Journal of Innovation and Development
ISSN: 2958-4752 | Vol. 13, No. 2, 2025

Digital Transformation and Performance in the New Energy Vehicle Industry from a Resource Orchestration Perspective: A Case Study of BYD

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Abstract: Against the backdrop of the global digitalization trend, the new energy vehicle (NEV) industry, recognized as a strategic emerging sector, has increasingly embraced digital transformation as a crucial pathway to enhance firms' core competitiveness. This study takes BYD as a representative case to examine the process and performance outcomes of digital transformation in NEV enterprises from the perspective of Resource Orchestration Theory (ROT). Specifically, the study first identifies the key driving factors behind BYD's digital transformation through an in-depth case analysis. It then explores the mechanisms through which resources are orchestrated during the transformation process. Finally, it evaluates transformation performance from both financial and non-financial dimensions. The findings reveal that effective resource orchestration significantly supports the success of digital transformation in NEV enterprises. BYD's experience provides valuable insights and practical implications for other firms in the industry seeking to design and implement their own digital transformation strategies.

Keywords: New Energy Vehicle; Resource Orchestration; Digitalization.

1. Introduction

In the process of global sustainable development, the new energy vehicle industry has become a core field for countries to implement the "dual carbon" goals. China's new energy vehicle market has achieved significant growth in recent years; its sales volume exceeded 10 million units in 2024, accounting for nearly 70% of the global market share, which highlights strong development momentum. Against this backdrop, digital transformation has become a key issue for the survival and development of new energy vehicle enterprises, and its role in optimizing the entire chain of enterprises' R&D, production, supply chain and services has become increasingly prominent. The Resource Orchestration Theory provides an important framework for analyzing the digital transformation of enterprises. This theory points out that an enterprise's ability to integrate, allocate and utilize resources is the key to converting resources into competitive advantages and performance. For new energy vehicle enterprises, how to efficiently coordinate internal and external resources such as technology, data, talents and funds during digital transformation has become a core issue to be solved urgently. As a benchmark enterprise in the global new energy vehicle industry, BYD has achieved remarkable market results. Exploring its digital transformation practice from the perspective of Resource Orchestration can not only provide a basis for BYD to optimize its transformation strategies, but also offer references for the high-quality digital development of the industry as a whole.

The target objects of resource orchestration include abstract resources and specific resources. The former covers the attention degree of senior executives, business systems and so on, while the latter includes social capital, human resources and so forth[1]. Resource orchestration plays a crucial role in bridging collaborative value creation and enterprise growth[2]. Resource orchestration exerts a positive impact on business model innovation. For entrepreneurs, effective resource orchestration can facilitate the transformation of business model innovation outcomes, thereby enhancing competitiveness and market share[3]. In the context of relatively abundant resources, entrepreneurs need to build resource utilization capabilities through resource combination, bundling, and utilization, thereby enhancing the use value of resources[4].

Digital transformation mediates the relationships between capabilities, experience, predictability, and vision, and corporate financial performance[5]. IT capabilities exert a positive impact on corporate performance through digitally-oriented development and organizational digital transformation[6]. A well-developed performance evaluation system bears significant guiding significance for reflecting the operating and development achievements of an enterprise's senior managers and facilitating the achievement of the enterprise's long-term strategic[7].

2. Case Introduction

BYD's new energy vehicles (NEVs) represent a leading enterprise among NEV manufacturers with green innovation characteristics. Compared with other NEV enterprises, it possesses leading technologies in areas such as new energy batteries. Moreover, it entered the NEV industry relatively early, so taking it as the research object is more influential and representative[8]. At the dawn of the digital era, BYD established a professional team, laying a talent foundation for its further digital transformation in subsequent phases[8].

2.1. Introduction to BYD Company

BYD Company Limited was founded in 1995 with its headquarters located in Shenzhen. In the early stage after its establishment, it fully focused on the R&D and manufacturing of rechargeable batteries as its core business. In 2003, the company officially entered the automotive industry by acquiring Qin Chuan Automobile, thus launching the dual-core business development pattern of "automotive +

battery". By 2008, BYD had fully committed itself to the new energy vehicle sector and became one of the early enterprises in China to deeply engage in this field. Adhering to the development philosophy of "Technology as the Core, Innovation as the Foundation", BYD has continuously deepened its efforts in core technology fields and successfully built an independent R&D system covering the entire industrial chain from batteries, motors and electronic controls to chips. It is the only new energy vehicle enterprise in the world that simultaneously masters the core technologies of the "three electric systems". The technologies it has launched, such as Blade Battery, CTB technology and DM-i Super Hybrid system, have driven industry innovation on multiple occasions. As of 2025, BYD has accumulated more than 59,000 patent applications worldwide, among which over 35,000 have been granted.

In terms of product layout, BYD's product matrix covers multiple categories including the Dynasty Series and the Ocean Series. In the first half of 2025, BYD's cumulative global automobile sales reached 2.146 million units, of which overseas sales exceeded 470,000 units, with a year-on-year growth of 132%. This sales volume has surpassed the total overseas sales of BYD in the entire year of 2024, and the company has ranked among the top in global sales rankings for consecutive years.

As a leader in the new energy vehicle industry, BYD not only drives the industry's transformation from "quantity growth" to "quality improvement" but also provides Chinese solutions for the global automotive industry upgrading through its practices in digitalization and intellectualization.

2.2. Development of BYD's Digital Strategy

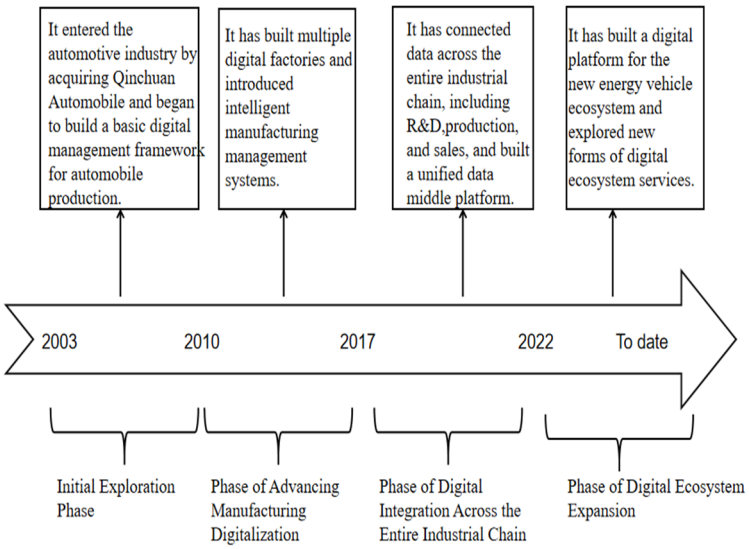


Figure 1. Timeline of BYD's Digitalization Strategy Development

As shown in Figure 1, as a leading enterprise in the new energy vehicle industry, BYD has gone through four phases in its digital strategy. When it entered the automotive manufacturing industry in 2003, BYD launched its initial exploration of digitalization: it introduced basic data collection systems in the production process, laid a digital infrastructure for production, and accumulated early practical experience. Starting from 2010, with the emergence of the new energy vehicle market, BYD accelerated the digital transformation of its manufacturing links. By introducing industrial robots and launching the e-Platform 1.0 to realize the platform-based management of the "three electric systems" (battery, motor, electronic control), it shifted its focus from "data recording" to "using data to optimize production", laying a foundation for capacity expansion. From 2017 onwards, BYD extended its digital strategy to the entire industrial chain, forming an integrated data loop covering "R&D, production, sales, services, and supply chain". Its digitalization effort upgraded from "technology application" to "model innovation", and in 2022, its new energy vehicle sales exceeded 1.8 million units. Since 2022, BYD has entered the ecological phase. It has built a digital ecosystem for new energy vehicles by opening up its technologies and conducting cross-sector cooperation. As of 2023, BYD has accumulated over 40,000 patent applications worldwide, with digital R&D investment accounting for more than 5% of total investment. Its ecosystem covers multiple fields, making it a core force in the industry's transformation.

The evolution of BYD's digital strategy is essentially a progressive process of "technology-driven, efficiency improvement, and ecosystem co-construction". From the partial optimization of the production end to the collaboration across the entire industrial chain, and then to the ecological expansion across fields, each step is closely aligned with industry demands and technological trends. This journey has not only supported its own leap from a "follower" to a "leader" but also provided a referenceable practical model for the digital transformation of the automotive manufacturing industry. Only by taking data as the core and technology as the lever can enterprises continuously create new value amid industrial changes.

2.3. The Drivers for BYD's Digital Transformation

The digital transformation of an enterprise depends on the interaction between its internal and external factors, and different combinations of the enterprise's internal and external factors may stimulate the intention of digital transformation[10].

2.3.1. Intensification of Industry Competition

Amid the digital wave sweeping across various industries, A key driver of digital transformation is the development of

digital technologies. The development of the new energy vehicle sector is deeply integrated with the digitalization process. BYD's advancement of digital transformation is an accurate response to the trends of the times. From the perspective of market competition, the industry is undergoing rapid expansion and pattern reshaping, forcing enterprises to break through challenges through digitalization. The new energy vehicle market is experiencing explosive growth. As shown in Table 1, from 2020 to 2024, the sales volume of new energy vehicles soared from 1.323 million units to 12.866 million units, achieving a nearly nine-fold increase in just five years. As a key player in the industry, BYD also saw its sales volume jump from 179,100 units in 2020 to 4.2721 million units in 2024. During the period of rapid market expansion, demands on the demand side for smarter and more personalized products continue to rise, while the supply side needs to cope with larger and more complex production and service systems. The traditional operation model has limited efficiency in links such as order processing, supply chain collaboration, and user demand response, making it difficult to adapt to changes in scale and demand. Against this backdrop, digital transformation has become an inevitable choice for BYD to keep up with the pace of industry expansion and accurately align with market needs.

Table 1. The changes in BYD's sales volume and the sales volume of new energy vehicles from 2020 to 2024

Year	2020	2021	2022	2023	2024
Sales Volume of NEVs (10,000 Units)	132.3	352.1	688.7	949.5	1286.6
Sales Volume of BYD's NEVs (10,000 Units)	17.91	59.37	186.35	302.44	427.21

From the perspective of competitive landscape, as the "pie" of the new energy vehicle market grows larger, more participants are flocking in at an accelerated pace, making competition increasingly fierce. The competitors facing BYD include global new energy vehicle giants like Tesla, which continues to strengthen its presence in the high-end market by virtue of advanced intelligent driving technologies and brand influence. There are also domestic new car-making forces: for instance, NIO breaks through with its user ecosystem and battery swap model, while X Peng focuses on intelligent cockpits and autonomous driving technologies. Additionally, there are traditional automakers transitioning to new energy, such as ORA under Great Wall, which seize market share by relying on their existing supply chain and channel resources. Behind the sales data lies the fierce competition among enterprises for technologies, efficiency, and user experience. To maintain its leading position amid this wave, BYD needs to reshape its core competitiveness through digitalization, thereby consolidating its competitive moat in the intense competition. This aligns with the industry's contemporary logic of pursuing competitiveness through digitalization. Driven by the dual impetus of explosive industry scale growth and intensified competition, digital transformation is a proactive change for BYD to adapt to the development of the times and anchor the future of the industry. It helps BYD continue to forge ahead in the tide of the new energy vehicle era, consolidate its own advantages, and open up new development prospects in the competition with Tesla, new car-making forces, and new energy brands of traditional automakers.

2.3.2. Meet the Changes in Consumer Demand

Against the backdrop of the in-depth penetration of the digital economy, the structural changes in consumer demand have become one of the core drivers for BYD's digital transformation. With the popularization of Internet technology and the expansion of application scenarios, the scale of Internet users in China has reached 1.108 billion, and the Internet penetration rate has risen to 78.6%. This nationwide digital lifestyle has profoundly reshaped the demand logic of consumers for automotive products.

From the demand perspective, the demands of contemporary consumers for new energy vehicles have gone beyond the scope of traditional transportation functions, presenting three main characteristics. First, the demand for intelligent experience is prominent. Consumers not only expect vehicles to have basic functions such as remote control and real-time vehicle condition monitoring, but also pursue personalized human-computer interaction experiences, which requires vehicles to be equipped with highly integrated intelligent connected systems. Second, the demand for full-cycle services has been upgraded.

Consumers have higher requirements for post-purchase service experiences, including convenient after-sales reservations, accurate fault diagnosis, and efficient charging network navigation, forming a full-chain service expectation covering "vehicle purchase, usage, and maintenance". Third, the demands for safety and environmental protection have been deepened. Users of new energy vehicles not only pay attention to technical guarantees such as battery safety and data privacy protection, but also attach importance to enterprises' social responsibility performance in fields such as green production and carbon footprint management, with a significant increase in attention to the "green attributes" and "safety attributes" of products.

To respond to the above-mentioned changes in demand, BYD has built a multi-dimensional demand response mechanism through digital transformation to reduce users' information acquisition costs and improve demand matching efficiency. This consumer demand-oriented digital layout is essentially a strategic choice for BYD to cope with market competition. By integrating digital technology into product R&D, service systems, and marketing links, the enterprise has been able to achieve real-time perception, rapid response, and forward-looking prediction of user demands. This not only consolidates user stickiness but also forms a differentiated advantage in the fierce competition of the new energy vehicle market, laying a foundation for its continuous leadership in the industry.

2.3.3. Strong Support from National Policies

In the course of BYD's development, policy factors have become a key external driver for promoting its digital transformation. The strong support from the state for the digital and new energy industries, through a series of policy documents and financial support, has laid a solid foundation

for BYD's transformation. As can be seen from the Table 2, BYD has continuously received government subsidies from 2020 to 2024. The government subsidy reached 1.678 billion yuan in 2020, increased to 2.263 billion yuan in 2021, decreased slightly to 1.710 billion yuan in 2022, and then rebounded again in 2023 and 2024. This subsidy fund has provided direct financial support for BYD's digital transformation, which is used in links such as the upgrading of digital production equipment and R&D investment.

Table 2. The changes in BYD's government subsidies and net profit from 2020 to 2024

Year	2020	2021	2022	2023	2024
Government Subsidies (100 million Yuan)	16.78	22.63	17.10	21.87	37.8
Net Profit (100 million Yuan)	42.34	30.45	166.22	300.41	402.54

The national policy *Development Plan for the New Energy Vehicle Industry* clearly states that it is necessary to focus on integrated innovation, make breakthroughs in key core technologies, optimize the industrial development environment, promote the high-quality and sustainable development of China's new energy vehicle industry, and contribute to building a strong automobile country. Among them, it provides directional guidance and policy expectations for the digital transformation and intelligent upgrading of new energy vehicle enterprises. At the same time, documents such as *Guiding Opinions on Deepening the Integrated Development of the New Generation of Information Technology and Manufacturing Industry* emphasize the importance of the digital transformation of the manufacturing industry and encourage enterprises to apply technologies such as big data and artificial intelligence to improve production efficiency and product quality. This is highly consistent with BYD's need to advance its new energy vehicle manufacturing toward digitalization.

Under the synergistic effect of policies such as tax incentives and additional deductions for R&D expenses, BYD has been able to free up more resources to invest in digital transformation. The sound industrial ecosystem built by policies enables BYD to not only accelerate the layout of digital infrastructure through financial subsidies on the new energy vehicle track, but also clarify the transformation path by relying on industrial planning and technology integration policies, thereby realizing the leap from the traditional manufacturing model to a digital and intelligent manufacturing system. This process not only aligns with the national strategy of coordinated development of new energy and digitalization, but also helps the enterprise consolidate its technological and production advantages in the global new energy vehicle competition and shape the core competitiveness for sustainable development.

2.3.4. Demand for Optimizing Operational Efficiency

In the fierce market competition of the new energy vehicle industry, BYD's demand for optimizing operational efficiency has become one of the core drivers for promoting its digital transformation. As a leading enterprise in the industry, BYD's business covers the entire chain including vehicle R&D, core component production, supply chain management, and terminal services. With the continuous enrichment of its product lines and the rapid expansion of its market scale, the traditional operation model has gradually exposed efficiency bottlenecks in multiple aspects, which urgently requires breaking through via digital means.

From the production perspective, the manufacturing process of new energy vehicles is complex, involving the precision production of core components such as batteries, motors, and electronic controls. Meanwhile, consumers' personalized demands for vehicle configurations and functions are increasing, which highlights the insufficient flexibility of traditional production lines. Previously, some production lines relied on manual scheduling and experience-based decision-making, which easily led to problems such as mismatched production rhythms and delayed process connections, making it difficult to maximize capacity utilization. Through digital transformation, BYD can realize visual monitoring of the entire production process by means of intelligent manufacturing systems, collect real-time equipment operation data and material flow information using the Internet of Things technology, and dynamically optimize production scheduling in combination with algorithm models. This helps reduce ineffective waiting time and improve production capacity per unit time.

In the internal management system, as the enterprise scale continues to expand, the complexity of organizational management has increased significantly, and the coordination costs across departments and regions remain high. The traditional hierarchical management model tends to cause delays in information transmission, making it difficult for user demand feedback from the market side to be quickly transmitted to the R&D and production links, which slows down the response speed of product iteration. Additionally, the resource scheduling of various production bases lacks a global optimization perspective, resulting in the idleness or over-investment of resources such as equipment and human resources. By building an integrated digital management platform, BYD can break down inter-departmental data barriers and realize the real-time interconnection of market demands, R&D progress, production data, and financial information. Management can rely on data dashboards to make agile decisions and improve the organizational response speed. Furthermore, the application of AI algorithms in scenarios such as equipment maintenance and energy consumption enable predictive maintenance to reduce fault downtime, and optimizes energy consumption configuration through energy management systems, further reducing operational costs.

3. Analysis of the Resource Orchestration and Integration Process in BYD's Digital Transformation

3.1. Construction of Resource Combination in BYD's Digital Transformation

3.1.1. BYD's Accumulation of Technological Resources

BYD has built its technological advantages through continuous R&D investment and an innovation-oriented philosophy. In 2024, its R&D investment reached 54.2 billion yuan, with a year-on-year growth of 36%, and it has maintained a high-intensity investment over the years,

demonstrating its long-term commitment to technological innovation. In the core fields of new energy vehicles, BYD mastered the three key technologies of batteries, motors, and electronic controls at an early stage. Its Blade Battery has redefined safety standards, while its motor and electronic control technologies have been continuously optimized, improving vehicle performance and energy efficiency.

Facing the intelligent transformation, BYD promotes the integration of electrification. Technologies such as the "Tian Shen Zhi Yan" (God's Eye) system have enhanced driving safety and user experience. It has established an independent R&D system in key links such as intelligent driving chips, while cooperating with enterprises like Huawei to achieve coordinated development. Massive scenario data provides support for technological iteration. In terms of charging technology, the Super e-Platform enables megawatt-level flash charging, and the planned and constructed flash charging stations reflect the long-term perspective of its energy ecosystem layout.

3.1.2. BYD's Accumulation of Human Resources

In the competition of the new energy vehicle industry, BYD's continuous innovation and development are inseparable from its full-chain human resource system. This system covers talent recruitment, cultivation, and retention, which is directly related to the enterprise's core competitiveness and long-term development. Talent recruitment is based on campus recruitment. BYD has continuously recruited fresh graduates since 1997, with a total of over 50,000 recruits in the past three years. In the 2024 campus recruitment, master's and doctoral graduates accounted for more than 67%, and R&D positions accounted for nearly 80%. Meanwhile, it attracts senior talents in the industry through social recruitment and cooperation with headhunting firms, focusing on strengthening capabilities in key technical fields.

In terms of talent cultivation, BYD has built a multi-level learning platform covering four major fields, combining online and offline methods to enhance employees' capabilities. The Postdoctoral Innovation Practice Base established in 2017 has formed a "Three Stations and Four Bases" structure. It has collaborated with 15 universities to train nearly 1,600 postdoctoral researchers, all of whom have stayed on board after completing their programs, achieving mutual improvement in industry-academia-research integration. Currently, BYD has more than 102,800 R&D personnel, who support the enterprise in making breakthroughs in a number of core technologies. It has accumulated over 48,000 patent applications, providing valuable references for talent cultivation in the industry.

3.1.3. BYD's Accumulation of Data Resources

In its digital transformation, BYD has built a data resource system covering the entire life cycle by relying on its full-industry-chain layout and scale advantages in the new energy vehicle sector. It has formed an all-scenario ecosystem through multi-dimensional data collection: tens of millions of in-service vehicles serve as a mobile data collection network, generating real-time dynamic data such as battery status, motor performance, and driving behavior. All links across the full industry chain accumulate data related to R&D, production, supply chain, and services—for instance, the whole-vehicle factory at the Xi'an base generates over 10 TB of production data per day. After expanding its business into the energy sector, BYD has integrated data from its charging network and energy storage projects with the aforementioned data, forming a "human-vehicle-energy-road-cloud" ecosystem.

Meanwhile, BYD has built an enterprise-level data middle platform to realize centralized data governance, formulated classification and grading standards, and ensured data security through encryption, privacy computing, and other technologies, laying a solid foundation for data. These data resources drive upgrades in multiple fields through value transformation: battery operation data optimizes Blade Battery technology, extending its cycle life to over 3,000 times; intelligent driving data shortens the iteration cycle of the Di Pilot algorithm, increasing the lane-keeping accuracy to over 98%; user data optimizes the Di Link system, improving the driving range by 5% to 10%, and helps establish a fault early warning mechanism that reduces the rescue rate by 40%. This "scenario-data-application" closed loop provides a practical model for the digital transformation of the manufacturing industry.

3.2. Resource Orchestration and Restructuring in Digital Transformation

3.2.1. Construction of an Intelligent Production System

The construction of BYD's intelligent production system is essentially a transformation of production resources from "decentralized utilization" to "systematic orchestration" through data connection, equipment intelligence, process reconstruction, and cross-domain collaboration. This system not only improves the resource efficiency of individual links but also enhances the enterprise's ability to respond quickly to market changes, providing core support for its capacity expansion in the new energy vehicle sector.

In terms of production data integration, BYD has deployed a full-domain data collection network, installing industrial sensors and edge computing nodes in core processes such as stamping, welding, painting, and final assembly. These devices capture real-time equipment operation parameters, material flow status, and process execution data. The data is aggregated into BYD's self-developed industrial internet platform via industrial Ethernet and 5G private networks. After processing, it forms a dynamic database covering production factors, which is deeply integrated with the Manufacturing Execution System (MES). This integration generates a key indicator dashboard that provides a data foundation for resource scheduling, converting the status of scattered resources into quantifiable and traceable digital assets. Meanwhile, BYD promotes the intelligent transformation and networked collaboration of production equipment. It has applied industrial robots on a large scale in core production lines. The equipment management system establishes a fault early warning model by collecting equipment data, and realizes the optimized allocation of production resources in the temporal and spatial dimensions through equipment collaboration.

At the level of intelligent management and control of production processes, BYD has introduced an intelligent scheduling system based on digital twins. This system converts factors such as order demands, material inventory, and equipment capacity into digital models, and generates optimal production plans through genetic algorithms and simulation. It can dynamically adjust plans based on real-time data, enabling flexible mixed-model scheduling of multiple vehicle types in new energy vehicle whole-vehicle production. As a result, the model changeover time has been significantly reduced, and the production line utilization rate has been

increased to 92%—a change that promotes the transformation of production resources from "static allocation" to "dynamic response."

In terms of supply chain and production collaboration, BYD has built an intelligent linkage mechanism between production and supply chain. It enables data interconnection between the intelligent production system and the supply chain management platform, realizing dynamic matching of raw material supply, work-in-progress flow, and finished product output. Based on production progress and material consumption data, the system automatically triggers replenishment orders, optimizes suppliers' delivery cycles and material reserve quantities, and enables linkage response between supply chain resources and production resources, thereby improving the resource collaboration efficiency of the entire production chain.

3.2.2. Construction of a Digital Management Platform

In its digital transformation, BYD's practice of building a digital management platform relies on multi-dimensional collaboration across processes, technologies, and security. It consistently centers on the core goal of efficient resource integration and dynamic allocation. Through a series of systematic measures, the platform is enabled to provide strong support for the enterprise's end-to-end operations.

In terms of business process collaboration, BYD has promoted the digital transformation of process management and introduced a full-process automation platform to achieve the connection and standardization of business links. It has integrated processes such as R&D project management, production scheduling, procurement approval, and finished product inspection into the digital system, enabling seamless connection of cross-departmental business and reducing resource idleness caused by process breakpoints. In this process, the platform is deeply integrated with the enterprise's organizational structure and post responsibility system. It automatically assigns task permissions based on business logic and promotes the dynamic flow of resources along with business processes, thereby improving collaboration efficiency.

At the system architecture level, BYD has built an elastic platform using microservice architecture and cloud-native technologies. It decomposes the management system into independent service units such as finance, human resources, and supply chain, and realizes data interaction through standardized interfaces—this ensures the professional operation of business and facilitates on-demand scaling. Combined with containerization technologies and orchestration tools, the platform can automatically adjust computing power allocation according to business peaks, optimizing resource utilization efficiency. Meanwhile, BYD adopts a zero-trust security model, achieving end-to-end monitoring through multi-factor authentication, dynamic permission adjustment, and API gateway protection. It introduces block chain evidence storage for supply chain and production quality data in key scenarios, supplemented by a network micro-segmentation strategy, thereby providing a secure and trustworthy environment for resource orchestration.

3.3. Optimal Utilization of Resources in Digital Transformation

3.3.1. Leveraging Resources to Expand Business Scope

From the perspective of resource orchestration, BYD's digital transformation practices demonstrate a systematic ability to leverage both internal and external resources. Based on this capability, it has achieved effective expansion of its business scope. The core path of this process is reflected in optimizing the acquisition, integration, and restructuring of resources through digital tools, thereby forming a dynamic alignment between resources and business operations.

At the resource acquisition level, BYD has built a digital R&D platform covering the entire business chain. It integrates R&D data and technical modules across multiple fields, and relies on big data analysis and simulation technologies to achieve rapid calling and reuse of cross-domain technical resources. The digital models developed for the core three-electric system of its new energy vehicles have been applied to the development of energy storage products, shortening the technical accumulation cycle of the energy storage business. By means of digital tools, BYD has transformed its existing automotive R&D resources into cross-business reusable resources, expanding the boundary of resource acquisition. At the resource integration dimension, BYD has promoted the digital upgrading of its intelligent manufacturing system. It has connected production bases nationwide, suppliers, and terminal service networks into an organic whole by virtue of its industrial internet platform. In the production link, it uses IoT technology for real-time monitoring and adjustment to flexibly allocate production capacity; in the supply chain link, it links upstream and downstream through data analysis to optimize inventory and logistics routes. This has realized the collaborative utilization of production and supply chain resources across multiple business scenarios.

From the perspective of the connection between resource restructuring and business extension, BYD has used digital tools to break down the resource barriers of traditional businesses. The internet-of-vehicles platform and data analysis capabilities formed through its intelligent connected technology R&D have been extended to the development of intelligent dispatching systems for urban rail transit business, endowing the transportation system with digital capabilities for vehicle-road collaboration and intelligent operation and maintenance. In the energy sector, the digital battery management system accumulated based on automotive power battery technology has been restructured and applied to the energy management of energy storage power stations, improving the safety and efficiency of energy storage systems. This cross-business restructuring has promoted BYD's transformation from a pure automobile manufacturer to an integrated service provider covering "vehicle manufacturing + new energy solutions + intelligent transportation" realizing the systematic expansion of its business scope.

3.3.2. Promoting Green, Low-Carbon, and High-Quality Development

Against the backdrop of the in-depth integration of the global green and low-carbon transition and the digital wave, BYD has achieved systematic optimization of resource acquisition, integration, and utilization through digital tools. This not only realizes the low-carbonization of the enterprise's own operations but also promotes the green and high-quality development of the new energy vehicle industry.

In terms of strengthening the precise alignment between green technologies and energy resources, BYD has built a digital supply chain management platform to dynamically monitor and evaluate upstream raw material suppliers. It focuses on selecting partners with green production qualifications to ensure the low-carbonization of key resources such as battery raw materials and chips during the

mining and processing stages. Meanwhile, BYD has constructed a global energy resource database using big data analysis technology, which tracks the distribution and supply of renewable energy sources such as photovoltaic power and wind power in real time. This database provides precise decision support for the energy supply of new energy vehicle production bases and energy storage projects, helping replace traditional fossil energy in the production process.

In the construction of a green collaborative system across the entire industry chain, BYD has leveraged industrial internet technology to build smart factories in the manufacturing link. It uses digital twin technology to conduct virtual simulation and optimization of the entire vehicle production process, enabling real-time monitoring and dynamic adjustment of energy consumption of production equipment, which effectively reduces carbon emissions per unit of product. For core components of new energy vehicles such as power batteries and drive motors, BYD has built a digital traceability system that integrates the full life cycle data from raw material procurement and manufacturing to recycling. This ensures the unification of green standards across all links of the industry chain. Meanwhile, BYD connects distributors and users through a digital platform, collects and analyzes the usage data of new energy vehicles, and provides users with energy management suggestions to promote low-carbonization in the vehicle usage link. This forms a green development pattern with collaboration between upstream and downstream of the industry chain.

To enhance the transformation and recycling efficiency of green technologies, BYD has accelerated the R&D and transformation process of green technologies by leveraging big data and artificial intelligence (AI) technologies. In the field of battery technology, it optimizes battery material formulas and structural designs through digital simulation experiments to improve battery energy density and cycle life, while reducing resource consumption in battery production. Meanwhile, BYD has built a digital management platform for power battery recycling and utilization. This platform enables accurate tracking of the flow and status of retired batteries, optimizes the layout of the recycling network, improves the recycling rate of battery materials, and thus realizes resource recycling.

4. Performance Analysis of BYD's Digital Transformation from the Perspective of Resource Orchestration

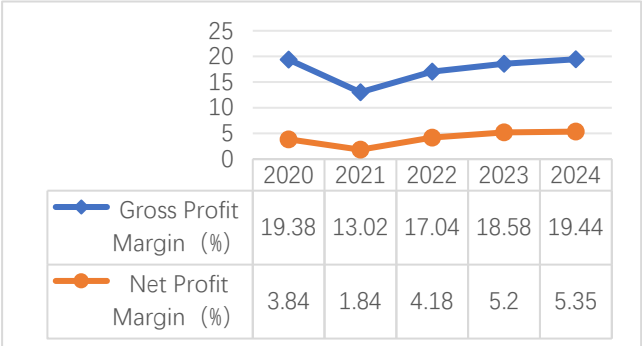
4.1. Financial Performance Analysis of BYD's Digital Transformation

There is a significant positive correlation between digital transformation and corporate performance, agile capabilities, and innovation capabilities[11]. Digital transformation can effectively promote the improvement of corporate performance and ambidextrous innovation level[12].

4.1.1. Profitability Analysis

Based on the financial data from 2020 to 2024, BYD's profitability during its digital transformation has shown a distinct "first decline and then rise" trend. The indicator decline in 2021 is a phased characteristic of the early transformation stage. However, the continuous recovery and subsequent surpassing of previous levels of various indicators since 2022 have confirmed the substantial effects of digital transformation in aspects such as cost control, efficiency improvement, and asset operation, laying a solid foundation for the sustainable growth of the enterprise's profitability.

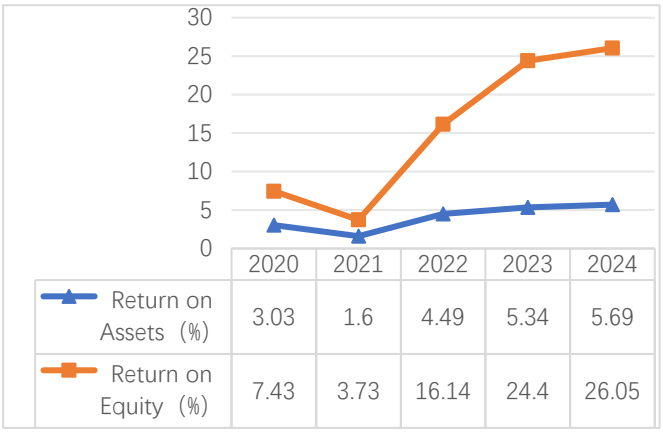
Gross profit margin reflects the core profitability of products. As shown in Figure 3, it stood at 19.38% in 2020, and dropped to 13.02% in 2021 due to the concentrated release of early-stage costs such as intelligent transformation of production lines and construction of data systems during the initial phase of digital transformation. It gradually recovered from 2022, reaching 19.44% in 2024, which exceeded the 2020 level. This is attributed to the intelligent production system enhancing supply chain collaboration, which increased the turnover efficiency of raw material inventory by more than 30%, and big data analysis helping raise the proportion of high-gross-profit vehicle models from 35% in 2021 to 62% in 2024. Net profit margin reflects the final profitability level. It was 3.84% in 2020, and fell to 1.84% in 2021, affected by the decline in gross profit margin and the year-on-year increases of 45% and 38% in R&D expenses and management expenses respectively during the transformation period. It continued to recover after 2022, reaching 5.35% in 2024. This stems from the ERP system integrating data, which reduced the management expense ratio from 8.2% in 2021 to 5.7% in 2024, and AI algorithms optimizing marketing investment, which decreased the sales expense ratio by 2.1 percentage points. The "cost reduction" from expense control and "revenue growth" from business expansion have jointly driven its improvement.



	2020	2021	2022	2023	2024
Gross Profit Margin (%)	19.38	13.02	17.04	18.58	19.44
Net Profit Margin (%)	3.84	1.84	4.18	5.2	5.35

Figure 2. The changes in BYD's gross profit margin and net profit margin from 2020 to 2024

As shown in Figure 3, return on Assets (ROA) and Return on Equity (ROE) reflect profitability from the perspective of asset operation. In 2021, ROA dropped from 3.03% in 2020 to 1.6%, and ROE fell from 7.43% to 3.73%. This was mainly due to the increase in fixed asset investment during the transformation period, while the release of production capacity had a lag, leading to a short-term decline in asset turnover efficiency. Starting from 2022, both indicators continued to rise: in 2024, ROA reached 5.69%, an increase of 255.6% compared with 2021; ROE reached 26.05%, a growth of 600.8% from 2021. Behind this is the in-depth empowerment of digitalization on asset operation: the Manufacturing Execution System (MES) increased the utilization rate of production equipment from 65% to 92%, significantly improving the turnover efficiency of fixed assets; the digital risk control model was used to optimize the capital structure, keeping the asset-liability ratio within a reasonable range, which amplified the return effect of profits on net assets. Ultimately, this achieved a leapfrog growth in the profit-generating capacity of assets.



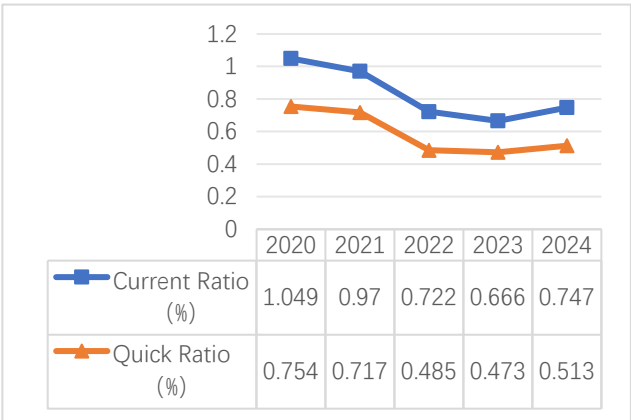
	2020	2021	2022	2023	2024
Return on Assets (%)	3.03	1.6	4.49	5.34	5.69
Return on Equity (%)	7.43	3.73	16.14	24.4	26.05

Figure 3. The changes in BYD's return on total assets and return on net assets from 2020 to 2024

4.1.2. Solvency Analysis

Based on the financial indicators from 2020 to 2024, BYD's solvency during its digital transformation has shown a phased fluctuation characteristic. Its short-term solvency has remained relatively weak, while the risk of long-term solvency intensified during the peak period of transformation investment, and slightly eased in 2024 as the effects of transformation were gradually released. This characteristic conforms to the general law of "high investment - gradual output" for enterprises in the transformation period. Specifically, the capital occupation in the early stage increases the debt-servicing pressure, while the improvement of operational efficiency in the later stage gradually enhances the solvency.

BYD has consistently shown insufficient resilience in short-term debt-servicing. The current ratio and quick ratio are important indicators for observing this capability, and both reflect the extent to which the company's current assets can cover current liabilities. As shown in Figure 4, from the specific data, the current ratio stood at 1.049 in 2020, dropped slightly to 0.97 in 2021, continued to decline from 2022 to 2023, and only rose slightly to 0.747 in 2024. The values in these years have all been below 1.5, indicating that current assets are insufficient to cover current liabilities, and the company faces considerable pressure in repaying short-term debts. Turning to the quick ratio, this ratio has remained below 1. This indicates that after excluding inventory, the ability of quick assets to cover current liabilities becomes weaker, and the risk associated with short-term solvency in terms of "immediacy" is quite prominent. The occurrence of this situation is closely related to the substantial capital investment in the initial stage of digital transformation. Activities such as technological research and development, the construction of digital systems, and the procurement of intelligent equipment all require large amounts of capital. These investments not only occupy current assets but also convert part of them into long-term assets, which inevitably lowers the indicators related to short-term solvency.



	2020	2021	2022	2023	2024
Current Ratio (%)	1.049	0.97	0.722	0.666	0.747
Quick Ratio (%)	0.754	0.717	0.485	0.473	0.513

Figure 4. The changes in BYD's current ratio and quick ratio from 2020 to 2024

In terms of long-term debt-servicing, BYD's risk has shown a trend of first increasing and then decreasing, but it

remains at a relatively high level overall. The asset-liability ratio and equity ratio are key indicators for measuring long-term debt-servicing capacity. The asset-liability ratio reflects the proportion of liabilities in total assets, while the equity ratio indicates the degree of protection that shareholders' equity provides to creditors.

As shown in Table 3, the asset-liability ratio was 67.94% in 2020, dropped to 64.76% in 2021, rose significantly from 2022 to 2023, and fell back to 74.64% in 2024. After 2022, this ratio has remained above 75%, indicating that liabilities account for a high proportion of the company's assets and the company faces considerable long-term debt-servicing pressure.

The equity ratio was 2.119 in 2020, 1.837 in 2021, increased to 3.068 and 3.516 in 2022 and 2023 respectively, and decreased to 2.943 in 2024. A higher value of this indicator means weaker protection of shareholders' equity for creditors. The equity ratio reached its peak in 2023; although it decreased in 2024, it was still higher than that in 2021. This shows that the potential risks of long-term debt-servicing have eased but not been fundamentally resolved.

This situation is directly related to the capital demand during the digital transformation period. Large-scale financing in the transformation stage increased the scale of liabilities, which in turn led to the rise of the asset-liability ratio and equity ratio. The decline of the relevant indicators in 2024 is due to the transformation driving revenue growth, which promoted asset expansion, and the optimization of the debt structure at the same time.

Table 3. The changes in BYD's asset-liability ratio and debt-to-equity ratio from 2020 to 2024

	2020	2021	2022	2023	2024
Asset-Liability Ratio (%)	67.94	64.76	75.42	77.86	74.64
Equity Ratio(%)	2.119	1.837	3.068	3.516	2.943

4.1.3. Operating Capacity Analysis

During its digital transformation, BYD has continuously improved its operating capacity through the refined and data-driven management of inventory, accounts receivable, and overall assets. This has laid a solid foundation for the company's business expansion and performance growth, and the specific situation can be analyzed from three dimensions: inventory turnover, accounts receivable turnover, and total asset turnover, this is specifically shown in Figure 5.

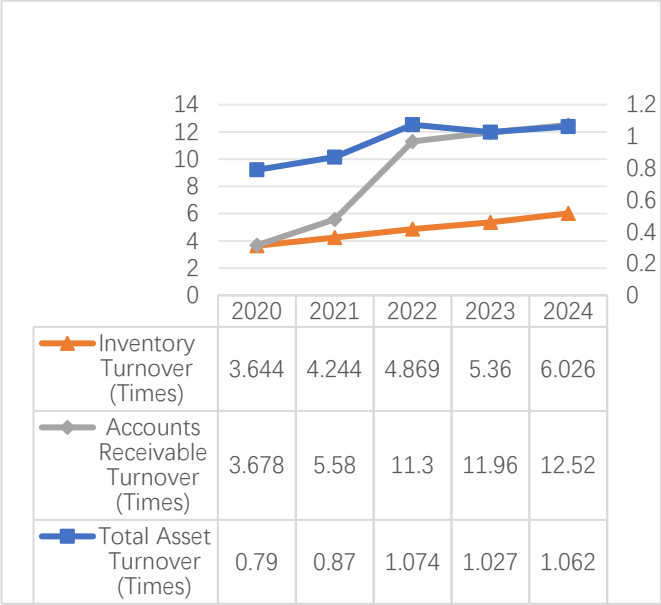


Figure 5. The changes in inventory turnover rate, accounts receivable turnover and total asset turnover rate from 2020 to 2024

In terms of inventory management, the inventory turnover (times) has continuously increased from 3.644 times in 2020 to 6.026 times in 2024. Digital transformation has played a key role in this process. By building an intelligent inventory management system, BYD has realized the real-time capture and analysis of data throughout the entire chain of production, procurement, and sales. This system not only enables accurate prediction of market demand to adjust production plans, but also dynamically monitors inventory levels to reduce overstock. It has shortened the cycle from inventory warehousing to sales, directly promoting the improvement of inventory turnover efficiency.

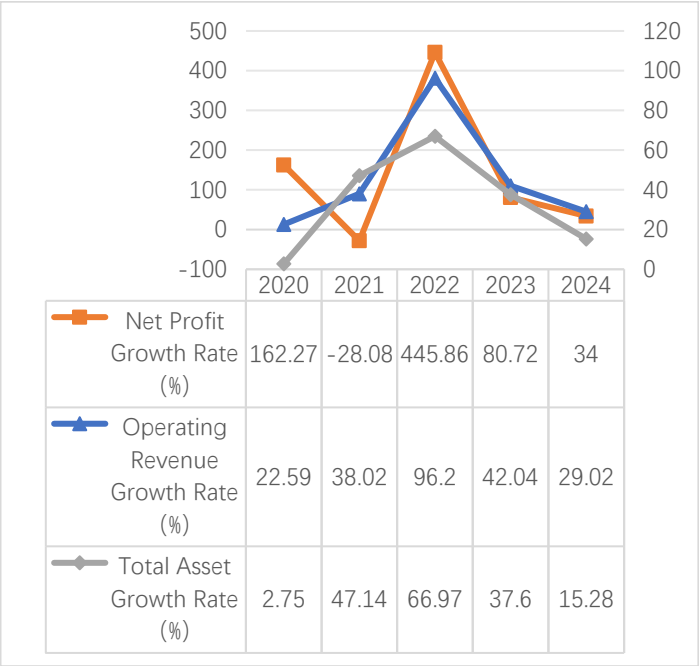
The improvement in accounts receivable turnover efficiency is even more notable. This indicator increased from 3.678 times in 2020 to 12.52 times in 2024, with leapfrog growth achieved between 2020 and 2022.This is attributed to BYD establishing a customer credit rating model through its digital platform. By integrating information such as customers' historical transaction data and repayment records, the company accurately assesses customer credit risks, thereby reducing the risk of bad debts at the source. Meanwhile, the online reconciliation, invoicing, and payment collection systems have simplified processes and shortened the cycle of fund recovery, 787 significantly accelerating the speed of capital withdrawal.

The performance of total asset turnover is also noteworthy, fluctuating upward from 0.79 times in 2020 to 1.062 times in 2024. This indicator reflects that the utilization efficiency of the enterprise's overall assets has been optimized during the digital transformation. Digital means have not only improved the turnover efficiency of inventory and accounts receivable, but also optimized the allocation of various types of assets such as fixed assets and current assets through intelligent production systems and supply chain collaboration platforms.

4.1.4. Development Capacity Analysis

Through phased resource input and benefit release, BYD's digital transformation has promoted the dynamic upgrading

of its development capacity. From cost pressure in the initial stage to benefit surge in the middle stage, and then to steady growth in the later stage, the changes in the growth rates of net profit, operating revenue, and total assets collectively confirm the positive role of digital transformation in the company's scale expansion, profit improvement, and resource allocation optimization.



	2020	2021	2022	2023	2024
Net Profit Growth Rate (%)	162.27	-28.08	445.86	80.72	34
Operating Revenue Growth Rate (%)	22.59	38.02	96.2	42.04	29.02
Total Asset Growth Rate (%)	2.75	47.14	66.97	37.6	15.28

Figure 6. The changes in net profit growth rate, operating revenue growth rate and total asset growth rate from 2020 to 2024

As shown in Figure 6, BYD's net profit growth rate reached 162.27% in 2020, turned to -28.08% in 2021, soared to 445.86% in 2022, and then gradually fell back to 80.72% and 34% in the following two years. This fluctuation is closely related to the progress of digital transformation. In 2021, during the initial stage of transformation, large-scale investments were made, including the construction of digital systems, the purchase of intelligent equipment, and the expansion of R&D teams. The short-term surge in costs led to a decline in profits. In 2022, the effects of transformation emerged concentratedly; the improvement in production efficiency and the optimization of operating costs directly drove a sharp increase in profits. The slowdown in growth rate from 2023 to 2024 indicates that the transformation has entered a stable period, where input and output tend to be balanced, and profit growth has returned to a normal state.

BYD's operating revenue growth rate has remained positive, rising from 22.59% in 2020 to 96.2% in 2022, and then decreasing to 42.04% and 29.02% in 2023 and 2024 respectively. This reflects the significant role of digital transformation in promoting market expansion. Digital marketing and the expansion of online channels have driven the rapid growth of revenue scale. The high growth in 2022 benefited from the improvement in product competitiveness after transformation; digital R&D has shortened the iteration cycle of new products, making them more in line with market demand. The slowdown in growth rate after 2023 is a reasonable adjustment under a high base, and the growth rate still remains higher than the levels in 2020-2021. This indicates that the driving effect of digitalization on operating revenue remains effective.

Changes in BYD's total asset growth rate reflect the pace of asset scale expansion during its digital transformation. The rapid growth from 2021 to 2022 mainly stemmed from fixed asset investment and intangible asset accumulation required for the transformation, and the expansion of asset scale provided hardware support for the digital transformation. The slowdown in growth rate after 2023 indicates that the investment in core resources required for the transformation has been basically completed, and the asset scale has entered a stage of steady growth. At this stage, the efficiency of resource utilization has become the focus, rather than simply pursuing scale expansion.

4.2. Analysis of BYD's Non-Financial Performance in Digital Transformation

4.2.1. Promote R&D Innovation

As shown in Figure 7, from 2020 to 2024, BYD's R&D investment increased from 8.556 billion yuan to 54.2 billion yuan, with a cumulative growth of more than 5 times over five years. This is directly related to the enhanced resource integration capability brought by digital transformation. Digital tools have helped identify demands accurately, optimize resource allocation, and improve the efficiency of R&D scale expansion, thereby driving explosive growth in the number of R&D patents. As of December 31, 2024, the cumulative number of patent applications reached 59,000, and 35,000 patents have been granted; the number of newly granted patents in 2024 far exceeded that of previous years. During the same period, although the proportion of R&D investment in operating revenue fluctuated slightly, it remained above 4.7%, and reached 6.63% in 2023—the highest in five years. This indicates that while digital transformation drives revenue growth, R&D innovation remains a core strategic direction. Moreover, the improvement in operational efficiency brought by digital transformation has freed up more profit space for the company, enabling it to ensure the strategic priority of R&D investment while expanding business scale and promoting the continuous output of innovative achievements.

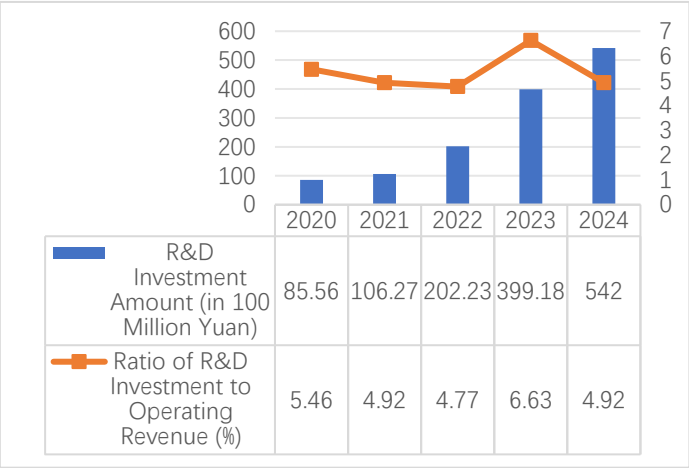


Figure 7. The changes in R&D investment from 2020 to 2024

In summary, the continuous growth of R&D investment and its stable high proportion directly reflect that digital transformation has provided stronger support for BYD's R&D innovation by optimizing resource allocation and improving operational efficiency. The abundant and high-quality R&D patent achievements, ranging from technological breakthroughs to product applications, comprehensively demonstrate BYD's strong R&D innovation capability during digital transformation and serve as core evidence for the improvement of R&D innovation capability in its non-financial performance.

4.2.2. Increase Market Share

As shown in Figure 8, based on market data from 2020 to 2024, BYD's market share showed a continuous and significant growth trend during its digital transformation. The improvement of this non-financial performance indicator is closely related to the enhancements in production efficiency, product competitiveness, and market responsiveness brought about by digital transformation.

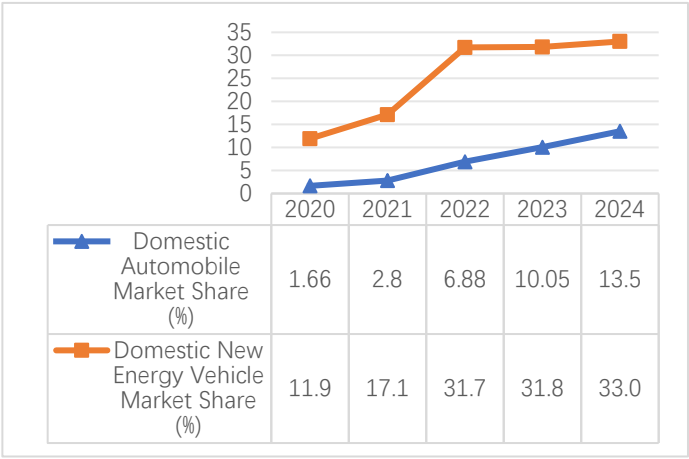


Figure 8. The changes in the domestic automotive market from 2020 to 2024

In the overall domestic automobile market, BYD's market share steadily increased from 1.66% in 2020 to 13.5% in 2024. Behind this growth, digital transformation has played a key role. By building an intelligent manufacturing system, BYD has realized the digital management and control of production processes. The efficiency of the entire chain, from parts procurement to vehicle assembly, has been significantly improved, enabling the company to respond more flexibly to fluctuations in market demand and ensure the stable supply of products. At the same time, the digitally driven R&D system has accelerated the iteration speed of new vehicles, making its products more in line with consumers' demands for intelligent connectivity, battery range, and other aspects. This has allowed BYD to capture a larger share in the fierce market competition.

In the new energy vehicle (NEV) segmented market, BYD's performance is even more prominent, with its market share increasing from 11.9% in 2020 to 33.0% in 2024. The year 2022 marked an obvious leap point, as the market share rose from 17.1% in 2021 to 31.7%, and maintained steady growth thereafter. This is directly related to BYD's in-depth digital development in the new energy field. The digital management of its battery production process ensures the stable mass production and quality control of core technologies such as blade batteries, enhancing the core competitiveness of its products. The improvement of the digital marketing system enables precise targeting of the target group through user behavior data analysis, strengthening user stickiness. In addition, the digital collaboration of the supply chain allows BYD to adjust its strategies more quickly in response to market changes such as fluctuations in battery raw material prices. This ensures the continuous supply and price competitiveness of NEVs, thereby consolidating and expanding its leading position in the NEV market. Digital transformation deeply integrates enterprise strategies into the Internet and digital technologies,

thereby promoting the innovative transformation of business models.

5. Conclusion and Outlook

Taking BYD as the research object, this paper adopts the perspective of resource orchestration to systematically analyze the internal logic and performance of digital transformation in new energy vehicle enterprises. Through a hierarchical analysis of the motivations for its digital transformation, the resource orchestration process, and the transformation performance, this paper clearly demonstrates the complete path of BYD in its digital transformation process: it builds a basic resource portfolio through the continuous accumulation of technology, talent, and data resources, and then realizes the maximization of resource value by relying on dynamic reorganization and optimized allocation. Ultimately, significant results have been achieved in terms of both financial performance and non-financial performance.

From a theoretical perspective, this study verifies the applicability of the resource orchestration theory in the context of digital transformation through a specific case. This is particularly true in the new energy vehicle industry, which is technology-intensive and highly dynamic. The study enriches the cross-application of the resource orchestration theory and research on enterprise digital transformation, and provides practical evidence for understanding the resource-driven mechanism of digital transformation in emerging industries.

From a practical perspective, BYD's case provides useful references for new energy vehicle enterprises to promote digital transformation. Enterprises need to attach importance to the forward-looking layout of technological resources, the professional development of talent teams, and the in-depth exploration of the same time, enterprises need to establish a dynamic mechanism for resource reorganization and optimization, and adjust the direction of resource allocation in a timely manner according to market demands, policy guidelines, and technological changes. This helps to improve the efficiency and effectiveness of digital transformation and ultimately achieve an all-round improvement in performance assets, and lay the foundation for transformation through the scientific construction of resource portfolios.

Acknowledgments

The authors are grateful to the editors and anonymous reviewers for their insightful comments which have leading to an improved version of this paper. This work was supported by Yi bin Federation of Social Sciences (No. YB25ND036), the System Science and Enterprise Development Research Center Project (No. Xq21B07), and Sichuan University of Science & Engineering Postgraduate Educational Reform Project (Nos.JG202407, JG202409).

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