Proceedings of ICEMGD 2025 Symposium: The 4th International Conference on Applied Economics and Policy Studies
DOI: 10.54254/2754-1169/2025.BJ24873

Analysis of Challenges Faced by Enterprises in Innovation and Future Development Strategies: Taking the New Energy Vehicle Industry as an Example

Jialu Tian

School of Public Finance and Public Administration, Shanghai Lixin University of Accounting and Finance, Shanghai, China
Tianjialu737725@163.com

Abstract. The global surge in environmental awareness and supportive policies have propelled the new energy vehicle (NEV) industry, particularly in China, which now dominates the world's largest NEV market. However, this rapid growth masks significant innovation challenges faced by NEV enterprises. This study investigates the multifaceted challenges hindering innovation within the NEV sector. These challenges are categorized into technical hurdles, such as limitations in battery technology and autonomous driving systems; market pressures, including intensified competition and diversified consumer demands; and supply chain disruptions, specifically the shortage of key raw materials and difficulties in supply chain coordination. The study employs a mixed-methods approach, utilizing literature analysis of recent authoritative sources from CNKI and in-depth case studies to provide a comprehensive understanding of the issues. The findings underscore the need for enterprises to prioritize R&D investment, forge collaboratio ns with research institutions, refine market positioning, develop differentiated products, and optimize supply chain management. Addressing these challenges is crucial for enhancing innovation capabilities and competitiveness. The study also advocates for government support in fostering a conducive environment for the industry's sustainable growth.

Keywords: New energy vehicles, Enterprise innovation, Technological ecosystem, Market strategy, Supply chain resilience

1. Introduction

Driven by the global imperative of carbon neutrality and rapid technological advancements, the new energy vehicle (NEV) industry has emerged as a cornerstone of global economic transformation. China, leveraging its policy support systems and massive market scale, has become the epicenter of NEV innovation and production, accounting for over 60% of global NEV sales [1, 2]. However, beneath this growth lies a complex web of innovation challenges that threaten to impede long-term sustainability. Technical bottlenecks in core components, intensifying market competition, and fragile supply chain networks have created a tripartite challenge framework that NEV enterprises must address [3- 5].

DOI: 10.54254/2754-1169/2025.BJ24873

Existing research has often focused on isolated aspects of NEV development, lacking a systematic analysis of how these challenges interrelate and impact enterprise innovation. This study aims to bridge this gap by integrating insights from technical innovation theory, industrial organization, and supply chain management. By synthesizing literature from CNKI and global databases, alongside case studies of leading NEV enterprises, the research seeks to: (1) deconstruct the multi-dimensional innovation challenges in the NEV sector; (2) develop a comprehensive strategic framework for addressing these challenges; and (3) provide actionable insights for both enterprises and policymakers. The findings are critical for guiding NEV enterprises through the transition from scale-driven growth to innovation-driven excellence.

2. Challenges faced by enterprises in innovation

2.1. Technical aspects: The core bottlenecks of innovation

2.1.1. Battery technology: A critical chokepoint for industrial advancement

Battery technology remains the most intractable technical challenge for NEV enterprises, encompassing a triad of energy density, charging efficiency, and safety that must be synergistically optimized. Current lithium-ion battery technologies, despite advancements, face physical limitations in energy density, with mainstream ternary lithium batteries struggling to exceed 300 Wh/kg—a threshold that constrains pure electric vehicle (PEV) range to approximately 700 kilometers under ideal conditions [6]. This range gap relative to internal combustion engine vehicles perpetuates "range anxiety," a psychological barrier to mass adoption [3, 6].

Charging infrastructure and technology compound this challenge. While 800V high-voltage platforms have reduced charging times to within 30 minutes for 80% capacity, the trade-off is a 30% reduction in battery cycle life, creating a dilemma between user convenience and long-term economic viability [6]. Safety concerns further exacerbate the issue: thermal runaway incidents in lithium-ion batteries, triggered by overheating or mechanical damage, remain a significant obstacle, with reported cases causing substantial reputational damage to manufacturers [6].

Chinese enterprises also face a technology catch-up in next-generation battery solutions. Solid-state battery research, though promising, lags international leaders in electrolyte stability and manufacturing scalability, while battery recycling technologies suffer from low efficiency—recovering less than 95% of precious metals compared to the global average of 98% [6]. These gaps highlight the urgent need for breakthroughs in both primary and secondary battery technologies.

2.1.2. Autonomous driving: Caught between technological promise and practical realities

The integration of autonomous driving technologies in NEVs has been marked by hype and hesitation, as technical, legal, and ethical challenges converge to slow commercialization. Environmental perception systems, relying on a fusion of lidar, radar, and cameras, demonstrate critical vulnerabilities in extreme weather conditions—with lidar detection ranges reducing by 60% in heavy rain and camera accuracy dropping significantly in backlight scenarios [5, 6]. Such limitations compromise the reliability of Level 2+ autonomous systems in real-world applications.

Decision-making algorithms, despite advancements in machine learning, struggle with "long-tail" traffic scenarios—uncommon but critical situations like construction zone detours or unregulated intersection crossings. Studies have shown that autonomous driving systems exhibit a 12.3% higher error rate than human drivers in complex traffic environments, undermining consumer trust [5, 6].

DOI: 10.54254/2754-1169/2025.BJ24873

Core hardware dependencies further compound these issues: China's self-developed vehicle-grade AI chips, with computing power typically below 200 TOPS, lag behind international counterparts like NVIDIA's Orin (254 TOPS), creating a "chip bottleneck" in intelligent driving development [5, 6].

Ethical and legal frameworks have not kept pace with technological progress. The "trolley problem" dilemma—how autonomous systems should prioritize lives in unavoidable collisions—lacks a societal consensus, while cross-border data flow regulations (e.g., China's Automotive Data Security Management Regulations vs. the EU's GDPR) create compliance hurdles for global technology iteration [5, 6]. These systemic issues transform autonomous driving from a technical challenge into a multi-stakeholder governance conundrum.

2.2. Market competition: Navigating a landscape of intensification and diversification

2.2.1. Intensified competition: From incremental to structural market changes

The NEV market has evolved rapidly from a blue ocean to a red ocean, characterized by intensified competition across all market segments. Traditional automakers such as Volkswagen and Toyota are leveraging their manufacturing expertise to accelerate electrification, while tech giants like Huawei and Baidu are entering the sector with software-defined vehicle (SDV) innovations, redefining industry value chains [4]. This influx of players has triggered price wars that have spread from mid-to-low-end segments to premium markets, with 250,000+ RMB models experiencing average price reductions of 18% in 2023 alone [4].

Market segmentation has become increasingly pronounced: foreign brands still dominate the high-end market (holding a 62% share in 300,000+ RMB segments), while domestic players like BYD and NIO compete fiercely in the mid-range market [4]. The low-end market, however, faces structural overcapacity, with inventory cycles exceeding six months for some models [4]. Global expansion adds another layer of complexity, as trade barriers like the EU's Carbon Border Adjustment Mechanism (CBAM) and the U.S. Inflation Reduction Act (IRA) impose significant cost increases for Chinese NEV exporters [4].

2.2.2. Diversified consumer demands: A paradigm shift in market expectations

Consumer preferences for NEVs have evolved from simple environmental considerations to a complex array of technological, functional, and experiential demands. Urban consumers in first-tier cities prioritize intelligent connectivity features, with 67% listing autonomous driving and over-the-air (OTA) updates as key purchase factors, while lower-tier markets emphasize affordability and practicality, with 72% of consumers requiring a range of at least 500 kilometers [1, 3].

Generational divides further complicate market segmentation: Gen Z consumers demand personalized cockpit experiences, such as in-car gaming and customizable UI interfaces, whereas middle-aged buyers focus on safety features and interior comfort [1, 3]. Gender dynamics also play a role, with 62% of female consumers citing "exclusive color schemes" as influential, compared to just 34% of male consumers [1, 3]. After-sales service expectations have risen exponentially, with high-end users prioritizing charging network coverage (expecting superchargers within 3 kilometers) and battery leasing services, while mass-market consumers value maintenance accessibility [1, 3]. These diversified demands require enterprises to shift from standardized production to agile, customer-centric innovation models.

DOI: 10.54254/2754-1169/2025.BJ24873

2.3. Supply chain: Fragility in the face of global uncertainties

2.3.1. Key raw material shortages: Risks rooted in geopolitical and resource concentration

The NEV supply chain faces existential risks from shortages of critical raw materials like lithium, cobalt, and nickel. Global lithium reserves are highly concentrated in the "Lithium Triangle" of Chile, Argentina, and Bolivia, leaving China—responsible for over 50% of global NEV production—with an 80% dependency on imported lithium concentrates [4, 7]. The cobalt supply chain is even more precarious, with 70% of global production originating from the Democratic Republic of Congo, where artisanal mining accounts for 20% of output, raising ethical and sustainability concerns [4, 5].

Price volatility in these materials has reached unprecedented levels: lithium carbonate prices surged by 400% between 2021 and 2022, while nickel prices fluctuated by 40% in 2023 alone, creating severe cost uncertainties for manufacturers [4, 5]. China's dominance in rare earth permanent magnet production (90% of global capacity) is undermined by a reliance on imported equipment for high-end magnet production, highlighting a "capacity advantage but technology deficit" paradox [5, 6]. These vulnerabilities expose the NEV industry to both supply disruptions and price speculation, threatening long-term cost stability.

2.3.2. Supply chain collaboration: Overcoming complexity and coordination gaps

The NEV supply chain's complexity—encompassing over 500 stages from mineral extraction to vehicle assembly—creates significant coordination challenges. Information asymmetry between original equipment manufacturers (OEMs) and tier-1 suppliers results in an average three-day delay in demand transmission, while tier-2 suppliers often respond even more slowly, as seen in the 2021 production halt at Tesla's Shanghai factory due to lithium salt shortages at CATL [5, 6].

Traditional "Just-In-Time" (JIT) inventory models have proven inadequate in the face of supply chain volatility. One leading NEV manufacturer was forced to extend its vehicle MCU inventory cycle from 45 to 120 days to mitigate chip shortages, tying up over 2 billion RMB in working capital [5, 6]. Geopolitical risks have added a new layer of complexity: the COVID-19 pandemic disrupted 15% of global vehicle MCU supply from Malaysian factories, while the Red Sea crisis in 2023 tripled logistics costs for Chinese battery exports to Europe, extending delivery times from 25 to 60 days [5, 6].

Compounding these issues are conflicting stakeholder interests: raw material suppliers prioritize price stability, battery manufacturers focus on cost reduction, and OEMs aim to balance production efficiency with market responsiveness. This misalignment results in an average order fulfillment rate of just 85%, underscoring the need for systemic supply chain optimization [5, 6].

3. Future development strategies: Building innovation-driven resilience

3.1. Technical innovation strategy: Cultivating ecosystem-level capabilities

To overcome technical bottlenecks, NEV enterprises must adopt an ecosystem-driven innovation model that integrates internal R&D with external collaboration. Leading enterprises should establish "innovation consortia" with research institutions like the Chinese Academy of Sciences and Beijing Institute of Technology, using "targeted research" mechanisms to tackle core technologies [4]. A dual-track technology strategy is essential: accelerating the commercialization of semi-solid state

DOI: 10.54254/2754-1169/2025.BJ24873

batteries (aiming for 350 Wh/kg energy density by 2025) while investing in next-generation solid-state battery R&D (targeting 500 Wh/kg by 2030) [5, 6].

In autonomous driving, a "hardware-software" (collaborative) approach is critical. Enterprises should partner with domestic chip designers like Horizon Robotics to develop 500+ TOPS AI chips for L4-level autonomy, aiming for 50% localization by 2025 [5, 6]. Simultaneously, building a "data closed-loop" system—leveraging real-time data from fleets of millions of vehicles—can reduce algorithm iteration cycles from 12 to 3 months, as demonstrated by leading new energy manufacturers [5,6]. Governments should facilitate the establishment of cross-enterprise data sharing platforms, defining clear rules for data ownership and transaction to unlock collective innovation [5, 6].

Talent development must be a strategic priority. Enterprises can emulate BYD's "technical talent pool" model, partnering with universities to establish NEV industry academies that offer specialized programs in battery materials and intelligent driving [4]. A competitive global talent strategy—combining equity incentives with world-class R&D facilities—can attract top international expertise, as seen in the 150% year-on-year growth of overseas R&D teams at leading Chinese NEV manufacturers [4]

3.2. Market competition strategy: From product competition to ecosystem building

Effective market competition in the NEV sector requires a shift from product-centric to ecosystem-centric strategies. Enterprises must develop dynamic consumer insight systems using big data and AI to enable real-time user profiling and demand forecasting [1, 3]. In the premium market, brands should emulate Porsche's "technology premium" strategy, focusing on differentiated features like 800V high-voltage platforms and two-speed transmissions, while mass-market brands can learn from Wuling Hongguang MINI EV's "scenario-based innovation" to develop cost-effective models tailored to specific user needs [1, 3].

Brand building should focus on establishing "technical brand" equity. BYD's "blade battery" test demonstrations exemplify how technical superiority can be translated into brand trust, contributing to a 12% increase in brand premium rates [3, 4]. Omni-channel strategies must be optimized for different market tiers: first-tier cities require "experience centers" that showcase technological innovation, while lower-tier markets need a network of "county-level experience stores + township service stations" to expand accessibility [3, 4].

Global market expansion demands a "localization first" approach. Entering the European market requires compliance with ISO 14067 carbon footprint standards and the development of WLTP-certified long-range models (≥600 km), while Southeast Asian markets need heat-resistant battery solutions and right-hand drive configurations [1, 3]. Enterprises should establish regional R&D centers, such as NIO's design center in Munich, to ensure products align with local preferences [1,3]. Active participation in international standard-setting—promoting Chinese charging interface standards (GB/T) as global norms—can enhance industrial discourse power [1, 3].

3.3. Supply chain optimization strategy: Building resilient and intelligent ecosystems

Supply chain resilience requires a fundamental shift from cost-driven to risk-aware management. Enterprises should implement a "dual-drive" strategy for raw material security: global resource layout through investments in African and South American lithium projects (e.g., Ganfeng Lithium's Cauchari-Olaroz project in Argentina) combined with the accelerated commercialization of alternative technologies like lithium-iron-manganese-phosphate batteries[4,5]. A national-enterprise dual-level strategic reserve system for critical materials, coupled with a "price stabilization fund," can mitigate market volatility [4,5].

Digital transformation is key to improving supply chain collaboration. Emulating CATL's "lighthouse factory" model, enterprises should deploy digital twin technologies to simulate the entire battery production process, improving yield rates to over 99.5% [5, 6]. Industry-level supply chain data platforms, integrating demand forecasting, capacity planning, and inventory management across stakeholders, can enhance response speed by 40% and inventory turnover by 25%, as seen in leading OEMs [5, 6]. Logistics networks should be optimized using Tesla's "3-km supporting circle" model, clustering key suppliers around production bases to reduce logistics costs by 18% [5, 6].

Policy support is critical to supply chain resilience. Governments should establish NEV supply chain security committees to develop resilience evaluation standards and early warning systems [4, 5]. A "supply chain resilience fund" can support enterprises in exploring alternative materials and overseas resource development, while supply chain finance innovations—such as blockchain-based warehouse receipt financing—can alleviate funding pressures for SMEs [4, 5].

4. Conclusion

This study has provided a comprehensive analysis of the innovation challenges facing NEV enterprises, spanning technical, market, and supply chain dimensions, and has proposed a multi-faceted strategy framework to address them. The research confirms that China's NEV industry, while enjoying scale advantages, must urgently address gaps in core technology autonomy, supply chain security, and global market positioning to transition from "scale leadership" to "innovation leadership."

Future research should deepen investigations into emerging technologies like hydrogen fuel cells and vehicle-to-grid (V2G) integration, as well as the policy mechanisms for integrating intelligence and low-carbonization. As the NEV industry evolves from "automobile manufacturing" to "mobile service ecosystems," enterprises must adopt a more macro-strategic perspective, redefining innovation frameworks to thrive in an era of global industrial transformation. The insights herein serve as a foundation for NEV enterprises to navigate challenges and seize opportunities, contributing to the sustainable development of China's NEV industry on the global stage.

References

[1] He Wentao & Hao Xiaoli. (2023). Competition and welfare effects of introducing new products into the new energy vehicle market: Empirical evidence from Tesla's entry into the Chinese market. Transportation Research Part A, 174, 103730.

[2] Lei Wang, Zhong-Lin Fu, Wei Guo, Ruo-Yu Liang & Hong-Yu Shao. (2020). What influences sales market of new energy vehicles in China? Empirical study based on survey of consumers' purchase reasons. Energy Policy, 142, 111484.

[3] Yu, B. (2025). Comparison of Consumer Demand for New Energy Vehicles Between China and Foreign Countries and Adjustment of Marketing Strategies. Auto Time, (08), 160-162.

[4] Yang, W. W. (2023). Formulation and Practice of Development Strategies for New Energy Vehicle Enterprises. Automobile & Driver Maintenance (Maintenance Edition), (11), 61-63.

[5] Zhou, T. C., Cheng, J. N., Li, B. J., Wang, J. S., & Zhang, X. R. (2025). Research on the Resilience and Security of China's New Energy Vehicle Industry Chain and Supply Chain. Supply Chain Management, 6(03), 35-45. doi: 10.19868/j.cnki.gylgl.2025.03.003.

[6] Pan, Y. W., & Lai, Y. (2023). Current Status and Development Trends of New Energy Vehicle Technology. Internal Combustion Engine & Parts, (13), 103-105. doi: 10.19475/j.cnki.issn1674-957x.2023.13.023

[7] Ning, T. Y., Ouyang, H. W., Chen, J. Y., & Ouyang, X. Y. (2023). Development Status and Problems of the New Energy Vehicle Industry. Modern Transportation and Metallurgical Materials, 3(04), 47-56.