Study on the Influencing Factors of Digital Intelligence Empowerment in Smart Manufacturing Enterprises

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Abstract: At present, enterprises have achieved more desirable results on digital transformation, with the continuous upgrading of technology and demand for digital intelligence empowerment is gradually introduced into people's vision. Digital intelligence empowerment provides new development mileage in agricultural mechanization, automotive industry, intelligent public service energy, and the World Smart Manufacturing Conference 2022 also announced the top ten technological advances in smart manufacturing in China, and the impact of digital intelligence empowerment on smart manufacturing enterprises is widely concerned. The article will study the influencing factors of digital intelligence empowerment of smart manufacturing enterprises, and considers that the external environment, user demand, industry progress, and organizational management model have influenced the digital intelligence empowerment of smart manufacturing enterprises.

1. Introduction

The wave of digitization has swept up a large number of traditional industries inclined to digital development and began to develop industrial digital economy, management models, production structures and methods with the aid of modern technology represented by the Internet, big data and artificial intelligence. China is now focusing on industrial intelligence and digital change, promoting digital industrialization and industrial digitalization seeking to the intelligence industry path. Intelligent manufacturing enterprises as the main force of intelligent industrial development should first focus on the role of intelligent manufacturing enterprises in the development of intelligence. Smart manufacturing is the core technology paradigm of the technological revolution, emphasizing that the combination of digital intelligence and practicality is an essential part of China's construction of a manufacturing power.At present, China's intelligent manufacturing industry technology level is relatively low, and many factors constrain the development of intelligent manufacturing, so it is necessary to strengthen the research on intelligent manufacturing system and understand the core technology of strengthening modernization. By studying the digital transformation of Fenxi Heavy Industries, Zhang [1]found that the enterprise built a digital control system from production to after-sales process through an intelligent control platform according to

the control objectives and management ideas, and finally achieved the reduction of production cost and production cycle. Ding [2] considered smart manufacturing as a necessary development stage for the intelligent transformation of enterprises, and constructed a three-stage theory of enterprise intelligent influence factors. Proposed three stages of intelligent manufacturing ecosystem: digital stage, network stage and intelligent stage, in which the development of enterprise intelligent manufacturing system has been significantly improved. Enterprises follow the paradigm of digital manufacturing to smart manufacturing and then to a new generation of smart manufacturing for uninterrupted updates. Chinese manufacturing enterprises transform and upgrade smart manufacturing with cross-technology paradigm [3]. To enhance management decisions, Pacheco [4] proposed a new RFID-based intelligent system to enable smart manufacturing companies to monitor and optimize the production process, thus providing support for decision making on problems that arise in the production process. Smart industrial technology innovation is also influenced by the value of smart industries, R&D funding, and internal expenditures [5]. You[6] believed that technological progress has a positive impact on industrial structure upgrading, while the level of industrial development and government policies have a positive impact on intelligence. Qiu[7] discussed the development of intelligent manufacturing from the perspective of the development of new energy vehicles, and believes that new energy vehicles are approaching the development of intelligent manufacturing, which has derived new areas while alleviating environmental pollution. Jin[8] found that both external environmental factors and industry progress affect the development of smart manufacturing companies in terms of digital intelligence empowerment based on structural equation modeling. Han [9] evaluated the enterprise's intelligent manufacturing capability from three dimensions: basic conditions, construction capability, and industry benefits and proposed to complete the digital intelligence empowerment of intelligent manufacturing enterprises by enhancing independent R&D capability, innovation capability, and intelligent equipment application capability. Xie[10] proposed to enhance the supply of intelligent manufacturing equipment such as basic components, intelligent workshop construction, intelligent industrial control system, and help to build intelligent manufacturing system to realize the digital upgrade and intelligent transformation of manufacturing enterprises. Through the combination of big data platform, artificial intelligence and other intelligent manufacturing enterprises to carry out digital intelligence empowerment, through the overview can be found in the subjective and objective factors that affect the enterprise digital intelligence empowerment, this paper selected the external environment, user demand, industry progress, digital intelligence technology, organizational management model five aspects to explore the impact of intelligent manufacturing enterprise digital intelligence empowerment factors.

2. Smart Manufacturing and Digital Intelligence Empowerment

2.1. Smart Manufacturing Connotation

Smart manufacturing is in line with the trend of industrial revolution development, combined with a new generation of information technology to optimize the manufacturing process and cycle of products generated by real-time management, through intelligent scientific methods, theories connected to the Internet, big data, artificial intelligence and other full participation in the product production process, including self-learning, self-decision, self-execution and other characteristics. Germany has a first-mover advantage in smart manufacturing, according to the Industry 4.0 strategy, through smart factories, smart logistics and smart production to achieve intelligent strategic transformation and upgrading, China to use new technologies, connect the industrial Internet, build a number of intelligent system for industrial characteristics, to enterprise products, equipment management, services, production methods intelligent, to train new talents, break through the neck,

establish core technology as the goal of developing smart manufacturing[11].

2.2. Digital Intelligence Empowerment Connotation

Digital intelligence empowerment is a digital advancement, in the digital intelligence environment to make the organization or system combination or re-build digital intelligence class production factors, so that the enterprise shareholders, creditors to achieve the goal of optimization, improve the production, management, competition, and other series of capacity for the development of the organization, to create higher value and capacity for the organization's activities [12]. After the enterprise digital intelligence empowerment can more accurately assess some complex non-quantitative data and information, through the digital intelligence platform and cloud server real-time dynamic monitoring, the macro data and information collected through the digital intelligence technology into two-dimensional, three-dimensional visual screen, graphics, optimize the market, users, the demand for communication and contact between enterprises and the three parties generated by the continuity of the data structure, through the digital intelligence technology derived Decision screening optimal decision making more human thinking more intelligent.

2.3. Smart Manufacturing Enterprise Digital Intelligence Empowerment

Internet infrastructure makes the core of intelligent manufacturing enterprises' digital intelligence empowerment, based on software and hardware facilities, factory internal and external networks, sensors and gateways and other Internet infrastructure as the basis for digital intelligence empowerment. Europe, the United States, Japan, South Korea and other countries in the era of Industry 4.0 opened gradually to adapt to the national conditions of the development of intelligent manufacturing strategy based on the industrial Internet. China also promotes the implementation of the manufacturing power strategy and proposes the top-level design of national intelligent manufacturing standardization in the "National Intelligent Manufacturing Standard System Construction Guide"[13]. After the improvement of network infrastructure, the key technology of smart manufacturing is the key to the success of smart manufacturing enterprises' digital intelligence empowerment. Some basic technologies such as design simulation and standard digital technology; advanced process technology; common technologies such as intelligent perception, intelligent sensing and digital twin; and applicable technologies such as artificial intelligence and big data are all needed to be grasped by smart manufacturing enterprises [14]. Smart manufacturing has a positive and significant impact on it, human capital is the mechanism of smart manufacturing enterprises to improve the number of intelligent empowerment, accelerate the manufacturing technology industrial intelligence level and output value will be positively affected [15].

3. Digital Intelligence Empowerment Influencing Factors Determination

3.1. External Environment

As a big manufacturing country, China wants to improve the quality of manufacturing industry and intelligent manufacturing is the main direction. The 14th Five-Year Plan for the Development of Intelligent Manufacturing points out that we should build a high-quality, high-speed, green and low-carbon, dynamic and optimized intelligent manufacturing system based on manufacturing, intelligence, technology and equipment, driven by big data, and factory and supply chain, and promote the digital transformation, networked collaboration and intelligent change of intelligent manufacturing enterprises. Firstly, universities and organizations are encouraged to use the public service platform of smart manufacturing, Gao [16] took Ningbo as a sample to observe that local

enterprises have improved the sustainable development of smart manufacturing after embedding the supply chain and blockchain smart service innovation system. Secondly, supported by national key scientific research projects and national key R&D programs for smart manufacturing development, Zhu [17] analyzed and study the financing efficiency of smart manufacturing enterprises based on data envelopment analysis (DEA model) and find that smart manufacturing enterprises currently have low R&D investment and government policies play a positive role in financing development of smart manufacturing enterprises. Finally collaborative development, gathering all kinds of human resources and resources to develop a digital intelligence road for smart manufacturing enterprises combined with their own situation. Zhou [18] studied the development of smart manufacturing in China's steel industry and introduced some smart production technologies suitable for the development of China's steel industry. China's digital intelligence road through the "One Belt, One Road" and the BRICS cooperation mechanism has brought more opportunities and challenges for domestic smart manufacturing enterprises through the absorption and exchange of foreign technologies and policies. The external environment for smart manufacturing enterprises includes government policy encouragement, national research funding, and domestic and international industry cooperation, all of which are conducive to digital intelligence empowerment.

3.2. User Requirements

3.2.1. Functional Requirements

The development of the digital intelligence era has triggered changes in all areas of the economy and society, and the needs of suppliers, consumers, and smart manufacturing companies for product production, management, innovation, and transportation modes have gradually changed. He [19] through the study of green port construction found that in order to strengthen the construction of port logistics operation system and in the lighting equipment of low-carbon energy-saving terminal assembly company to intelligent, digital, green transformation. In order to solve the problem that experts cannot visit and inspect the sudden failure of production lines in manufacturing companies, Epson released a new type of digital intelligence glasses to promote the upgrading of the industry's digital intelligence [20]. To measure the height and slope of the base station Zhang established communication base station parameters intelligent collection terminal [21]. In order to achieve new functional requirements and difficult human needs cannot be completed, enterprise digital intelligence is inevitable so functional requirements in the digital intelligence environment can promote intelligent manufacturing enterprise digital intelligence empowerment.

3.2.2. Quality Requirements

China is in the stage of high quality development and the national demand for quality of smart products is increasing. The selection of parameters in process making has a great impact on product quality, in order to improve product qualityWen [22] based on genetics and artificial neural network honing parameters intelligent selection system to achieve intelligent selection of honing parameters. Chen [23] proposed an intelligent controller based on fuzzy control and artificial neural network (ANN) technology to implement control of EDM parameters in order to realize the determination of EDM online parameters. Huang [24] designed an artificial intelligence mechanism based on quantum neural network for decision making of touch screen film printing control parameters to improve printing product quality, which provides ideas for printing efficiency and digital intelligence transformation of printing enterprises. This shows that the improvement of product quality control and demand is conducive to the transformation of enterprise digital intelligence thus promoting digital intelligence empowerment.

3.3. Industry Progress

3.3.1. Technological Progress

The rise of big data and artificial intelligence makes the access to information easier, and industrial and technological upgrades arise from the complex and numerous information collisions. The future development direction of intelligent manufacturing is related to demand; green and intelligent are the two key development directions of intelligent manufacturing, which requires more advanced technology to prompt intelligent manufacturing to meet the green and intelligent demand. At present, the new cross-technology formed by artificial intelligence and multi-technology has been widely used in medical, mobile Internet, education and other industries and plays a key role in the knowledge economy, which is rapidly developing in four aspects of the main problem reasoning solution, machine learning, network structure and knowledge processing [25]. The new cross-technology formed by artificial intelligence and multi-technology has substantially enhanced the development of digitalization, networking and intelligence in related industries. Li [26] analyzed the stride from weak artificial intelligence to strong artificial intelligence stage based on two aspects of algorithm and arithmetic power, arguing that artificial intelligence technology is continuously progressing in the industry and its application is deepening. New generation of information technology advances to promote the development of digital intelligence technology,leading intelligent manufacturing enterprises to widely apply intelligent technology thereby, promoting the development of enterprise digital intelligence empowerment.

3.3.2. Intelligent Knowledge Cognitive Progress

The profound changes brought by emerging technologies are not only reflected in smart products and smart production, but also change the carrier and form of knowledge, the way of dissemination and the way of understanding. Both intelligent knowledge and knowledge intelligence will be understood, and learning in the era of artificial intelligence requires a shift from knowledge learning to learning of ability, and the cognition of intelligent knowledge is transformed into the ability to apply intelligent technology [27]. Knowledge management mode also gradually tends to be intelligent; emphasizing human-machine collaborative management this management mode combines the advantages of expert experience and data mining is conducive to deepening the cognition of intelligent knowledge by integrating innovation in acquiring and integrating knowledge [28]. The maintenance of knowledge intelligence through text data makes it easy to know the causes of errors in production and management [29], and improve the rate of troubleshooting in digital intelligence empowerment.

3.4. Organizational Management

In the context of digital intelligence, big data and artificial intelligence technologies are widely used which requires intelligent manufacturing enterprises not only to be digital intelligent in product production, but also need digital intelligent innovative talents and new organizational management model. Ding[30] through the study of the relationship between artificial intelligence and accounting work found that the organization should change and upgrade management thinking, the application of intelligent technology, upgrade the intelligent manufacturing enterprises to achieve the effect of digital intelligence empowerment, the best way for the organization to respond to digital intelligence is to actively change and upgrade their own management thinking to change the traditional management model to continuously absorb the introduction of fresh digital intelligence innovative talent, enhance the organization's own knowledge structure to enhance

complex decision-making Judgment and thus positively promote the organization's digital intelligence empowerment. The level of digital intelligence knowledge of the organization's management affects the organization's awareness of digital intelligence. Traditional managers are less willing to absorb digital intelligence knowledge and thus have a more negative attitude toward the organization's implementation of digital intelligence empowerment than managers with higher levels of digital intelligence knowledge [31]. Organizations tend to establish data management departments in management, data management departments require leaders and employees to upgrade the application of data, data architecture control and platform construction capabilities, so that the technical and data issues that arise in the digital intelligence empowerment of timely and dynamic monitoring and feedback. Organizational intelligent risk control management, intelligent decision management also affects the number of intelligent empowerment to a certain extent, intelligent risk control management by driving real-time data and external data to assess the credit risk outside the organization, the organization's internal data leakage anti-fraud risk. Build decision indicators body, intelligent decision-making in which there will be a complex and huge data group organizational management to provide decisions based on shared dynamic operational data [32]. Ma [33] believed that digital concretization, problem-oriented, result-oriented and systematic thinking in organizational management is conducive to accurate and efficient decision-making, thus enabling enterprises to adapt to the digital intelligence environment to complete digital intelligence empowerment.

4. Conclusion

Digital intelligence empowerment of smart manufacturing enterprises is a complicated and multiple activities, and not only has a single factor affected empowerment. From this paper, we can draw the following conclusions:

(1) From the external environment, the government encourages the development of digital intelligence in smart manufacturing enterprises, and R&D funds to finance the research and development of digital intelligence technology, and cooperation with external parties all promote the digital intelligence empowerment of enterprises.

(2) From the point of view of user demand, the change in demand for intelligent functions of consumers in the market has triggered changes in the functions of intelligent products and production methods, and the increase in demand for intelligent functions has also promoted the progress of digital intelligence empowerment of enterprises; digital intelligence is more stringent in controlling the quality of products, and as the market demands for improved quality, intelligent manufacturing enterprises are increasingly turning to intelligent production. Therefore, the increase of intelligent function demand and quality demand has a positive impact on the digital intelligence empowerment of intelligent manufacturing enterprises.

(3) From the viewpoint of industry progress, the progress of intelligent technology leads more intelligent manufacturing enterprises to intelligence, completes the transformation from digitalization to digital intelligence, and continuously deepens intelligent knowledge cognition to find the road of digital intelligence suitable for the development of intelligent manufacturing enterprises. Therefore, the progress of digital intelligence technology and the progress of intelligent knowledge cognition positively promote digital intelligence empowerment.

(4) From the perspective of organizational management mode, the management applicable to the organization itself and the internal and external environment is more conducive to the long-term development of the enterprise. In the digital intelligence environment, the organization's intelligent risk control management; intelligent decision management; organizational digital concretization, problem-oriented, result-oriented and systematic management have a positive impact in the

enterprise's digital intelligence empowerment.

Acknowledgements

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