A Review of the Research on the Dual Path of Performance Breakthrough and Ecological Synergy for Smart Evs -- Taking Xiaomi Su7 Technology Architecture and Track Performance as an Example

Yujia Qian

School of Public Finance and Taxation, Shanghai Lixin University of Accounting and Finance, Shanghai, 200000, China

yuki01281212@outlook.com

Abstract. This paper takes Xiaomi Su7 Ultra Smart electric vehicle as a typical case, and systematically reviews the research progress and practical achievements of smart electric vehicle on the dual path of performance breakthrough and ecological synergy in recent years. Through a literature review, the paper provides in-depth analysis of innovative mechanisms for key technology paths such as high-performance electric drive systems, lightweight and aerodynamics design, and battery and intelligent energy management. It also discusses Xiaomi's eco-synergy models in technology integration, supply chain collaboration, user community building and experience innovation. The study shows that the success of the Xiaomi Su7 is due to a two-way combination of "Performance breakthroughs", which set the technological benchmark and brand appeal, and "Ecological synergies", which allow the SU7 to become more attractive, the latter provides cost advantages and incentives for continuous innovation. The two promote each other, forming a sustainable competitive advantage. This paper reveals that the development of intelligent electric vehicles has been restructured from a single technology to a systematic and iterative way, which provides theoretical reference and practical enlightenment for the transformation and upgrading of China's new energy vehicle industry.

Keywords: Smart Electric Vehicles, Performance Breakthrough, Ecological Synergy, Technology Integration.

1. Introduction

The global electric vehicle industry is undergoing unprecedented changes, with global sales 2024 more than 17M units, with the Chinese market continuing to lead with a global share of more than 40 per cent. Behind this rapid growth lie both the drivers of technological innovation and the structural challenges of infrastructure imbalances, the fragmentation of technological standards and supply chain volatility. In this context, the development of intelligent electric vehicles is no longer limited to a single technical dimension of the race, but evolved into the ecosystem as a whole and performance breakthrough of the dual competition. Xiaomi's SU7 Ultra is the signature product of the Chinese New Energy Vehicle Market in 2025, with 1,548 horsepower and 1.98 seconds acceleration, breaking the long-held records of the Tesla Model S Plaid and Porsche TAYCAN Turbo GT. This technological achievement not only represents the innovative path of new-type automobile manufacturing enterprises to realize leapfrog development through ecological synergy. Xiaomi's SU7 Ultra New North Limited Edition set a time of 6:46.874 at the Nurburgring circuit, surpassing traditional fuel-efficient cars such as the mercedes-AMG GT 63s, to a certain extent, rewrote the 100-year-old fuel vehicle established performance standards.

By using the method of literature review, this paper systematically reviews the research progress and practical experience of intelligent electric vehicle on the two paths of performance breakthrough and ecological synergy in recent years, based on the typical cases of Xiaomi's SU7, such as its technical structure and track performance, the paper analyzes its internal mechanism and synergy effect. This paper aims to reveal how the dual development path can jointly promote the industrial upgrading and the construction of enterprise competitiveness by integrating the empirical research results from the multi-disciplinary perspective. It also provides theoretical reference and practical enlightenment for future policy making, technology research and development and business model innovation.

2. Introduction of the Research Object

Intelligent Electric Vehicles (IEVs) are defined as vehicles equipped with electric drive systems and advanced intelligent driving and connectivity functions [1]. Its core features include electrification, intelligentization, networking and sharing [2]. Typical features of smart electric vehicles include high-performance electric drive systems, lightweight and aerodynamics design, Intelligent Energy Management, ecological synergy and cost innovation [3].

In recent years, the research on intelligent electric vehicle (EV) has been interdisciplinary, including technical performance, ecosystem, charging infrastructure and so on. In the aspect of performance breakthrough research, scholars mainly focus on electric drive system innovation, battery technology advancement and lightweight material application. Many studies conducted experimental tests on heat dissipation technology of high-speed motors and proposed a multi-layer oil-cooling structure design scheme, which effectively solved the heat management problem of high-load motor operation, this coincides with the 27200rpm rpm technology used in Xiaomi's V8s Motors [4].

In the field of ecological synergy, scholars generally pay attention to the value of resource integration and cross-industry cooperation. The study proposed a two-wheel drive strategy of "Multi-dimensional Innovation + Ecological Synergy", which has been applied in the transformation and upgrading of traditional manufacturing industries, particularly in the new energy vehicle (NEV) sector, emphasizing that the automotive revolution has been upgraded from technology iteration to full ecological reconstruction [5]. It study points out that innovation practices in the Chinese market are redefining global industry rules, and that a single technological advantage is no longer sustainable, need to build technology, supply chain, user community, and a comprehensive ecological system. The integration of charging infrastructure and smart grids is another important research direction, as it ensures energy efficiency and long-term scalability of EV adoption. Another study proposed a data-driven optimization-based network resilience framework that integrates genetic algorithms and reinforcement learning to achieve adaptive scheduling for EV charging. The study confirms that smart charging management can reduce daily peak demand by 9.6% and significantly improve grid stability and energy efficiency [6].

However, most of the existing studies focus on a single technical or ecological dimension, and lack of systematic analysis that combines performance breakthrough with ecological synergy. Especially in the background of the rapid development of China's intelligent electric vehicle (EV) enterprises, the research on the internal mechanism and path choice of its technological transcendence is not enough. The purpose of this paper is to fill this research gap and to analyze how the dual path can promote each other and form sustained competitive advantage through the case of SU7 in Xiaomi.

3. An Overview of Empirical Research on Performance Breakthrough Paths

The performance breakthrough for electric vehicles is a multidisciplinary project involving collaborative innovations across mechanical, electrical, and material sciences. The Xiaomi Su7 Ultra is a leading example of electric performance cars, whose technology path focuses on the importance of interdisciplinary and system integration. Most of the existing research focuses on the partial optimization of a particular technology point, such as motor speed improvement, battery charge and discharge performance or independent improvement of the aerodynamics package, however, there is a lack of systematic analysis on the linkage mechanism between “Performance breakthrough” and “Ecological Synergy”. Specifically, the performance breakthrough should not only be in a single dimension of power output, but also need to be integrated into the overall technical framework such as efficient energy use, environmental adaptability, resource cycling and grid synergy. The practice of Xiaomi's SU7 Ultra demonstrates the potential integration of power performance and sustainability, which can be achieved only through the synergy of multiple systems such as drive systems, lightweight design, battery management and energy dispatch [3]. Therefore, future research should pay more attention to the modeling and analysis of cross-domain coupling effects, and explore how to achieve system synergy with energy networks, driving scenarios, and material cycles under high performance requirements, therefore, the development path of electric vehicles will be changed from single performance optimization to system-level ecological development.

3.1. Drive System Innovation

Electric drive system is the core of vehicle power performance. The self-developed three-motor system on Xiaomi's SU7 Ultra -- including two V8s and one V6s -- represents the state-of-the-art technology in the current mass-produced motor industry. Among them, V8s motor achieved the highest speed of 27200rpm, single power up to 578 horsepower, assisted by V6s motor 392 horsepower, the system integrated power up to 1548 horsepower. This allowed the 2.3-ton SU7 Ultra to achieve a 0-to-100 KPH acceleration of just 1.98 seconds, outperforming the Tesla Model S Plaid (2.1 seconds) and Porsche Taycan Turbo GT (2.3 seconds), the benchmarks of electrical performance have been redefined.

In the breakthrough of motor technology, the problem of heat dissipation and material is particularly critical. Many studies showed that the multi-layer oil cooling structure used in Xiaomi allowed the motor to keep the temperature stable within 90 â °C at high speeds, to ensure that the continuous high power output will not be caused by overheating and attenuation [4]. For another, the application of carbon fiber rotor wrap technology, significantly reduced the moment of inertia (17%) [3], the switch response speed to 83 milliseconds, greatly enhanced the vehicle's dynamic control quality. In addition, the intelligent torque distribution system can be 0-100% of the front and rear axle output torque real-time adjustment. Especially in drift mode, the rear wheel torque can reach 95%, enhancing handling flexibility and driver control. The mode not only shows the flexibility of power distribution, but also shows the design concept of deep synergy between electronic control system and vehicle dynamic performance.

3.2. Aerodynamics and Lightweight Design

In a race-level driving scene, aerodynamics efficiency and lightweight design are key factors that affect vehicle top speed, cornering stability and energy performance. The time of Xiaomi Su7 Ultra at Nurburgring North Ring (6:46.874), Shanghai International Circuit (2:09.944) and Zhuzhou international circuit (1:41.806), it is a testament to the state of the art in aerodynamics design. Equipped with an efficient aerodynamics kit including a U-blade and an active diffuser, it can generate a combined 285kg downforce at high speeds and achieve a lift coefficient as low as -0.18 at 200kph, improved tire adhesion in high speed corners.

Lightweight is an important approach to achieve high thrust-weight ratio and sensitive dynamic response. The SU7 Ultra Body uses a lot of carbon fiber material and covers an area of 3.74 m2. The roof component alone reduces the weight by 21 kg, thereby contributing significantly to acceleration efficiency and stability. The final thrust-to-weight ratio of the vehicle reaches 0.67 hp/kg. The lightweight design not only directly contributes to the acceleration and braking performance, but also improves the body rigidity and enhances the handling stability and durability of the vehicle under extreme operating conditions. It should be noted that there is a close coupling between the lightweight and the aerodynamics, and that the thinning and strengthening of the material needs to be coordinated with the configuration design to maintain stable aerodynamic performance at high speeds, this has not been systematically analyzed in the current study.

3.3. Battery and Energy Management

Battery system is the energy source of electric vehicle, its output characteristics, durability and charging efficiency directly affect the performance of the vehicle ceiling. The SU7 Ultra comes in a Kirin II track-specific high-power battery pack developed by Ningde Times. The battery supports a maximum charge rate of 5.2 C and a peak voltage of 897 volts, it shows the leading technology layout on the high voltage platform path. Research by the Landau team, based on laboratory performance testing, shows that the battery has an ultra-high discharge capacity of 16C, which can maintain a power output of 800kW even with 20% remaining [7]. The invention avoids the problem that the performance of the traditional electric vehicle will decline sharply when the electric power is low.

At the level of energy management, the intelligent system dynamically adjusts power allocation strategy according to real-time road conditions and driving behavior to balance the conflict between performance and energy consumption, thereby extending driving range while preserving power output. The study proposed a data-driven charging scheduling model, which combined genetic algorithm with reinforcement learning to reduce peak load of the grid by 9.6%, showing that energy management technology not only serves the vehicle itself, it also has the potential for two-way interaction (V2G) with smart grid [6]. The SU7 Ultra can dynamically adjust battery output characteristics based on driving intent prediction and maintain battery temperature stability with advanced cooling systems to maximize battery potential and delay performance degradation in race mode.

To sum up, most of the current research is limited to the optimization of a single technical point such as motor, battery or pneumatic, there is a lack of synergy mechanism between high performance EV and many factors, such as energy ecology, driving scene, material utilization, etc. The practice of the Xiaomi Su7 Ultra shows that substantial performance breakthroughs depend on a deep fusion of electric drive innovation, lightweight design, aerodynamics and Smart Energy Management. Therefore, there is an urgent need for a “Performance-ecology” transdisciplinarity in the future, which combines modeling and simulation with intelligent optimization algorithms to build an analytical framework that integrates the performance and sustainability of a vehicle class, thus guiding both industrial application and policy formulation.

4. Ecological Synergy Path Analysis of SU7 in Xiaomi, China

4.1. Technology Integration and Supply Chain Synergy

Xiaomi's SU7 performance breakthrough is due to its unique technology integration and supply chain coordination strategy. Unlike traditional carmakers, Xiaomi has successfully transplanted its supply chain management experience and eco-partnership model from the consumer electronics sector to the automotive sector, form a high degree of vertical integration and open synergy of the combination of innovation model.

The vertical integration strategy plays a central role in Xiaomi’s technology integration. Xiaomi has achieved a high proportion of in-house development of key components, which strengthens its competitive edge by reducing reliance on external suppliers. Through vertical integration, Xiaomi not only reduces production costs but also ensures that key technologies are under its control, effectively avoiding the risks of supply chain volatility. This strategy is particularly evident in the core three-power system (Battery, motor, electronic control), which Xiaomi has developed through its own core technology and deep integration to achieve both performance and cost optimization.

The Xiaomi-Ningde partnership exemplifies a pioneering model of supply chain synergy, characterized by deep co-development and long-term technological alignment. The two companies jointly developed the Kirin II track dedicated high-power battery pack, which supports 5.2 C ultra-fast charging technology with a peak voltage of 897 volts. This kind of in-depth technology cooperation goes beyond the traditional supplier-customer relationship, which often suffers from limited knowledge sharing and slower innovation cycles. The Kirin Battery is designed with a high energy density of 101 kwh, coupled with the 800V silicon carbide high voltage platform developed by Xiaomi, the SU7 Max version achieves an 800km CLTC range and a 15-minute recharge of 510km with excellent performance.

Xiaomi's Supply Chain Co-operation in smart driving is also a collaborative innovation model. In cooperation with HESAI technology and Sotheon Juchuang, Xiaomi has established a “Pre-demand + joint r & D” mechanism. Take Xiaomi's SU7-mounted Hesay At128 lidar for example. It is designed for urban Noa scenarios, with 128-line vertical resolution and 200m ranging capability, the recognition rate of obstacles is 99.5% under complex road conditions. Hesai Technologies' custom-built ASIC architecture for Xiaomi enhances computational efficiency and reduces latency, enabling faster obstacle detection [5]. This in-depth customization enabled the SU7 to be the first in the 200,000-yuan class to achieve the L-3 level perception capability, driving the lidar to penetrate the mainstream market from high-end models.

The parallel development model is another innovation in Xiaomi's supply chain collaboration. In traditional supply chain, there is obvious time difference between hardware development and vehicle development, which leads to frequent rework in integration stage. Xiaomi innovates with suppliers through a “Parallel development” process that compresses the lidar development cycle by 40% [6]. In the development of Yu7 models in Xiaomi, Suiteng Juchuang was involved in the body structure evaluation during the conceptual design stage, and the installation location of LIDAR was optimized through CAE simulation to solve the problems of visual field occlusion and heat dissipation conflict in traditional solutions. The patented “Embedded Mount” technology, developed jointly by the two sides, improves lidar integration with the front bumper by 60% and aerodynamics performance by 15%. This “Hardware-body” collaborative design mode makes the Yu7 the world's first laser radar “Zero-heave” design of the production model.

Xiaomi also achieves continuous optimization through a “Data closed loop” development system with suppliers. In Xiaomi's Automotive Test Fleet, the Hesay lidar relays real-time point cloud data to the joint laboratories of both sides for automatic labeling of obstacle types and motion trajectories via AI algorithms. This “Development-test-optimization” real-time iterative mechanism has tripled the efficiency of the development of urban Noa in Xiaomi, and by 2025 Q2 will have achieved 100-city unmapped navigation. This open and collaborative supply chain mode not only accelerates the product development process, but also reduces the research and development cost and improves the system reliability.

4.2. User Community and Experience Innovation

Xiaomi's SU7 eco-synergy path extends beyond technology to user community building and experience innovation. Xiaomi has successfully applied its user experience in mobile phones and smart homes to the automotive sector, creating a unique automotive user ecosystem.

Xiaomi has built a community of users called “Player N”, with more than 8,000 registered car owners and 132 track days organised. This kind of user participation innovation not only enhances the user stickiness, but also becomes an important source of product iteration and innovation. Through user feedback and track data collection, Xiaomi is able to continuously optimize vehicle performance and driving experience, creating a virtuous cycle of innovation, lowering the threshold for performance vehicles. This kind of experience innovation breaks the limitation of traditional performance cars only for professional drivers, allows more users to safely enjoy the driving fun of high-performance electric cars, and expands the audience base of the products.

Xiaomi's ‘Eco-friendly’ strategy, centered on cross-terminal connectivity, is at the heart of its experiential innovation. At the end of the 2023, mijia had 85.8 m monthly users and 14.5 m users with five or more devices connected to the Xiaomi Platform. Supported by the bottom of Xiaomi's Paper OS, the SU7 can connect cars to mobile phones, tablets, home appliances and other terminals in both directions. This synergy is directly reflected in market performance: 35% of the 258,000 SU7 owners are already mobile or smart home users in Xiaomi [6].

Xiaomi continues to improve the user experience through data-driven experience optimization. In August 2025, Xiaomi introduced an end-to-end large-model system based on 10 million Clips (high-quality driving Clips) training into all SU7 models, marking an intergenerational breakthrough in intelligent driving technology. The system reconstructs the decision logic and control ability of the vehicle completely through the training of a large amount of real scene data. In the longitudinal control dimension, the new system makes a breakthrough: based on deep learning of the driving curves of more than 100,000 hours of experienced drivers, the system achieves millisecond accuracy in acceleration and braking control. The actual test shows that the acceleration and deceleration impact of urban congested road sections decreases by 57%, leading to smoother rides and reduced passenger discomfort. The passenger vertigo index decreases significantly [8].

5. Discussion and Future Challenges

5.1. Dual Path Interactions

The success of the Xiaomi Su7 was due to the mutual promotion of the dual pathways of performance breakthrough and Ecological Synergy. On the one hand, the ultimate performance breakthrough provides the Technological Foundation and brand attraction for eco-synergy; on the other hand, eco-synergy provides cost advantage and innovation source for performance breakthrough. This dual-path model provides a new way for China's new energy vehicle enterprises to catch up and surpass technology.

The Xiaomi case shows that a single technological advantage cannot create sustained competitiveness and requires an all-encompassing innovation ecosystem. As Wu Zhen, president of Magna China, puts it: “The automotive revolution has moved from a technological iteration to a full-scale ecological restructuring, and innovation practices in the Chinese market are redefining global industry rules” [8]. This kind of ecological reconstruction not only involves technology supply chain, but also includes multi-dimensional innovation such as user community, experience mode and cost structure.

Performance breakthrough lays the foundation for ecological synergy. The Xiaomi Su7 has built its brand technical image and market attention through outstanding performance parameters (such as zero-hundred acceleration in 2.78 seconds, range of 800km and high-voltage platform of 871V). This technical image provides a foundation of trust and user acceptance for eco-synergy, enabling Xiaomi to quickly build car user communities and ecosystems. Without a performance breakthrough as a basis, it is difficult for ecological synergy to produce market attraction independently.

Ecological collaboration provides support for performance breakthroughs. Through ecological synergies, Xiaomi has optimised costs and accelerated innovation, enabling high-performance technologies to be brought to market at more competitive prices. In-depth cooperation with HEISAI technology, Suteng Juchuang and other suppliers not only reduces the cost of core technology, but also accelerates the industrialization of innovative technology applications. Without the cost innovation and support of ecological synergies, such as reducing battery production costs, Xiaomi could not achieve such cost-effective product positioning.

This dual path interaction creates the unique competitive advantage of the Xiaomi Su7. While Tesla's technology is advanced, its relatively closed ecosystem limits its ability to localize and control costs in the Chinese market, and while traditional automakers have supply-chain advantages, but the lack of ecological collaboration experience and user operation capacity. Xiaomi has found just the right mix of technology and ecology to create the right model of innovation for the Chinese market.

5.2. Technological and Industrial Challenges

In spite of the remarkable success of the Xiaomi Su7, many challenges remain. First, the uneven development of the charging infrastructure limits the user experience. The research shows that the availability and compatibility of the charging posts are still a problem even if the 5c overcharge is supported. The application of Internet of things (IoT) in intelligent charging management provides some solutions, but it still faces challenges such as network security risks, interoperability barriers, and lack of communication protocol standardization, which hinder user adoption and confidence.

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Network security has become a potential risk for smart electric vehicles. Research shows that EV charging systems are vulnerable to network attacks and require integrated intrusion detection system (IDS) and blockchain technology to ensure security. Although the current IDS system can achieve 94.1% accuracy and 0.97 AUC, and detect attacks within 50-300 ms, the detection accuracy is only 74% in 50% new attack scenarios, which needs further improvement [9].

Data privacy and compliance challenges are increasing as intelligentization deepens. The vast amount of driving and user behaviour data collected by the Xiaomi Su7 is both a foundation for large-scale training and a source of privacy risks. Finding the right balance between data use and privacy protection is an important compliance challenge for Xiaomi as the country's data security and personal information protection laws are implemented.

Finally, there is still uncertainty about supply chain resilience. While Xiaomi has reduced supply risks through vertical integration and supply chain synergies. Global chip shortages, geopolitical factors, and trade policy changes could affect supply chain stability both in the short term and in long-term strategic planning. In particular, key components such as high-performance chips and advanced sensors remain dependent on a small number of global suppliers, posing potential risks.

5.3. Future Research Directions

Based on the findings of this study, future research can focus on the following aspects: first, to explore the balance between high energy density batteries and ultra-fast charging technology, how to improve energy density without sacrificing charging speed and safety performance; The second is to study the large-scale application of V2G (vehicle-to-grid) technology to make electric vehicles become distributed energy storage units of the smart grid, and the third is to explore the application of bio-based materials in electric vehicles. For example, Magna's bio-based composites have achieved a 30% lightweight breakthrough, which could be applied in vehicle chassis, interior panels, and other structural components [10].

Artificial Intelligence and big data will be widely used in the field of electric vehicles [11]. The research shows that the accuracy of the AI-based charging time prediction system can reach 96% by integrating computer vision automatic recognition of EV models and adaptive charging time estimation [12]. This kind of system can help users to optimize the charging decision-making and improve the utilization efficiency of charging facilities. Future research could explore the applications of AI in battery health management, personalized adaptation, and predictive maintenance, while also addressing issues such as model interpretability and computational efficiency.

Vehicle-network interaction (V2G) technology is another important research direction [13]. With the increase of the number of electric vehicles, electric vehicle batteries become distributed energy storage resources, which can participate in peak load regulation through intelligent dispatching. The Xiaomi Su7 fully supports VTOL external discharge, and the MAX performance flagship also supports V2V reverse-charging vehicles with a power output of 6.6 kw [14]. This capability lays the foundation for V2G technology, and future research could explore how economic incentives and technological innovation can promote EV participation in grid regulation and increase renewable energy absorption.

The application of sustainable materials is an important direction for the sustainable development of electric vehicles. With the popularity of electric vehicles, how to reduce the carbon footprint in the production process and improve material recycling has become an important issue. Future research could explore the application of bio-based materials, recyclable composites and low-carbon production processes in electric vehicles to promote life-cycle carbon neutrality.

Finally, the study of man-vehicle relationship will become an important direction in the future. With the development of intelligent driving technology, the vehicle is changing from driving tool to mobile space, and the relationship between people and vehicle is changing fundamentally. Future research can explore how the smart cockpit can better meet the emotional needs of users, improve work efficiency and promote social interaction, and how to design human-computer interfaces more consistent with human cognitive habits, drawing on insights from cognitive psychology and human factors engineering.

6. Conclusion

This study shows that the sustainable competitiveness of Smart Evs no longer depends on the leading of single technology, but on the deep integration and mutual promotion of “Performance breakthrough” and “Ecological Synergy”. The practice of Xiaomi's SU7 Ultra has shown that companies can leapfrog performance in areas such as electric drive systems, battery technology, lightweight and aerodynamics, with in-house Research and Development and deep synergy. At the same time, with the help of supply chain vertical integration, user community co-creation and cross-terminal ecological connectivity, to build an efficient, flexible and cost-effective innovation ecosystem. This “Technology plus ecology” two-wheel drive model not only redefines the industry standard for electric vehicles, but also provides a systemic solution to the challenges of uneven charging infrastructure, network security, data compliance and supply chain resilience. In the future, the development of smart electric vehicles will evolve further towards energy network convergence (V2G), sustainable materials applications, personalized service driven by artificial intelligence, and reconfiguration of human-vehicle relationship, to promote the automotive industry towards the whole life cycle of intelligent and ecological new stage.

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