

Research on the Path and Motivation of The Integration of Digitalization and Green Development to Improve the Performance of Manufacturing Enterprises

-- Take BYD as an example.

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Abstract: In the new era, manufacturing enterprises are facing the new trend of digital and green development. The Party's Report to the 20th CPC National Congress proposed to build a modern industrial system, speed up the construction of a manufacturing power and a digital China, and at the same time, unswervingly take the road of ecological priority and green development. In this context, based on the digital transformation practice of BYD, an automobile manufacturing enterprise, this paper systematically explores the path of green development and digital transformation of manufacturing enterprises to enhance economic benefits. The results show that: (1) Digital transformation of manufacturing industry can make up for the deficiency of green development and realize economic benefits, while green development also brings ecological benefits to manufacturing industry, and the integration of the two is conducive to the improvement of economic benefits; (2) Based on the integration of digitalization and green development, there are three paths to improve economic effects: green technology innovation, green production and supply chain innovation and green management model innovation; (3) The three paths correspond to the most important green technology, green production and supply chain, and green management, which support the improvement of economic benefits of manufacturing enterprises. In this paper, by building a strategic change model of the coordinated development of greening and digitalization, we find out the path of the integration of digitalization and green development to improve the economic benefits of manufacturing industry, and try to make up for the research gap of the integration of digitalization and green development to improve the economic benefits. At the same time, we deeply explore the motivation of the integration of the two, which has certain reference value for the transformation path of other enterprises.

Keywords: Digitalization, Green development, Integration mode, Economic benefits.

1. Introduction

The Party's Report to the 20th CPC National Congress proposed to promote new industrialization, that is, to achieve "high technology content, good economic benefits, low resource consumption, less environmental pollution, and give full play to the advantages of human resources". The Tenth Five-Year National Informatization Plan puts forward that "the construction of green wisdom and ecological civilization should be further promoted, and the coordinated development of digitalization and greening should be promoted".

Digital transformation can improve the efficiency of enterprises by innovating technology, production and supply chain, so as to achieve the purpose of improving the economic benefits of enterprises. Green development strategy urges enterprises to actively carry out green innovation, which can not only achieve economic benefits but also social and ecological benefits. For enterprises, digitalization and green development are not relative. By integrating digitalization and green development, we can not only control the transformation cost through digital transformation, improve the technical level and resource utilization efficiency, but also obtain ecological benefits through green development, so that enterprises can obtain more economic benefits.

Based on the reality of the integration of digital technology and green transformation in automobile industry, this paper selects BYD's digital green development as the research object and conducts a case study, focusing on the path of integration of digital and green development and related

motives. By solving the above problems, it provides theoretical and practical basis for the integration and transformation of digitalization and green development of other manufacturing enterprises.

2. Digitalization and Green Development: A Fusion Perspective

2.1. Digitalization, Green Development and Manufacturing Status

With the development of artificial intelligence, big data, cloud computing, Internet of Things and other digital technologies, digitalization is affecting the whole manufacturing industry, providing power for the development of the manufacturing industry, and digital transformation has become a new trend in the future development of the manufacturing industry. The 14th Five-Year Plan for People's Republic of China (PRC)'s National Economic and Social Development and the Outline of Long-term Goals in 2035 proposes to meet the digital age, activate the potential of data elements, give full play to the advantages of massive data and rich application scenarios, drive the changes of production methods, lifestyles and governance methods with digital transformation as a whole, empower traditional industries to transform and upgrade, and expand the new engine of economic development.

Manyika et al. (2011) found that the digital economy has a significant role in promoting the transformation and upgrading of manufacturing industry. From the perspective of

digital transformation path, Lu Tie (2019) analyzed the problems faced in the current digital transformation practice of traditional manufacturing industry in China, and believed that the digital transformation of traditional industries should be actively and pragmatically promoted from three paths: enterprise intelligent manufacturing, industry platform empowerment and park ecological construction. From the perspective of industrial chain, Li Chunfa, Li Dongdong and others (2020) believe that strengthening the construction of digital infrastructure in manufacturing industry and strengthening the integration and sharing of industrial chain data can better play the driving role of digital economy in the transformation and upgrading of manufacturing industry. Li Xiaohua (2022) found through research that the development of digital technology has promoted profound changes in product form, production mode and customer relationship in manufacturing industry, thus affecting the layout of global industrial chain value chain. From the perspective of organizational management reform, Anjiaji and Di He (2022) believe that the digital transformation of manufacturing enterprises can be realized through strategic changes in industrial layout, structural changes in R&D departments, process-oriented changes in production and sales, and people-centered changes. From the perspective of digital talent management, Cao Zhengyong (2018) believes that under the background of digital economy, strengthening the support of talent team and breaking through key technologies and equipment can improve the quality of China's industrial development and promote the digital transformation and upgrading of manufacturing industry.

However, there will also be misunderstandings and challenges in the process of digital transformation. Zhang Guosheng and Du Pengfei (2022) found that enterprises are keen to use the advantages of digital transformation to improve the quantity of technological innovation, but it will inhibit the improvement of the quality of technological innovation in digital transformation. Lv Tie (2019) found that traditional industries will encounter problems in digital transformation, such as inadequate understanding of digital transformation, weak accumulation of data assets, and low level of industrial synergy. Zhu Heliang and Wang Chunjuan (2021) found that enterprises are also facing challenges in the process of digital transformation, such as the lack of industrial core technology hindering industrial cycle, the lack of industrial model innovation limiting market demand, the bottleneck of industrial innovation chain restricting governance model innovation, and the lack of digital infrastructure leading to weak basic guarantee.

Research on the present situation of green development of manufacturing industry. Under the background of "double carbon", the manufacturing industry is facing great challenges, and green development has become an indispensable part of the development path of manufacturing enterprises. From the perspective of innovation, Bi Kexin and Liu Gang (2015) believe that the operational mechanism synergy model of China's manufacturing green innovation system is an organic combination of three stages and three levels, including initial stage, formation and growth stage, maturity and transfer stage, and green technology innovation, green industry innovation and green supply chain innovation. Yue Hongfei, Xu Ying, etc. (2017) concluded through empirical analysis that it is the key to further study the green development of industry driven by technological innovation to choose an effective technological innovation mode according to the characteristics of industrial

industry. Wan Panbing and Yang Mian (2021) think that under the environmental technical standards, manufacturing enterprises mainly realize green transformation by choosing a more gradual technological transformation path, that is, on the one hand, strengthening terminal governance, on the other hand, speeding up capital renewal, thus improving the utilization efficiency of energy resources and optimizing the energy structure. Stan and Li Peng (2019) believe that in addition to technological innovation, technological transformation by updating production equipment and then absorbing advanced production technology has always been an important path for China's manufacturing technology progress and productivity improvement. In terms of security mechanism construction, Yang Jianliang, Tang Fangcheng and others (2020) think that we should study the systematic security mechanism of green development of manufacturing industry from four aspects: organization, system, capital and talents, and create a good development environment. Bi Kexin and Huang Pingping (2012) constructed the green innovation policy system of manufacturing industry based on informatization from six aspects, which provided the basis for green innovation policy, improved the green innovation ability of manufacturing industry and promoted the transformation and upgrading of manufacturing industry.

However, there are also shortcomings in green development. Stan (2018) believes that there is still a big gap between green and low-carbon technologies and industrial development level, and it is necessary to accelerate industrial green development. Jiang Nanping and Xiang Renkang (2013) believe that there are still many misunderstandings in China's economic green development. Li Xinan and Villi (2021) studied the green development of manufacturing industry, and found that there were some problems in the green development of manufacturing industry in China, such as unbalanced development level in different regions, insufficient endogenous motivation and capacity for green transformation, and imperfect regional coordination mechanism.

2.2. Integration path of digitalization and green development

Under the new situation of forming a new development pattern in an all-round way, it is an important direction of China's economic and social development to further promote digital and green development. The future development should be both green and digital, and more importantly, promote the integration of "two industries". Regarding digitalization and green development, we should implement the green consensus in the digital transformation, promote green development, adhere to data-driven and promote wisdom first in the green development. Guo Hanwen (2022) thinks that digital economy and green development are complementary, and the green development of digital economy can promote the realization of "double carbon" goal, and the leading of "double carbon" goal can promote the development of digital economy.

At present, most scholars mainly focus on the impact of digital or green development on enterprises. However, the coordinated development of green economy and digital economy is the trend of future development and the only way to improve economic benefits. Jin, Lei and others (2022) concluded that effective measures to realize green digitalization include promoting technology upgrading, energy management and technology application to obtain

potential efficiency, and increasing the penetration of advanced digital technology. Zheng Xiaoyun and Cassandra (2021) believe that the digital economy promotes the green transformation of the traditional economy, which is a new path to lead the green development. At the same time, the green economy helps the digital economy and realizes the green, low-carbon and sustainable development of the digital field itself. Chen Jinhe (2021) concluded through analysis that digitalization is a new driving force for high-quality development; Green economy transformation is the fundamental way to high-quality development; Digitalization is an important way to achieve the goal of double carbon. Qian Lihua and Fang Qi (2020) think that both green economy and digital economy involve a large number of technology-intensive industries, and both contribute to improving the production efficiency of traditional industries. Stan (2022) pointed out that the high energy consumption characteristics of the digital industry and the ecological environment constraints it faces determine that the development of the digital economy must proceed on the track of green development, and the synergy of digital greening is the fundamental way to solve the green paradox of digital technology.

3. Research Design and Case Introduction

This paper attempts to explore the relationship between digitalization and green development and the influence of their synergy on enterprise performance.

3.1. Method selection

This paper chooses the case study method to explore the path of integration of digitalization and green development of manufacturing enterprises for the following reasons: First, the case study method is suitable for concretizing the problems to be discussed and making the research conclusions more universal. Secondly, the research on the integration of digitalization and green development is still in the primary stage, and it cannot be studied with the data of multiple enterprises. The case study can reflect the effect of the integration of digitalization and green development of enterprises, and its data is more intuitive and clear.

3.2. Case selection

Report to the 20th CPC National Congress of the Communist Party of China clearly put forward that "the focus of economic development should be on the real economy", which strengthened the development confidence of the manufacturing industry, and emphasized that "promoting the energy revolution and implementing the dual-carbon strategy step by step" pointed out the direction for the transformation and upgrading of the manufacturing industry. Automobile industry has become the benchmark of manufacturing industry in China because of its strong comprehensive characteristics. With the development of society, automobile enterprises are a typical example of the integration of digitalization and green development. On the basis of defining the industry of case selection, and based on the degree of integration of BYD's digitalization and green development, choosing BYD as a case company better fits the core issues studied in this paper, and also makes the construction of theoretical framework representative.

First, the case selection is representative. As one of the

leaders in the new energy automobile industry, BYD's integration of digitalization and green development is more representative. Second, case selection has the principle of contrast. The horizontal and vertical analysis of BYD's data can completely describe the impact of the integration of enterprise digitalization and green development on enterprise economy, which is very important for theoretical construction.

3.3. Data collection

BYD's digitalization and green development mainly include the following two types of data: (1) Internal information of the company, mainly including the company's website information, archive information (promotional videos, PPT and internal publications of the company), announcement annual report, social responsibility report, internal publications and information obtained from on-site observation. (2) Collecting data through Internet channels. BYD is a leading enterprise in domestic automobile manufacturing industry, and there are a large number of related reports, news, academic papers and industry yearbooks on the Internet. We use octopus crawler software to collect and sort out second-hand data with a series of words such as BYD, digitalization and green development as key words.

4. BYD Digital Transformation and Green Development Integration Path Analysis

4.1. Digitalization and green development are integrated in technological innovation.

Digitalization and green development simultaneously act on technological innovation and upgrading, realizing the integration at the technical level. Technology integration can make manufacturing enterprises play the synergistic effect of digitalization and green development more comprehensively, and achieve the effect of "1+1>2". On the one hand, it can reduce the investment of enterprises, on the other hand, it is also conducive to saving the research and development costs of manufacturing enterprises, improving the utilization efficiency of resources, promoting green technology innovation, and realizing the technical integration of digitalization and green development. At the same time, the addition of digital technology makes the efficiency of green innovation faster.

BYD skillfully integrates the green concept with digital technology. BYD integrates superior technical resources such as lithium iron phosphate battery, photovoltaic, energy storage system and charging through digital energy solutions, opens up the whole industrial chain of energy from acquisition, storage and application, and implements the strategy of "whole industrial chain+whole market", which provides a package of overall solutions for the low-carbon and energy-saving high-quality development of urban rail transit, realizes energy saving and consumption reduction, and helps achieve the goal of "double carbon".

4.2. Digitalization and green development are integrated in the production process.

Cars have begun to enter the era of trams. High pollution and high fuel consumption are no longer the labels nailed to cars, but green and intelligent. Automobile enterprises realize economies of scale through the input of digital production

factors, digital network connection effect and long tail effect of marginal cost of digital products, and improve performance by improving information asymmetry, promoting business model innovation and cost saving, resulting in multiplier effect. Driven by innovation empowerment effect and multiplication effect, digital transformation can effectively optimize production process, improve energy efficiency, reduce production cost, reduce environmental pollution and promote technology research and development, so as to achieve the effect of promoting green production.

BYD Electronics actively responded to the national dual-carbon policy, created a "green factory", paid close attention to technological transformation and resource recycling, and gradually built a clean, efficient, low-carbon and recycling industrial system; At the same time, do a good job in the purification and beautification of production lines and buildings and the greening of the factory, create a green and ecological factory environment, and minimize consumption and pollutant emissions. With the concept of green development and unique technical advantages, the company will achieve healthy and sustainable development from green energy, green intelligence and green system.

4.3. Digitalization promotes the integration of green supply chain innovation.

BYD practices the three principles of fairness, transparency and competition, promotes competitive procurement, comprehensively optimizes the system, improves the management system, and builds an efficient, collaborative and mutually beneficial supply chain platform. In the main links of the procurement process, online records are realized by means of information technology, which is efficient and transparent (leaving traces). Continue to promote green procurement and practice corporate social responsibility.

BYD's supply chain and raw materials always adhere to green procurement. Form a green procurement system of green suppliers and green raw materials with the company as the leading factor and the regions, divisions and factories as the core, and strictly manage the environment in the procurement process to ensure that every purchased part meets the requirements of green environmental protection. The company strictly fulfills the social responsibility of green development, and requires suppliers to consider the impact on the environment in the process of product design and manufacturing, and take sustainable improvement measures, including replacing materials and improving the disposal and treatment of air, water and soil wastes. Ensure that the raw materials or products supplied by the supplier meet the relevant regulations on poisons stipulated by BYD Company. Conduct regular evaluation and research on CSR of suppliers, and conduct on-site inspection to check whether they comply with CSR regulations. According to the properties of materials, materials with high energy consumption and high pollution, such as PCB, FPC, connectors, etc., were investigated, and those that failed to meet the standards or increased energy consumption were ordered to make improvements. The main business performance of enterprises with high energy consumption and high pollution was investigated, accounting for about 60%. If it is found that it is unqualified or the energy consumption of the supplier increases, the supplier shall be ordered to make corrections and follow up the improvement. The green development of BYD's supply chain has become an important component of BYD's green transformation, and it will become a strong

support for the green transformation of enterprises in the future.

5. BYD Digital Transformation and Green Development Integration Motivation Analysis

Digital transformation is based on digital technology, and the whole process is supported by digital technology, which is conducive to the integration of green development strategies of enterprises and helps to improve enterprise performance. There are many reasons for enterprises to integrate digital transformation with green development. Based on the actual situation of manufacturing industry, this paper discusses the motivation of the integration of digitalization and green development of manufacturing enterprises from two aspects: external environment and internal industry.

5.1. Macro policy promotion

Promoting the integration of digitalization and green development of manufacturing enterprises is an inevitable trend for China manufacturing enterprises to achieve high-quality development, and it is also a positive measure in response to national policies. Manufacturing industry is the core and key link in China's industrial chain and an important guarantee for a country's infrastructure construction. Under the background that China's economic development has changed from a high-speed growth stage to a high-quality development stage, the environment, content, characteristics and objectives faced by the government's macro-control have undergone earth-shaking changes. In the 2015 government work report, it is proposed to implement the national development strategy of "Made in China 2025", adhere to innovation-driven and intelligent transformation, lay a solid foundation, develop green, and realize the leap from "manufacturing power" to "manufacturing power". With the implementation of "Made in China 2025" and the development of "Industrial Internet" technology, manufacturing enterprises will continue to increase investment in digital technology and industrialization, and fully promote the integration of digital and green development.

5.2. Driven by industry competition

Since 2002, the urbanization process in China has accelerated, the demand for infrastructure construction has also increased, the construction machinery manufacturing industry has made great progress, and its competitiveness in the world has also been greatly improved. However, after 2011, China's economy entered a "new normal". Studies have shown that due to changes in domestic macro-economy and the rise of foreign manufacturing industries, the overall performance of China's manufacturing industry will decline, and it will enter a long-term adjustment stage and face fierce market competition. China's industry, especially the manufacturing industry, lacks profitability and innovation ability, and its business model is unsustainable. The degree of market competition will affect the urgency of digital transformation of enterprises. The fiercer the market competition, the more urgent the digital transformation is. The competition in the world manufacturing market has intensified, and the emergence of digital technology has become an export for enterprises in various countries to seek

breakthroughs. Digitalization has become an important means for enterprises to enhance their competitiveness and achieve sustainable development.

5.3. The theme of green development is deepening.

Once the theme of green development was put forward, it directly promoted the coordinated development and high-quality development of China's environment, resources and economy. For manufacturing enterprises, green development is the only way in the future. With the support of green development, the energy-saving and environmental protection technology of manufacturing industry can realize rapid innovation. This is also of great benefit to the overall transformation and upgrading of China's economy. With the acceleration of green development of manufacturing industry, all kinds of waste resources can be reused. This can continuously improve the input-output ratio of resources and help enterprises effectively control costs. Especially in the environment of reduced benefits, the value of reducing costs and increasing efficiency can not be ignored. The development and design of energy-saving and environmental protection products can reduce the operating costs of enterprises, and at the same time, it can better meet the basic demands of the whole market and society for green products.

6. Conclusion and Discussion

6.1. Main conclusions

The key to the integration of digitalization and green development lies in their high similarity in the path of improving the economic benefits of enterprises, which makes the integration of the two possible. At the same time, they just complement each other, which makes the integration of digitalization and green development consistent. Therefore, the integration of digitalization and green development is the only way for manufacturing industry to transform. BYD can not only improve the economic benefits, but also promote the high-quality development of the enterprise itself, which is conducive to the sustainable development of the whole industry.

6.2. Research enlightenment and significance.

As a leading domestic automobile enterprise, BYD should not only realize individual digitalization, but also play a key role in building a platform ecosystem, radiating the digitalization of the entire industrial chain and the integrated development of digitalization. Therefore, leading enterprises should fully mobilize their own resources and capabilities, use their own digital capabilities to incite the green transformation of the whole ecology, realize the efficient use of their own resources, and finally lead the green transformation of the whole enterprise and even the whole industry.

6.3. Research deficiency and future prospect.

First, this paper is a single case longitudinal study, and the

universality of the research results needs to be tested by a large sample. Although the case selection of BYD is typical and representative, the types and characteristics of manufacturing enterprises are complicated, so the research conclusions can be further enriched through large sample research. At this stage, the integration of digitalization and green development involved in this study is also facing a measurement dilemma. Subsequent research can further deepen the measurement of related constructs and test this relationship with second-hand data. Second, the vast majority of manufacturing enterprises in China are still in the process of digital transformation or only green transformation, because the simultaneous transformation of digital and green development will produce higher production costs, and the future direction of green transformation is uncertain, which may lead to more ways to leverage resources with the development of the times. Future research can further expand and deepen the green transformation paradigm of manufacturing enterprises under the digital ecological development pattern in combination with the development background of the times.

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