RESEARCH ON THE PATHWAYS AND EFFECTS OF DATA-DRIVEN VALUE CREATION IN ENTERPRISES: A CASE STUDY OF SANY HEAVY INDUSTRY

KangChuo Song*, ZongQiao Li, YuQing Kan, Xi Tian, ErXian Li
School of Accounting, Beijing Wuzi University, Beijing 101126, China.
Corresponding Author: KangChuo Song, Email: 1093285171@qq.com

Abstract: With the rapid development of information technology, data has become an indispensable core production factor in the era of digital economy. In the context of this era, how enterprises can effectively explore and utilize the value of data elements to promote business innovation and management change has become an important way to enhance the core competitiveness of enterprises and achieve sustainable development. This paper analyzes the effect of data elements driving enterprise value creation of SANY Heavy Industry by using financial performance and non-financial performance, and selects data for a total of 10 years from 2013 to 2023. Through in-depth analysis of SANY Heavy Industry, we find that data elements play a crucial role in the process of enterprise value creation. By deeply mining and applying advanced technologies such as big data and artificial intelligence, SANY Heavy Industry has successfully constructed a data-driven decision support system and intelligent manufacturing system, and realized the intelligent upgrading of production operation, product development, marketing and other aspects. The value of data elements lies in their analysis and application capabilities. Enterprises should establish a perfect data analysis team and mechanism, use advanced data analysis techniques and tools, and dig deep into the laws and trends behind the data to provide a scientific basis for their strategic planning and business decisions.
Keywords: Data elements; Enterprise value; Data-driven; SANY Heavy Industry

1 INTRODUCTION

With the rapid development of information technology, data has become an indispensable core production factor in the era of digital economy. In this era, how enterprises can effectively explore and utilize the value of data elements to promote business innovation and management change has become an important way to enhance the core competitiveness of enterprises and achieve sustainable development. SANY Heavy Industry, as a leader in China's construction machinery industry, has made remarkable achievements in the field of digital transformation in recent years, and its practical experience of utilizing data elements to drive enterprise value creation not only provides valuable insights for the industry, but also provides useful reference for enterprises in other industries.

Against the background of increasingly fierce competition in the global manufacturing industry and the diversification of customer demands, SANY Heavy Industry has deeply realized the importance of data elements for enterprise development. Facing the rapidly changing market environment, the traditional production and management mode has been difficult to meet the enterprise's demand for efficient, precise and flexible development. Therefore, SANY Heavy Industry actively responds to the national strategic plan on the development of digital economy and establishes digital transformation as the core strategy to enhance the competitiveness of the enterprise. By building a comprehensive and perfect data collection, processing, analysis and application system, SANY Heavy Industry has realized the in-depth integration and wide application of data elements in the whole chain of enterprise operations, such as R&D and design, production and manufacturing, supply chain management and customer service. This process not only greatly improves the operational efficiency and market response speed of the enterprise, but also opens up new value growth points for the enterprise, and strongly promotes the transformation and upgrading of the enterprise and high-quality development. Based on this, this study aims to explore how SANY Heavy Industry utilizes data elements to drive the path of enterprise value creation and its actual effect, with a view to providing experience and reference for other enterprises.

In terms of theoretical significance, firstly, it can enrich the theory of data elements to a certain extent, by exploring how data elements affect the enterprise value chain, this study can provide more perspectives and frameworks for the theoretical system of data elements, especially for understanding how enterprises can reshape the process of value creation through the use of data resources and technologies. Second, it can extend the theory of value creation, and this study helps to deepen the understanding of the logic, process and model of value creation, especially in its new form in the context of the digital economy. By analyzing how data technology affects value creation at different stages, it can provide new additions and updates to existing theoretical models of value creation. In terms of practical significance, on the one hand, it enriches policy formulation and adjustment, and the research results can provide empirical analyses and suggestions on the development of the digital economy for management agencies, which can help formulate and adjust relevant policies, optimize the digital economy ecosystem, and promote the healthy and sustainable development of the industry. On the other hand, it can help enhance the competitiveness of enterprises. The research results of the project can help enterprises better understand and cope with the challenges of the digital era, enhance their market competitiveness and achieve long-term development by optimizing the allocation of resources, innovating the business

model, and improving operational efficiency.

2 THEORETICAL FOUNDATIONS

2.1 Technological Innovation Theory

The theory of technological innovation occupies a pivotal position in the field of economics, and was first systematically articulated by Schumpeter in his classic work, The Theory of Economic Development. The concept of "innovation" he proposed refers to the formation of new modes of production by integrating factors and conditions of production in a unique way and introducing them into the production system. This "innovation" covers five key aspects: the development of entirely new products, the application of new production technologies that have not yet been generalized to the industry, the creation of entirely new markets that have not yet been reached, the discovery of new supply channels, and the construction of new organizational models. The neoclassical school takes Solow's Technical Progress and the Aggregate Production Function as an example, and his research shows that from 1909 to 1949, the contribution of technical progress was as high as 88% in the remarkable growth of the total output value of the U.S. manufacturing industry. The institutional innovation school believes in injecting new dynamics into economic growth by reforming the organization or business management of the economy. The national innovation system school, on the other hand, emphasizes that technological innovation is a systematic project, which not only relies on the individual ability of entrepreneurs, but also relies on the overall promotion of the national innovation system. Combined with the current research hotspots, it is not difficult to find that there is an inseparable relationship between data elements and technological innovation. Therefore, future research should pay more attention to technological innovation in the context of data elements, explore its influence mechanism on enterprise performance, and provide strong theoretical support and practical guidance for enterprise development.

2.2 Value Chain Theory

Value chain theory, is the exploration of how a company creates value through a series of specific, interrelated activities. These activities do not exist in isolation, but are closely interconnected and together form a dynamic, value-creating process. It contains a triple meaning, first, the interconnectedness of activities, the activities within the enterprise are closely linked, they influence each other, promote each other, and jointly promote the value growth of the enterprise; second, the multiplicity of value, whether explicit or implicit value, each activity is contributing to the enterprise's unique value; third, the external extension of the value chain, the value chain not only covers the internal activities of the enterprise, it also extends to activities outside the enterprise, such as the network of relationships established with customers, suppliers, etc.

2.3 Value Creation Theory

In the process of exploring enterprise value creation, it is first necessary to clarify a core point, that is, enterprise value creation is mainly embodied in the part of its operating activities to create income over the cost of capital invested by shareholders' capital. With the depth of academic research, the theory of value creation has been continuously enriched and developed. Referring to the value network theory, the concept originated from Slywotzky's insight in 1997, which continued the "customer value-centered" viewpoint of Peter's new value chain theory. However, this theory was further enriched by Prabakar and David in 2001, who not only emphasized the importance of satisfying customers' needs, but also introduced the perspective of suppliers and other stakeholders and the need to create customer value. This theoretical framework contains three core elements: superior customer value, the core competencies of the value network, and the interactions among the members of the value network. Under the value network model, enterprises need to examine their position and role in the value network and think about how to enhance their core competencies. Based on this theoretical background, this paper will conduct an in-depth value creation analysis of the internal and external value chains of enterprises. Through this analysis, we will have a more comprehensive understanding of the value creation activities of enterprises in each link.

2.4 Factor Theory of Production

Factors of production, in short, are all resource inputs that can be used in the production process. In the field of economics, this concept has been interpreted in various ways, but the core idea is the same: they are the resources necessary to drive productive activity. The form and priority of these resources are closely linked to the state of productivity and evolve with the times in a distinctly contemporary and developmental way. From a broad perspective, all intermediate inputs that are not transformed into final use form can be considered as factors of production, which reflects the idea of the expenditure and production approach. Therefore, factors of production are a dynamic concept, whose type, quality and quantity all affect the material creation and product production of society, and are both social and economic in nature. With the restructuring of the economy and society and the development of productive forces and production relations, the composition of factors of production is also expanding. From William Gundry's "two-factor theory", to Say's "three-factor theory", to Marshall's "four-factor theory", and later on, Gao Fuping and Ran Gora proposed the "five-factor theory"[1]. The connotation of factors of production is constantly enriched by the

"five-factor theory" summarized, followed by the "six-factor theory" proposed by Xu Bin and Xu Shoubo[2]. In the era of digital economy, data, as a new production input resource, has expanded the boundary of knowledge creation and has been widely used in the sale of existing goods and the continuous development of new services or products. As a result, data has also been established as a new factor of production.

3 LITERATURE REVIEW

3.1 Data Elements

From the perspective of economics, data as a factor of production has become a much-anticipated research hotspot. With the rapid development of the digital economy era, data plays an increasingly important role in various aspects of production, distribution, exchange and consumption. As a result, theoretical studies and empirical analyses on data production factors have been springing up, attracting the attention of many Chinese and foreign scholars and experts. The theme of "Data, National Accounts and Public Policies" was widely discussed at the 2020 ASSA Annual Forum. Participants had an in-depth discussion on the construction of data value assessment methods and accounting systems, aiming to better understand and quantify the value of data in the economy. At the same time, they also focused on the use of data in the economy, exploring how to more effectively utilize data to drive economic development and policymaking. And at AEA's 2021 Annual Meeting, the use of big data technology in the economy was also at the center of the discussion. As big data technology continues to evolve and spread, its use in the economy is becoming more widespread. Participants had in-depth exchanges and discussions on how big data technology can change the traditional economic model and provide more accurate data support for enterprises and governments, etc. Farboodi and Veldkamp provided a narrow interpretation of data elements, which they defined as information that is encoded as binary sequences and processed and stored in the form of bits. Based on this, a Solow-like growth framework was used for the study and it was found that data elements have a positive effect on increasing productivity[3]. The increase in productivity further attracts more investment, thus expanding the scale of production. This expanded scale of production in turn facilitates the production of more data, creating a process of cyclical data accumulation.Carriere-Swallow and Haksar define data as an economic good, which consists of a string of binary bits and refers specifically to the portion of information that does not contain knowledge and creativity[4]. They point out that data elements have unique characteristics such as non-exclusivity and non-competitiveness, which enable them to match supply and demand in a precise and efficient manner, there by improving the operational efficiency of the macroeconomy and reducing the market failure caused by information asymmetry. Jones and Tonetti   share the same viewpoint in this regard, and they argue that the data elements have the zero marginal cost of use The characteristics of the data element. Due to the non-rivalrous nature of data, any number of machines, individuals or firms can use the same data at the same time without reducing the amount of data available to others[5]. As a result, data can lead to productivity gains and exhibit the law of increasing returns to scale. However, Posner and Weyl hold the opposite view ofT this[6]. hey argued that the study found that data elements exhibit increasing marginal returns when invested upfront. However, when the input reaches a certain value, the data factor still follows the law of diminishing marginal returns. Therefore, the overall remuneration of data factors shows a phased form of increasing and then decreasing.

Related research has also received much attention in recent years in China, and in exploring the impact of data factors on production efficiency, Xie Kang et al. started from the perspective of product innovation, and studied in depth how data factors affect the mining of business value and the enhancement of dynamic capabilities of enterprises[7]. Their study found that the input of data factors can significantly expand the productivity of the original production factors and play an important role in improving production efficiency. The publication of relevant literature on data factors in China has only begun to gradually increase in the past two years. The following is a compendium of major studies on data factors by domestic industry and scholars. In terms of the perception of data elements, Kong Yanfang et al. argue that data elements, as the "new oil of the future", have deeply penetrated into the production process in various fields[8]. They emphasize that the use of modern information technology for data collection and activation, and its conversion into 0 and 1 binary symbols can enhance data productivity and make it participate more actively in production activities. Li Zhiguo and Wang Jie   suggested that the data factor not only has the same importance as traditional factors such as capital and labor, but also it can improve the established ratio of factor inputs, optimize the allocation efficiency of multidimensional resource factors, and have a significant channeling effect on the improvement of manufacturing productivity[9]. On the other hand, Qi Yudong and Liu Huanhuan , from the perspective of consumer demand, argue that the consumer's induced demand is an important factor in promoting data as a factor of production[10]. At the same time, they emphasize that with the empowerment of digital technology, data, as the digital carrier of information and knowledge in the digital economy era, can further enhance the effectiveness of access to resources and knowledge, thus promoting the high-quality development of productivity.In 2020, the Central Committee of the Communist Party of China (CPC) and the State Council explicitly put forward that the data factor can follow the value reward mechanism of the traditional factors, and leave it to the market to be evaluated and determine its value according to the size of its contribution. This decision further clarified the identity of data as a factor of production, forming the "seven-factor theory" in the era of digital economy. Thanks to the development of modern technology, the value of data factors has become increasingly prominent, and has been compared to the "new oil" and the most important raw material of the twenty-first century.

In summary, data elements have become important factors of production and socialized resources, fully and deeply

involved in value creation. Today's factors of production are characterized by broad connotation, dynamic content, diverse themes and high degree of scarcity, which have a profound impact on the development and reform of society and economy. In this paper, the terms "factors of production" and "factors" will be used synonymously in most cases, unless otherwise specified in specific guidelines.

3.2 Factors Affecting Enterprise Value Creation

For the influencing factors of enterprise value creation, different scholars at home and abroad have different perspectives: by studying A-share listed companies, Yang Qingxiang and Liao Dangtian carried out theoretical analysis and empirical test on the interactive relationship between internal control, technological innovation and value creation ability, and came to the conclusion that technological innovation can enhance the value creation ability of enterprises[11]. Technological innovation can on the one hand increase the knowledge stock of the enterprise, reduce the production cost of the enterprise, and enhance the operating profit of the enterprise; on the other hand, it can also enhance the confidence of investors in the future development of the company, and stimulate the improvement of the stock price.MICHAEL PORTER put forward the concept of the value chain in his book Competitive Advantage, and he believes that every enterprise is in the process of designing, producing, selling, sending and supporting its products[12]. All these activities can be indicated by a value chain, and the value creation of a firm is constituted through a series of activities. Zhang Renzhi studied the conclusion that digital transformation of enterprises mainly promotes the efficiency of intellectual capital value creation by improving human capital, enhancing the innovation capability of enterprises and strengthening the relationship between enterprises and suppliers and customers[13]. Pan Liurong suggests that technological progress intervenes in novelty-type (efficiency-type) business model innovation and enhances corporate value creation through the technology introduction path[14].

3.3 Literature Review

In summary, according to the above research, it can be seen that scholars have conducted in-depth research from multiple perspectives and put forward many valuable views and conclusions, and this trend has triggered extensive attention from scholars in the boom of data elements development. At present, domestic and foreign academics have shown a spurt of discussions on data elements, and many scholars have proposed that the application of data elements has a positive effect on the creation of enterprise value, and at the same time, enterprise value creation as a more mature field of study, its theoretical and practical application has a long history, and the research results are also quite rich. However, it is worth noting that, although these two fields have been relatively mature in their respective studies, the in-depth exploration of combining the two is still insufficient, and the start time is relatively late, and the existing combined research stays at the theoretical level and lacks in-depth analysis of the actual application of the enterprise, especially at the level of empirical research and enterprise practice, which has a broad space for exploration. Therefore, this paper will take SANY heavy work as a case enterprise, and try to combine the data element related and enterprise mechanism creation for research.

4 CASE PRESENTATIONS

4.1 Introduction to SANY Heavy Industry

Since its establishment, SANY Heavy Industry Co., Ltd. has always been adhering to the corporate mission of "Quality Changes the World", adhering to independent innovation, and has rapidly risen to become a leader in the global equipment manufacturing industry. The development course of the company is full of challenges and opportunities, but SANY Heavy Industry has always maintained a steady development trend. With the corporate vision of "creating a first-class enterprise, creating first-class talents and making first-class contributions", SANY Heavy Industry is committed to becoming a leading equipment manufacturing enterprise in the world. The company focuses on the construction of corporate culture, advocates the core values of "being a human being first, doing things later", and encourages employees to be honest, dedicated, innovative and devoted. Meanwhile, SANY Heavy Industry also actively fulfills its social responsibility, pays attention to environmental protection and sustainable development, and strives to promote the green transformation of the industry. 2003, SANY Heavy Industry was successfully listed on the A-share market, becoming the first privately listed company in China's construction machinery industry. SANY Heavy Industry attaches great importance to technological innovation and invests more than 5% of its annual sales revenue in research and development. Up to now, the company has applied for more than 10,000 patents and authorized more than 7,000 patents, which is in the leading position in the industry. In terms of cost structure, SANY has achieved significant optimization through digital transformation.

4.2 Status of SANY Heavy Industry's Application of Data Elements

4.2.1 Process of applying data elements
Digital transformation strategy-Since 2018, SANY Heavy Industry has clearly put forward a digital transformation strategy, and with the deepening of digital transformation, it has begun to gradually increase the investment in and use of data elements. The core of this strategy lies in realizing the strategic transformation goals of "all business data" and

"all data business". Under the guidance of this strategy, SANY Heavy Industry has launched a comprehensive digital transformation process, and is committed to transforming all business activities into data, and optimizing business processes, improving operational efficiency, and innovating products and services through the analysis and application of data. Digital transformation for SANY Heavy Industry is not only a technical innovation, but also a profound business and management change. By introducing advanced technologies such as big data, cloud computing and artificial intelligence, SANY Heavy Industry has comprehensively reshaped and optimized its traditional business model and management processes. From product design, production and manufacturing to marketing and after-sales service, every link is integrated with digital elements, realizing the comprehensive coherence and intelligent application of data. Driven by digital transformation, SANY Heavy Industry has achieved high performance growth. Through the accurate analysis and application of data, the company is able to more accurately grasp market demand, optimize product design, improve production efficiency and reduce operating costs. At the same time, digital transformation has also improved SANY's market response speed and customer service capability, enabling the enterprise to better meet customers' individual needs and enhance market competitiveness.

Data analysis and application-SANY Heavy Industry makes full use of big data, artificial intelligence and other advanced technologies. Since 2008, SANY Heavy Industry has started to build a "terminal + cloud" industrial big data platform, which marks an important step for SANY Heavy Industry in the application of data elements. With the deepening of digital transformation, especially in the stage of comprehensive digital transformation (2018 to the present), SANY Heavy Industry has made full use of big data and artificial intelligence technology to an ever-deepening extent. The massive data collected is deeply mined and analyzed. Using advanced data analysis algorithmic models, it is able to extract valuable information and knowledge from the data, providing powerful data support for various business activities of the enterprise. In product development, SANY Heavy Industry uses data analysis technology to optimize product design and improve product performance and quality. By analyzing market feedback, customer usage data, etc., the enterprise can more accurately grasp the market demand and product performance requirements, so as to develop products that are more in line with market demand. In the manufacturing process, data analysis technology is used to optimize the production process and improve production efficiency and quality. Through real-time monitoring and analysis of various data in the production process, the enterprise can timely identify problems in production and make adjustments to ensure the stability and efficiency of the production process. After-sales service link, the use of data analysis technology to provide more efficient and intelligent after-sales service. Through the analysis of equipment operation data, enterprises can real-time monitoring of equipment operation status, timely detection of potential failures and early warning, to provide customers with more proactive, attentive service.

Intelligent service platform construction-Relying on the advanced industrial Internet platform, SANY Heavy Industry has successfully built a smart service platform covering the whole world. This platform integrates advanced technologies such as big data, cloud computing and artificial intelligence to realize real-time monitoring and intelligent management of SANY Heavy Industry' equipment worldwide. Through the intelligent service platform, SANY Heavy Industry is able to monitor the operation status of the equipment in real time, including the working hours, operation status and fault information of the equipment to ensure the normal operation of the equipment. Once the equipment is found to be abnormal or faulty, the platform can immediately carry out fault diagnosis and provide remote troubleshooting services to quickly solve the equipment problems and reduce the customer's downtime and maintenance costs. The intelligent service platform can also optimize the operation mode of the equipment. Through the analysis and mining of equipment operation data, the platform can discover the operation pattern and potential problems of the equipment, provide customers with more scientific operation suggestions and maintenance programs, and improve the operation efficiency and stability of the equipment.

The construction of the intelligent service platform not only improves the after-sales service level of SANY Heavy Industry, but also brings customers a more efficient and intelligent after-sales service experience. Customers can understand the operation status and maintenance situation of the equipment at any time through the platform, and obtain fault warning and maintenance suggestions in time to ensure the normal operation and productivity of the equipment.

4.2.2 Status of application of data elements

Intelligent Operation Ecosystem-SANY Heavy Industry has successfully built a comprehensive and intelligent operation ecosystem since 2018 through the in-depth application of data elements and relying on the advanced industrial internet operating system. In this ecosystem, SANY makes full use of the powerful functions of the industrial internet operating system to achieve comprehensive intelligence in all aspects of equipment, production and supply chain. Through real-time data collection and analysis, the enterprise can accurately grasp the production status, equipment status and market demand, so as to make more accurate decisions. This data-based decision-making not only improves production efficiency, but also reduces operating costs, bringing significant economic benefits to the enterprise. At the same time, the construction of the intelligent operation ecosystem also further enhances the market competitiveness of SANY Heavy Industry. Through digital transformation and the realization of intelligent manufacturing, the enterprise is able to respond more quickly to market changes and provide more personalized, high-quality products and services.

Lighthouse factory construction-Since the beginning of 2020, SANY Heavy Industry has built a number of lighthouse factories, becoming a leader in the global heavy industry. Among them, Beijing Piling Plant and Changsha Plant 18 stand out as the only two world lighthouse factories in the global heavy industry, which signifies that SANY Heavy Industry has reached the international leading level in intelligent manufacturing and application of data elements. The construction of these lighthouse factories is an important result of SANY Heavy Industry's in-depth application of data

elements and the construction of an intelligent operation ecosystem relying on the industrial Internet operating system. Through the in-depth integration of the manufacturing operation system, the Internet of Things management platform and other advanced systems, it realizes the intelligence and high efficiency of production and manufacturing, and greatly enhances the production efficiency and product quality of the enterprise. In the lighthouse factory, the manufacturing operation system is tightly integrated with the IoT management platform and other systems, realizing the comprehensive digitalization and intelligence of all aspects of equipment, production and supply chain. Through real-time data collection and analysis, companies can accurately grasp production conditions, equipment status and market demand, so as to make more accurate decisions. This data-based decision-making approach not only improves production efficiency, but also reduces operating costs, bringing significant economic benefits to the enterprise.

Data-driven product development-In the field of product development, SANY Heavy Industry has made full use of big data analysis technology to comprehensively optimize the product development process, significantly improving the efficiency and quality of product development. SANY Heavy Industry applies big data analysis technology to the whole process of product development, from demand analysis, design, testing to market, every link is integrated with the wisdom and power of data. At the early stage of product development, SANY Heavy Industry is able to accurately grasp the trends and changes in market demand for products by analyzing equipment operation data and market feedback data. This enables the company to fully consider the actual and potential needs of the market when designing products, avoiding blind development or excessive design. Big data analysis technology also plays an important role in the process of product development. Through real-time analysis and mining of design data, enterprises can identify problems in design and optimize them in time to ensure the progress and quality of product development. When the product enters the testing phase, big data analytics also plays an irreplaceable role. Through comprehensive analysis and mining of test data, enterprises can accurately assess the performance and stability of the product, and identify and solve potential problems in a timely manner. Ultimately, when the product is launched, big data analytics still provides strong support for the enterprise's marketing strategy. Through real-time analysis and mining of market feedback data, enterprises are able to keep abreast of product market performance and changes in customer demand, providing strong data support for continuous product improvement and upgrading.

Data-driven decision support-SANY Heavy Industry has built an advanced decision support system by fully utilizing the powerful capabilities of big data and artificial intelligence technology. This system provides real-time business data analysis and decision-making suggestions for the top management of the enterprise, enabling the enterprise to more accurately grasp the market dynamics and competitive situation, and providing powerful data support for the formulation of scientific and reasonable strategic planning and business strategies. The core of the decision support system lies in its powerful data analysis and forecasting capabilities. Through the real-time collection, storage and analysis of massive business data, the system is able to dig deeper into the laws and trends behind the data, revealing the nature and causes of market changes. This enables corporate executives to keep abreast of the latest market dynamics, including changes in customer demand, competitors' strategic adjustments, etc., so that they can make more rapid and accurate responses. In addition to data analysis and forecasting capabilities, the decision support system also provides rich visualization tools and interactive interfaces. This makes it easier for corporate executives to view and analyze data and discover key information and potential opportunities in the data. The ability to provide personalized decision-making suggestions and optimization solutions based on user preferences and needs further enhances the scientific and practical nature of decision-making.

5 DATA ELEMENTS DRIVE ENTERPRISE VALUE CREATION

This paper analyzes the effect of SANY Heavy Industry's data element-driven enterprise value creation using financial performance and non-financial performance. Among them, SANY Heavy Industry actively researches and develops and manufactures intelligent equipment in the process of realizing value creation, optimizes the industrial chain in the internal process of the enterprise, improves the production efficiency, and reduces the cost.

5.1 Financial Indicators

5.1.1 Total assets
The larger the size of an enterprise, the easier it tends to be able to access various resources, including capital, manpower, technology, etc. Therefore, this paper selects the company's total assets from 2013-2023 as the value of the company's size. These resources are the foundation for the development of the enterprise, which can support the enterprise to conduct more R&D, marketing and business expansion, so as to enhance the competitiveness and market position of the enterprise. At the same time, large-scale enterprises usually have a stronger ability to integrate resources, and can effectively allocate various resources to all aspects of the enterprise, improve the efficiency of resource use, reduce costs and increase profits, which can reflect the company's enterprise value from the side. As shown in Figure 1, since 2018, SANY Heavy Industry has vigorously developed the application of data elements, the company's scale has developed rapidly, even during the new crown epidemic, the company's scale is still showing an overall upward trend, and in 2022 it is more than double that of 2017, which can be intuitively seen that the application of data elements has a high impact on the development of enterprises.
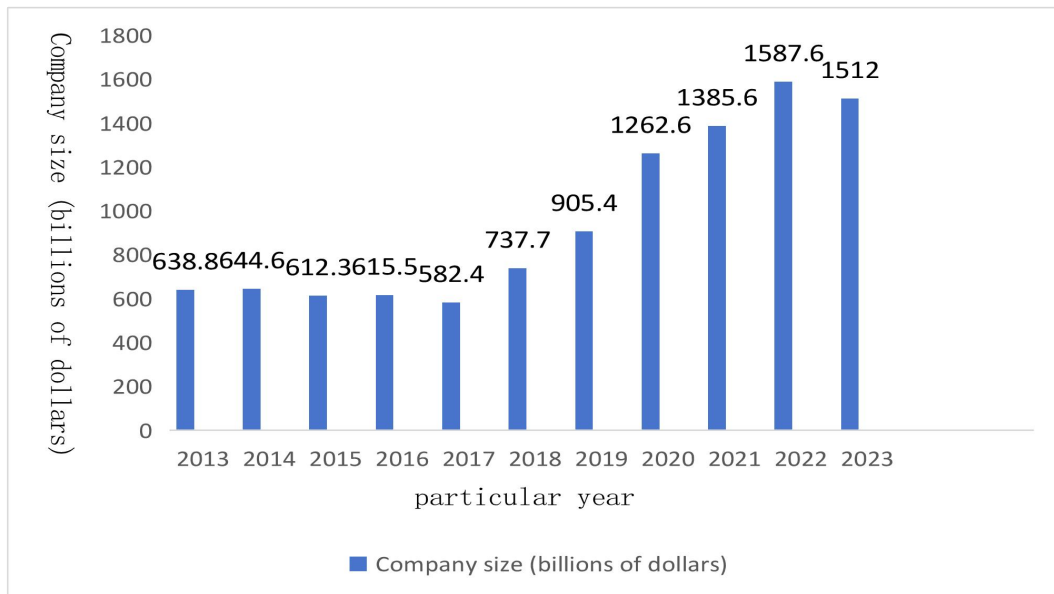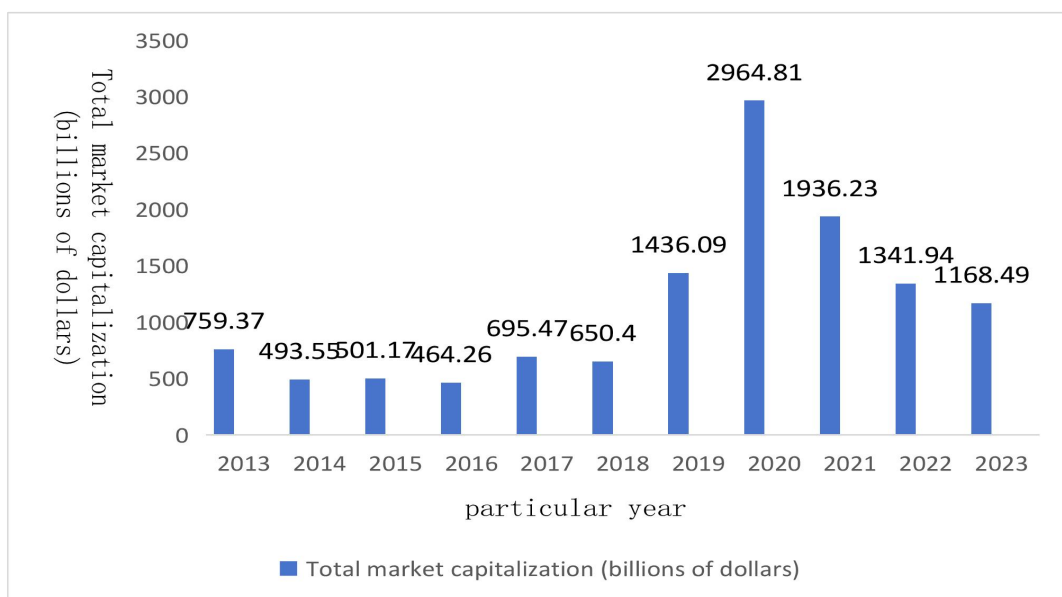
Figure 1 Total Assets of SANY Heavy Industry, 2013-2023

Data source: SANY Heavy Industry annual report collated

5.1.2 Total market capitalization

The total market capitalization indicator is selected by taking the value of the company's total market capitalization for the calendar years 2013-2023, because the change in the company's total market capitalization is usually closely related to the company's performance and growth. When a company performs well and has good growth, investors are confident in the future development of the company and are willing to buy the company's shares at a higher price, thus driving up the total market capitalization of the company. Conversely, when a company performs poorly or has limited growth, investors' confidence in the company declines, which may lead to a decline in the company's total market capitalization. As can be seen in Figure 2, since Trinity Heavy Industry vigorously developed the application of data elements in 2018, the market capitalization doubled in the following year, and then doubled again in 2020, reflecting strong investor support for the policy, and although the market capitalization slowly declined after 2020, it is still a great progress compared to before 2018, which side by side reflects the impact of data elements on the company's enterprise value.
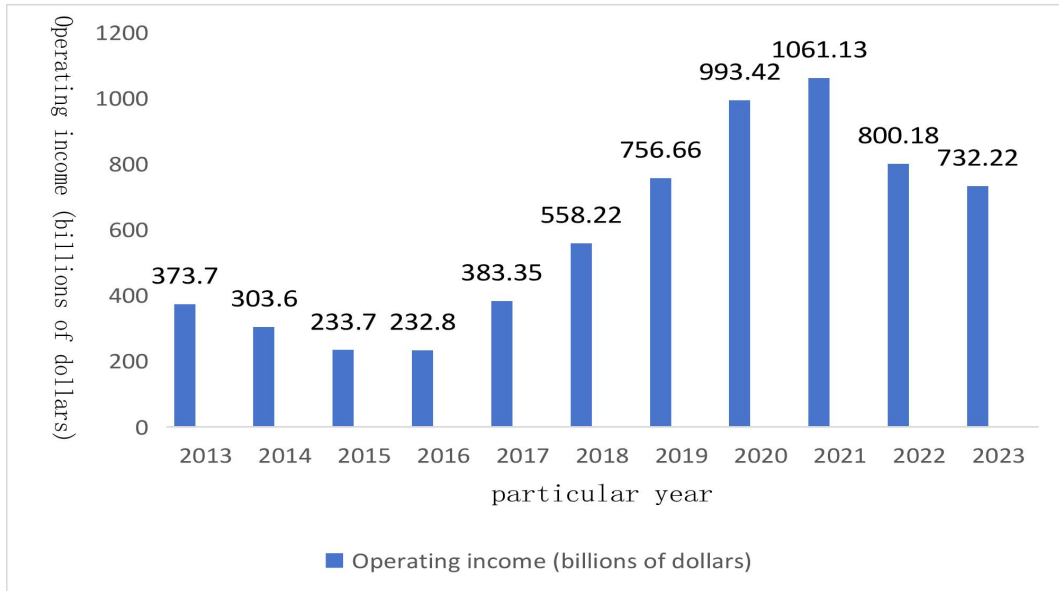
Figure 2 Total Market Capitalization of SANY Heavy Industry, 2013-2023

5.1.3 Operating income

The operating income indicator is selected by taking the value of the company's operating income for the calendar years of 2013-2023, because the growth speed and quality of operating income also reflect the operating efficiency and

market competitiveness of the enterprise. Under the same conditions, enterprises with faster growth in operating income tend to have higher operating efficiency and stronger market competitiveness, and can better meet market demand and resist market risks, thus enhancing enterprise value. As can be seen from Figure 3, the company's operating income is generally showing an upward trend, with rapid development and fast growth since 2018, and there is a decline in operating income in 2021 due to the impact of the epidemic, but the overall trend is showing an increase, which also side by side reflects that the application of the data elements in 2018 has a significant impact on the enterprise value of Trinity Heavy Industry.

Figure 3 Annual Operating Income of SANY Heavy Industry, 2013-2023

5.1.4 Enterprise value

In terms of enterprise value, the enterprise value calculated in Figure 4 is measured using the (total market capitalization/total assets) measure, as can be seen in the table, it reached 2.3 in 2020, indicating that at this time, SANY Heavy market performance is high, also from 2018 onwards, significant growth, in 2018, SANY Heavy began to focus on the development of the importance of the data elements, even if the challenges of the epidemic are faced in 2021, SANY Heavy also can realize the gradual expansion of the company's size, the overall trend of the total market capitalization is upward, and the company's growth is generally upward task shows that investors recognize the value of the enterprise.
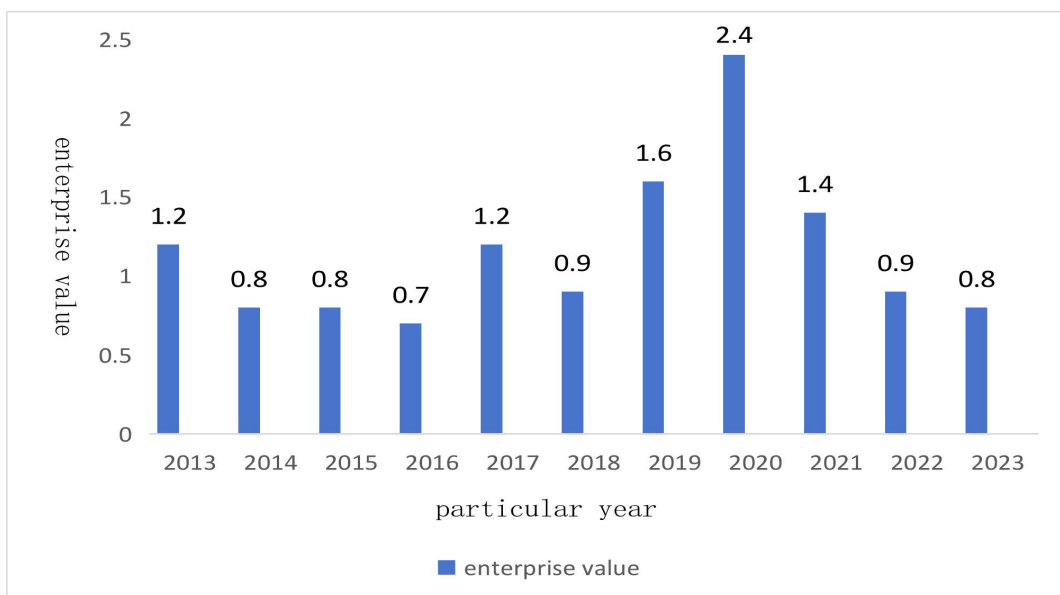
Figure 4 SANY Enterprise Value, 2013-2023

5.1.5 Selling and administrative expense ratios

As can be seen from Figure 5, after optimizing the internal value chain, SANY Heavy Industry enhances the flexibility and adaptability in storage, transportation and sales, and improves the efficiency of the flow. The application of data

elements improves the level of enterprise operation and management, and the position in the value chain has been improved, with the right to speak. From the point of view of sales expense ratio and management expense ratio, the overall ratio is getting lower and lower, and the cost of spending on product sales has been reduced; the management expense ratio has a large change, and the whole is in a downward trend, which indicates that its management costs have been controlled, reflecting that SANY Heavy Industry has improved the utilization rate of expenses through the use of digital technology, automated equipment, etc., which in turn has improved the value creation of the enterprise.
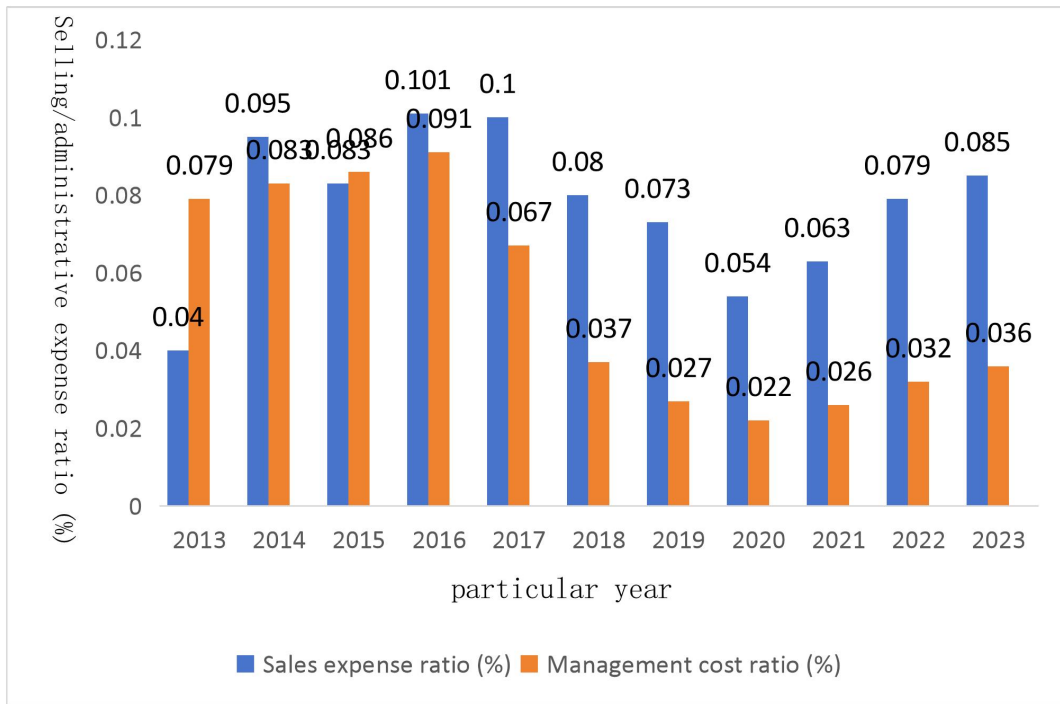

Figure 5 Selling Expense Ratio and Administrative Expense Ratio of SANY Heavy Industry 2013-2023

5.2 Non-financial Indicators

5.2.1 Breadth of data element coverage
We can make an in-depth analysis from multiple dimensions such as the breadth of data element coverage, innovation ability, brand value and market position. The following is a specific analysis, the breadth of data element coverage refers to the frequency of keywords related to data elements in the annual report of each year, Figure 6 can be seen that SANY Heavy Industry is focusing on the development of this direction precisely on the occasion of 2018, and SANY Heavy Industry has realized the operation status of the equipment on a global scale through the industrial Internet platform   of real-time monitoring and data analysis. This not only covers all kinds of data in the production process, but also includes multi-dimensional information such as market feedback, equipment operation, etc., showing the breadth of data elements covered.
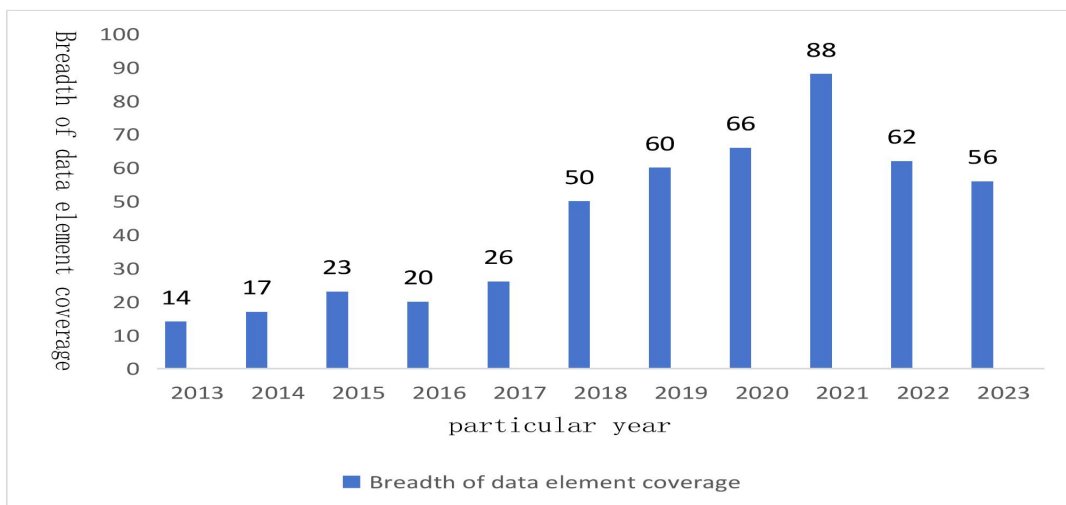

Figure 6 Breadth of SANY Heavy Industry's Data Element Coverage Rate from 2013-2023

5.2.2 Creative ability

SANY Heavy Industry has made remarkable achievements in the field of intelligent manufacturing, significantly improving the level of manufacturing processes and production efficiency by introducing robots, automation systems, IoT, visual recognition, AI and other technologies. The company also actively promotes digital transformation and has established several digital platforms, such as MES (Manufacturing Execution System) and MOM (Manufacturing Operation Management Platform), realizing the digitization of the whole process from product design, manufacturing to sales and service. Meanwhile, SANY spares no effort in innovation, constantly launching new products and technologies. For example, the company's self-developed L4-class driverless dump trucks, intelligent all-ground cranes, and disaster relief robots are all innovative products in the industry, demonstrating the company's strong strength in technology research and development.

5.2.3 Market position or market power

SANY Heavy Industry's share of the construction machinery market has continued to expand, and the company's market position and influence have increased significantly through digital transformation and the promotion of intelligent manufacturing. In several segments, such as excavators and concrete machinery, SANY occupies a leading position. Meanwhile, SANY Heavy Industry' business and industrial bases are spread all over the world, with overseas R&D and manufacturing bases in many domestic cities as well as in India, the United States, Germany and Brazil. This globalization layout not only enhances the company's market competitiveness, but also improves its international influence.

5.2.4 Brand value or brand influence

As SANY Heavy Industry continues to make breakthroughs in intelligent manufacturing and digital transformation, the company's brand influence is also increasing. The company has repeatedly won recognition and awards from domestic and international authorities, such as the "Lighthouse Factory" certified by the World Economic Forum, etc. These honors have further enhanced SANY Heavy Industry's brand image and market position. As shown in Figure 7, SANY Heavy Industry did not appear on the Forbes Global 2000 list during the period of 2013-2019, but has been vigorously developing the application of data elements since 2018, and the maturity of the technology will enable the company to enter the Global 2000 in 2020, and even the Global 500 in 2021.
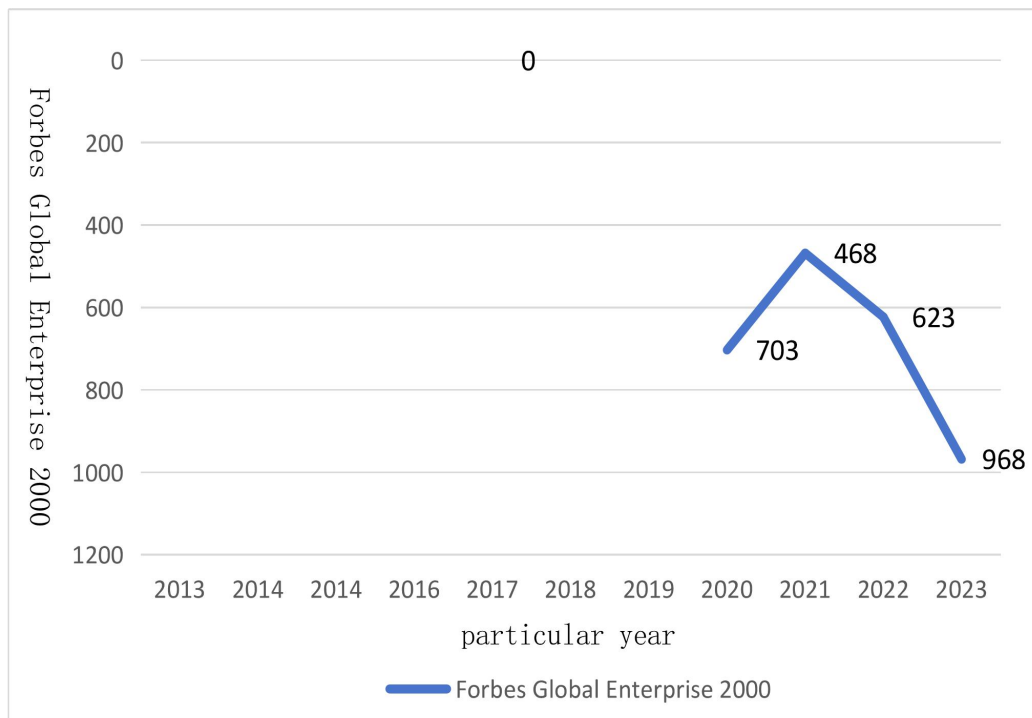

Figure 7 SANY Heavy Industry World Ranking 2013-2023

6 CONCLUSIONS AND IMPLICATIONS

Through in-depth analysis of SANY Heavy Industry, we find that data elements play a crucial role in the process of enterprise value creation. SANY Heavy Industry has successfully constructed a data-driven decision support system and intelligent manufacturing system through the deep excavation and application of big data, artificial intelligence and other advanced technologies, realizing the intelligent upgrading of production operations, product development, marketing and other aspects. In this process, data has not only become a key tool for enterprises to gain insight into market demand, optimize resource allocation, and improve product quality and efficiency, but also promotes the innovation of business models and the reconstruction of the value chain. SANY Heavy Industry's practice shows that the effective utilization of data elements can significantly enhance the core competitiveness of enterprises and drive the continuous growth of enterprise value. Enterprises should fully recognize the importance of data as a new production

factor, strengthen the accumulation, integration and management of data resources, and ensure the authenticity, integrity and timeliness of data. Through the establishment of a perfect data governance system, the quality and usability of data can be improved to provide strong support for enterprise decision-making. SANY Heavy Industry's successful experience tells us that enterprises should actively introduce advanced information technology, promote the optimization and reengineering of business processes, and realize the intelligent upgrading of production operations, product development, marketing and other aspects. By building a data-driven decision support system and intelligent manufacturing system, the operational efficiency and innovation ability of the enterprise is enhanced. The value of data elements lies in their analyzing and application capabilities. Enterprises should establish a perfect data analysis team and mechanism, use advanced data analysis technology and tools, dig deep into the laws and trends behind the data, and provide a scientific basis for the strategic planning and operational decision-making.

COMPETING INTERESTS

The authors have no relevant financial or non-financial interests to disclose.

FUNDING

REFERENCES

[1] Gao Fuping, Ran Gaora. Data Factor Market Formation Theory--A Mechanism Framework for Data Factor Governance. Shanghai Economic Research, 2022, (09): 70-86.

[2] Xu Bin, Xu Shoubo. Hierarchy theory of factors of production. Journal of Beijing Jiaotong University (Social Science Edition), 2006, 5(4): 15-18.

[3] Farboodi M, Veldkamp L, A Growth Model of the Data Economy. SocialScience Electronic Publishing, 2020, 28(8): 13-58.

[4] Carriere-Swallow Y, Haksar V. The Economics and Implications of Data; AnIntegrated Perspective. IMF Departmental Papers / Policy Papers, 2019, 19(13): 1-51

[5] Jones C I, Tonetti C. Nonrivalry and the Economics of Data. American Economic Review, 2020, 110(9): 2819-2858.

[6] Posner E, Weyl E. Radical Markets: Uprooting Capitalism and Democracy for a Just Society. Princeton: Princeton University Press, 2021: 205-249.

[7] Xie Kang, Xia Zhenghao, Xiao Jinghua. Enterprise realization mechanism of big data becoming a real production factor: A product innovation perspective. China Industrial Economy, 2020, 386(5): 42-60.

[8] Kong Yanfang, Liu Jianxu, Zhao Zhongxiu. Research on market allocation of data factors: connotation deconstruction, operation mechanism and practice path. The Economist, 2021, 275(11): 24-32.

[9] Li Zhiguo, Wang Jie. Digital economy development, data factor allocation and manufacturing productivity improvement. The Economist, 2021, 274(10): 41-50.

[10] Qi Yudong, Liu Huanhuan. Research on production factor attributes of data and its market-oriented allocation mechanism under digital economy. Economy, 2020, 420(11): 63-76+2.

[11] Yang Qingxiang, Liao Sweet. Research on the relationship between internal control, technological innovation and value creation ability. Journal of Management, 2017, 14(08): 1190-1198.

[12] Michael Porter. Competitive Advantage: Creating and Sustaining Superior Performance. New York: Free Press, The Academy of Management Review. 1985.

[13] Zhang Renzhi. Can enterprise digital transformation improve the efficiency of intellectual capital value creation? Research on Financial Issues, 2023, (5): 89-100.

[14] Pan Liurong. Technological Progress Path, Business Model Innovation and Corporate Value Creation--Taking Listed Companies in Distribution Industry as an Example. Research on Business Economy, 2023, (4): 150-153.