

Integration of Number and Reality for High-Quality Development of Hunan's Advanced Manufacturing Industry

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Abstract: This article focuses on the promotion of the integration of number and reality to the high-quality development of advanced manufacturing industry in Hunan province. Under the background of a new round of scientific and technological revolution and industrial transformation, Hunan province's advanced manufacturing industry is facing challenges, and the integration of numbers and facts has become a key breakthrough. Through literature research and theoretical analysis, this article analyzes the mechanism of digital and real integration to promote its high-quality development, and studies the present situation and problems of digital and real integration in Hunan province advanced manufacturing industry. It is found that although some progress has been made in this field, such as the promotion of digital infrastructure construction and the active transformation of some enterprises, there are still problems such as insufficient application depth of digital technology and lack of talents. Based on this, this article puts forward some strategies, such as strengthening the innovation and application of digital technology, improving the construction of digital infrastructure, strengthening the training and introduction of talents, and improving the policy support system, so as to promote the advanced manufacturing industry of Hunan province to achieve high-quality development through the integration of data and reality.

1. Introduction

Under the background of a new round of global scientific and technological revolution and industrial transformation, the manufacturing industry is accelerating the transformation to digitalization and intelligence [1]. Hunan province, as a major manufacturing province, advanced manufacturing occupies a key position in its economic system, which is of great significance to promoting regional economic growth and enhancing industrial competitiveness [2]. However, with the profound changes in the international market environment, Hunan province's advanced manufacturing industry is facing many challenges, such as the unsustainable traditional development model, insufficient innovation ability and the need to improve the level of industrial synergy [3]. How to achieve high-quality development has become an important issue to be solved urgently in Hunan province's advanced manufacturing industry.

The deep integration of digital technology and real economy has become a key force to promote industrial upgrading and innovation [4]. In the field of manufacturing, digital integration can effectively improve production efficiency, innovation ability and product quality by widely applying digital technologies such as big data, artificial intelligence and Internet of Things to product design, manufacturing and supply chain management, and inject new impetus into the high-quality development of advanced manufacturing [5]. For Hunan province's advanced manufacturing industry, actively promoting the integration of numbers and facts is not only an inevitable choice to conform to the development trend of the times, but also an important way to realize industrial transformation and upgrading and enhance core competitiveness [6]. The purpose of this article is to deeply analyze the internal mechanism of the integration of numbers and facts to

promote the high-quality development of Hunan province's advanced manufacturing industry, analyze its development status and existing problems, and put forward targeted strategies in order to provide useful reference for Hunan province's advanced manufacturing industry to achieve high-quality development.

2. Related theoretical basis and literature review

Digital-real integration aims to deeply penetrate and transform all aspects of the real economy by using digital technologies, such as big data, cloud computing, artificial intelligence and Internet of Things [7]. Its core lies in realizing the digital transformation of the real economy, improving production efficiency, optimizing resource allocation and promoting new business models with the help of the innovative driving force of digital technology. In the context of Hunan province's advanced manufacturing industry, the integration of data and reality is manifested in the use of industrial internet to connect equipment, systems and personnel, and through the collection, analysis and application of data, the intelligent manufacturing and scientific management decision-making are promoted.

The high-quality development of advanced manufacturing industry emphasizes the improvement of industrial innovation ability, product quality optimization, green sustainable development and industrial ecological improvement while maintaining scale growth [8]. This theory requires the advanced manufacturing industry to achieve a breakthrough in technological innovation and master the core key technologies; Reach the international advanced level in product quality; Pay attention to green environmental protection and efficient use of resources in the development model; Build a cooperative and symbiotic industrial chain system in industrial ecology. This is of great guiding significance for Hunan province's advanced manufacturing industry to define its development direction and set its development goals.

Scholars have carried out a lot of research around the integration of numbers and reality and the development of advanced manufacturing industry. Part of the research discusses the influence of the integration of number and reality on the innovation efficiency of manufacturing industry and the reform of production mode, and affirms its positive role [9-10]. However, there is little research on the integration of numbers and facts in Hunan province's advanced manufacturing industry, especially the lack of multi-dimensional in-depth analysis from regional characteristic industrial base and policy environment. There are still gaps in the existing literature in the specific path and strategy of promoting the high-quality development of Hunan province's advanced manufacturing industry through the integration of numbers and facts. This leaves room for this study, which needs further in-depth discussion to fill the gap between theory and practice.

3. Mechanism analysis of the integration of numbers and facts to promote the high-quality development of Hunan province's advanced manufacturing industry

Under the background of digital integration, Hunan province advanced manufacturing enterprises use digital technology to broaden innovation channels. Through big data analysis, enterprises can accurately grasp market demand and provide direction for product research and development. The application of virtual design and simulation technology shortens the development cycle of new products and reduces the research and development cost. Taking Sany Heavy Industry as an example, using digital simulation technology, the performance can be tested and optimized in the product design stage, reducing the number of physical prototype manufacturing and accelerating the product listing process.

The integration of number and reality optimizes the production process of Hunan province advanced manufacturing industry by introducing automation and intelligent technology. Relying on the industrial Internet, equipment networking and digitalization of production links are realized, and the production process can be monitored and accurately regulated in real time. Table 1 clearly shows the changes before and after the integration:

Table 1: Comparison of Indicators for Production Process Optimization through the Integration of Digital and Physical Economies

Indicator	Before Integration	After Integration
Equipment Downtime Due to Faults (hours/month)	30	10
Product Defect Rate (%)	5	1
Increase in Production Efficiency (%)	-	50

The integration of number and reality has promoted the upstream and downstream enterprises of Hunan province advanced manufacturing industry chain to strengthen cooperation. With the help of digital supply chain management system, enterprises can realize real-time information sharing, accurately arrange production and distribution, and improve the response speed and stability of supply chain. At the same time, the integration of number and reality has spawned new formats and models such as personalized customization and service-oriented manufacturing. This expansion of industrial ecology has promoted the position of Hunan province's advanced manufacturing industry in the global industrial chain and enhanced the overall competitiveness of the industry.

4. Present situation and problems of the integration of data and reality in Hunan province advanced manufacturing industry

4.1. Development Status

In recent years, Hunan province advanced manufacturing industry has taken solid steps in the process of integration of data and reality. Some leading enterprises in the province are actively playing a leading and demonstrating role. Taking Zhuzhou CRRC as an example, they have carefully built smart factories with digital technology, successfully achieving the intelligentization and flexibility of rail transit equipment production and becoming the industry benchmark. At the same time, the government has also given strong support and timely issued a series of policies to effectively guide enterprises to increase investment in digital transformation. In-depth analysis from the perspective of the degree of digital application of enterprises can clearly present the specific situation of enterprises of different scales through Table 2:

Table 2: Distribution of Digital Application Levels among Advanced Manufacturing Enterprises in Hunan Province

Enterprise Size	Automation Implementation Rate in Key Production Links	Description of Production Automation Coverage	Deployment Status of Management Information Systems	Evaluation of Information Integration Degree	Involvement in Digital Production Methods	Application Status of Management Digitalization
Large Enterprises	Over 85%	Full automation in key production links, covering core processes such as processing and assembly	92% have deployed ERP, CRM, and other systems, achieving multi-system collaborative operations	Highly integrated, real-time data sharing of all systems, and seamless business processes	Extensively adopting digital production technologies, such as intelligent manufacturing and flexible production	Fully applying digital management tools, covering all areas including finance, human resources, and supply chain
Medium-sized Enterprises	Around 65%	Partial automation in key production links, with higher automation levels in processing links	75% have implemented some informatization modules, such as financial management and human resource management informatization	Moderately integrated, with some data interaction possible between systems but certain information barriers exist	Partially introducing CNC equipment for production and beginning to explore digital production modes	Applying basic management digitalization tools, mainly concentrated in finance and human resources management
Small Enterprises	Around 45%	Only a few key production links adopt CNC equipment	38% have started using basic office automation software, such as financial accounting software and simple personnel management software	Low integration degree, with low digitalization levels across various business links and difficult data sharing	Initially attempting to adopt simple CNC equipment for production, with digital production in its infancy	Only using basic digital tools in finance and office aspects, with low management digitalization levels

4.2. Exist problem

Although Hunan province's advanced manufacturing industry has made some achievements in the integration of data and reality, it still faces a series of problems to be solved urgently. The first problem is that the application depth of digital technology is insufficient. Most enterprises are only in the primary stage of digitalization at present, and have not mastered the ability to fully tap the potential value of data and effectively apply it to production decision optimization. Secondly, the lack of digital and real integration professionals has become an important bottleneck restricting the development of enterprises. Because the number of compound talents who are proficient in manufacturing business and digital technology is scarce, enterprises are facing great challenges in attracting and retaining such talents. Furthermore, with the deepening of digitalization of enterprises, data security issues are increasingly prominent, and key data such as production data and customer information are facing severe leakage risks. However, the current data security protection system of enterprises is still not perfect, and it is difficult to effectively deal with increasingly complex network security threats. In addition, the data compatibility between different enterprises and different systems is poor, and the phenomenon of information islands is widespread. This seriously hinders the coordinated development between upstream and downstream enterprises in the industrial chain, making it difficult to give full play to the overall efficiency of the integration of data and reality.

5. Strategy of promoting the high-quality development of advanced manufacturing industry in Hunan province by the integration of number and reality

The government should encourage advanced manufacturing enterprises in Hunan province to increase investment in digital technology research and development, and establish a Industry-University-Research cooperation mechanism among enterprises, universities and scientific research institutions to jointly overcome key technical problems such as artificial intelligence in production quality inspection and big data-driven supply chain optimization. The government can set up a special research fund to give financial support to enterprises that actively carry out digital technology innovation. A digital technology application demonstration platform should be established to guide other enterprises to learn from successful application cases by selecting industry-leading enterprises.

The government needs to increase investment in digital infrastructure such as 5G, industrial Internet and data center. A detailed infrastructure construction plan should be formulated, with clear construction goals and timelines. Table 3 shows the specific construction objectives, covering network coverage, platform construction indicators and other aspects, providing clear guidance for infrastructure construction and promoting equipment interconnection and data interactive sharing among enterprises.

Table 3: Target Planning for Digital Infrastructure Construction in Advanced Manufacturing in Hunan Province

Infrastructure Type	Construction Time Frame	Specific Construction Targets
5G Network	Next 3 years	Full 5G signal coverage in advanced manufacturing clusters, with download speeds exceeding 800Mbps
Industrial Internet Platform	Next 5 years	Achieve a 70% penetration rate and add 500,000 sets of connected devices
Data Center	Next 2 years	Build 3 new data centers, expand storage capacity to 200PB, and increase processing capacity by 50%

The government should promote colleges and universities in the province to adjust the setting of disciplines and specialties, set up related majors such as "intelligent manufacturing engineering" and "industrial Internet technology", pay attention to practical teaching, and jointly build practical training bases with enterprises. Online and offline integrated skills training courses for in-service personnel should be conducted. Outstanding talents from other regions should be attracted through preferential policies such as providing housing subsidies and research start-up funds. Talents who

have made outstanding contributions in the field of integrating digital and reality should be recognized and rewarded through the establishment of a talent reward mechanism.

The government needs to improve the preferential tax policies, and reduce the relevant taxes and fees on digital equipment purchase and software research and development for advanced manufacturing enterprises that carry out digital integration. The government should also increase financial subsidies, set up special subsidy funds for digital integration, and give a certain proportion of financial subsidies to enterprises' digital transformation projects. In addition, the government needs to formulate relevant laws and regulations on data security, standardize data use and management, ensure enterprise data security, and create a good policy environment for the integration of data and reality in Hunan province's advanced manufacturing industry.

6. Conclusions

The integration of number and reality is the only way for Hunan province's advanced manufacturing industry to move towards high-quality development. Based on the in-depth study of relevant theories and the actual situation of Hunan province, this article clarifies the important role of the integration of numbers and facts in improving innovation ability, optimizing production process and expanding industrial ecology. Although Hunan province's advanced manufacturing industry has achieved initial results in the process of digital integration, such as the gradual improvement of digital infrastructure and the active exploration of digital transformation of some enterprises, many problems can not be ignored. These problems include superficial application of digital technology, shortage of professionals, hidden dangers of data security and isolated islands of information, which limit the depth and breadth of digital-real integration.

A series of strategies are put forward to solve the above problems, covering many dimensions such as technological innovation, infrastructure construction, talent cultivation and introduction, and sound policy system, which have strong pertinence and operability. By strengthening the innovation and application of digital technology, we can further tap the potential of digital technology; Improve the digital infrastructure and lay a solid foundation for integrated development; Strengthen the construction of talent team and provide core intellectual support; A sound policy support system will create a good external environment. The concerted efforts of many parties are expected to comprehensively deepen the integration of numbers and facts, promote the advanced manufacturing industry of Hunan province to achieve high-quality development, enhance its position in the national and even global industrial competition pattern, and promote the sustainable prosperity of Hunan's economy.

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