

Potential of an Integrated Platform for EV Charging Station and Ancillary Services

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Abstract: Since the creation the first successful electric car in 1890, the world has seen a rapid increase in the advancement of Electric Vehicle (EV) cars along with increasing demand for such vehicles. However, despite multiple benefits that EV cars offer, such as their sustainable nature, potential car buyers are still hesitant on purchasing an EV car due to concerns about its relatively short travelling range. While the technology powering EV cars has made significant strides, petrol cars can travel much further on a single tank of fuel than EV cars can on a single charge: electric cars can only travel between 100-300 miles on a single charge, whereas gas cars have a range of 300-600 miles. Furthermore, infrastructure is another benefit that gas-powered vehicles have over electric ones. Particularly in rural areas, gas stations are far more common and easily accessible than charging stations. While some owners of electric vehicles might be able to charge their vehicles at home or at the office, they might have trouble finding charging stations when they are out and about. Hence, EV drivers or potential car buyers share a common concern that EV cars will run of gas frequently, leading to inconvenient trips to gas stations. Through our research, by abstaining user experience and feedback, we were able to identify substantial demand for a platform or service that improves the accessibility of EV charging stations for EV car drivers. This paper will include a thorough representation of relevant results and a deep analysis on the potential of a platform that provides easily accessible charging stations as well as other car-related services.

Keywords: electric vehicle, Charging piles, Third-party platform, Porter's Five Forces Model.

1. Introduction

The primary objective of our research is to understand the preferences, challenges, and requirements of electric vehicle (EV) users, particularly focusing on aspects related to charging and associated car services. We aim to explore these areas to inform the development of a user-centric third-party platform that effectively addresses the common pain points of EV owners and enhances their overall

experience. Our approach involves a comprehensive survey designed to shed light on key elements of the EV user experience, including charging habits, brand loyalty, and receptiveness towards ancillary services and platforms. The data gathered from this survey will be pivotal in crafting a platform that not only aligns with user needs but also anticipates future market trends and user preferences. To enrich our understanding, this study will also incorporate an analysis of the current landscape of China's third-party operation platforms for charging piles. This will involve a blend of qualitative and quantitative research methods to assess the stakeholder dynamics within this industry. We aim to investigate their modes of cooperation, benefit distribution mechanisms, and explore potential avenues for business model innovation. By integrating these insights with our survey findings, our goal is to devise a comprehensive EV charging platform that transcends typical user challenges, ultimately fostering a more satisfying experience for EV users globally.

2. Methodology

Firstly, we use the literature analysis method to collect domestic and foreign theoretical information related to the marketing of charging pile products and use it as the basis to analyze and summarize the development of China's third-party operation platform for charging piles, the industrial chain and the business model situation. The business model of the existing third-party operation platform of the charging pile is sorted out to provide enough realistic and theoretical basis for the business model analysis of the third-party operation platform of the charging pile.

Our survey, which featured a blend of quantitative and qualitative questions, was strategically designed to capture a wide array of data—ranging from user habits and preferences to brand loyalty through multiple-choice questions, while also incorporating open-ended responses for in-depth insights into desired features and services for a potential platform. Leveraging tools for data classification and organization, such as charting and listing, we conducted a thorough and nuanced interpretation of the internal and external environments shaping the third-party EV charging platform's market space. This analysis drew from a substantial and diverse sample pool of EV owners across different regions, collected over a set period, to ensure a comprehensive representation that provides a rich set of perspectives. To gain a multifaceted perspective and to understand the range of needs and desires of potential users, purposive sampling was employed to target individuals of different age groups, geographic locations, and EV models. Age was a significant factor in our sampling strategy as younger demographics, such as those in their 20s and 30s, tend to be early adopters of EV technology, often driven by their affinity for tech innovations and environmental concern, whereas older demographics, such as those in their 40-50s, tend to be more inclined to purchase a petrol car. As Chen et al. explain, younger individuals have been exposed to technology from an early age, which has shaped their perception and acceptance of innovative solutions [1]. As the Younger generation is more likely to be our target customers than those in their 40s-50s, our research will focus mainly on young adults. Geographical location was another pivotal criterion because while urban areas with a high vehicular population is more representative of urban EV users, suburban areas compose of EV users who likely have different opinions on their expectation of EV charging services. A study conducted by Zhuge and Shao, found that the geographical location of the study area can significantly impact the sample size required for a comprehensive analysis of urban EV adoption patterns [2]. The author also argues that due to urban areas being more advanced in infrastructure and purchasing power, first-tire EV consumers in such areas will have varying opinions on EV charging stations due to an accelerated adoption of EV cars in urban areas [2]. Thus, understanding the preferences and concerns of users in both cities and suburban regions are required to obtain well-rounded insights. Furthermore, the results were also drawn from different EV brand car owners because the type of EV model can greatly influence a user's experience and preferences on EV charging stations. For instance, Tesla owners, given the brand's early market entry and significant

brand recognition, might have different needs and feedback compared to owners of newer or less renowned brands. Tesla's expansive charging network, unique features, and consumer community have cultivated a distinct user experience. Sampling from this segment offers insights into the needs of users who have invested in premium and well-established EV brands.

Utilizing digital platforms and social media channels, our survey reached out to a broad spectrum of EV users, systematically gathering 32 pieces of data within a set timeframe to capture their charging preferences, demand for additional platform features, and receptivity to non-branded charging equipment. The survey questions were crafted to tap into the nuances of user behavior and expectations, which, complemented by a diverse range of samples from EV owners in various regions, provided a robust foundation for the development of our third-party platform, ensuring that the insights were representative.

3. Result Analysis

Analysis of literature research: To better assess the market for third-party operating platforms for charging piles in China, this paper will draw on Porter's Five Forces model to analyse the key competitors, barriers of entry into the industry, alternatives' substitutability, and the bargaining power of buyers and suppliers.

3.1. Analysis of Major Competitors

According to the 'overall situation of major charging operators in China as of September 2023' from China Charging Union. The 12 operators accounted for 88.2% of the total, and other operators accounted for 11.8% of the total, pulling away from the back of the enterprise by a large margin; the industry concentration is high. The highest market share of TELD core, its parent company TGOOD in the charging pile field, has completed the "equipment manufacturing - charging operation - solution" of the whole industry chain layout and has the most extensive charging network. In second place is Star Fast Charging, in the form of its parent company Wan Gang, the formation of the industrial services of a dragon, its high-speed charging network, and membership programs for users to make it expand fast. So, as an emerging brand, it needs to expand its market share and establish its brand image as soon as possible to ensure quality and reputation. Table 1 below analyzes three different types of charging operators.

Table 1: Pros and cons of different competitors

Potential Competitors	Vintage	Disadvantage
EV manufacturers (e.g., Tesla)	Its brand service chain is highly closed, with complete and high-quality services. Their car owners have a high degree of loyalty.	Vehicles of these brands are usually incompatible with other charging posts and can only travel to specific areas for setting, which is somewhat inconvenient.
Energy companies and electricity suppliers	Traditional energy companies and electricity suppliers have mature grid and operational experience, comprehensive coverage, and often offer lower prices.	Its specialization lies in the grid and distribution of electricity, and it is primarily a public product. So, it can't provide quality feedback to the different needs of the owners.

Table 1: (continued).

Government and urban projects	Some government-supported charging post-operation projects will provide subsidized or even free charging services.	These projects are usually limited to a single type of charging port, and the fast-charging service is inefficient as it is only applied to public transport. Not a good solution to vehicle owners' charging anxiety.
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3.2. Barriers to Entry into the Industry

Although China's third-party platforms have only been in development for a few years, it is still very challenging for newcomers to gain a foothold and grow in the industry. This is because there are barriers to qualification, marketing network, and operational experience.

(1) Qualification Barriers: Based on considering the safe operation of the power grid, the process of charging piles involves several government regulations and regulatory requirements, including power management, electricity tariff pricing, etc. The platform must be compatible with different brands of charging piles. Platforms must ensure strict, standardized management when compatible with other trusting piles brands to pass the qualification review. These will form a specific qualification barrier for new entrants.

(2) Barriers to marketing network and operation experience: Car charging piles are mostly customized products, and different brands and grid companies have additional equipment requirements, leading to the emergence of diversified charging equipment on the market. This requires third-party platforms to have rich service experience in meeting the protocols of different charging piles and an in-depth understanding of the operating habits of individual customers. Therefore, it is essential to have a mature marketing and service network to meet different needs. From the industry dynamics, it is difficult for new enterprises to reap the benefits without comprehensive advantages in scale, marketing network, technical level, and after-sales guarantee.

3.3. Substitutability of Alternatives

Due to the nature of third-party platforms, it's fair to say that there are basically no alternatives on the horizon. Potential substitutes for charging piles are switching stations, and possible substitutes for electric vehicles are hydrogen vehicles. However, the function of third-party platforms is to provide channels for buyers and sellers, which means that third-party platforms are compatible with goods on the market. If we can ensure that we can integrate with reality and pay close attention to technological development, we can do it all the time.

3.4. Bargaining Power of the Buyer

Buyers and sellers are usually in a relationship of mutual checks and balances, and whoever has the central control has the bargaining power. However, there is minimal price fluctuation because of the national standardized tariffs and policies. And most tram owners say they are willing to pay higher fees for faster charging speed and service. So, starting from solving customers' charging anxiety and making breakthroughs, this third-party platform has bargaining power in the market.

3.5. Bargaining Power of Suppliers

The operation cost of the platform mainly lies in the operation and maintenance cost of the software, data storage and analysis, and after-sales service. Suppose the company can have solid technical

talents and independent R&D capability, with strong technical support in data collection, functional modules, and human-machine interaction. Help small and medium-sized charging operators expand their exposure and reduce management costs. When negotiating, they can have strong bargaining power.

Based on this, the quantitative data was systematically analyzed using statistical software that allowed us to derive percentages and explain trends in different areas. Qualitative responses were thematically coded and analyzed to identify prevalent themes and concepts regarding desired services and platform features. This dual approach allowed for a balanced and comprehensive interpretation of the data. Based on the analyzed data, platform recommendations were developed to ensure alignment with the needs and wants of EV users. Despite the insightful data obtained, our approach may not be fully representative of the broader EV user demographics.

3.6. Findings

- (1). High Willingness to Use a Third-Party EV Charging Platform
- (2). The Sense of Power Crisis Among the Masses
- (3). Support for Paying More for Efficiency
- (4). Second- and Third-Tier Cities is a Better Choice

4. Discussion

The readiness of 88% of respondents to adopt a third-party platform for accessing EV charging information indicates a clear market demand for such services. This willingness likely stems from the challenges faced by EV drivers in navigating the current fragmented landscape of charging infrastructure. J.D. Power's 2021 Electric Vehicle Experience (EVX) Public Charging Study points out that one of the major hurdles for EV owners is dealing with multiple charging networks, each requiring separate accounts and payment methods [3]. This fragmentation can lead to a cumbersome experience for users, increasing the appeal of a unified platform. Moreover, the growth in EV adoption, as reported by the International Energy Agency (IEA), has not been matched by an equivalent expansion in public charging infrastructure, leading to concerns about charging availability and range anxiety [4]. A platform that aggregates real-time information on charging station availability, pricing, and compatibility across different EV brands and charging networks can significantly alleviate these concerns. Additionally, a study on consumer technology adoption suggests that ease of use and perceived value are critical factors driving the adoption of new technology platforms [5]. By offering a user-friendly interface that provides valuable information such as charging speed, cost comparisons, and real-time availability, your platform can address these key user needs. In conclusion, there's a significant opportunity for our platform to serve as a comprehensive resource for EV owners, not only simplifying the process of finding and using charging stations but also enhancing the overall EV ownership experience through additional services like maintenance, repair, and battery exchange.

According to our survey, most people will have a power crisis when they have 30% of their battery remaining or when the range reaches 50km! This allows us to find the function of charging reminders, as an app can not only have the ability to find charging stations and charging piles, we also need to have other useful functions. We can set a battery alarm function, connect the car through the mobile phone, and synchronize the power level. When the car's power consumption reaches a certain amount, the mobile phone will give an alarm to remind the car owner to charge and find a charging pile for this purpose. The so-called prompt power will be set by the owner when the user turns on the experience function! Of course, if the car owner sets an unreasonable amount, the system will still start the alarm function.

Regarding our research, the report shows that more people are willing to pay more for a shorter period, which may also be a business opportunity for us. Because in this day and age, time is more of a kind of money. Many people are not willing to spend more time to recharge, so most of them will take other methods. But maybe at that time, there will be charging piles in other areas with airspace, and these spare charging piles may be our business opportunities. Without the help of these devices, people often look for charging stations at known charging stations, but most people will charge at the same charging station, which also leads to crowding. Our software is mainly to find charging piles, so we can also find other charging piles in addition to the commonly used charging stations. Those charging piles are relatively hidden or remote, so few people know about them, but this can provide convenience for consumers who are in a hurry to charge or don't want to wait for a long time. So, we can seize this opportunity and offer consumers a higher cost service from it. But at the same time, we will also offer discounts to regular customers or enjoy a few free search opportunities! Maybe this can attract more different consumers!

The Chinese market has always had great potential, not only in the first tier developed cities but also in the second and third-tier underdeveloped regions. As a new company, it is an excellent choice to start from the second or third-tier cities instead of the highly competitive first-tier cities. The development of charging facilities in underdeveloped areas can bring more demand. Document No. [2023] 545 issued by China's central government clearly states the government will provide financial support for the charging operation and third-party platform in the second and third-tier cities. As large companies already monopolize the market in first-tier cities, it is challenging to capture market share. In addition, there are many small and medium-sized charging operators in second and third-tier cities. These operators often need a third-party platform to help them manage their charging stations and expand their brand awareness due to expensive upfront construction costs and lack of operational experience. As a result, second and third-tier cities are more conducive to developing a new third-party platform since they not only benefit from government subsidies but also have fewer competitors and more opportunities.

5. Conclusion

In conclusion, the rapid development of new energy vehicles has posed challenges in terms of infrastructure and services, particularly in the context of charging piles. These challenges include inefficiency, poor distribution, and inconsistent caliber of charging piles, as well as a lack of uniformity in settlement platforms, resulting in a complicated user experience. Our research has highlighted the importance of integrating appropriate resources and accurate marketing to address these challenges and enhance the user experience. Furthermore, user feedback and experience play a crucial role in the successful implementation of our program. By promoting new energy market methods and establishing an efficient and stable market, our research holds significant guiding significance for the development of the relevant industry. This study emphasizes the need for a user-centric approach and aims to develop a comprehensive third-party platform that addresses common pain points of electric vehicle owners and anticipates future market trends. Through a combination of literature analysis, survey methodology, and data interpretation, we have gathered valuable insights to inform our platform's development and business model analysis. With a diverse sample pool and purposive sampling approach, we have ensured comprehensive representation and consideration of different user needs and desires. Overall, our research strives to foster a seamless and satisfying experience for electric vehicle users globally, transcending typical industry challenges and promoting the advancement of the new energy industry.

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Yanrui Qin and Yuling Luo contributed equally to this work and should be considered co-first authors.

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