Research on the Innovation Dimensions and Evolutionary Paths of Business Models for New Energy Vehicles

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Abstract. The global pursuit of carbon neutrality is prompting a transformative shift in the automotive industry—from product electrification to systematic innovation in business models. In the context of subsidy reductions, Chinese new energy vehicle (NEV) enterprises are encountering a "hardware profitability dilemma," necessitating breakthroughs through strategic business model innovation. This study adopts the triadic framework of "value discovery, value creation, and value capture," integrating ecosystem theory, data element theory, and service-dominant logic to construct a three-dimensional innovation model for NEV business models: ecologization, digitalization, and service orientation. Drawing on representative cases such as NIO's Battery-as-a-Service, Tesla's Full Self-Driving system, and Didi's Mobility-as-a-Service, this paper analyzes the practical pathways within each innovation dimension. The findings reveal that successful implementation of business model innovation hinges on three critical enablers: organizational capability reconstruction, institutional coordination, and cultural value reconfiguration. Currently, the industry confronts two pivotal challenges: disputes over data sovereignty and competition among infrastructure technology pathways. Looking ahead, as intelligent connectivity matures, battery recycling systems become circular, and carbon credit mechanisms deepen, the NEV industry is poised to transition from fragmented service offerings to integrated ecological collaboration. This research offers both theoretical insights and practical guidance for traditional automakers transitioning toward sustainability and emerging NEV players seeking competitive advantage, ultimately contributing to the dual objectives of carbon neutrality and high-quality industrial development.

Keywords: new energy vehicles; business model innovation; digitalization; service-oriented evolution; value capture.

1. Introduction

1.1. Background of the Study

The global energy transition and the pursuit of carbon neutrality have imposed a structural imperative on the automotive industry. By 2024, major economies worldwide had established clear timelines for achieving carbon peak and carbon neutrality. As a significant contributor to greenhouse gas emissions, the automotive sector's shift toward electrification has evolved from an "optional pathway" to an "inevitable trajectory." According to the International Energy Agency (IEA), achieving net-zero emissions by 2050 will require the global market penetration of new energy vehicles to exceed 60% by 2030[1]. This target necessitates a strategic transition in the industry—from mere product electrification to systemic business model innovation.

China's subsidy-driven policy framework catalyzed the initial breakthrough of its new energy vehicle (NEV) industry, enabling a transition from inception to scale. However, following the phased withdrawal of subsidies, many firms have encountered challenges in achieving hardware profitability. In 2023, the average gross margin for domestic NEV manufacturers stood at only 8.5%, below the 12% average observed among traditional internal combustion engine vehicle producers, with battery costs accounting for over 40% of total production expenses. Consequently, how to overcome the "selling cars without profit" dilemma through business model innovation has emerged as a central issue of shared concern for policymakers and market stakeholders alike [2].

1.2. Significance of the Study

1.2.1 Theoretical Contribution

This study integrates the "value discovery - value creation - value capture" framework of business model transformation into the context of the new energy vehicle (NEV) industry. Specifically, value discovery lies in uncovering the multi-dimensional value potential of "energy services + mobility services + data services," such as the energy regulation value enabled by V2G (Vehicle-to-Grid) technology and the data service value derived from FSD (Full Self-Driving) subscription models. Value creation is realized through the reconfiguration of resource allocation across the supply chain and cross-sectoral ecological collaboration—for instance, NIO's BaaS (Battery-as-a-Service) model redefines battery asset management, while Didi's MaaS (Mobility-as-a-Service) model integrates mobility resources. Value capture is demonstrated through the transition from "single hardware profit" to a composite profit model encompassing "hardware + services + data," as exemplified by Tesla's high-margin software services and BYD's revenue from battery recycling. By aligning this value logic with the unique characteristics of the NEV industry, this study enriches the theoretical framework of "ecological + digital + service-oriented" three-dimensional innovation and addresses the research gap concerning the evolutionary pathways of business models in this emerging sector.

1.2.2 Practical Contribution

By analyzing representative cases such as Weenergy's BaaS, Tesla's FSD, and Didi Autonomous Driving's MaaS model, this study identifies actionable pathways for organizational capability reengineering, institutional collaborative innovation, and cultural value transformation. These insights not only offer practical guidance for traditional automakers seeking to overcome the constraints of "vertical integration" and achieve supply chain openness and business unit optimization—as exemplified by BYD's "Fudi System" restructuring—but also provide replicable operational frameworks for emerging EV manufacturers aiming to integrate product philosophy with direct sales systems and establish agile organizational responses, such as XPeng Motors' digital organizational architecture. This contributes to overcoming the industry's overreliance on hardware profitability and supports the sustainable, high-quality development of the new energy vehicle sector [3].

2. Fundamental Concepts and Theoretical Frameworks

2.1. Definition of Key Concepts

2.1.1 New Energy Vehicle Business Models

This study defines it as: a "value discovery - creation - capture" system that centers on the "product - service - data" elements of new energy vehicles and achieves multi-value synergy of "energy service + travel service + data service" by reconfiguring the resource allocation mode of the industrial chain. Compared with the traditional model, its core difference lies in: shifting from "profit from single hardware" to "profit from hardware + service + data" and from "linear cooperation of industrial chain" to "cross-domain ecological collaboration".

Drawing on industry practices, business model innovation in the new energy vehicle (NEV) sector can be categorized into three key dimensions: ecological transformation, digital upgrading, and service-oriented extension.

2.2. Theoretical Foundation

2.2.1 Ecosystem Theory

This theory emphasizes the co-evolution of "participants – resources – interactive relationships," offering theoretical support for the construction of the "vehicle – energy – road – network – cloud" ecosystem in the new energy vehicle industry. For example, V2G (vehicle-to-grid) technology, through bidirectional interaction between vehicles and the power grid, transforms new energy

vehicles from "single-function energy consumers" into "distributed energy storage units," serving as a representative case of resource complementarity and value co-creation within the ecosystem [4].

2.2.2 Data Element Theory

As a novel production factor, data possesses distinctive characteristics—replicability, reusability, and diminishing marginal cost—which serve as a core driver for business model innovation in the new energy vehicle industry. Tesla's FSD (Full Self-Driving) subscription model exemplifies this mechanism by continuously collecting user driving data, such as road conditions, braking patterns, and steering decisions, to refine its algorithms. This process generates a "data accumulation – algorithm iteration – service enhancement" flywheel effect, demonstrating data's pivotal role in reshaping value capture models [5].

2.2.3 Service-Dominant Logic

This logic posits that "service is central to value creation," aligning closely with the trend of "service extension" in the new energy vehicle sector. The Mobility-as-a-Service (MaaS) model integrates services such as autonomous vehicle fleets, route optimization, and payment processing to transform "one-time purchase value" into "ongoing mobility service value," exemplifying user value co-creation under Service-Dominant Logic.

3. Dimensions of Business Model Innovation in the New Energy Vehicle Industry – A Current Analysis

3.1. Ecological Transition: Overcoming Industrial Silos through Cross-Domain Collaboration

The core of ecological transition lies in transcending the boundaries of the traditional "automobile manufacturing" domain through cross-sectoral resource integration, thereby establishing an integrated value loop encompassing "energy – transportation – recycling". This transformative approach is exemplified by three representative model types:

3.1.1 Battery-Separated Model: Professionalized Operation of Battery Assets

Represented by NIO Battery Asset Service (BaaS), a specialized battery asset management subsidiary of NIO, the value proposition of battery assets is redefined through a model that separates vehicle ownership from battery ownership, offers battery leasing, and enables usage-based payment. Under this model, consumers are no longer required to purchase batteries when buying a vehicle; instead, they pay a monthly leasing fee ranging from 980 to 1,580 yuan, thereby reducing initial costs by approximately 50,000 yuan and significantly lowering the financial barrier to vehicle ownership. Concurrently, through centralized battery management, optimized slow-charging protocols, and multi-stage utilization strategies, battery lifespan is extended from 8 to over 12 years, establishing the operational framework of a "battery bank." As of 2024, 65% of NIO's total user base has adopted the BaaS model, with the total value of managed battery assets surpassing 20 billion yuan. This demonstrates the commercial viability of shifting from traditional hardware-centric revenue models to asset-based operational strategies.

3.1.2 Energy Integration and Innovation: V2G Technology Redefining the Role of Electric Vehicles in Power Markets

V2G (Vehicle-to-Grid) technology enables bidirectional energy exchange between new energy vehicles and the power grid, allowing vehicles to charge during off-peak periods and supply electricity back to the grid during peak demand. This not only alleviates grid congestion but also generates additional revenue for vehicle owners. For example, BMW Group in Germany has partnered with State Grid Corporation of China to launch a V2G pilot project in Munich. Participants providing grid peak-shaving services receive a subsidy of 0.3 euros per kilowatt-hour, yielding an average annual income gain of approximately 1,200 euros. Concurrently, the grid leverages V2G-enabled vehicles as distributed energy storage assets, reducing operational costs associated with peak-

valley price management by 18%. This paradigm shift transforms new energy vehicles from passive "energy consumers" into active "energy regulators," thereby fostering deep integration between the automotive and power sectors [6].

3.1.3 Green Value Chain: Closed-Loop Design for the Full Battery Lifecycle

In response to the environmental challenges and resource potential associated with battery recycling, leading companies have established a closed-loop system encompassing "recycling - cascaded utilization - material regeneration." For example, BYD has implemented a technical pathway of "waste recovery - cathode material regeneration - battery reassembly," achieving a battery material recovery rate of over 95%, with nickel, cobalt, and manganese recovery rates surpassing 99%. The cost of regenerated materials is 20% lower compared to virgin materials. Furthermore, BYD repurposes end-of-life batteries for energy storage applications, such as in the Shenzhen Pingshan Energy Storage Project, thereby realizing the full lifecycle value chain from "automotive batteries → energy storage batteries → recycling and regeneration." In 2023, BYD's battery recycling business generated revenue of 3.5 billion yuan, emerging as a significant new source of profit growth [7].

3.2. Digital Transformation: Data as a Core Production Resource Reshaping Service Models and Profit Mechanisms

The digital transformation is centered on "data-driven" strategies, leveraging the accumulation and application of user and vehicle data to achieve precise user management and subscription-based service models. Specifically, this transformation is manifested through two types of innovation:

3.2.1 User Operations System: Community-Driven Engagement Fosters High-Value User Relationships

The NIO App exemplifies digital user operations, with its core logic centered on "leveraging the app as a platform to build an interactive 'user–enterprise–user' community." The app integrates three key modules: vehicle services (remote vehicle control, maintenance scheduling), social interaction (owner forums, offline events), and co-creation features (voting on vehicle configurations, submitting service improvement suggestions). As of 2024, the NIO App has accumulated over 8 million registered users, with a daily active user (DAU) rate reaching 30%. User-initiated "NIO Car Owner Clubs" span more than 100 cities globally. This community-driven operational model not only strengthens user engagement—evidenced by a 60% owner repurchase rate, significantly surpassing the industry average of 30%—but also facilitates rapid product iteration through direct user feedback, such as improvements in seat comfort based on user input, thereby establishing a closed-loop system of "user-participated innovation."

3.2.2 The Internet of Vehicles Service Ecosystem: The Subscription Model Unlocks Profit Potential

Traditional vehicle networking services have traditionally relied on hardware sales (e.g., one-time purchases for navigation upgrades), offering limited profit margins. In contrast, the subscription model leverages the "reusability and low marginal cost" attributes of data elements, breaking through these constraints through continuous service iteration. Its core logic can be systematically analyzed through the "value discovery – creation – capture" framework. At the value discovery stage, the subscription model identifies user demand for "dynamic upgrade services"—such as the need for "on-demand access and continuous optimization" of autonomous driving features during urban commutes. At the value creation stage, enterprises enhance service value through a closed-loop process of "data collection – algorithm iteration – service improvement." For example, Tesla updates its Full Self-Driving (FSD) algorithm quarterly based on user driving data, including road conditions, extreme weather responses, and complex intersection decisions. In Q2 2024, Tesla introduced features such as "automatic construction zone avoidance" and "urban congestion following optimization." BMW's "Driving Assistance Upgrade Subscription Package" similarly improves adaptive cruise control

response times for high-speed scenarios. At the value capture stage, the subscription model enables significant profitability through high gross margins. In 2023, FSD subscriptions accounted for 60% of Tesla's software revenue, with an average annual subscription fee of approximately $12,000 per user and a gross margin exceeding 70%—far surpassing the 30% margin for hardware [8]. During the same period, BMW's Driving Assistance Subscription Package reached 150,000 users, while Xpeng's "XPILOT 4.0 Subscription Service," tailored to Chinese road conditions, achieved a subscription rate of 28%—above the industry average of 18%. Furthermore, to address data security concerns and build user trust (as discussed in Chapter 5, "The Data Sovereignty Dispute"), Tesla implemented a "local data storage + tiered authorization pop-up" mechanism, allowing users to choose whether to share high-speed driving data. This approach increased the data authorization rate to 82%, laying a solid foundation for the adoption of the subscription model and validating that the "data-driven subscription model" is the core revenue driver for vehicle networking services.

3.3. Service-Oriented Expansion: Redefining the Core of the Automotive Industry — From Product-Centric Sales to Service-Driven Value Delivery

The core of service-oriented expansion lies in transforming the automobile's "tool attribute" into a "service attribute," thereby generating sustainable value through mobility services and full lifecycle management. This paradigm shift encompasses two primary strategic directions:

3.3.1 Mobility as a Service: Platform-Driven Reconfiguration of Transport Capacity and the Transformation of the Mobility Market

Didi Autonomous Driving's MaaS (Mobility as a Service) platform leverages "autonomous vehicle fleets and intelligent dispatching systems" to deliver an on-demand, driverless mobility experience. The Beijing MaaS platform exemplifies this approach by integrating multiple transportation modes—including public transit, metro, cycling, walking, and ride-hailing—into a unified ecosystem. In 2024, Didi launched pilot programs for autonomous taxis in Guangzhou and Shanghai, enabling users to book rides via its mobile application with an average wait time of just eight minutes and reducing per-kilometer costs from 2.5 yuan to 1.8 yuan. Concurrently, Didi has established a platform-based mobility capacity system through the integration of autonomous vehicles, charging infrastructure, and maintenance services. As of Q2 2024, the company's autonomous fleet comprised 1,500 vehicles, having completed over 500,000 service trips [8]. This model not only transforms user travel behavior but also accelerates the automotive industry's strategic shift from consumer-oriented (To C) sales to business-oriented (To B) mobility service provision, thereby unlocking significant new market opportunities.

3.3.2 Full Lifecycle Management: The "Vehicle Purchase with Battery Leasing and Battery Swap Network" Model in the Commercial Vehicle Sector

To address the operational characteristics of commercial vehicles—such as heavy trucks and logistics vehicles—that are "high-frequency used and highly sensitive to battery range," leading enterprises have introduced a full lifecycle solution combining "vehicle purchase with battery leasing and battery swap networks." For example, CATL has partnered with SAIC Hongyan to launch the "Jiehu H6 battery swap heavy-duty truck": users purchase the chassis without the battery, reducing initial costs by 200,000 yuan compared to traditional vehicle purchases, and lease the battery under a "pay-per-kilometer" model at 0.8 yuan per kilometer. Simultaneously, they achieve rapid energy replenishment through CATL's "heavy-duty truck battery swap stations," which require only 15 minutes per swap—2 hours faster than conventional charging. This model effectively resolves key pain points in commercial vehicle operations, including high upfront costs and slow energy replenishment. In 2023, sales of this model reached 12,000 units, capturing 40% of the domestic battery swap heavy truck market. Furthermore, enterprises generate continuous revenue through "battery leasing and battery swap services," establishing a full lifecycle profit chain encompassing "vehicle sales, service fees, and battery recycling."

4. Implementation Strategies for Business Model Innovation in New Energy Vehicles

The successful implementation of business model innovation depends on three key enablers: "organization, institutional framework, and culture." By driving capability reconfiguration, fostering collaborative innovation, and advancing value co-creation, organizations can overcome implementation barriers and realize the transition from "concept" to "practice."

4.1. Organizational Capability Reengineering: Dismantling Traditional Silos and Constructing an Innovation-Oriented Organizational Architecture

Organizational capability serves as the core enabler for business model implementation. Different types of enterprises—such as traditional automakers and startups—must reconfigure their organizational architectures and capability systems according to their inherent organizational DNA.

4.1.1 Self-Transformation of Traditional Automakers: Supply Chain Openness and Strategic Business Unit Decoupling

The establishment of BYD's "Fudi Series" represents a paradigmatic case of organizational restructuring among traditional automakers. In 2020, BYD disaggregated its core automotive businesses—including battery production, motor systems, electronic control, and vehicle manufacturing—and established independent entities such as Fudi Battery, Fudi Power, and Fudi Technology, with the strategic objective of achieving supply chain openness. On one hand, Fudi Battery has become a key supplier to global automakers such as Tesla and Toyota, generating external revenue of 8 billion yuan in 2023, which accounted for 15% of its total revenue. On the other hand, the operational independence of these business units has driven efficiency improvements through market-based competition; for instance, Fudi Power increased motor efficiency from 96% to 98%, while reducing costs by 12%. This organizational transformation model—characterized by "disaggregation, openness, and competition"—effectively dismantled thebarriers inherent in traditional automakers' "vertically integrated" structures, thereby laying a robust supply chain foundation for ecosystem-oriented transformation.

4.1.2 Organizational Gene Formation in Startups: Integrating Product Philosophy with a Direct-to-Customer Operating Model

Xpeng Motors embraces the product philosophy of "technology democratization" and has established a strategic capability framework integrating a "direct-to-consumer sales model" with a "digitally enabled organization". In product development, Xpeng emphasizes the "downward deployment of intelligent technologies"-for instance, standardizing L2+ autonomous driving features in models priced at 150,000 yuan. In 2023, the penetration rate of its intelligent configurations reached 90%, with user satisfaction for the XPILOT autonomous driving system exceeding 85%. On the channel front, the company operates a nationwide direct sales network comprising over 600 retail locations, ensuring "price consistency and service standardization", which contributed to a 92% customer satisfaction rate in the vehicle purchasing experience. From an organizational perspective, Xpeng has formed cross-functional agile development teams—uniting product, technology, and user operations—to reduce software iteration cycles from three months to one month, thereby accelerating responsiveness to user needs. This integrated triad of "product philosophy - direct sales system - agile organization" underpins Xpeng's sustained competitive advantage in the digital transformation era.

4.2. Institutional Synergistic Innovation: Policy Adaptation and Financial Instrument Linkage to Reduce Innovation Risks

Business model innovation must overcome institutional barriers—such as regulatory misalignment and fragmented standards—and alleviate financial constraints associated with capital-intensive investments, necessitating a supportive framework driven by the integration of policy coordination and financial innovation.

4.2.1 Policy Alignment: Stakeholder Coordination in the Standardization of Battery Swapping Systems

The battery swap model confronts a critical challenge stemming from "inconsistent standards among automakers"—evident in the divergent battery swap interfaces of companies such as NIO, CATL, and Geely—necessitating policy-driven standardization efforts. In 2024, the Ministry of Industry and Information Technology initiated the formation of the "New Energy Vehicle Battery Swap Standards Working Group," collaborating with automakers and battery manufacturers to develop the "General Technical Requirements for Battery Swap [6]." This document established unified specifications for battery dimensions, interface protocols, and safety standards. Concurrently, policy instruments such as "construction subsidies for battery swap stations" 500,000 yuan per station incentivized enterprises to adopt the standardized framework. By the second quarter of 2024, the national share of battery swap stations adhering to unified standards had risen from 10% to 40%, markedly improving user convenience in battery swapping. This collaborative governance model—characterized by "policy leadership and enterprise participation"—has effectively addressed the institutional barrier of "standard fragmentation," thereby laying a solid foundation for the large-scale adoption of the battery swap model.

4.2.2 Financial Instrument Innovation: Risk Mitigation in Battery Asset-Backed Securities (ABS)

Battery assets exhibit the characteristics of "high capital intensity and extended investment cycles," necessitating the use of financial instruments to alleviate capital occupation pressures. WeiLink issued "Battery Lease Asset-Backed Securities (ABS)", utilizing monthly rental payments from users as the underlying asset pool. The issuance scale reached 2 billion yuan, with the priority tranche offering an interest rate of only 3.5%—1.2 percentage points below the benchmark bank loan rate. Risk mitigation was achieved through mechanisms such as "excess spread coverage" where the value of underlying assets exceeded the issuance scale by 15% and "asset pool diversification" spanning over 100,000 users. In 2023, three tranches of this ABS were successfully issued, raising a cumulative 6 billion yuan and significantly easing the financial burden associated with battery asset investments. This financial innovation—combining asset securitization with systematic risk diversification—provides critical funding support for capital-intensive investments during the ecological transformation process.

4.3. Improvement of Concept

4.3.1 From "Tool" to "Companion": Brand Design as a Family Emotional Anchor

Li Auto positions itself as a "family technology brand," cultivating emotional bonds within households through strategic product design and service innovation. On the product side, its L series models feature standard configurations including a "six-seat layout, rear entertainment screens, and infant-safe cabin materials," effectively addressing the dual demands of "multi-person travel" and "child safety." In 2023, 75% of its customer base consisted of families with children. In terms of service, the company introduced a "Family Service Package" encompassing free vehicle washes, child safety seat rentals, and holiday road rescue services, achieving a user satisfaction rate of 94%. Regarding brand communication, initiatives such as the "Family Travel Festival" and "Parent-Child Camping Program" reinforced its positioning as a trusted "family partner." In 2023, Li Auto's Net Promoter Score (NPS) reached 80%, significantly surpassing the industry average of 50%. This cultural strategy centered on "family emotional anchor points" has fostered strong user loyalty, supporting the brand's expansion into service-oriented mobility solutions.

4.3.2 Monetization of Environmental Values: How Carbon Credit Trading Shapes Corporate Strategy

Carbon credits, functioning as a "quantifiable vehicle" for environmental value, are increasingly shaping business model innovation across enterprises. According to China's "Administrative

Measures for New Energy Vehicle Carbon Credits," new energy vehicle manufacturers are permitted to sell surplus carbon credits to traditional fuel vehicle producers, with the 2024 trading price estimated at approximately 300 yuan per credit [9]. Concurrently, companies are integrating carbon credit mechanisms into their business strategies. For example, NIO introduced its "Carbon Credit Incentive Program," under which users earn carbon credits by adopting battery swapping which reduces charging-related emissions and participating in battery recycling initiatives. These credits can be redeemed for charging services or branded merchandise. In 2023, users accumulated over 10 million carbon credits, resulting in a 20% increase in battery swapping adoption. This hybrid model of "environmental value + monetary incentives" not only enhances consumer engagement in sustainability efforts but also enables enterprises to capitalize on policy-driven benefits under the carbon neutrality agenda, thereby influencing strategic decisions—such as increased investment in battery swapping infrastructure and recycling operations.

5. Challenges and Future Outlook of Business Model Innovation in the New Energy Vehicle Industry

The current business model innovation in the new energy vehicle (NEV) industry faces two core contradictions. First, the "data sovereignty dispute" arising from digital transformation presents a significant challenge. According to a 2024 survey by the China Association of Automobile Manufacturers, 68% of users expressed concerns over the potential misuse of driving data [10]. While enterprises rely on such data to optimize services—such as Tesla's iterative FSD algorithm development—the industry lacks a unified standard for defining "data boundaries," including whether metrics like "braking frequency" and "route preference" constitute personal privacy. As a result, some companies have slowed down data-driven innovation due to compliance risks. Second, there is a strategic divergence in infrastructure development between battery swapping and ultra-fast charging technologies. Battery swapping offers rapid energy replenishment within 10–15 minutes but requires a high initial investment of approximately RMB 3 million per station. In contrast, ultra-fast charging stations are more flexible and cost-effective, with individual costing around RMB 100,000, though full charging typically takes 40–60 minutes. Divergent technology choices among automakers and energy providers have led to a 45% overlap in the coverage of domestic battery swapping and ultra-fast charging stations in 2024, resulting in resource inefficiencies and hindering the large-scale adoption of Mobility-as-a-Service (MaaS). Despite these challenges, the future outlook remains promising. With the maturation of 5G and L4-level autonomous driving technologies, MaaS is projected to account for 30% of urban mobility in China's first-tier cities by 2030, potentially replacing 15% of personal vehicle purchases. By 2025, the recycling rate of retired batteries in China is expected to reach 100%, and by 2030, battery recycling operations could contribute 15–20% of automakers' total revenue. Furthermore, by 2028, Carbon credits are anticipated to become a standard component of business models, driving the industry toward coordinated development in "low-carbonization and marketization." This evolution will ultimately enable a transition from "single-service provision" to "ecological synergy," supporting the realization of national goals for "carbon neutrality and high-quality development."

6. Conclusion

This study, through an analysis of the innovation dimensions and implementation pathways of new energy vehicle (NEV) business models, arrives at the following conclusions. The core of NEV business model innovation lies in reconstructing the "value discovery–creation–capture" chain by advancing ecological transformation, digital transformation, and service-oriented extension—thereby overcoming the traditional hardware-centric profit trap. Successful implementation hinges on three enabling levers: organizational capability reengineering to break down silos, institutional coordination and innovation to mitigate risks, and cultural value reshaping to strengthen stakeholder

identification. Current challenges—including data sovereignty disputes and competition between technological pathways—must be addressed through policy regulation and cross-industry collaboration. Looking ahead, as intelligent connectivity, battery recycling, carbon credit mechanisms, and supporting systems mature, NEV business models are poised to transition from isolated services to integrated ecological synergy, driving the industry toward the dual objectives of carbon neutrality and high-quality development.

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