



# Research on the Development of Intelligent Manufacturing for Big Data

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## Abstract

In the global economy, due to industrial big data technology, digital tide has gradually become an important production factor of intelligent manufacturing system. In addition to the connotation and characteristics of smart manufacturing, based on the design of R & D, production process and management system, the dimension data of large-scale commercial spaces such as smart manufacturing industry, functional research, innovation and practical application are analyzed, intelligent manufacturing, China's industrial talent training and other big data fusion development put forward some actions and countermeasures.

## Keywords

Big Data; Intelligent Manufacturing; Development Research

## Introduction

In the new round of technological and industrial revolution, the intelligent manufacturing industry has emerged and is gradually becoming an inevitable and mainstream trend in China's manufacturing industry. During this transformation, intelligent manufacturing will promote the widespread application of industrial big data. In the future, industrial big data technology will become an important production factor and a key factor in the productivity, competitiveness, and innovation capabilities of intelligent manufacturing systems. In recent years, the global digital wave, the in-depth development of manufacturing, and policies promoting internet integration have driven the development of big data and the integration of manufacturing in China. However, there are still gaps in the quantity, depth, scale, and balance of integration. Therefore, it is crucial to seize this rare opportunity to integrate large-scale industrial and manufacturing data into existing manufacturing sectors, especially in the field of intelligent manufacturing, to accelerate innovation and continuously improve data capabilities, thereby promoting the transformation and upgrading of the manufacturing industry.

## 1. The Connotation and Characteristics of Intelligent Manufacturing

a highly flexible integrated system that simulates human intelligent activities, information technology implementation, self-learning technology, intelligent decision-making technology, and automated technologies for design, manufacturing, assembly, storage, and handling. It encompasses the entire production process, digital design, and chain development of product lifecycle value, resulting in environmentally friendly, high-quality, and low-consumption manufacturing and services. Intelligent manufacturing improves production efficiency, reduces production risks, and enhances production sustainability. Its characteristics are mainly reflected in the following three aspects: First, intelligent production processes. Intelligent manufacturing production processes must possess self-awareness, learning, decision-making, and execution capabilities. Based on production needs, the combined units of various systems can form an ideal structure. This operating mode exhibits excellent self-regulating flexibility and may face failures. It

also allows for self-diagnosis and maintenance. Second, it facilitates resource allocation. The deep integration of information technology and manufacturing technology, the rapid development of 5G technology, and the better openness and sharing of the industrial chain links such as intelligent manufacturing, R&D, production, and logistics can drive global information sharing and resource integration, enabling the production of raw materials and components anytime and anywhere in a faster and more optimized configuration when needed. Third, it allows for the design of personalized products. Intelligent design systems can operate products through sensing, control, and storage technologies, self-monitoring and automatically controlling data analysis to identify operational problems and user feedback, thereby achieving product lifecycle management and control. Simultaneously, online users can participate in the entire production process, leading to customized post-sales, meeting consumers' individual needs, and avoiding excessive effort (Liu, 2018).

## 2. The Relationship Between Smart Manufacturing and Industrial Big Data

While enterprise big data management itself doesn't have direct value to the industry, data processing transforms data into information that people need, fully realizing its value. The perfect integration of manufacturing systems allows intelligent equipment to possess self-learning and autonomous capabilities, enabling intelligent control of information through data transmission. However, currently, Chinese manufacturing enterprises lack the capacity to analyze and process large volumes of data, and limited equipment procurement results in overall low quality and ultimately low-value collected data. Therefore, the goal is to promote the development of big data analytics technology in intelligent manufacturing enterprises, rather than focusing on industrial data itself. Enterprises need to pay attention to big data analytics technology and select appropriate data analysis and processing technologies based on the characteristics of industry big data. Industrial big data can effectively promote the development of intelligent manufacturing, becoming a major driving force for its growth. By managing the big data of industrial manufacturing enterprises, researchers can gain a higher-level perspective on manufacturing development. In the new era of industrial manufacturing competition, diversification has become a focus for large-scale production enterprises. Industrial big data can convey various information to manufacturing organizations in different ways. The combination of data and innovation in the R&D and operational management of industrial manufacturing enterprises enables them to more effectively supplement the diversity of product innovation, promoting the development of the manufacturing industry. Currently, market competition is fierce, the industry is developing rapidly, and enterprise production efficiency determines the development trend of the manufacturing industry. Future development will increasingly depend on production lines for machinery and equipment. Enterprises need to reduce resource waste in R&D during the production process. Large amounts of real-time data are easily generated at each stage of actual production, R&D, logistics, and sales. This industrial big data has wide applications; whether in procurement or production, big data processing and analysis are beneficial to the overall development of the manufacturing industry. Through the analysis and mining of big data, organizations can better understand customer data, apply information transactions, and provide back-end services. The rational use of big data tools allows manufacturers to better understand manufacturing problems and find solutions through industrial data processing, driving the transformation towards intelligent manufacturing. In recent years, Chinese manufacturing enterprises have increasingly used industrial big data, but there are still many problems in its application. On the one hand, industry big data analysis and application require support from core technology big data; however, in the early stages of my country's industrial development, manufacturing enterprises lack basic technologies and need to upgrade their industrialization and development status. To promote intelligent manufacturing through the application of industrial big data in my country, it is necessary to process big data, improve the existing industrial data infrastructure system, and make the management and maintenance of system data more reliable. Furthermore, at the current stage of my country's industrial big data development, data acquisition equipment and technologies are not yet mature, making it difficult for industrial big data to play a role in intelligent manufacturing. On the other hand, there are problems with the data integration and application of Chinese manufacturing enterprises. Most organizations primarily use big data platforms for business and customer data management. The value of this data is limited; there's a lack of internet data reporting, and data collection and processing methods are relatively simple. This data insufficiency hinders the development of smart manufacturing. Furthermore, internal data integration within enterprises is hampered by difficulties in internal information exchange. The application of industrial big data is relatively complex, and enterprises' inability to improve ultimately leads to reduced production efficiency and compromised product quality. Moreover, industrial big data analysis represents a new application model, catering to the evolving needs of skilled technical personnel. The development of smart manufacturing also requires a large

number of data analysis professionals. In this respect, the significant talent shortage hindering the application of industrial big data is a major obstacle to the development of smart manufacturing (Qiao, 2019).

### 3. The Driving Role of Industrial Big Data in Intelligent Manufacturing

The concept of industrial big data. Industrial big data refers to the application of information technology in the industrial manufacturing process, collecting large amounts of data from various sensors to serve decision-making problems, big data technology, and data applications. In addition to the characteristics of large-capacity data, general large scale, diversity, and speed, industrial big data, scheduling, correlation, manufacturing process, and professional influence also exhibits the characteristics of multi-channel, high throughput, and convergence. It is related. In the process of intelligent manufacturing, a large amount of data will be generated. Based on the collection and storage of industrial technical data, through statistical analysis of scientific data, it can include in-depth mining, modeling, and management of tacit knowledge, realizing data information transformation and knowledge transformation. This makes the intelligent manufacturing process more efficient and convenient (Ren, 2020).

The role of industrial big data in intelligent manufacturing. The role of intelligent manufacturing methods in industrial big data is mainly reflected in the following four aspects. First, innovative R&D design. User-level big data and industry data can help users collect dynamic data, mine and analyze user needs, help users participate in the product design process, and realize customized and customized design; enterprise-level, digital graphics, standard parts library data and other design methods can improve the comprehensive management and collaborative design capabilities of intelligent manufacturing industry chain resources, thereby more effectively reorganizing the R&D process, improving production efficiency, and making full use of social innovation funds and financial resources. Second, improved production processes. The core of intelligent manufacturing system is the use of data and models. By integrating the production process analysis of sensor detection data, the production process can be analyzed, faults or bottlenecks can be found in time, production process simulation technology can be improved, and mass production can be achieved. The goal is to save energy and reduce consumption. With the support of industrial big data technology, the intelligent manufacturing process will continuously improve itself and accelerate the establishment of a modern production system, with the greatest automation, flexibility and customization, and continuously improve precision manufacturing, advanced manufacturing and rapid manufacturing capabilities. Third, improved management system. Supported by technologies such as electronic identification, the Internet of Things, and the Internet, large industrial enterprises can acquire supply chain data faster and more conveniently, enabling them to make better decisions and reduce supply chain costs through data analysis. This will significantly reduce costs. Simultaneously, industrial big data can help enterprises integrate data resources into the entire management process. Based on data mining and analysis of production, finance, management, and procurement, the proportion of investment in production factors can be optimized, promoting scientific and efficient management decisions and operational integration capabilities. Fourth, it expands the workspace. Companies can utilize sensor technology to monitor data throughout the entire product lifecycle and leverage data platforms for sales, customer data, etc. Based on this, and with the help of big data technology, enterprises can extract deep model products based on current situation analysis and prediction, and can operate value-added services such as fault diagnosis, repair, and quality control, achieving convenient, online, and face-to-face product and service delivery. The commercial value space of products in the manufacturing and service industries is changing.

### 4. Practical Applications of Industrial Big Data in Intelligent Manufacturing

Sales Data Behavior Trend Analysis. Industrial data application is a major trend in the development of the manufacturing industry, but it requires large-scale data analysis technology to collect and analyze industrial data, and finally generate reliable data reports. The practical application of industrial data in intelligent manufacturing can be divided into four aspects. First, use industrial big data to understand users' purchasing habits and future expectations. At the same time, intelligent manufacturing products will continue to be upgraded and improved, and finished products will meet the needs of most users. Second, use industry data for precise marketing. Traditional data analysis cannot understand the actual characteristics of users. Accurate data analysis is not enough for accurate marketing, but industry data can accurately convey information and improve the company's influence. Similarly, industrial data can identify key customers, key customers and priorities that can be understood through big data analysis, navigate to high-value users, and provide economic benefits. Finally, the application of industrial data in intelligent manufacturing can help

enterprises find the right direction for brand development, and use reputation analysis and product attribute analysis to understand the enterprise's positioning. According to the actual situation of users, choose accurate marketing plans according to the actual situation of users. At the same time, use big data technology to understand intelligent products in new markets, learn from data analysis, understand new user needs, and improve product satisfaction with industrial products.

Development Trend Prediction and Analysis. Trend prediction and analysis, intelligent manufacturing applications of industrial big data, and database capability building have played an important role. Manufacturing companies use big industrial data through data prediction models that can predict future time. They can predict future market development and market demand in a predictable way, providing reference data for the long-term development of enterprises. Industrial big data prediction is based on the analysis of past data, and finally exists in a database to achieve accurate prediction. However, big data has high prediction accuracy and supports data for enterprise managers. Therefore, it is necessary to make a complete prediction of data trends and industry analysis based on the actual situation of enterprise development, market development and changes.

## **5. Strategies for the Integrated Development of Intelligent Manufacturing and Industrial Big Data**

The rapid development and advancement of intelligent manufacturing and big data technology will be crucial for enhancing intelligent manufacturing and competitiveness. However, the integration of intelligent manufacturing and industrial data technology in my country is generally shallow, especially given the complexity of industrial processes and the numerous difficulties faced by industrial data applications. Therefore, this article proposes the following suggestions for developing intelligent manufacturing in the context of industrial data: First, emphasize innovation and breakthroughs. Intelligent manufacturing is the foundation for the application of industrial technology innovation and development. Currently, the development and application of industrial database technology lags behind big data. Further collaboration and technological innovation among government agencies, research institutions, enterprises, and other key entities are needed. Breakthroughs in core technologies such as data extraction, integration, storage, processing, and analysis in industrial manufacturing processes are crucial, and it is essential to jointly support the development of intelligent manufacturing technologies, experimental equipment, and the transformation of new technologies and equipment.

Second, enhance practicality. Currently, my country's intelligent manufacturing industry has made more breakthroughs in strategic emerging industries and is the main battleground for the integration of big data and intelligent technologies. However, in the long run, intelligent manufacturing targets the development of traditional industries, covering basic units such as SMEs. In these areas, we need to plan for the future of big data technology, as well as track and practice it. Intelligent technologies are constantly improving the level of intelligent and digital production management. At the national level, relevant policies and support measures are required to be formulated to promote intelligent management systems and industrial data technologies through pilot demonstrations and promote industrialization. Third, strengthen talent cultivation. Technological innovation and application cannot come from comprehensive talent support, artificial intelligence, big data, etc. New generation technologies are good at cultivating talent. At present, intelligent manufacturing has a very high demand for big data talent, and the supply is serious. The main problem is that talents in this field must be familiar with relevant knowledge and manufacturing-related professional knowledge. Therefore, in order to promote the deeper application of industrial data in the field of intelligent manufacturing, we will focus on cultivating and training multidisciplinary talents in technology, management, and innovation, as well as compound senior management talents, to provide modern intelligent manufacturing services.

## **6. Conclusion**

The integration of information technology with industrial enterprises is widespread. Industrial manufacturing companies generate massive amounts of data, making industrial big data extremely valuable in the field of intelligent manufacturing. Through the analysis of industrial big data, various aspects of a company's data can provide support, including user needs and product innovation, all of which are controlled during the production process. The application of industrial big data analytics is a development trend for intelligent manufacturing enterprises. Enterprises should prioritize improving data acquisition equipment, strengthening data analysis and processing technologies, and utilizing big data analytics to promote the stable development of manufacturing enterprises.

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