

The impact of digital transformation on BYD

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Abstract. In recent years, the digital economy has been booming, and digital transformation has become an important development model for enterprises. In the automotive field, BYD's digital transformation has been advancing steadily. Through various channels and strategies, it has achieved the efficient construction of a new management data governance system. This article uses case analysis to analyze the problems encountered in BYD's digital transformation process and its problem-solving ideas, and explores the possible future development paths of BYD. Thus, six advantages of BYD after its digital transformation are concluded: improving the operational efficiency of the enterprise, optimizing products and services, enhancing the enterprise's competitiveness, promoting the coordinated development of the industry, achieving mutual assistance and interconnection within the industry, and facilitating sustainable development. Moreover, the transition from electrification to intelligence is also an important turning point for BYD's future development. It is necessary to actively seek transformation approaches based on the industry characteristics and resource conditions of the automotive manufacturing industry, and formulate a digital transformation strategic plan suitable for the long-term development of the enterprise, so as to achieve the digital and intelligent transformation of the value chain.

Keywords: digital transformation, new energy, efficiency, brand effect, development

1. Introduction

In today's society, under the dual pressure of geopolitical issues dominated by the West and technological blockade, market development is greatly restricted, and high-end manufacturing and technology enterprises are facing difficulties. China's economic structure has continuous contradictions, the upgrading of the supply structure lags behind, consumer demand remains weak, and enterprises are implementing digital transformation to adapt to the new economic environment. BYD borrowed from its battery production methods in new energy vehicle production, adopting a strategy of combining imitation and innovation to reduce costs in the automotive design process. It applied the cost-leadership strategy in financial management, assembling stable-performing, reliable, and high-quality vehicle products with cost-effective components, achieving a successful digital transformation, and reaping both sales volume and reputation. This article explores the development significance of BYD and its feasible future paths through cases and data analysis.

2. Introduction to BYD company

BYD Company was established in February 1992. In its early days, it mainly focused on battery production and supply. In 2003, it entered the automotive industry, and in 2010, it officially started electric vehicle production. On February 17, 2022, BYD announced the renewal and upgrade of its brand. In March, BYD announced a cooperation with NVIDIA, an artificial intelligence computing manufacturer, in intelligent driving technology, kicking off the upsurge of digital transformation. On January 2, 2024, BYD surpassed Tesla in the fourth quarter of 2023 and became the world's largest pure electric vehicle manufacturer.

3. Digital transformation

There are different interpretations from various parties on how enterprises should carry out digital transformation. Shu Zixian believes that it is to reshape the business model using advanced digital technologies and achieve comprehensive digital management, including R&D digitization, production digitization, management digitization, and marketing digitization [1].

4. The impact of digital transformation on BYD

4.1. R&D investment and the proportion of artificial intelligence

BYD's investment in R&D has been increasing steadily. According to incomplete statistics in the past five years, BYD's R&D investment has been growing steadily, and the proportion of artificial intelligence has also been increasing steadily, approaching 50%.

Table 1. BYD's R&D investment and the proportion of artificial intelligence in recent five years

	2020	2021	2022	2023	2024 (Prediction)
R&D Investment	85	106.27	186.5	395.75	450
Artificial Intelligence	10%-15%	15%-20%	20%-25%	30%-35%	35%-40%

From 2018-2020, the R&D investment remained at around 8.5 billion yuan. At that time, BYD had already made some arrangements in intelligent networking and other fields, but the overall investment in intelligence had not yet exploded. Therefore, the investment in artificial intelligence technology and other aspects accounted for a relatively small proportion of the total R&D investment, probably around 10%-15%. In 2021, the total R&D investment reached 10.627 billion yuan. In this year, BYD launched the new e-platform 3.0 and other projects, and the proportion of emerging technology projects increased. The investment in software and intelligence increased. It is speculated that the investment in R&D tools, software, artificial intelligence technology, etc. accounted for about 15%-20% of the total R&D investment. In 2022, the R&D investment was 18.65 billion yuan. BYD launched the DiLink intelligent vehicle-machine system and made some progress in intelligent cockpit software. The investment proportion in R&D tools, software, artificial intelligence technology, etc., may have increased to about 20%-25%. In 2023, the R&D investment was 39.575 billion yuan. BYD launched the "TianShen Zhi Yan" high-level intelligent driving assistance system and vigorously developed it in artificial intelligence and software. It is speculated that the investment proportion in R&D tools, software, artificial intelligence technology, etc., accounted for about 30%-35% of the total R&D investment. As for 2024, the estimated R&D investment is about 45 billion yuan. Wang Chuanfu said that in the future, 100 billion yuan will be invested in the intelligent field. The intelligent driving engineering team has nearly 5,000 people, and advanced technology R&D centers, including AI laboratories, have been established. It is expected that the investment proportion in R&D tools, software, artificial intelligence technology, etc., will further increase throughout the year, possibly reaching 35%-40%.

4.2. Automated factory production

At the beginning of 2025, BYD received good news: it won the top three sales championships in 2024—the sales champion of car companies in the Chinese automotive market, the sales champion of brands in the Chinese automotive market, and the sales champion in the global new energy vehicle market. BYD achieved the feat of going from the first new energy vehicle to the 10 millionth in 16 years [2].

According to the survey, BYD has three factories that achieve a high degree of automated production: Hefei Factory, Xi'an Factory, and Shenzhen Factory. Before 2022, the first phase of the welding factory in the Shenshan Factory invested 1,740 robots, with an automation rate of over 87%. A white-body assembly was produced every 58 seconds, and the maximum annual production capacity was 300,000 units. Just two years later, in 2024, the automation rate of the welding workshop in the Shenshan Factory exceeded 90%, and the annual production capacity exceeded 400,000 units. In 2023, the Hefei Factory produced nearly 500,000 vehicles. The automation rate of the welding process in the factory was relatively high, and many automatic workstations were reserved, with the potential to increase the automation rate and production capacity in the future. In 2024, the automation rate of the welding process production line in the Hefei Factory reached over 97%, with a vehicle produced every 50 seconds on average. Among BYD's automotive industry layout, the Xi'an Factory took the lead in exceeding the production scale of one million vehicles in 2024. As early as 2022, the Xi'an Factory had produced 995,000 vehicles, accounting for 97.9% of Xi'an's new-energy vehicle production [3].

4.3. Market expansion and exploration

BYD has a vast market. It has constructed a passenger-vehicle product matrix covering all categories, including micro-cars, SUVs, family cars, pickups, and high-end models. From economy-class electric vehicles to high-end luxury models, from pure-electric to hybrid-electric, and from sedans to SUVs, there is a wide range of products, such as the Han, Tang, Song, and Yuan series models of BYD, meeting the needs of different consumers. At the same time, BYD conducts targeted product R&D. According to the market demands of different countries and regions, it accurately launches targeted products. For example, on September 19, BYD

delivered 100 pure-electric buses to CUTCSA, an electric bus operator in Uruguay. In Hungary, the 700th pure-electric bus rolled off the production line at BYD's factory, further consolidating its position in the European market.

At the same time, BYD successfully won the electric bus procurement project of the Azerbaijani government, winning an order for 160 12-meter pure-electric buses (K9UD), providing a green and environmentally friendly public transportation solution for the local area. In China, it has established close cooperative relationships with battery suppliers and charging-facility operators, improving the industrial chain layout. Internationally, it has cooperated with Toyota of Japan to jointly develop new energy vehicle technology and with levomobilityllc of the United States to sell BYD's medium- and heavy-duty pure electric vehicles. BYD takes social responsibility and environmental protection concepts as important parts of its corporate culture. By participating in green travel and promoting electric transportation tools, it enhances its brand image and strengthens consumers' trust in the brand [4].

"I believe that the era of Chinese automobiles has arrived. A group of world-class brands will surely emerge in the Chinese automotive industry, and we all have the opportunity to become respected world-class brands." Wang Chuanfu, the chairman and president of BYD Group, said so [5].

4.4. Improvement of company profitability

This article selects three indicators, namely return on equity, return on total assets, and gross profit margin from 2019-2023 to analyze BYD's profitability [6].

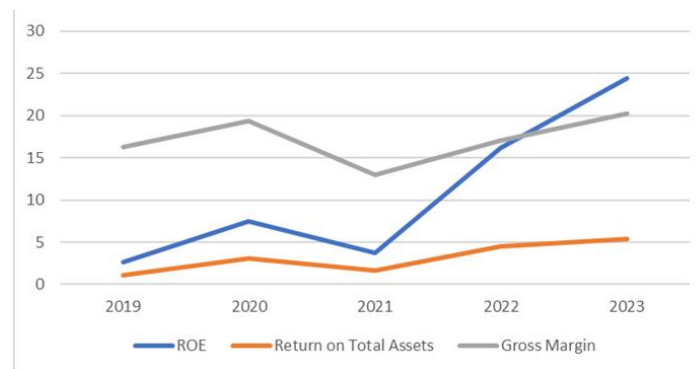


Figure 1. The profit rates of BYD in the past five years

According to Figure 1, from 2019 to 2023, BYD's return on equity, return on total assets, and gross profit margin all increased significantly. Although there was a decline in 2021 due to the impact of the epidemic and other reasons, relying on the strong foundation established through digital transformation, BYD gained a certain competitive advantage in the industry and greatly promoted the improvement of the company's profitability. Ouyang Zhidong, the manager of BYD Group's East China Information Department, said in an interview, "Due to the large number of BYD employees, it is difficult to achieve effective collaboration among departments if software provided by external suppliers is used. BYD's DNA is 'technology-driven and innovation-oriented', and its core technologies rely entirely on independent design and R&D" [7]. This fully demonstrates that under digital transformation, BYD can significantly enhance the company's resilience and achieve profit growth.

4.5. Improvement of user satisfaction

In the wave of digital transformation, BYD is committed to enhancing the user experience. It develops its business around consumers, pursues better product value, and brings consumers a more satisfactory consumption experience and service level [8].

First of all, in terms of technological innovation, BYD promotes the intelligent driving experience and introduces the self-developed "dipilot" intelligent driving assistance system, which has functions such as automatic parking, adaptive cruise, and lane-keeping, improving vehicle maneuverability and driving safety.

At the same time, the intelligent networking system supports functions such as voice control, navigation, and music playback. It can also remotely control the vehicle through a mobile application, adding fun to use and enhancing the attractiveness of the vehicle model. At the same time, the "blade battery" technology improves the driving range and safety, reduces the charging frequency, and BYD also strengthens the layout of charging facilities to solve users' "range anxiety".

In terms of optimizing the customer-service process, BYD has established one-stop service centers across the country, covering vehicle maintenance, repair, consultation, and technical support, simplifying the process. Employees have received strict training to provide professional services. It promotes the development of online service platforms. Customers can make appointments, inquiries, and complaints through the official website or mobile application, realizing the combination of online and offline services and improving service efficiency. It has established multiple feedback channels, such as hotlines, online customer service,

and social media, and regularly analyzes customer opinions and suggestions to improve products and services. At the same time, to meet users' personalized needs, BYD has launched customized services, allowing users to choose vehicle configurations, colors, and interiors, meeting personalized needs and enhancing the sense of participation and belonging in car purchases.

In terms of strengthening community construction and user interaction, BYD actively promotes the construction of user communities, holds online and offline activities, allows users to communicate with the company's senior management and technical teams, enhances brand recognition and loyalty, and also provides a reference for new users. It provides systematic education and training courses covering driving skills, vehicle maintenance, and troubleshooting, and helps users master professional knowledge through the combination of online and offline methods, enhancing the user experience.

5. Significance

5.1. Improving enterprise operation efficiency

By adopting advanced automated production lines and robot technologies, the production process can be made intelligent, networked, and flexible, enabling rapid response to market changes, flexible adjustment of production plans, and reduction of inventory costs and resource waste.

Through big data analysis and artificial intelligence technologies, it is possible to more accurately grasp market demands and industry trends, providing intelligent decision-making support for formulating scientific and reasonable production plans, product strategies, etc., and avoiding decision-making errors.

5.2. Optimizing products and services

In terms of R&D informatization, a comprehensive informatization deployment of the electric vehicle industry chain and innovation chain is carried out, realizing full-process digital guidance and monitoring, which helps to speed up R&D and launch products that better meet market demands.

Centering on the user experience, through technologies such as big data, full-chain digital management from product R&D, production and manufacturing to marketing and after-sales service is achieved. It can provide personalized services based on user data, such as intelligent route planning and energy-consumption prediction based on driving habits.

5.3. Enhancing enterprise competitiveness

Digital transformation enables BYD to obtain and analyze market data in real time, understand the dynamics of competitors and changes in market trends in a timely manner, make advance arrangements and adjust strategies, and gain the initiative in market competition. It also provides strong support for BYD's technological innovation. For example, in the field of intelligent driving, through the analysis and application of vehicle CAN data, it provides rich training materials for autonomous driving algorithms and improves the intelligence level of the autonomous driving system.

5.4. Promoting industrial collaborative development

It drives the technological upgrading of upstream raw material suppliers in the industry chain, prompting suppliers to improve the digital and intelligent levels of production, better meeting BYD's needs and ensuring the supply quality and stability of raw materials. At the same time, it promotes the digital transformation of downstream distributors. For example, through digital marketing platforms, more accurate marketing and sales can be achieved, improving sales efficiency and service quality, and also helping to build a more complete after-sales service network.

5.5. Realizing industry mutual assistance and interconnection

As a leading enterprise in the new energy vehicle industry, BYD's digital transformation sets a benchmark for the entire industry, providing other enterprises with referenceable experience and models, and promoting the digital development of the entire new energy vehicle industry.

It is necessary to actively seek transformation paths according to the industry characteristics and resource conditions of the automotive manufacturing industry, and construct a digital transformation strategic plan suitable for the long-term development of the enterprise, thereby realizing the digital and intelligent transformation of the value chain [9].

5.6. Promoting sustainable development

In the production process, through digital technologies, the optimal allocation of resources is realized, energy-use efficiency is improved, energy consumption and waste emissions are reduced, and the impact on the environment is minimized. Digital transformation enables BYD to better adapt to market and policy requirements, continuously expand its business in the fields of new energy vehicles and intelligent transportation, and lay a foundation for the long-term sustainable development of the enterprise.

6. Conclusion

To sum up, the road of BYD's digital transformation in the future is still long and arduous. It needs to actively explore the application of new battery technologies such as solid-state batteries to meet the market's demand for high-range and fast-charging. Strengthen the R&D of intelligent networking technologies to achieve deep interconnection between vehicles and other intelligent devices such as mobile phones and smart homes, and create a more intelligent travel ecosystem. On the basis of existing pure electric and plug-in hybrid models, increase the R&D and promotion of fuel cell vehicles. Launch more models for different market segments, such as high-performance sports cars, large MPVs, and small commuting cars, to meet the diverse needs of consumers. At the same time, BYD needs to master the leadership of the industry chain on a global scale. First, firmly grasp the key core technologies of automotive electrification and intelligence, strive to achieve self-control in important fields and key nodes of new-energy vehicles, and build an enterprise-led industry chain and supply chain. Second, automotive enterprises should accelerate the filling of gaps in advanced processes, basic components, key materials, etc., in important fields such as automotive chips and operating systems, and focus on overcoming the "bottleneck" problems of key core technologies. In areas where the enterprise already has advantages, it should step up the implementation of technology-upgrading projects to strengthen and consolidate its leading position. Finally, actively carry out external cooperation, take the cross-field enterprise cooperation to build an intelligent vehicle ecosystem as the central link, and achieve the coordinated development of electrification and intelligence. At the same time, reach cooperation agreements with multiple internationally renowned automotive brands, jointly develop the new energy vehicle market, learn from internationally advanced management experience and technologies, and enhance the international influence of its own brand [10].

Electrification is the first half of the game, and intelligence is the second half. According to the "2024 McKinsey China Automotive Consumer Insights Report", a large part of the reason why consumers choose Chinese high-end new-energy vehicle brands is based on the advancement of their intelligent driving and intelligent cockpits. It can be seen that intelligence has become one of the important factors for most people to purchase high-end new-energy vehicles [11]. Therefore, BYD's journey towards intelligence has also begun.

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