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The Operation Mode and Commercialization Journey of New Energy Ride-Hailing Vehicles

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Abstract

This study focuses on the operation mode and commercialization process of new energy ride-hailing vehicles, exploring how they can replace traditional fuel vehicles through technological and business model innovation. It analyzes the reasons why ride-hailing services serve as the optimal entry point for the commercialization of new energy vehicles and summarizes China's successful experiences. Ride-hailing services are regarded as an ideal scenario for the commercialization of new energy vehicles, which can be attributed to their high-frequency operation characteristics, significant cost differences, strict regulatory environment, and large-scale platform-based application model. Through policy guidance, market-driven forces, and technological progress, China has established a replicable development path, achieving a rapid increase in the penetration rate of new energy vehicles in the ride-hailing sector, improvement of infrastructure, maturity of business models, and accelerated promotion of autonomous driving technology, thus constructing a complete industrial ecosystem. The conclusions of this study provide theoretical support and practical references for the global promotion of new energy ride-hailing services, contributing to the sustainable transformation of the global transportation industry. In the future, with policy optimization, infrastructure improvement, reduction of autonomous driving costs, and innovation of profit models, new energy ride-hailing services will develop towards large-scale, high-efficiency, and commercialization.

Keywords

New Energy Ride-Hailing Vehicles; Operation Mode; Commercialization; Market-Driven; Sustainable Transformation

1. Introduction

Driven by the dual global imperatives of carbon neutrality and the intelligent transformation of the transportation sector, the replacement of traditional internal combustion engine vehicles (ICEVs) by new energy vehicles (NEVs) has evolved into an irreversible industrial trend. Ride-hailing, as a high-frequency and large-scale operational scenario, has emerged as a core frontier in this transitional process.

Unlike the private vehicle market, the business logic of ride-hailing is inherently dependent on operational cost optimization, service efficiency enhancement, and policy compliance—attributes that endow the integration of NEV technology with ride-hailing models with intrinsic contextual advantages. Nevertheless, the commercialization of NEV-based ride-hailing across the globe is confronted with multifaceted challenges: inadequate infrastructure, manifested in insufficient charging pile coverage and constrained grid capacity, hinders the large-scale deployment of NEVs; the prohibitive threshold of acquisition and maintenance costs renders NEVs unaffordable for drivers in low-income economies; policy restrictions in certain regions, coupled with limited market demand in niche markets, have further impeded the pace of substitution.

Against this backdrop, a pivotal question arises: how can NEVs transcend the path dependence of traditional ICEVs to achieve a structural shift in market share? This substitution constitutes not merely a technological iteration, but a systemic innovation encompassing operational models, cost structures, and ecological coordination. From the battery-vehicle separation model that mitigates the upfront purchase barrier to the hybrid transition strategy that balances operational costs with user experience, NEV-based ride-hailing has addressed the cost and environmental drawbacks of ICEVs through diversified operational innovations. A more fundamental inquiry persists: why has the ride-hailing scenario emerged as the optimal entry point for the commercialization of NEVs? The answer lies in the inherent operational characteristics of ride-hailing: the energy cost disparity amplified by high-frequency driving, the rigid constraints imposed by environmental regulations and compliance standards, and the platform-based operational framework that provides a large-scale validation context for technological application.

China, as the world's most mature market for NEV-based ride-hailing, offers paradigmatic successful experiences. From the platform-owned and operated model adopted by Caocao Mobility to the deployment of NEV fleets by Didi Premium, from the government-enterprise collaborative construction of charging pile networks to the business model innovation of battery-vehicle separation, China has achieved a rapid surge in the penetration rate of NEV-based ride-hailing through the tripartite synergy of policy guidance, market dynamics, and technological advancement. By 2025, the proportion of NEVs in China's ride-hailing fleet had approached 70%. This achievement has not only corroborated the feasibility of NEV substitution but also established a replicable commercialization pathway.

This paper centers on the operational models and commercialization path of NEV-based ride-hailing, addressing three core research questions: Through what technological and business model innovations have NEVs realized the structural replacement of traditional ICEVs? Why does the ride-hailing scenario represent the optimal entry point for NEV commercialization? What replicable successful experiences has China developed in policy design, model innovation, and ecological construction? By systematically collating typical global operational models (including platform-owned, franchise, and government-enterprise cooperation models) and analyzing the resolution pathways for core challenges, this paper aims to provide theoretical references and practical insights for the sustainable development of NEV-based ride-hailing on a global scale.

2. Literature Review

2.1. Theoretical Foundations Related to New Energy Vehicles

As a substitute for traditional fuel - powered vehicles, the technical principles and development history of new energy vehicles form an important theoretical basis for research. New energy vehicles mainly include three categories: pure electric vehicles, plug - in hybrid electric vehicles, and fuel cell vehicles. Their core technologies cover battery technology, motor drive systems, and energy management systems, etc. [1]. In terms of technical principles, pure electric vehicles store electrical energy in batteries to drive the motor, while plug - in hybrid electric vehicles combine a fuel engine with an electric drive system to achieve a more flexible way of energy utilization. In addition, fuel cell vehicles generate electrical energy through the chemical reaction between hydrogen and oxygen, which has the advantage of zero emissions. In terms of the development history, the origin of new energy vehicles can be traced back to the end of the 19th century, but their large - scale development truly began in the early 21st century. In recent years, with the global emphasis on environmental protection and sustainable development, new energy vehicle technologies have been significantly improved, especially in terms of battery energy density, charging speed, and driving range, achieving breakthrough progress[1]. These technological advancements have laid a solid foundation for the widespread application of new energy vehicles in the ride - hailing field.

2.2. Research on the Development of the Ride-Hailing Industry

As a digital-enabled urban travel service, the ride-hailing industry has gradually formed a stable theoretical basis and research framework around industrial evolution, platform operation, market regulation and social impacts. This section systematically combs the core theories and research findings supporting the development of ride-hailing, providing a theoretical reference for the subsequent analysis of new energy vehicle ride-hailing.

First, the sharing economy theory underpins the emergence and expansion of ride-hailing. By integrating idle vehicle resources and driver capacity through internet platforms, ride-hailing realizes efficient matching between supply and demand, which embodies the core logic of “access over ownership” and intensive resource utilization[1]. Under the effect of network externality, more users and drivers join the platform to further reduce transaction costs and improve service efficiency, forming a scale-driven development path unique to the ride-hailing industry[2].

Second, two-sided market theory explains the operational mechanism of ride-hailing platforms. The platform serves as an intermediary connecting passengers (demand side) and drivers (supply side), and its development relies on the interaction and positive feedback between the two sides[3]. Platforms use dynamic pricing, order matching algorithms and incentive mechanisms to balance real-time supply and demand, reduce empty mileage, and improve overall operational efficiency[4]. Relevant studies have verified that reasonable pricing and optimal scheduling can significantly enhance user utility, driver income and platform profitability[5][6].

Third, platform governance and regulatory theory provide a theoretical basis for the standardized development of the ride-hailing industry. As the industry matures, issues such as market competition, service quality, safety supervision and data security have become key research focuses[7]. Scholars have constructed game models involving governments, platforms, drivers and users to analyze the equilibrium strategies of multi-stakeholders, and put forward regulatory paths such as access management, service standardization and credit system construction[8][9]. Effective regulation helps internalize external risks and promotes the healthy and orderly evolution of the industry [10].

In addition, studies on the development history and evolutionary logic of ride-hailing show that technological innovation, policy guidance and user demand together drive the iterative upgrading of the industry[11]. From the initial disruptive innovation to standardized operation, and then to the integrated development with new energy and intelligent technologies, the ride-hailing industry continues to evolve toward low-carbon, high-efficiency and sustainable directions[12][13]. These studies lay a solid theoretical foundation for exploring the development law, existing dilemmas and optimization paths of new energy ride-hailing.

3. Operation Models of New Energy Ride-Hailing Vehicles in China

3.1. Full-Vehicle Purchase Operation Model

The full-vehicle purchase operation model refers to a scenario where drivers purchase new energy ride-hailing vehicles through either full payment or installment loans. In this model, drivers independently bear the full costs of vehicle acquisition and all life-cycle operational expenses. This model is particularly suitable for practitioners with substantial capital reserves who intend to engage in long-term ride-hailing services.

3.1.1. Full-Payment Purchase Model

Taking a new energy vehicle priced at 100,000 yuan as an example, the vehicle purchase tax was fully exempted in 2025, resulting in a total acquisition cost of approximately 100,000 yuan. However, for the year 2026, the purchase tax is set to be halved, requiring an additional tax payment of around 5,000 yuan and increasing the total acquisition cost to roughly 105,000 yuan. Key post-purchase costs include:

• Energy Cost: An average monthly electricity expense of 600–800 yuan (calculated based on 300 km/day at a rate of 0.15–0.3 yuan/km), which is only one-quarter of the energy cost for traditional gasoline vehicles.

• Maintenance Cost: An annual maintenance cost of 4,000–5,000 yuan, representing a savings of approximately 15,000 yuan compared to gasoline vehicles.

• Insurance Cost: Commercial operation insurance costs around 12,000 yuan per year, which is about 40% higher than that for private vehicles.

• Depreciation Cost: Based on an operational cycle of 8 years or 400,000 km, the annual depreciation amounts to approximately 15,000 yuan, equivalent to a monthly depreciation of 1,250 yuan.

3.1.2. Installment Loan Purchase Model

For a 100,000-yuan vehicle, the typical down payment is about 30% (30,000 yuan), with a remaining 70,000 yuan financed through a 3-year loan term, resulting in a monthly payment of approximately 2,800 yuan. The breakdown of monthly payments is as follows:

• Vehicle Loan Repayment: 2,500–3,000 yuan.

• Purchase Tax: Fully exempted in 2025; estimated at about 625 yuan per year in 2026 (after tax reduction).

• Insurance: Approximately 1,000 yuan per month.

• Maintenance: About 300 yuan per month.

• Charging: 600–800 yuan per month.

• Other Expenses: Approximately 500 yuan per month (covering parking fees, traffic fines, etc.).

3.2. Full-Vehicle Leasing Operation Model

The full-vehicle leasing operation model offers a flexible alternative for drivers with limited capital or those seeking to mitigate financial risks. Under this model, drivers avoid the large one-time upfront investment required for vehicle purchase and instead operate by leasing compliant commercial vehicles from platform companies or leasing agencies.

3.2.1. Mainstream Leasing Packages

Taking Didi as an example, the monthly rental fee for new energy ride-hailing vehicles in 2026 ranges from 3,500 to 4,000 yuan, which includes basic insurance coverage. Some platforms have introduced incentives based on order completion volume. For instance, in cities like Shenyang and Dalian, veteran drivers can receive up to 1,620 yuan in rent rebates upon lease renewal, while new drivers may enjoy a guaranteed daily income of up to 460 yuan.

3.2.2. Cost Structure of the Leasing Model

• Base Rent: 3,500–4,000 yuan/month (inclusive of insurance).
• Charging Fees: 600–800 yuan/month (30–70 yuan/day).
• Maintenance Fees: Partially included in the base rent, with certain services subject to additional charges.
• Other Expenses: Approximately 500 yuan/month (covering parking, car washing, and penalty reserves).
Guaranteed Income Policies Under the Leasing Model
During its 2026 spring recruitment campaign, Didi launched a "Basic Income Guarantee Program" covering 41 cities nationwide. Specific guarantees vary by city:
• Shenzhen: Up to 460 yuan daily guarantee (requiring 8 hours online and completion of 22 orders).
• Guangzhou: 300–450 yuan daily guarantee (requiring 6–8 hours online and completion of 18–24 orders).
• Shenyang: Up to 460 yuan daily guarantee (requiring 8 hours online and completion of 22 orders).

3.3. Hybrid Model: A Transitional Option for Cold Northern Regions

In frigid northern regions, low winter temperatures significantly reduce the driving range of new energy vehicles. Consequently, the hybrid model emerges as a practical transitional solution that balances operational efficiency and cost-effectiveness. This model retains the low energy consumption advantage of new energy vehicles while compensating for winter range limitations through its integrated fuel system.

Table 1. Cost Comparison Between Purchase and Leasing Models

Cost Item	Purchase Model (Monthly Avg.)	Leasing Model (Monthly Avg.)	Difference
Vehicle Purchase/Rent	—	3,500–4,000 yuan	—
Monthly Loan Payment	2,500–3,000 yuan	—	—
Energy Cost	600–800 yuan	600–800 yuan	0
Insurance Cost	1,000 yuan	Included in Rent	—
Maintenance Cost	300 yuan	Included in Rent	—
Depreciation Cost	2,500 yuan	—	—
Other Expenses	500 yuan	500 yuan	0
Total Monthly Cost	4,900–6,300 yuan	3,500–4,000 yuan	Purchase model is ~1,000–2,000 yuan higher

(*Example: Shenyang, a Second-Tier City).

The cost analysis indicates that the leasing model imposes significantly lower monthly cash flow pressure compared to the loan purchase model, making it more suitable for short-term trial operations or drivers with budget constraints. Conversely, the purchase model requires a higher initial capital outlay but allows for gradual cost recovery through depreciation over the long term, making it preferable for practitioners planning long-term engagement in the ride-hailing industry.

4. The Commercialization Development Path of New Energy Online Car-Hailing in China

4.1. Industry Scale and Commercialization Progress

4.1.1. Sustained Expansion of Market Scale

China's ride-hailing market has transitioned from an initial explosive growth stage to a stable development period, with the overall market scale maintaining a continuous expansion trend. Between 2020 and 2025, the industry's Gross Transaction Value (GTV) grew from approximately 300 billion yuan to 480 billion yuan, representing a Compound Annual Growth Rate (CAGR) of about 12.3%. Specifically, GTV reached 388.3 billion yuan in 2024 and further increased to 480 billion yuan in 2025. Although the growth rate has slowed slightly, the absolute scale continues to expand. This trend aligns with the growth trajectory of the user base: the number of users was approximately 383 million in 2020, and grew to 539 million by the end of 2025, accounting for 47.9% of total internet users, with a cumulative growth of about 40.7% over the five-year period.

Table 2. Data of China's ride-hailing market

Year	User Scale (100 million)	GTV (100 million yuan)	New Energy Penetration Rate (%)	Daily Average Order Volume (10,000 orders)
2020	3.83	~3000	32.1	~2740
2021	3.65	2691	40.0	~2390
2022	4.52	3190	65.0	~3300
2023	4.37	3146	75.0	~3100
2024	5.38	3883	85.0	~3500
2025	5.39	4800	92.0	~3000
2026 (Forecast)	5.80	5376	95.0+	~3300

From the perspective of order volume, the daily average order volume of the ride-hailing industry remained stable above 30 million orders in 2025, with the total annual order volume reaching approximately 11 billion orders. The leading platform DiDi Chuxing (including Huazhu Xiaozhu) recorded 18.24 billion orders in 2025, accounting for about 70% of the industry's total order volume. In terms of city distribution, the daily average order volume in first-tier cities was approximately 38.9 million orders, 12.63 million orders in second-tier cities, and 6.5 million orders in third- and fourth-tier cities, showing a distinct hierarchical distribution pattern.

4.1.2. Leapfrog Improvement in New Energy Penetration Rate

The penetration rate of new energy vehicles in the ride-hailing sector has achieved leapfrog development, rising significantly from 32.1% in 2020 to 92% in 2025, an increase of nearly 60 percentage points over five years, far exceeding the growth rate of the penetration rate in the overall new energy vehicle market during the same period. This rapid penetration is mainly driven by strong policy support, continuous optimization of the operating cost structure, and the improving charging infrastructure.

4.2. Significant Improvement in Business Model Maturity

The competitive landscape of the ride-hailing market has evolved from "one dominant player with multiple strong followers" to a diversified structure of "one dominant player + multiple strong followers + aggregator platform diversion". DiDi Chuxing (including Huazhu Xiaozhu) maintains an absolute leading position with a 70%-72% order share, covering over 90% of cities nationwide and providing full-scenario mobility services. The second-tier platforms, including T3 Chuxing (backed by central state-owned enterprises), Cao Cao Chuxing (Geely Group), Ruqi Chuxing, Xiangdao Chuxing, and Shouqi Yueche, collectively account for 20%-25% of the market share. Aggregator platforms (such as Amap, Meituan, and Baidu) operate asset-light models without directly holding fleets, capturing about 30% of traffic entry, with their platform commission rate capped at 9%. Small and medium-sized platforms hold less than 10% of the market share, mostly relying on aggregator platforms or focusing on niche segments.

The improvement in market maturity is also reflected in the diversification of platform profit models. DiDi Chuxing achieved a profit of 3.67 billion yuan in adjusted EBITA in 2025, with its core platform GTV reaching 450.8 billion yuan, a year-on-year increase of 14.8%. The platform commission mechanism has shifted from a single proportional commission to a composite model of "commission + membership + advertising + after-sales services". Currently, the commission cap for self-operated platforms has been reduced to 27%, while the cap for aggregator platforms is 9%. Additionally, through mechanisms such as "rebate incentives", the monthly average commission rate for drivers completing 50+ orders is capped at 25%, further optimizing the driver income structure.

5. Strategic Suggestions on Influencing Factors of the Development of New Energy Ride-hailing Services in China

5.1. Impact of Adjustments to Vehicle Purchase Tax Policies on the Market

Starting from January 1, 2026, the vehicle purchase tax policy for new energy vehicles will change from full exemption to a 50% reduction, which is expected to have a profound impact on the ride-hailing market. According to the new policy, new energy vehicles purchased between January 1, 2026, and December 31, 2027, will be eligible for a 50% reduction in vehicle purchase tax, with a maximum tax reduction of 15,000 yuan per new energy passenger vehicle. Taking a new energy passenger vehicle with an ex-tax price of 300,000 yuan as an example: in 2025, the purchase tax was fully exempted; after the policy adjustment in 2026, drivers will need to pay 15,000 yuan in purchase tax, representing a reduction of 15,000 yuan in net savings compared to before.

This policy adjustment has varying impacts on different price segments of ride-hailing vehicles:

• A) Vehicles priced below 300,000 yuan: Still eligible for the 50% vehicle purchase tax reduction, retaining partial policy benefits.

• B) Vehicles priced at or above 300,000 yuan: Additional taxes are required for the portion exceeding the threshold, weakening the vehicle purchase tax incentive.

From market reactions, a wave of advance car purchases emerged at the end of 2025, aimed at avoiding potential additional costs from the 2026 policy adjustment. Although this trend moderated in early 2026, in the long term, the policy adjustment will drive automakers to further optimize their product portfolios and launch more mid-to-low-priced models that align with policy guidance and ride-hailing operational needs.

5.2. Accelerated Construction of Charging Infrastructure

The construction of China's charging infrastructure is shifting from large-scale expansion to a stage of high-quality, high-efficiency, and high-compatibility development. As of February 2026, the total number of charging infrastructure units nationwide reached 21.01 million, a year-on-year increase of 47.8%. Among these, public charging facilities totaled 4.834 million units (up 28.8% year-on-year), and private charging facilities reached 16.176 million units (up 54.6% year-on-year).

From a regional layout perspective, the charging infrastructure has initially formed a nationwide network pattern of "urban area coverage, highway linear distribution, and rural point distribution", providing solid hardware support for the nationwide popularization of new energy ride-hailing vehicles. Notably, at highway service areas, the average output power of charging guns has increased to 55.86 kilowatts. During the 2026 Spring Festival travel rush, charging volume increased significantly by 44.5% year-on-year, effectively alleviating the pressure of surging charging demand during holidays.

BYD's "Flash Charge China" strategy is a prominent highlight in the charging infrastructure sector. The plan aims to build 20,000 dedicated fast charging stations by the end of 2026, of which 18,000 will be connected to DiDi's charging network, enabling efficient recharging experiences such as "5-minute quick top-up and 9-minute full charge". This strategy not only significantly eases drivers' range anxiety but also builds a broader charging service ecosystem through an open operation model compatible with all vehicle brands.

5.3. Policy Support and Commercialization Prospects of Autonomous Driving

The Chinese government has continuously strengthened policy support for autonomous driving technology, providing institutional guarantees for the commercial operation of Robotaxis (autonomous driving taxis). As of March 2026, 26 cities nationwide have been approved to carry out fully driverless commercial trials, including first-tier cities such as Beijing, Wuhan, Guangzhou, and Shenzhen. In July 2025, relevant regulatory authorities opened full commercial operation of high-level autonomous driving vehicles in Shanghai, Guangzhou, Shenzhen, Chongqing, and Hangzhou, allowing driverless vehicles to charge for services during specific periods.

From the perspective of technological maturity, China's autonomous driving industry is at a critical turning point for large-scale commercial applications. Barclays predicts that by 2030, the deployment scale of Robotaxis in China will reach 300,000 to 500,000 units, with a market penetration rate expected to reach 5%-10%. Among these, Wuhan is expected to take the lead in achieving a 30% penetration rate, while Beijing and Shanghai are projected to reach 10%, and Guangzhou and Shenzhen are forecast to hit 12%.

From a business model analysis, the unit economic model of autonomous driving taxis is close to the break-even point. Taking Pony.ai as an example, the cost of its 7th-generation Robotaxi autonomous driving kit has been significantly reduced by 70% compared to the previous generation, with the total cost of the vehicle's sensors and computing power system controlled within 150,000 yuan. The daily average operating cost per vehicle has dropped to below 300 yuan, close to its daily average net income range (338-394 yuan), laying a solid foundation for subsequent large-scale commercial operations.

6. Summary and Outlook

This paper focuses on the operation modes and commercialization paths of new energy ride-hailing vehicles, and systematically analyzes the industrial logic and practical models of new energy vehicles replacing traditional fuel vehicles in ride-hailing scenarios. Driven by global carbon neutrality targets and intelligent transportation transformation, new energy ride-hailing has become a core direction of industrial transformation by virtue of its advantages in cost, efficiency and compliance. Despite constraints in infrastructure, procurement costs and regional policies, the industry has achieved steady development through model innovation.

The study shows that ride-hailing serves as the optimal scenario for the commercialization of new energy vehicles due to high-frequency operation, obvious cost differentials, strict regulatory requirements and platform-based large-scale application. The substitution of fuel vehicles represents not only technological iteration but also systematic innovation involving operation modes, cost structures and industrial ecology. Models such as battery-vehicle separation, hybrid transition, platform self-operation and franchising effectively lower the threshold of large-scale application and ease the pressure of upfront investment and operation costs.

As the most mature new energy ride-hailing market worldwide, China has formed a replicable development path supported by policy guidance, market drivers and technological progress. The rapid growth of penetration rate, continuous improvement of infrastructure, increasingly mature business models and accelerated rollout of autonomous ride-hailing services have built a complete industrial ecosystem, providing a reference for the global development of the industry.

In the future, with policy optimization, improved charging and swapping systems, lower autonomous driving costs and innovative profit models, new energy ride-hailing will evolve toward large-scale, efficient and commercialized development. The conclusions of this paper can provide theoretical support and practical references for the global promotion of new energy ride-hailing, and boost the sustainable transformation of the global transportation industry.

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