hours.
Charging point	A specific outlet or plug where an EV can connect to a power source to charge.
Charging site	A location with multiple charging stations, often managed by a single operator.
Charging station	A physical unit with one or more charging points where EVs can be charged.
Charge Point Operator	An entity responsible for managing and maintaining charging stations and providing access to charging points.
Commercial vehicles	Vehicles used for transporting goods or passengers for business purposes.
DC charging	Fast charging using direct current, ranging from 50 kW to over 350 kW.
Destination charging	Charging facilities located at places where EV drivers typically spend several hours, such as hotels, shopping centers, and gyms.
En-route charging	High-speed charging stations located along highly frequented roads like highways to support long-distance travel.
Half-public charging	Charging infrastructure available to a limited group during assigned times and available for public at remaining time.
Home charging	Charging an EV at a residential location, typically through a dedicated AC charging unit.
Passenger vehicles	Vehicles designed primarily for transporting individuals, typically seating 1-8 passengers.
Private charging	Charging at locations restricted to specific users, such as individual home or business owners.

Public charging	Electric vehicle charging stations accessible to all users in public areas.
Roaming	The ability for EV drivers to access multiple charging networks with a single account or app, facilitated by agreements between MSPs and CPOs.

Appendix

List of Appendixes

Appendix 1: Selected Business Model Definitions

Authors (Year)	Business Model Definition
Timmers (1998)	The business model is a framework that outlines the structure of products, services, and information flows. It includes an explanation of the roles and responsibilities of different business participants, the potential benefits for each actor, and the sources of revenue.
Amit and Scott (2001)	The business model illustrates the content, framework, and governance of transactions, structured to generate value by leveraging business opportunities.
Magretta (2002)	Business models are narratives that describe how businesses operate. A well-crafted business model addresses Peter Drucker’s known questions: Who is the customer? What does the customer value? Additionally, it tackles essential managerial questions: How does the business generate revenue? What is the economic rationale that enables value delivery to customers at a viable cost?
Chesbrough and Rosenbloom (2002)	The business model serves as the intuitive framework that links technical capabilities to the creation of economic value.
Shafer, Smith, and Lindner (2005)	A business model is a representation of a company's fundamental logic and strategic decisions for generating and capturing value within a network of interconnected stakeholders.
Morris, Schindehutte, and Allen (2005)	A business model is a clear depiction of how interconnected decision variables in venture strategy, structure, and economics are managed to establish a sustainable competitive advantage in specific markets.
Osterwalder and Pigneur (2010)	A business model is a conceptual framework that includes a set of elements, concepts, and their relationships, designed to articulate the business logic of a specific company. It requires identifying the key concepts and connections that enable a simplified depiction of the value delivered to customers, the processes involved in delivering it, and the resulting financial implications.
Johnson, Chistensen, and Kagermann (2008)	Business models comprise four interconnected elements that work together to create and deliver value: the customer value proposition, the profit formula, key resources, and key processes.
Casadesus-Masanell and Ricart (2010)	A business model describes the logic of a company, outlining how it functions and generates value for its stakeholders.

Zott and Amit (2010)	Expanding on the concept that transactions connect activities, the authors redefined a firm’s business model as a system of interconnected activities that goes beyond the firm itself and crosses its organizational boundaries.
Teece (2010)	A business model outlines the rationale, data, and supporting evidence behind a value proposition for the customer, along with a sustainable revenue and cost structure for the organization providing that value.
Aspara et al. (2013)	The business unit-level business model is seen as the managers' understanding of how the unit operates and generates value, both in relation to its market environment and within the broader corporation, including its interactions with other business units.
Velu and Stiles (2013)	A business model sums up the architecture and logic of a business as a whole.
Taeuscher and Abdelkafi (2016)	An iterative feedback loop links the value provided to customers, the value accrued by the company, and the benefits created for the natural environment.
Wirtz et al. (2016)	Business models are simplified and comprehensive representations of a company's key activities. They illustrate how the organization generates marketable information, products, and services through its value-adding processes. Alongside detailing the architecture of value creation, they incorporate strategic, customer, and market elements aimed at achieving and sustaining a competitive advantage.

Own depiction based on Zott, Amit, and Massa (2011)

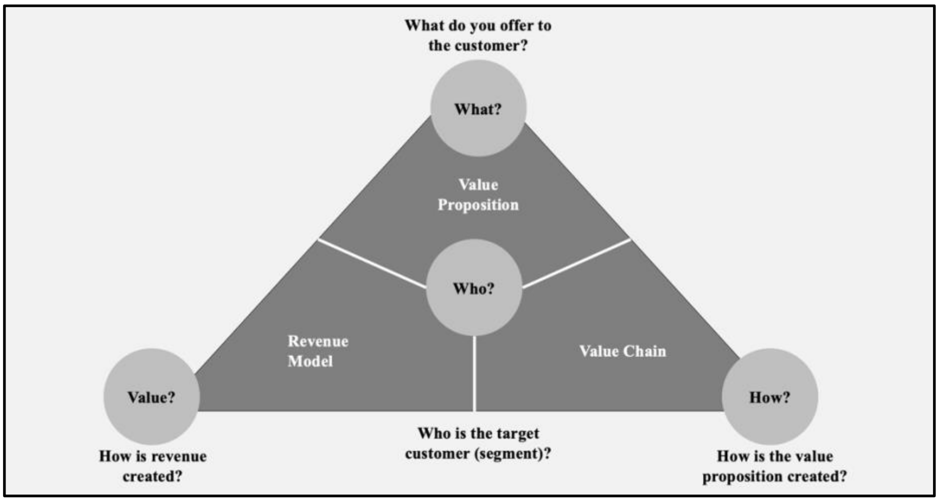
Appendix 2: Overview of Selected Business Model Framework Elements

<table>
<tr><th>Author(s)</th><th colspan="2">List/Framework and Elements</th></tr>
<tr><td rowspan="3">Osterwalder (2004); Osterwalder and Pigneur (2010)</td><td colspan="2">Business Model Canvas</td></tr>
<tr><td>First-Order Theme(s)</td><td>Second-Order Theme(s)</td></tr>
<tr><td>• Customer Segments
• Value Proposition
• Channels
• Customer Relationships
• Revenue Streams
• Key Resources
• Key Activities
• Key Partnerships
• Cost Structure</td><td></td></tr>
<tr><td rowspan="2">Afuah (2014)</td><td colspan="2">Afuah’s Business Model Framework</td></tr>
<tr><td>1. Customer Value Proposition
2. Market Segments
3. Revenue Model
4. Growth Model
5. Capabilities</td><td></td></tr>
<tr><td rowspan="2">Gassmann, Frankenberger, and Csik (2013)</td><td colspan="2">The Magic Triangle (appendix 3)</td></tr>
<tr><td>1. Who
2. What
3. How
4. Value</td><td>1. Who: Target customer segment
2. What: Offering of products/ services, value proposition
3. How: Processes & activities, resources
4. Value: Cost and revenue structure</td></tr>
<tr><td rowspan="2">Teece (2010)</td><td colspan="2">Business Model Design</td></tr>
<tr><td>1. Core Offering: Select technologies and features to be embedded in the product/ service.
2. Value Proposition: Determine benefit to customer from consuming/ using the product/ service.
3. Customer Segmentation: Identify market segments to be targeted.
4. Revenue Streams/ Pricing: Confirm available revenue streams.
5. Value Monetization: Design mechanism to capture value.</td><td>Key Questions to evaluate the provisional business model based on these criteria's:
• Customer Value: Ensure the product meets real customer needs and the market is existing and scalable.
• Differentiation: Offer a unique advantage that’s hard to imitate.
• Cost Efficiency: Build a scalable cost structure for profitable growth.
• Defensibility: Protect the business model with intellectual property or strong customer relationships.</td></tr>
</table>

Johnson, Christensen, and Kagermann (2008)	• Customer value proposition • Profit formula • Key resources • Key processes	• **Customer value proposition**: Target customer, job to be done, offering. • **Profit formula:** Revenue model, cost structure, margin model, resource velocity. • **Key resources:** People, Technology & Products, Equipment, Information, Channels, Partnerships & Alliances, Brand. • **Key processes:** Processes, Rules & Metrics, Norms.

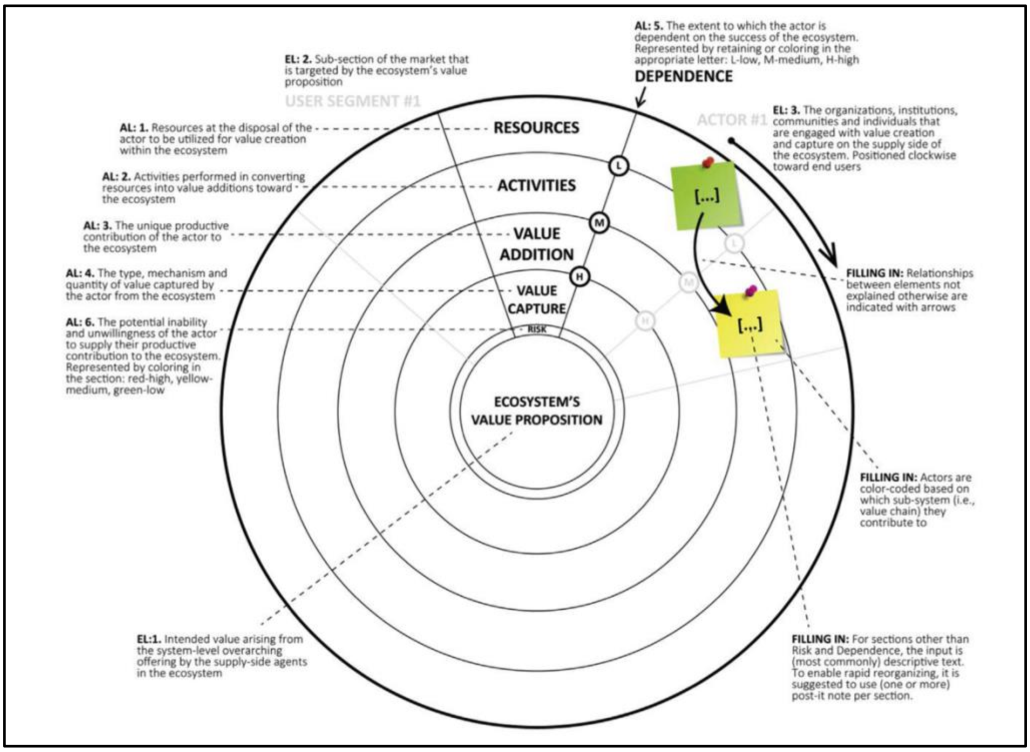
Own depiction based on sources indicated

Appendix 3: Magic Triangle framework

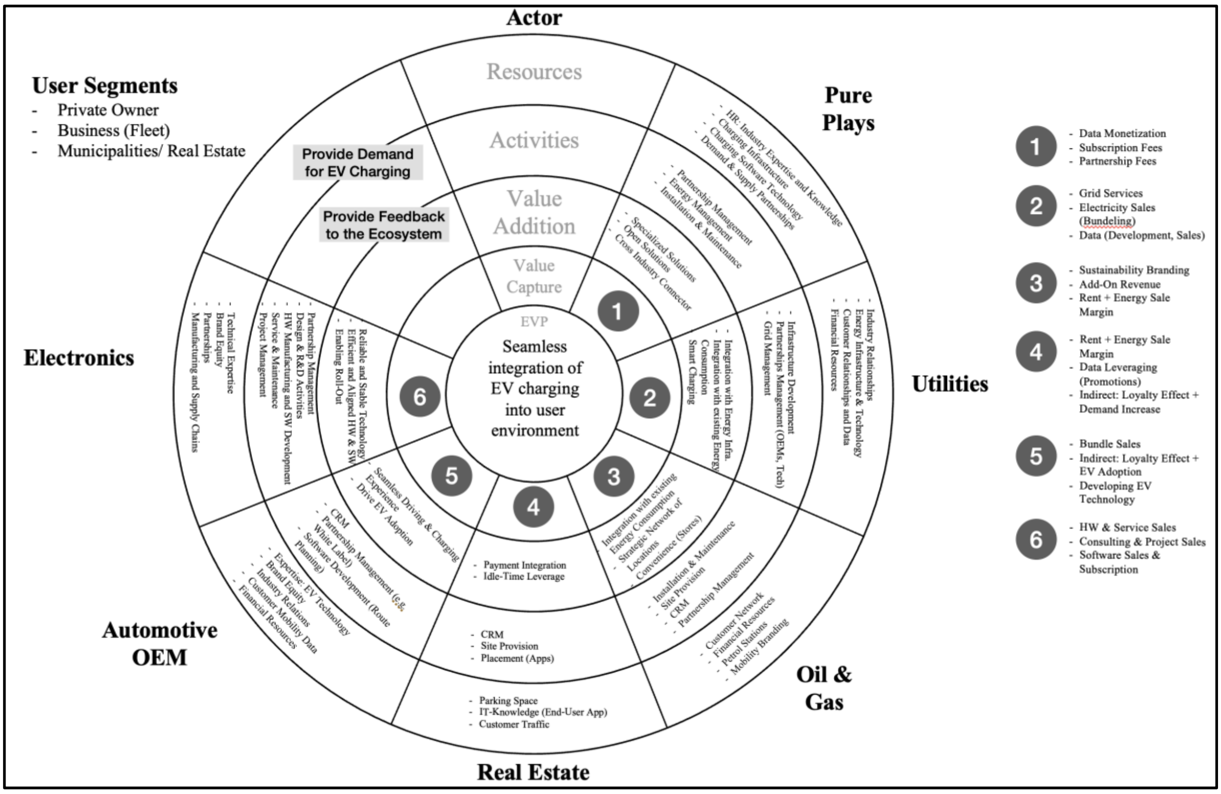


Own depiction based on Gassmann, Frankenberger, and Csik (2013)

Appendix 4: Ecosystem Pie Model



Talmara et al. (2020)



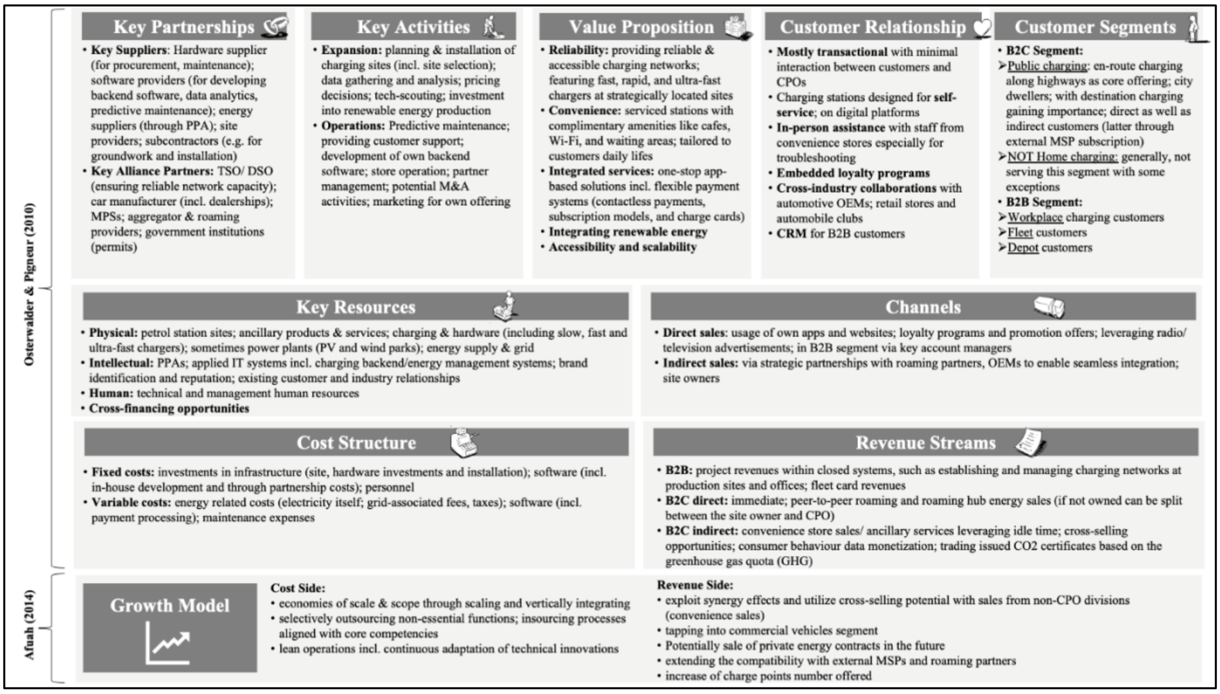
Adapted version of the Ecosystem Pie Model, developed during team workshop

Appendix 5: Prevalent definitions of BMI

Authors (Year)	Business Model Innovation Definition
Morris, Schindehutte, and Allen (2005)	Business model lifecycle, "involving periods of specification, refinement, adaptation, revision and reformulation. An initial period during which the model is fairly informal or implicit is followed by a process of trial-and-error, and a number of core decisions are made that delimit the directions in which the firm can evolve".
Markides (2006)	Business model innovation, "the discovery of a fundamentally different business model in an existing business".
Demil and Lecoq (2010)	Business model innovation, "a fine-tuning process involving voluntary and emergent changes in and between permanently linked core components".
Teece (2010)	Business model learning, an established firm modifies its business model in face of competition from a new business model.
Aspara et al. (2013)	Business model transformation. "a change in the perceived logic of how value is created by the corporation, when it comes to the value creating links among the corporation's portfolio of businesses, from one point of time to another".
Björkdahl and Holmén (2013)	A business model innovation is the implementation of a business model that is new to the firm.
Khanagha, Volberda, and Oshri (2014)	Business model innovation "can range from incremental changes in individual components of business models, extension of the existing business model, introduction of parallel business models, right through to disruption of the business model, which may potentially entail replacing the existing model with a fundamentally different one".
Juul Foss and Stiglitz (2015)	"designed, novel, and non-trivial changes to the key elements of a firm's business model and/or the architecture linking these elements".

Own depiction based on Foss and Saebi (2018)

Appendix 6: An analysis of the Oil & Gas CPO business model



Own depiction based on Osterwalder and Pigneur (2010) and Afuah (2014)

Appendix 7: Business Model Recommendations and Innovation Matrix

			Ten Types of Innovation Framework									
			Configuration				Offering		Experience			
Rank	NUF Score	Business Model Recommendations:	Profit (Revenue) Model	Network	Structure	Process	Product Performance	Product System	Service	Channel	Brand	Customer Engagement
1	25	Standardizing Customer Experience	✓	✓	✓	✓		✓	✓	✓	✓	✓
2	24	Introducing Battery Energy Storage Systems	✓	✓		✓	✓		✓			
3	23	Enhancing Utilization and Site Selection Capabilities using Data Analytics			✓	✓	✓	✓				
4	21	Establishing Modular Charger Architecture			✓	✓	✓					
5	20	Introducing Reservation Feature	✓		✓	✓	✓	✓	✓			✓
6	19	Implementing Investment Reduction Initiatives		✓	✓							
7	19	Demand-Based Dynamic Pricing	✓			✓	✓					

Own depiction based on Deloitte (2024)

Appendix 8: Interview Questionnaire Templates

Interview Questionnaire Template: Business Models		
CHAPTER 0: Introduction		

• Self-Intro & Thesis setting
• Explain topic and that expert's opinion is highly valuable.
• **Objective**: gaining a better understanding of developments and business models in EVCI
• **Personal background of interviewee:**
  o Could you please provide a brief overview of your professional background?
  o What role do you currently play in your company, and what experience do you have in the area of charging infrastructure?
  o How would you define the Business Model of your company?		

CHAPTER 1: Charging Business Model		
1	**Customer Segments**	Which customer segments from your view are most important to serve now and in the future with your BM? Is their behavior changing or are there bigger trends that need to be addressed?
2	**Value Proposition**	What specific features or strategies does your company emphasize to differentiate itself in the field of public charging infrastructure, considering technological innovations, sustainability aspects and other factors?
3	**Channels**	What are the main channels through which you reach your customers and sell your products/services? How has it developed and will develop in the future?
4	**Customer Relationships**	What strategies and potentially feedback mechanisms do you use to increase user adoption, to build trust and maintain customer loyalty in the competitive public charging market?
5	**Revenue Streams**	Can you describe the main revenue streams for your company in the EV charging industry? What pricing strategies are used and how are prices determined?
6	**Cost Structure**	EV Charging is often described as being unprofitable: What are the major cost drivers in your business, and can they be reduced to make the business model more attractive?
7	**Key Activities**	What are the most critical activities your company undertakes to expand and manage its public charging network, and how do you address challenges such as regulatory requirements, urban planning, and regional adaptation?
8	**Key Resources**	What resources do you consider as key resources required to operate and expand your business?
9	**Key Partnerships**	What types of key partnerships are most important for your company to succeed in the EVCI? What are the benefits and challenges of collaborating with other industry players?
CHAPTER 2: Opportunities of the Business Model		
10	**Opportunities**	What are the biggest and most promising opportunities for your business model? What are important trends in the market?
11	**Opportunities**	If you could change something fundamentally to improve your business, what would it be?
CHAPTER 3: Threats of the Business Model		
12	**Threats**	What are the biggest risks or threats to your business model and how can you mitigate them?
13	**Threats**	Do you see constraints/trends in the market hindering your company to become/maintain the market leader?

14	**Threats**	Who do you see as your direct competitors? Do you think it changes in the future?
CHAPTER 4: General Industry Trends		
15	**General**	What trends in the industry will have the biggest impact on your business model in the coming 5-10 years?
16	**General**	Do you think the industry is going to consolidate or undergo significant changes during the next 5-10 years? What do companies need to do to stay on top?
17	**General**	What innovations are you most excited about and could change the industry as it is now?
18	**General**	Did you observe different behaviors/trends in other countries/markets? Could they also be implemented at your company?
CHAPTER 5: Conclusion		
Summary and Gratitude: • "Thank you very much for your insights. Is there anything else you would like to add that we have not covered yet?" Follow-up: • "May I reach out to you again if I have further questions?"		

Interview Questionnaire Template: Industry Experts
CHAPTER 0: Introduction
• Introduction & Context → Objective → Structure • Personal background of interviewee: o What experience do you have in the area of charging infrastructure?
CHAPTER 1: Current State of Industry
What do you see as the current state of the public (fast-) charging market in Europe? (Maturity level)
Who are the main players driving innovation in this space, and what are emerging trends?
CHAPTER 2: Opportunities of the Business Model
How did you see business models changing in the past years and how do you expect the development in the next 3-5 years?
In your opinion, what are the most significant drivers of business model innovation in the EV charging sector?
CHAPTER 3: Challenges and Barriers
What are the biggest challenges faced by companies trying to innovate their business models in this industry?
What innovations could potentially threaten or transform the current EV charging business models? More specifically battery swapping, hydrogen fuel cells, charging robots
How do you see competition from other sectors (e.g., utilities, oil & gas) impacting this market?
CHAPTER 4: Key Opportunities and Future Trends
How do you see emerging technologies like vehicle-to-grid (V2G) systems or wireless charging impacting the industry?
How do you see the development in other markets e.g., the Chinese market and are there lessons to be learned and transferred to the European market?
CHAPTER 5: Conclusion
Summary and Gratitude: • “Thank you very much for your insights. Is there anything else you would like to add that we haven't covered?” Follow-up: • “May I reach out to you again if I have further questions?”

Interview Questionnaire Template: Recommendation Validations with Strategy Consultants
CHAPTER 0: Introduction
• Introduction & Context à Objective à Structure • **Objective:** Focus on validating feasibility of recommendations, focusing on O&G CPOs • *Show slide with recommendations and NUF evaluation: Explain procedure to first focus on 3 recommendations in the beginning and quickly talk about other 7 in the end* • Personal background of interviewee: o What experience do you have in the area of charging infrastructure?
CHAPTER 1: Key Recommendation - Battery Energy Storage Systems (BESS)
How critical do you think integrating BESS is for O&G CPOs to address grid capacity and demand-supply challenges? What are the main advantages?
In your opinion, what are the main obstacles for companies integrating BESS into their operations, and how might they overcome these?
Generally, do you think that the advantages from installing this system exceed the investment effort?
CHAPTER 2: Key Recommendation - [Formerly] Integrating Partnership Offerings
What are recent innovative trends of partnerships that O&G CPOs can pursue (e.g., with retailers, restaurants) to boost utilization and profitability?
What are the most important benefits O&G CPOs can gain from such partnerships?
What is important for the implementation of partnerships as a O&G CPO?
CHAPTER 3: Key Recommendation - [Formerly] Data Analytics and Predictive Models
What type of advanced data analytics use cases do you see in the area of O&G CPOs?
How important are advanced data analytics tools, like digital twins, for optimizing network performance, predictive maintenance and site selection?
What challenges do you see in the implementation of advanced data analytics as a O&G CPO? How can you mitigate them?
CHAPTER 4: Validation of other [Formerly] 7 Recommendation
Share the screen and quickly guide through the other 7 BMI recommendations. To each dimension 1-2 sentences. Based on your first impression, do you think that these recommendations are feasible to recommend?
Looking at these other 7 recommendations, is one of them eye-catching that you would see as more relevant than the first 3 key recommendations?
Optional: Regarding the 4th recommendation: What do you see as most interesting functionalities that the O&G CPOs can incorporate? Do you think that it's feasible for O&G companies to aim for cooperation with infrastructure funds and private equity firms? Do you see potential for introducing a bidding system for electricity?
CHAPTER 5: Branding
Do you see branding as an important factor when it comes to EV charging services? In the context of B2C, B2B and financials (Example: Eni - Plenitude as endorsed brand)
CHAPTER 6: Additional Recommendation
If you were advising an O&G CPOs, what additional recommendations or strategies would you propose to enhance profitability and scalability?
CHAPTER 5: Conclusion
Summary and Gratitude: • "Thank you very much for your insights. Is there anything else you would like to add that we haven't covered?" Follow-up: • "May I reach out to you again if I have further questions?"

Appendix 9: Interview List

Code	Interview Date	Duration (min)	Role	Business Model	Industry	Total Employees
CON1	06.11.24	45	Partner		Strategy Consulting	10,000-50,000
CON2	11.11.24	50	Senior Manager		Strategy Consulting	<1,000
CON3	31.10.24	45	Principal		Strategy Consulting	1,000-5,000
CON4	02.12.24	47	Partner		Strategy Consulting	10,000-50,000
CON5	02.12.24	44	Manager		Strategy Consulting	10,000-50,000
CPO1	11.11.24	43	Executive Board Member	Charge Point Operator	Oil&Gas	50,000-100,000
CPO2	15.11.24	67	Head of Business Development	Charge Point Operator	Oil&Gas	1,000-5,000
CPO3	18.10.24 24.10.24	54	Product Manager App // Managing Director	Charge Point Operator	Utilities	50,000-100,000
CPO4	14.10.24	180	Strategy & Portfolio Business Partner	Charge Point Operator	Oil&Gas	5,000-10,000
CPO5	18.10.24	74	COO	Charge Point Operator	Automotive	<1,000
CPO6	13.11.24	59	Head of Strategy	Charge Point Operator	Utilities	5,000-10,000
CPO7	23.10.24	69	Department Manager	Charge Point Operator	Oil&Gas	10,000-50,000
CPO8	23.10.24	42	Co-Founder & CPO	Charge Point Operator	Pure Player	<1,000
CPO9	11.10.24	32	Senior Project Developer	Charge Point Operator	Automotive	>100,000
CPO10	17.10.24	69	CEO	Charge Point Operator	Utilities	5,000-10,000
CSP1	14.11.24	32	CDO	Charging Service Provider	Pure Player	1,000-5,000
HSP1	23.10.24	73	Leader Business Development	Hardware & Software Provider	Technology	>100,000
HSP2	17.10.24	72	Former CEO	Hardware & Software Provider	Technology	1,000-5,000
HSP3	02.12.24	57	CCO	Hardware & Software Provider	Technology	>100,000
OEM1	24.10.24	63	Manager	OEM	Automotive	<1,000
SWS1	11.11.24	45	Team Lead Business Development	Mobility Service Provider	Pure Player	<1,000

Appendix 10: Interview Insight Consolidation

Interview Code	Date	Role	Business Model & Industry
CON1	06.11.2024	Managing Director & Partner	Strategy Consulting
Key Insights			
Industry Trends: - Site owners at good locations think about doing their own CPO business; decreasing partnership effort - Separation of MSP and CPO may decrease as new technologies like Ad-Hoc Payment, Plug-and-Charge and Auto-Charge are introduced - Important for CPOs to have great amount of user and retain customers - Small players (CPOs and MSPs) are going to have a harder time in future - Industry consolidation upcoming: CPO acquisitions - interest solely on CPs, employees are overhead - Financial infrastructure investors may enter the CPO business through M&A or CPOs who would like to expand into new countries - Energy Optimization with Energy Storage to leverage arbitrage **New Technologies:** - V2G in fast charging does not fit together - Plug-and-Charge impact not fully understood yet - Truck charging: more and more integrated systems to increase utilization - Energy transition: performance-oriented pricing: energy is for free unless you need it; dynamic energy prices will be standard; stable energy prices will be luxury - Energy distribution will be challenging; energy volume won't be a problem - Interpretation errors of software standards will become less **Customer Needs and Value Proposition:** - Utilities have problems to understand the customer needs of EV chargers and may have troubles in public charging (no image of mobility) - O&G have advantage of “foodvenience” business offering - Charging locations need to get connected and integrated into the area - Current convenience stores are too less frequented with EV users; customer needs change in terms of food - How does the integrated value proposition look in the future? Cheapest no thrills offer or offer integrated customer offer with food - Combination of home and public charging need to be a deal for customers **Market trends:** - U.S. not really advanced; China advanced - Norway: highest single home share; depends a lot on specific country requirements - Pan-European offering: have different focus and offering in countries; some activities can be centralized like charger monitoring = overhead reduction - Destination and en-route charging can be different in each market - Synergies to other markets should be analysed **Profitability:** - Sale of kWh should be possible = analogy to current fuel business - Market will regulate; less Charging Point construction leads to higher utilization and to profitable business			

- Peak pricing could be possible - Munich/ Kitzbühl - building mobile charging units and use arbitrage to make more money. -> Introducition of route-based pricing
- Financing expensive at market start because higher risk --> may change in future as it becomes infrastructure business

Data Sales:

- Should collect as much data as possible, but information is not proprietary enough; in future may be available for third parties; may be used in ecosystem models; Cross financing probably not possible through data
- Every car producer will have better knowledge about charging processes through car data collection
- Ad-Hoc payment data collection not really possible and MSPs will have better knowledge for customer insights
- Energy data: forecasting can be beneficial to optimize energy arbitrage
- Aggregator: may have portfolio effect and can manage loads between industry/charging/home usage and optimize

Interview Code	Date	Role	Business Model & Industry
CON2	11.11.2024	Senior Manager	Strategy Consulting

Key Insights

Industry Trends:
- Consolidation in the high powered charging (HPC) market creating oligopolistic conditions, favoring large players with strong capital and infrastructure
- Increasing integration of retail services into charging networks to enhance customer experience and drive profitability

New Technologies:
- Expansion of smart charging solutions, including Vehicle-to-Grid (V2G) and bidirectional charging, tailored for depot and fleet applications
- Potential for advanced data analytics in charging networks to optimize energy distribution and operational efficiency

Customer Needs & Value Proposition:
- Customers seek efficient, location-specific charging stations with integrated retail or service offerings to optimize their charging downtime, intending to profit from customer loyalty programs
- Commercial users prioritize low-cost energy solutions with reliable and scalable infrastructure for fleet operations
- Heavy duty segment difficult to target with charging station infrastructure for light duty (mainly due to increased space requirements and the need for lower kWh prices)

Market Trends:
- Big Oil companies are rapidly entering the market by leveraging existing infrastructure and investing heavily in charging networks
- Regional players maintain dominance in niche markets through strategic partnerships and localized service adaptations

Partnership Opportunities:
- Increased potential for OEM-CPO partnerships to improve rollout strategies, leveraging vehicle data for better site planning
- Collaboration in integrated service offerings, such as in-car payment systems and predictive maintenance for charging networks

Cost Dynamics:
- High CAPEX for hardware, network installation, and site acquisition, often exceeding €100,000 per charging unit
- Ongoing OPEX costs driven by maintenance, energy procurement, and site leasing, emphasizing the need for high utilization rates

Strategic Differentiation:
- Retail-service ecosystems enhance competitive positioning, attracting customers through complementary offerings
- Economies of scale and cost optimization remain critical, with large networks outperforming smaller, regional players in profitability

Interview Code	Date	Role	Business Model & Industry
CON3	31.10.2024	Principal	Strategy Consulting

Key Insights
Industry Trends: - EV sales grew faster than expected by many and many OEMs are suffering now (Portugal one of the highest European penetration rates) - Infrastructure development is lagging a bit behind, research points to 8-12 cars per charging point as good public infrastructure level - Market was first addressed by incumbents but now traditional players like utilities or O&G companies are dominating the market - Not yet the time for consolidation and new players might enter the market like infrastructure investors - In Portugal, the operator of the highway concessions and polls is thinking about entering the market as they have expertise and experience in managing a big mobility network and have existing relations to consumers - Nobody alone is capable of building all the needed infrastructure due to high capital intensity - Portugal has special situation with only one MSP which could become a trend in Europe with new regulations **Market Participants:** - Big players can leverage their partnerships and cash to grow in many areas - Other companies than utilities are not very interested to get into the commercialization of energy because the complexity of this business - CPOs will be more focused on the charging experience, product and location and will leave specialized software solutions to specialists like MSPs **CPO Business Model:** - CPOs focused so far mainly on scaling instead of becoming a better service provider and building a new product - Increasing competition will force players to improve their business models - Location is one of the main drivers for success for CPOs - Key success factor will be high-quality experience and product with a recognizable concept

Interview Code	Date	Role	Business Model & Industry
CON4	02.12.2024	Associate Director & Partner	Strategy Consulting

Key Insights

Key Recommendations:

BESS:

- Can be implemented quickly, costs are manageable as partnerships provide a viable solution
- Access to energy market not a barrier, can be implemented
- Mitigating issues of grid connection
- Revenue depending on peak demand times -> fluctuating
- Savings potential for grid fees that you pay according to peak power
- Savings potential would generally exceed the increase in CAPEX

Customer Experience (and Partnership Offerings):

- Convenience and Experience will be the key drivers of differentiation in the future; will be most important drivers for the customer's decision on which charger to choose (e.g. a charger that is closer to McDonalds will be preferred)
- Basic Services to be provided: Payment, Safety, Sanitary, Charging Speed
- Standardized charging stations give customers an advantage in terms of convenience
- Make it clear to the customer that you have an attractive location (e.g. proximity to fast-food outlets; toilets; payment options that customers can expect)
- Sees the point of substituting opposing food vendors with the O&G CPO convenience offering less critically, if these are advertised in the MSP apps; customer would see the providers' giant logo when parking anyway, which makes concealing this information useless
- Economies of Scale for standardized station concept highly relevant from a cost perspective
- Scaling with standard will be key
-The most important hygiene factors for consumers in 2030 include price, location, charging speed, filters in the navigation system, user-friendliness, payment options, services, availability, reliability and customer reviews

Data Analytics (Network Optimization):

- Relevant for internal optimization
- For site selection, competition is already advanced in selecting strategic locations, hindering O&G CPOs from identifying new location for destination charging if capabilities are not fully mature yet

Other Recommendations:

- CAPEX reduction measures: highly M&A related -> Not most value-adding for O&G CPOs
- Dynamic electricity tariffs are a trend, e.g. during nighttime charging discount to increase utilization rates
- Plug-and-Charge compatibility highlighted as important; network size relevant to have negotiating power also with MSP providers; also to offer strong own MSP
- Sees standardization of station concept as relevant: potential for economies of scale especially if you are forced to grow quickly

Interview Code	Date	Role	Business Model & Industry
CON5	02.12.2024	Manager	Strategy Consulting

Key Insights
Key Recommendations: **BESS:** - Highly relevant and useful, but not customer facing **Customer Experience (and Partnership Offerings):** - Key Differentiator for CPOs as high density of PCPs is projected - Customer facing recommendations are key to scaling the business and leading the industry - Standardized Station Concept: safe environment, flexible payment, loyalty schemes, design - Impact on site utilization - Integrating 3rd party offerings in app solution will only factor the cannibalization which already occurs today anyways (petrol station next to Fast Food Chain -> should leverage regional clusters) - 3rd party offerings are key for destination charging which as well is necessary for O&G CPOs if they want to lead the industry **Data Analytics (Network Optimization):** - O&G companies need to build these capabilities now, as they can still improve them over time - Load Management is another way of leveraging this technological recommendation **Other Recommendations:** - CAPEX reduction measures: due to industry depression willingness to provide capital is low, it is not an issue of access to cash but of the current pivotal challenges related to the industry transition toward mass adoption

Interview Code	Date	Role	Business Model & Industry
CPO1	11.11.24	Executive Board Member	Charge Point Operator - Oil & Gas

Key Insights

Industry Trends:
- Customers want charging stations with good lighting to feel safe, manned; where infrastructure is in place
- Fewer store purchases of Tesla customers (due to advanced infotainment)
- Dynamic pricing: not yet used (risk of customers finding it confusing and aim for price stability); but will definitely come because the market is changing
- Higher charging speeds, larger batteries, more cost-efficient batteries
- Trucks increasingly important for CPOs

BM Overview:
- Clear focus on ultra-fast charging since competition in slow AC-Charging is already high
- Aims to be service leader, owning infrastructure around chargers (shops, toilets)
- Active in energy supply: acquired offshore wind licenses in the Northern Europe; wind power plants under construction in the Western Europe; joint ventures in solar); acquired energy company (focusing on supplying industrial customers and wholesale electricity trading); but will not cover grid operation in the future
- Effective demand partnership; loyalty program (loyalty and couponing provider), sustainable image campaigns
- Increasingly build giga hubs without gas offering
- Increased relevance of destination charging (e.g. at supermarkets), since more customers want to integrate charging with their errands
- In-house software development as key activity, insourced approach
- Around 90 percent of sales volumes are inbound roaming, i.e. customers from other MSPs
- 20 times as many petrol and store transactions as charging transactions

BM Opportunities:
- 2000 strategically located properties on main roads
- Perception as a mobility brand, trusted partner what utilities CPOs do not have; better offering (shops, toilets) compared to other BM
- Their focus lies on ultra-fast charging

BM Risks:
- No data ownership of inbound-roaming customers (can’t place advertisement for them)
- Uncertainty of amortization of past investment
- Uncertainty in demand development

Customer Segments:
- B2C: Private customers (currently wealthy early adopters, frequent travelers), very susceptible to social media channels
- B2B: Ride sharing; freight forwarders with a focus on delivery vans (special prices, potential sales volume guarantee in return), supported by key account management

Key Activities:
- Offer vouchers in MSP app for example: cheaper coffee in petrol store

Cost Structure:
- Electricity cost of 8-9 ct per kWh

Interview Code	Date	Role	Business Model & Industry
CPO2	15.11.2024	Head of Business Development	Charge Point Operator - Oil & Gas

Key Insights
Industry Trends: - Plug&Charge; Process automation & digitization; market consolidation **BM Opportunities:** - Acceleration in EV sales; EVs getting better, cheaper, and better range; commercial charging **BM Threats:** - Regulatory environment causing uncertainty; phase-out of subsidies; lack of stability **BM Overview:** - Responsible for regenerative energies & EV charging in corporate -> distinct entity and brand for environmentally conscious investors - Energy provider in Southern Europe, incl. energy provision to households -> energy & EV bundling - Other countries: focus on public charging at existing gas stations to facilitate transition to e-mobility - Additionally, charging hubs & destination charging partnerships for user convenience w/ focus on DC - Cross-financing of new EV charging through legacy oil business **Value Proposition:** - European and prominent presence in >10 countries, existing fuel station network -> define the "gas station of the future" with modern ancillary services - Has its own backend infrastructure to drive digitalization, connectivity of EV & charger, Plug&Charge, V2C **Revenue Streams:** - Main revenue: energy sales at charge point (current utilization: 8-20%); idea: eliminate network fees to lower energy prices - Minor add. revenue through convenience stores, dependent on user behavior - No business case in customer data sales, due to EU data regulations - Flexible pricing currently not applicable due to lack of digitalization (extensive integration of Smart Meter necessary) **Cost Structure:** - Country-dependent (energy prices Germany: 65ct/kWh vs. France: 40ct/kWh) - Pure energy production costs: 3-7 cents/kWh depending on energy source - Processes could be leaner, long time period for HW installation - Fragmentation of network operators (Germany: 900) leads to lack of standardization in HW, especially for transformers

Interview Code	Date	Role	Business Model & Industry
CPO3	18.10.2024 // 24.10.2024	Product Manager App // Managing Director	Charge Point Operator - Utilities

Key Insights
Industry Trends: - Innovations in battery technology, route planning for better customer journey -> OEM partnerships, plug&charge, industry consolidation, bi-directional, industry standardization **BM Opportunities**: - Leverage integrated energy value chain -> better charging offering and unique cross selling opps; focus on coverage, tarif, and service offering Commercial charging: better plannability of speed & volume -> low margins, but high reliability; integration of renewable energy value chain; growing at a faster pace than private charging **BM Risks**: - Price competition (non-utility CPOs offer cheaper price per kWh but are not profitable), Chinese EV charging competition; slow adoption, underutilization & price dumping; low customer loyalty **BM Overview**: - Split between public (infrastructure driven), and fleet operations (use case based). Fleet as a strategic growth enabler due to advantages of closed systems **Customer segments:** - B2C (frequent vs. infrequent drivers); B2B (more profitability potential, more value chain coverage, better predictability of value streams) Channels: app, website, customer service; co-branding initiatives, partnerships **Value Proposition**: - Trusted brand, integrated energy solutions, customer loyalty programs, financial resources to invest in infrastructure **Key Activities**: - European service provider -> international growth, grid management, developing solutions for commercial sector; improve app features (e.g. smart routing, data integration) **Revenue Streams**: - Energy sale, cross selling within own utility ecosystem **Cost Structure:** - Major costs stem from infrastructure investments, such as setting up and maintaining charging stations, and app development - Scalability and optimization of administrative costs are challenges, with limited potential for cost reduction in the near term **Channels:** - Customers are reached through the E.ON Drive app, company websites, and a dedicated customer service team **Key Resources**: - Critical resources include app development teams (a bottleneck) and physical infrastructure such as charging stations **Key Activities** - Expansion of app services across more European countries and enhancing app features like smart routing and plug-and-charge. **Key Partnerships** - Collaborations with CPOs for roaming services and automakers for co-branding. - Partnerships with municipalities and retail chains for strategic station placements.

Interview Code	Date	Role	Business Model & Industry
CPO4	14.10.2024	Strategy & Portfolio Business Partner	Charge Point Operator – Oil & Gas

Key Insights

Industry Trends:
- E-MSP is an important topic; believes in large MSPs with large compatibility (with MOBI.E in Portugal with one contract access to majority of CPOs; in Spain it is very different and fragmented)
- Market competition: big players will have advantage; small ones will have a hard time
-Chinese players are becoming increasingly important, with autonomous driving technologies

BM Overview:
- USP lies on sustainability aspect (clean energy to the grid); covering value chain E2E; have energy trading team
- have sales team with key accounts for B2B customer segment

BM Opportunities:
- Expanding based on existing infrastructure, being an advantage helping the company to scale
- Governmental connections are an advantage
- Synergies with other business units; bundled offerings
- Smart charging, V2G, load balancing
- Combining utility contracts for e,g, gas with charging business and offering discounts

BM Risks:
- Tech advancements reducing idle time at charging station; cost competition, regulatory uncertainty
- potential introduction of charging tax with the shortfall of petrol tax revenue for governments
- energy costs

Customer Segments:
- 30% B2B & 70% B2C -> focused on public charging network
- B2B: offering charging points for business customers, provide them with infrastructure, platform that manages charging sessions

Key Partnerships:
- Collaborating with automotive firm to test wireless charging technologies
- Partnerships with retail partners, real estate owners, energy providers
- Outsourcing of mobility solution services
- Joint Venture to evaluate possibility to build lithium refining plants; aiming to provide complete answers to sustainability topics

Key Activities:
- M&A for digital expertise -> app based, grid management etc. // Scaling the business starting in Iberia // OEM Partnerships// M&A activities to enter energy supply segment (through offshore wind turbines and solar plants)
- Urban planning; integrate in city infrastructure (smart city projects)
- Sourcing from hardware from suppliers
- OEM Partnerships (e.g. with the purchase of a car, get one year of free charging, lower tariffs)

Revenue Streams:
- Cross selling at convenience stores, electricity contracts for B2C
- Experimenting with V2G by extracting energy from fleet providers to react to peak consumptions; led to six-digit cost reduction for customer, which is sold as added benefit for additional fee

Cost Structure:
-Highlighted relevance of regulatory compliance, permits since time consuming

Interview Code	Date	Role	Business Model & Industry
CPO5	18.10.2024	Chief Operating Officer	Charge Point Operator – Automotive

Key Insights

BM Overview:
- The CPO focuses on a pan-European high-power charging network primarily targeting long-distance EV travelers.
- The business model emphasizes partnerships with major automakers and the provision of high-power charging stations.
- Price sensitivity is very high and this willingness to pay is very low
- Consolidation is to be expected, also partly necessary so that overheads therefore investments in IT systems, backend systems and apps amortize

BM Opportunities:
- Expanding into urban markets (city borders) with fast-charging stations at supermarkets and retail locations.
- Exploring commercial vehicle segments, including heavy trucks, by providing tailored infrastructure solutions. Still very nascent industry.
- Potential to be increasingly preferred in OEMs route planning software with existing partnerships

BM Risks:
- Dependency on EV adoption rates and market development, which vary significantly by region.
- Challenges with grid connections and energy supply bottlenecks, particularly in underdeveloped markets like Spain.
- B2B fleet segment involves risk of loss of data ownership

Value Proposition:
- High-speed charging capabilities (up to 350kW) that minimize downtime for long-distance travelers.
- Subscription models offering cost-effective pricing and simplified user experiences.

Customer Segments:
- Long-distance EV drivers prioritizing efficiency and cross-border mobility.
- Emerging segments: urban EV users and commercial fleets, such as delivery vans and trucks (due to ultra-fast charging stations); ensuring sufficient space for this segment on new sites

Key Activities:
- Developing scalable IT systems to manage operations and enhance charging station performance.
- Conducting hardware testing and technology scouting for innovative solutions like robotic charging.

Key Resources:
- A skilled in-house technical team for station maintenance and troubleshooting.
- Strategic partnerships with automakers and suppliers to integrate services into vehicle ecosystems.

Key Partnerships:
- Cooperation with 2 German car manufacturers to offer free charging for one year when buying a new car or at more affordable conditions.

Revenue Streams:
- Core income from kilowatt-hour sales, complemented by subscription fees
- Additional revenues from government subsidies (e.g., GHG quotas) and potential future advertising.

Cost Structure:
- Major cost drivers include CAPEX for station installations and network connections.
- Ongoing OPEX: maintenance, IT systems, and overhead, with potential reductions through

automation.
Industry Trends:
- Increased focus on urban charging and commercial vehicle electrification
- Complexity of Public Charging Networks requires a higher level of standardization
- Market consolidation driven by the need for scalability and cost efficiency in operations.

Interview Code	Date	Role	Business Model & Industry
CPO6	13.11.2024	Head of Strategy	Charge Point Operator – Utilities

Key Insights
BM Overview: - CPO operates in Public and Business Charging segments; different BM & ownership structures depending on client needs - M&A to enter the currently targeted market by acquiring CPOs for faster market entry; with the exception of one country where the company has grown organically due to a collaboration with a large fast food provider -Customer loyalty supported by loyalty programs of retail partners **BM Opportunities:** - Expansion through partnerships (e.g., parking space providers that receive rental fees as well as a share of the profit from energy sales), scalable deployment, and leveraging renewable energy for competitive differentiation (especially for receiving attractive destination sites) - Does not see the en-route charging sites of O&G CPOs as a major advantage of these players because they are also there via service station partnerships - Potential for BESS at public chargers, but not their core business - B2B sustainability branding beneficial compared to O&G CPOs **BM Risks:** - Dependence on utilization rates, regulatory changes, market saturation, and competitive station placements - Regulatory uncertainty due to German Fastned, Tesla and Autobahn GmbH conflict **Value Proposition:** - Comprehensive charging solutions for both fleets and public, with strong sustainability credentials and tailored service offerings **Customer Segments:** - Public EV drivers, business fleets, and location partners in fast food industry and furniture retail industry - Increasingly also focusing workplace and depot charging, also because of synergies potential - More increasingly targeting light-duty vehicles; ensuring compatibility of roof heights and technical integration of queuing tools **Key Activities:** - Infrastructure development, partnership management, market analysis, customer engagement via loyalty programs, and operational excellence **Key Resources:** - Renewable energy expertise, partnerships with large firms, data-driven market insights that can be leveraged for better assessment of market potential; and scalable charging infrastructure **Revenue Streams:** - Energy sales margins, leasing agreements, and tailored B2B services (e.g., dashboards, fleet management integration) **Cost Structure:** - High upfront investments in infrastructure, location leasing, and ongoing operational costs for network maintenance **Industry Trends:** - Shift towards sustainable mobility, increased regulatory focus, consolidation in CPO markets, and innovations like bidirectional charging - Shift from dominating home charging segment driven by EV adoption, especially in urban areas - Many CPOs work with market leaders who feed live charger data into apps such as Google Maps

Interview Code	Date	Role	Business Model & Industry
CPO7	23.10.2024	Department Manager	Charge Point Operator - Oil & Gas

Key Insights

Industry Trends:

- Customer experience, value chain integration, complex value chain requires lean operations to enhance both cost efficiency and operational effectiveness, customer segments

BM Opportunities:

- Leverage existing fuel station network, cross-selling with add. services, loyalty programs & retail partnerships, battery technology improvements

BM Risks:

- High CAPEX (energy infrastructure and site), better infotainment systems of EVs, slow EV adoption, regulatory environment, many players, little standardization

BM Overview:

- Integrated offering (energy supply, installation & maintenance, partly HW, MSP)
- **B2C**: MSP with on-the-go charging and destination; through app, roaming, OEM partnerships; loyalty programs, e.g. in-store vouchers (collection of customer data)
- **B2B**: leasing companies, fleet operators, charge-at-work, depot solutions; direct sales; loyalty programs in retailer app (full offering: at work charging, on-the-go, home, depot solutions, destination charging), growth enabler, supported by key account management, fleet transitions
- **USP**: Premium (reliability, safety, customer experience) and sustainable charging services; Future: seamless experience (in-car-payment) = plug&charge
- **Partnerships** with OEMs, retailers, energy providers, HW manufacturers, backend providers
- **Resources**: Fueling sites, high-end technology, IT know-how, capital for infrastructure, qualified people, renewable energy production (depending on country)
- Activities: Location selection; installation, maintenance & development of backend; customer service operations, software development
- **Revenue**: Subscription, Pay per use (slight mark-ups), partnerships with OEMs, roaming (energy sale), add-ons like snacks, car wash etc., impact on sustainability as a brand
- **Costs**: CAPEX: site set-up (hardware + installation), OPEX: energy costs (driving long-term project profitability), IT service fees & licensing, personnel costs, maintenance, R&D

Interview Code	Date	Role	Business Model & Industry
CPO8	23.10.2024	Co-Founder and CPO	Charge Point Operator – Pure Player

Key Insights
Industry Trends: - CPOs competition has shifted towards points including quality, reliability, credibility, and pricing - Splits of people that have the ability to charge in a private environment home will decrease dramatically from what it is today **BM Overview:** - Two value propositions mentioned: 1. Biggest CPO ownership in selected markets (diluted until this point); 2. Innovative BM (zero OPEX, zero CAPEX for destination charging) -Focus lies on destination charging - Site providers receive fixed rent + revenue share - Not having MSP app, since done through partnerships; MSP-Entry not planned ("better customer experience if owned by externals"); are not B2C company; don't want to tab into this business **BM Opportunities**: - Benefit in scalability: more volume (hardware & software costs are split across more units); Unit economics; Geographical factor: wide European spread - More agility and more speed against competitors - Full focus on this business is a benefit in comparison to O&G CPOs - Potential technological advancements in battery efficiency and battery sizes **BM Risks**: - Energy distribution/ grid operations is a main problem; slow grid connection procedures - Regulation: local regulation can block - Pace of EV adoption is uncertain: expansion plan based on demand assumptions (mitigating with: effective prediction model; be patient, trust that demand will come; prioritize best locations) - Need to make sure that energy generation and grid (DSO/ TSO) is prepared for the incoming demand **Customer Segments**: - "B2B2C" company: install and operate charging points in public; their stakeholder are real estate owners -> revenue sharing models as risk in terms of CAPEX is shared - Focus on light duty and not heavy duty vehicles due to nascent stage of heavy duty vehicles, also because of destination charging focus **Key activities:** - Do not manufacture our own hardware; operate chargers and manage them with the technology developed. - Location selections, speed of deployment and customer experience (incl. Pricing, reliability)

Interview Code	Date	Role	Business Model & Industry
CPO9	11.10.2024	Senior Project Developer	Charge Point Operator – Automotive

Key Insights

Technologies:

- Battery technologies will shape the fast-charging market and Chinese competitors are improving technologies and increasing the voltages
- Battery sizes will improve but not unlimited as it is not cost-efficient at some point (range limit max. 1000km)
- Technology evolution will be driven by adjacent markets like commercial vehicles (electric trucks)
- Trends in overengineering chargers for trucks and use them also for passenger vehicles
- Chargers will mainly continue to be cable based because of cost-efficient and easy engineering and be commoditized but there are trends towards alternative technologies (e.g., contactless chargers) that might create niche or premium markets

Markets & Market Participants:

- The CPO's fast-charger network represents 10% of total cost but only 1% of total revenue of the company and is more a real estate game that depends on locations
- Current market is not realistic but important for the future with benefit of being first mover
- Fast charger market is a commodity market, and costs are most important
- Market will evolve into leaner and cost savvy stations with easy to operate chargers
- Small startups will likely not survive until then because they acquired too many bad locations
- Consolidation is about to happen in the very fragmented market, probably within next 18 months to five years (Total market size is not big enough for niche players)
- O&G or electricity companies are smart, savvy, well-funded and will acquire startups over time when markets are more mature
- Charging market outgrew EV car market in last 6 months in Europe which is concerning (low utilization rates at many sites)
- Players need a strategy which is based on different kinds of stations: big hubs, small stations (low charges)
- Many players are buying bad locations which will not be needed in the future
- Some players are trying to build a system and platform between energy demand and energy supply
- European market has several problems: Complexity, Fragmentation, bad software offerings from automotive OEMs
- Chinese market most developed due to high quantity of innovation, technology, market size and governmental support

BM Opportunities:

- Integration of storage systems and grid services from CPOs
- Future business and markets will be based on data and the ability to manipulate data (e.g., communication between systems and components)
- Integration of players into the business of electricity providers

Interview Code	Date	Role	Business Model & Industry
CPO10	17.10.2024	Co-Founder & CEO	Charge Point Operator – Utilities

Key Insights
Industry Insights: - Smart Energy Management, data integrated grid management - Building charging stations is not sufficient if not enough energy can be provided due to lacking or old infrastructure, especially renewable energies pose challenges (Renewables fail due to storage challenges) - Chinese market advanced from a technology perspective - Public stations lack the grid capacity in many cases **BM Opportunities**: - Monetizing data, creating seamless experience with data driven, tailored marketing - Station design and integration of energy storage can mitigate challenges CPOs are facing and open new revenue opportunities - If someone could operate and own a network of infrastructure, it can be used as a huge battery and stabilize the grid - Big data to manage, predict and optimize and manage grid capacities, and improve charging performance - Charging as part of the energy infrastructure - Integration of smart advertisement **BM Risks**: - Market fragmentation, regulatory uncertainty - Dependency on a few hardware manufacturers - Slow adoption of EVs and psychological barriers of end customers **BM Overview**: - Station concept designed on a modular basis reducing complexity and maintenance costs (reduced need of failure prone power electronics) and allows for more flexibility - Cloud-based charging management system to manage charging points intelligently **Customer Segments**: - B2B very attractive due to advantages of closed systems and no uncertain buying decisions of customers **Key Activities**: - Building supportive energy infrastructure **Revenue Streams**: - Lesser focus on charging itself but focus on data and ancillary revenues

Interview Code	Date	Role	Business Model & Industry
CSP1	14.11.2024	Chief Development Officer	Charging Service Provider

Key Insights
BM Overview: - CSP1 sells hardware and subscription-based software to CPOs, acting as a non-CPO provider - The model emphasizes flexibility, supporting CPOs in customizing charging management systems for their operations **BM Opportunities:** - Expansion of modular and customizable platforms to address diverse CPO needs across geographies and use cases - Growth in U.S. market, leveraging rising adoption of EVs and infrastructure development **BM Risks:** - Unprofitability in the EV charging sector poses challenges for clients, potentially impacting hardware and software demand - Competitive & regulatory risks in crowded European markets and emerging U.S. consolidation **Value Proposition:** - Flexibility in platform customization with pre-negotiated MSP compatibility and easy module integration for MSPs and CPOs - Plug&Play solutions simplifying onboarding and enhance user experience, while adhering to strict GDPR standards **Customer Segments:** - Core customers: CPOs in Europe (focus on Software sales), enterprise and fleet operators in the U.S. - Emerging focus on MSPs and gas/oil companies transitioning into the CPO business **Key Activities:** - Hardware and software sales, combined with strong post-sale services, including station maintenance, warranties, and replacements - AI innovation and other technologies for optimizing station diagnostics and user experiences **Key Resources:** - Proprietary platforms, offering SLA guarantees to customers - Acquisition of energy software company to enhance European software capabilities and custom platform solutions **Revenue Streams:** - One-time hardware sales and recurring subscription revenues from cloud-based software - Revenue enhancement through AI-driven diagnostic solutions and expanded support services **Cost Structure:** - Software development, and post-sale support form key cost drivers **Industry Trends:** - Transition from integrated to disaggregated hardware-software models, fostering partnerships and interoperability - Increasing adoption of AI and software innovations to enhance station efficiency and lower OPEX **Channels:** - Direct sales of hardware and software to CPOs, complemented by partnerships and platform integrations

Interview Code	Date	Role	Business Model & Industry
HSP1	23.10.2024	Leader Business Development	Hard- & Software Provider
Key Insights			
Industry Trends: - Increasing focus on decarbonization mandates and electrification across Europe, especially in logistics **Business Model Opportunities:** - Integration of hardware, software, and consulting for comprehensive energy and charging solutions **Business Model Risks:** - Fragmented European regulations and market immaturity hinder streamlined cross-country implementations **Value Proposition:** - Offering end-to-end energy solutions with interconnected products, software, and maintenance for efficiency **Channels:** - Flexible mix of direct sales, partner collaborations, and consulting tailored to regional market needs **Revenue Streams:** - Diverse streams from hardware sales, software subscriptions, licensing and maintenance services **Cost Structure:** - High initial capital expenditure on infrastructure; long-term focus on extending product lifecycle. **Key Activities:** - Market monitoring, R&D, and tailored energy management consulting for diverse customer needs **Key Resources:** - Strong R&D team, extensive partner network, and expertise in energy infrastructure and software integration			

Interview Code	Date	Role	Business Model & Industry
HSP2	17.10.2024	Former CEO	Hard- & Software Provider
Key Insights			

Industry Trends:
- Consolidation of Hardware manufacturers; profitability issues due to industry dynamics, exploration of different technologies including hydrogen; innovations in energy management; customer experience (e.g. plug&charge)

BM Opportunities:
- Dynamic pricing for electricity tariffs for higher margins; V2X; end-to-end service providers; commercial charging & fleet customers

BM Risks:
- Regulatory uncertainty; less trust in smaller companies due to insolvencies; entry of Asian hardware manufacturers into European market

BM Overview:
- Development and manufacturing of wallbox (AC) for home and businesses. Including the software for configuration of wallbox. Sales over wholesale and no direct contact to customer.

Customer Segments:
- no direct sales to B2C
- B2B: business owners for charge-at-work and depot; garage companies; utilities companies; OEMs

Value Proposition:
- Sustainable, reliable, with calibration laws, technological advancement (load management), customer service

Channels:
- Multi-layer sales organization: sales to wholesaler & electricians, sales to utilities that offer wallbox as a service

Key Activities:
- R&D and sales

Revenue Streams / channels:
- Wholesale, utilities, OEMs // B2C only via surveys as no direct contact

Cost Structure:
- Extreme cost pressure due to high R&D, HR and facility costs

Key Partnerships:
- Utility partners to improve grid integration
- R&D software partners
- In the future, production may be outsourced due to price pressure

Interview Code	Date	Role	Business Model & Industry
HSP3	02.12.2024	Chief Commercial Officer	Hard- & Software Provider

Key Insights

General:
- Critical to define business model now as market maturity moves to mass adoption
- Industry depression phase, consolidates on the hardware side
- CPOs profitability negative and their investment horizon too long

BESS recommendation:
- Highly relevant, especially in Iberia where there are high penalties if there are no PCPs at a petrol station installed; roll-out particularly recommended there, requesting grid connection can take up to one year
-5 categories for use-cases:
1. Load Management: Savings potentials of grid connection payments depending on peak loads
2. Operate a stationary storage facility that offers grid services; use as reactive power that can be used to balance the grid in the short term, similar to fast-acting gas-fired power plants
3. Buy, Low, Sell, High: Energy trading on the stock
4. Avoiding penalties for gas CPOs. If they do not provide petrol stations with functioning EV chargers, 3-4 million per station in fines; experience showed that chargers sometimes cannot be connected because they are waiting for a grid connection; with battery can be used instantly
5. Ecosystem offering: Integration with renewable energy at charging site makes it even more powerful (especially PV); Stationary storage as intermediate buffer

- Does not always make sense, case-by-case evaluation important (CAPEX increase must be seen as critical for CPOs that are often already unprofitable)
- Battery costs fully fledged 150 euros per kilowatt hour, therefore can lead to hundred thousand investment for the battery system
- Arbitrage business can help the charging station to become profitable -> local energy storage
- Implementation into an already challenging ecosystem can cause complications
- Grid connection and upgrading is expensive and takes time which can be mitigated by BESS
- Physical dimensions are an obstacle to the integration of the systems on sites
- Purchase of individual components that are not compatible with each other causes problems; compatibility is important

Customer Experience (and Partnership Offerings):
- Focus primarily on own convenience stores (O&G CPOs should try to support their core convenience offering)
- Sees little potential for O&G CPOs in the destination sector because the retailers etc. would operate the chargers themselves

Data Analytics (Network Optimization):
- Focus only on driving utilization and site selection (selecting from legacy-sites) and not on maintenance which is hardware supplier led
- Focus on how data analytics drives the CPO core business

Other Recommendations:
- CAPEX reduction measures: due to industry depression willingness to provide capital is low, it is not an issue of access to cash but of the current pivotal challenges related to the industry transition toward mass adoption
- Modular Charger Architecture: makes sense for large sites with four or six or more chargers; leverage both for customer experience and for costs
- Introduction of Bidding System rather realizable in the sense that the kW demand is queried; can control utilization

- Partnership with Municipal Utilities to enter the home-charging area is unrealistic; since market far too fragmented and too small

Dimensions of a CPO:

- Key Dimensions for CPO business: Access to land, cash, customers, technology and grid

Interview Code	Date	Role	Business Model & Industry
OEM1	24.10.2024	Manager	Automotive OEM

Key Insights
Industry Trends: - Most fleet customers already have a solution in place - Experience is as important as the EV itself for customers - Battery swapping unlikely to function in Europe **BM Opportunities:** - Smart charging and V2G but connected with many challenges and multiple involved parties - Software-defined vehicles and integrations like in-car payments - Solid state batteries and technologies improving charging speeds increase acceptance rate for EVs and benefit the BM - Currently still a disconnect between the car and the charging infrastructure or the CPO (e.g., in the case of charging errors or problems) **BM Risks:** - Plug&Charge is affected by a lot of factors that influence the authentication and take a lot of time that decrease the customer experience (e.g., hardware, network latency, CPO, backend) **BM Overview:** - Customers expect to get a charging offer along an EV (achieved via partnership) - Charging BM dependent on core business as OEM with a transformation nowadays towards an agency model **Value Proposition:** - Subsidized rates for charging without subscription fee for customer - Branded charge card and home charging station with company look & feel - Offer Plug&Charge with CPOs that already partially activated it **Key Activities:** - Partnership with experienced CPO who can offer public and home charging (Partner is taking over all processes in the background like invoicing or billing) – white label solution - Partnership also about technology enablement (Plug&Charge) - Route planning and integration of other features directly in the vehicle (e.g., battery preconditioning, charging times) - No own MSP **Revenue Streams / channels:** - Discount rates at partner CPOs especially at fast charging sites are welcomed and used by customers as prices are quite expensive for fast charging - Charging itself doesn't drive revenues and is a very competitive market, rather a strategic decision to keep customers close to the core product **Cost Structure:** - Building charging hubs for OEMs too expensive and some are doing some pilot projects on this - One needs 15-20 charges per day at a station to break-even - Main cost driver is subsidizing charging prices, other costs include licensing fees, roaming fees, operational costs

Interview Code	Date	Role	Business Model & Industry
SWS1	11.11.2024	Team Lead Business Development	Mobility Service Provider

Key Insights

Industry Trends:
- High variation in customer behavior per country -> comply scaling considering slow adoption in Europe from customer and regulation perspective
- New emerging technologies like Plug&Charge, queueing (especially in the HDV segment), dynamic pricing
- V2G at the current state no business case for implementation
- Cost optimization potentials through artificial intelligence in the area of predictive maintenance and billing
- Consolidation in the MSP segment expected as it becomes more difficult to stay/be profitable
- Own MSP creation difficult due to difficult taxation problem if users not from a single country
- Users request more and more convenience offerings

BM Opportunities:
- MSP is only indirectly affected from slower EV adoption -> opportunity for higher market share
- Winning market share in times of slow growth in EVCI; higher number of migrations than new implementations

BM Risks:
- Technological advancements of bigger players with significant financial resources (from Tech or OEM side)
- Influence on regulation but no guaranteed result
- Connectivity problems like payment and handshake (communication between car and charging station)

BM Overview:
- Split between public (infrastructure driven), and fleet operations (use case based)
- White-label solution for CPOs
- Focus on commercial site of product: billing, taxation

Value Proposition
- Technical factors: automated, scalable, decrease operative costs
- Soft factors: self-service für Customer Relationship Management, B2B community to engage, bottom-up innovation through voting system, market place for add-ons

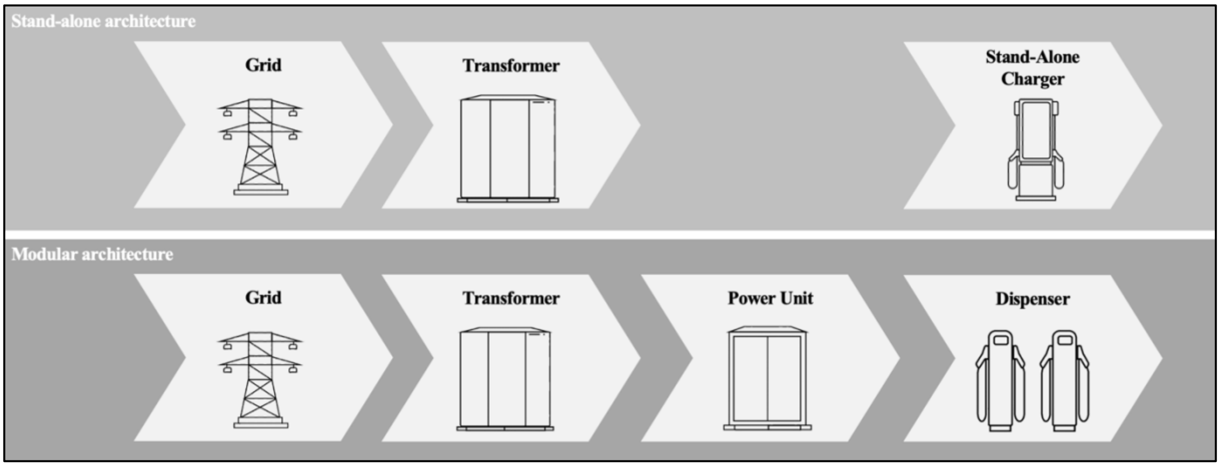
Partnerships
- Roaming platforms/hubs
- Other MSPs (competition) to stay in contact regarding interfaces
- Amazon Web Service regarding server infrastructure
- Hardware supplier
- Industry associations (regulations)

Customer Segments:
- Use case based: utility, OEM, multiplicators (reselling software)

Key Activities:
- Improving software solution even further based on B2B feedback

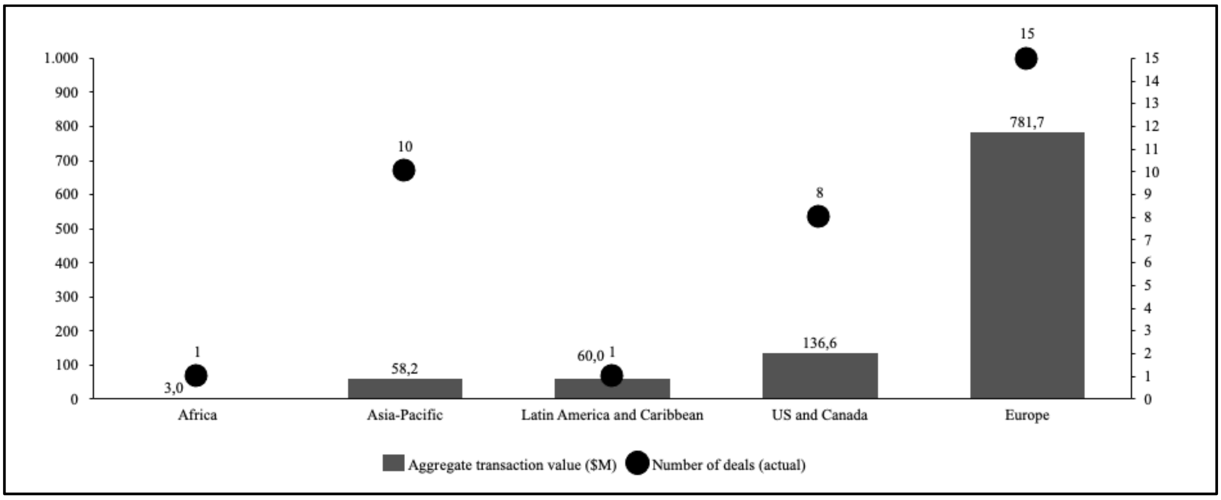
Revenue Streams:
- SaaS -> recurring revenue, roaming and reimbursement with multiplicators (service providers for smaller locations)

Appendix 13: Different Layout for Stand-Alone vs. Modular Architecture



Own depiction based on Hagenmaier et al. (2024)

Appendix 14: PE/ VC-backed investments in EV chargers in 2024



Own depiction based on Siccion and Gupta (2024)