

Collaborative Optimization of Supply Chain Intelligent Management and Industrial Artificial Intelligence

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Abstract: It is urgent for the manufacturing industry to transform its development mode and achieve intelligent transformation. With the increasingly fierce global market competition, relying solely on first-class product quality can no longer guarantee a long-term competitive advantage for enterprises. Therefore, this article conducts research on the collaborative optimization of supply chain intelligent management and industrial AI(Artificial Intelligence). By timely displaying the quality status of each link, intelligent management of goods is achieved, strengthening control and tracking of product quality, greatly improving the efficiency of the quality management system, and ensuring that enterprises can provide high-quality products as much as possible. Incorporate supplier production flexibility, continuous research and development capabilities, and information technology into the criteria for selecting suppliers, seek higher quality suppliers, and establish strategic partnerships with suppliers. The research in this article is beneficial for improving the production and manufacturing efficiency of enterprises, and is an important theoretical exploration in the development process of intelligent manufacturing.

Keywords: Intelligent Management of Supply Chain; Industry; AI; Collaborative Optimization.

1. Introduction

The development level of manufacturing industry directly reflects a country's comprehensive national strength, plays a decisive role in the national real economy, and is a powerful pillar of national economic development. In recent years, developed countries around the world have simultaneously launched national strategic development plans for the transformation and upgrading of manufacturing industry. China's macro-economy has been influenced by factors such as declining demographic dividend, trade protection, structural adjustment and environmental constraints, and the growth rate has dropped significantly. The turning point of industrial economy from high-speed growth to medium-high-speed growth has arrived [1]. It is urgent for the manufacturing industry to change its development mode and realize intelligent transformation. With the increasingly fierce competition in the global market, only relying on first-class product quality can no longer guarantee the long-term competitive advantage of enterprises. This is because customers are increasingly demanding on product quality and service level. If enterprises want to maintain and expand market share, they must improve their agility to ensure that enterprises can provide customers with low-cost and high-quality goods in a timely manner in the unpredictable market [2-3]. Therefore, more and more enterprises begin to pay attention to supply chain management. In this paper, the collaborative optimization of supply chain intelligent management and industrial AI is reasonably applied in daily work, so as to improve the efficiency and quality of management in an all-round way, and promote the common development of multi-agents while exerting the role of supply chain management. In this network, suppliers provide raw materials, which are processed by manufacturers and sent to customers through wholesalers and retailers [4]. The research in this paper is conducive to improving the manufacturing efficiency of enterprises, is a theoretical exploration of great significance in the development of intelligent manufacturing, and has important theoretical research significance and

practical application value in promoting the transformation and upgrading of China's manufacturing industry to high efficiency, intelligence and automation [5].

2. Collaborative Optimization of Supply Chain Intelligent Management and Industrial AI

2.1. Collaborative Management Optimization Objectives

Optimize the traditional information sharing mode, establish a distributed database based on the supply chain, thereby reducing the threshold for edge enterprises to use data, improving the flow level of supply chain information, and achieving comprehensive collaboration of supply chain information. Introducing smart contract technology to minimize human interference and improve the efficiency of information transmission, thereby accelerating the flow of supply chain information, reducing error probability, saving operational costs, reducing the consumption of human and material resources in the supply chain, and achieving an intelligent management model. Adopting AI in the supply chain can achieve intelligence on the terminal, create intelligent products, form intelligent data, and carry out related intelligent businesses[6]. AI will provide an intelligent warehousing model for the material supply chain, forming an intelligent warehouse. Enterprises upload their own data information to the system, and government departments can complete the filing and release relevant audit results based on the information[7]. On this basis, enterprises can easily identify their own shortcomings in a timely manner and make reasonable adjustments in accordance with relevant legal provisions to ensure product quality.

2.2. Collaborative Management Optimization Framework

In this paper, the supplier-manufacturer-raw material supplier integrated supply chain is taken as the research

subject. By analyzing the influence of AI technology on supply chain information collaboration, the collaborative process is analyzed from the perspectives of logistics, inventory and procurement, which provides a new paradigm and reference for improving the automation and decentralization of supply chain information collaboration[8]. Based on the AI mode, the supply chain of materials makes some adjustments to the warehouse in time, which makes the management of the warehouse effectively avoid some abnormal phenomena, or the situation that the goods in some warehouses are in short supply [9]. Most supply chain enterprises have not formulated a standardized information sharing mechanism, which leads to more restrictive factors in improving the level of information collaboration, and the sustainability of system benefits is insufficient. In addition, some enterprises are satisfied with existing interests, and the stability of the relationship between cooperative enterprises is relatively low, resulting in a low level of information collaboration, which has a great impact on the realization of synergy [10]. Establish an information collaboration system, and integrate the information of application layer, core layer and data layer of supply chain, so as to improve the intelligent level of information collaboration management and achieve the effect of decentralized management and control. The overall structure is shown in Figure 1.

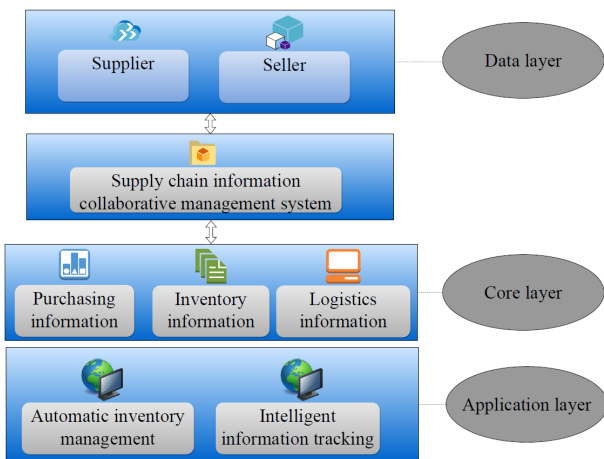


Figure 1. Overall Framework for Information Collaborative Management Optimization

By utilizing the optimized supply chain information collaboration system, intelligent analysis is conducted on real-time data information of all enterprises in the supply chain, obtaining high-value information from three levels of the supply chain. Under the premise of achieving decentralization and improving intelligence level, many goals such as demand forecasting, plan formulation, and automatic inventory management are achieved. Such AI can enable different businesses and management processes to collaborate with each other, achieving a smooth circulation process and achieving the ultimate goal.

3. Development Trend of Enterprise Application Supply Chain Intelligent Management based on Industrial AI

3.1. Reduce the Scale of Supply Warehouse with More Optimized Supply Chain Members

The characteristics of the production process of process

industry determine that the core of realizing the overall optimization of the whole production process is to realize the intelligent optimization decision of its operation parameters, that is, to optimize and adjust the operation parameters according to the characteristics of raw materials and production conditions to ensure the completion of production objectives, to increase the degree of information openness in the supply chain, to include upstream suppliers into the supply chain, to help upstream suppliers realize informationization and visualization, to realize the sharing of warehousing and transportation resources among suppliers, and to improve the collaborative management ability by using AI technology and cloud computing. With the increasingly fierce competition in the global market, only relying on first-class product quality can no longer guarantee the long-term competitive advantage of enterprises. This is because customers are increasingly demanding on product quality and service level. If enterprises want to maintain and expand market share, they must improve their agility to ensure that enterprises can provide customers with low-cost and high-quality goods in a timely manner in the unpredictable market.

3.2. Meet the Increasingly Personalized Needs of Customers with Faster Response Speed

By utilizing AI technology, information sharing and coordinating the work plans of supply chain members can be maximized, thereby integrating the supply chain. The highly optimized supply chain management through AI technology can also ensure that enterprises timely evaluate their partners and screen out excellent enterprises that meet the requirements of the enterprise, establish unified performance standards with them, better manage all aspects of the supply chain, and monitor the overall supply chain. Under the conditions of meeting various constraints of the process, search for a suitable set of controlled variables and select the appropriate set values of the controlled variables. When the process is affected by uncertain interference factors within a certain range, there is no need to change the set values of the controlled variables. The actual operating conditions can still be at the approximate optimal operating point, that is, the deviation between the actual objective function value of the industrial process and the optimal objective function value is reasonable Within an acceptable range. Therefore, more and more enterprises begin to pay attention to supply chain management. In this paper, the collaborative optimization of supply chain intelligent management and industrial AI is reasonably applied in daily work, so as to improve the efficiency and quality of management in an all-round way, and promote the common development of multi-agents while exerting the role of supply chain management and achieve product quality control through supplier supply of high-quality and high-performance components, and collaborative development and management with suppliers.

3.3. Intelligent Integration of Supply Chain Management and Quality Control

Supply chain management involves many links that need to be closely linked, and any issues related to product production will affect the quality of the final product. AI is fully utilized in supply chain management, where different process labels on the production line provide additional quality information, enabling the identification and tracking of raw materials, components, semi-finished products, and finished products. In this regard, this article constructs a

structural diagram of an industrial process intelligent optimization decision-making system, as shown in Figure 2.

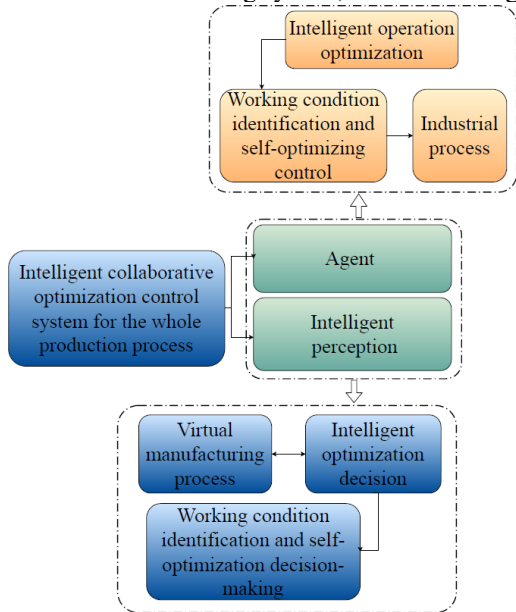


Figure 2. Structure diagram of industrial process intelligent optimization decision-making system

The overall structure of the integrated optimization decision-making and control system for the entire process consists of optimizing the target values of comprehensive production indicators, optimizing the target values of the entire process production indicators, multi-objective optimization of the target values of operational indicators, and process automation systems. Optimize comprehensive production indicators, full process production indicators, and operational indicators at different time scales in a hierarchical manner based on monthly, daily, and hourly cycles. By timely displaying the quality status of each link, intelligent management of goods is achieved, strengthening control and tracking of product quality, greatly improving the efficiency of the quality management system, and ensuring that enterprises can provide high-quality products as much as possible. Combining push and pull supply chains, achieving large-scale production for the push part, diversified production for the pull part, and moving the push pull connection point as far back as possible while meeting diverse customer needs, strengthening manufacturing flexibility by achieving large-scale manufacturing.

4. Conclusion

The process manufacturing industry has the characteristics of high production continuity, numerous production equipment, strong coupling between variables, fixed products and large production capacity, etc. The whole management decision-making process of production enterprises still depends on people and knowledge workers. When the market demand and production factors change, it is difficult to make timely and accurate decision-making responses to enterprise objectives, planning and scheduling, operation indicators, production instructions and control instructions, and it is impossible to optimize the comprehensive production indicators such as product quality, output, consumption and cost of enterprises. Introducing smart contract technology to

minimize human interference and improve the efficiency of information transmission, thereby accelerating the flow of supply chain information, reducing error probability, saving operational costs, reducing the consumption of human and material resources in the supply chain, and achieving an intelligent management model. Adopting AI in the supply chain can achieve intelligence on the terminal, create intelligent products, form intelligent data, and carry out related intelligent businesses. The application of AI technology in it can realize the purpose of information sharing and make up for the shortcomings of each subject in business development. It can be seen that the intelligent management collaborative system of supply chain based on AI plays an important role in achieving the goal of multi-win situation. It enables enterprises to intelligently perceive the situation of material flow, energy flow and information flow, learn independently and respond actively, which lays a foundation for realizing intelligent optimization manufacturing of process industry.

References

- [1] Juan W, Shifeng Z, Management D O, et al. Collaborative Operation Mechanism of Intelligent Supply Chain under the New Retail[J]. Journal of Hubei University of Arts and Science, 2019, 19(7):46-52.
- [2] Rana J, Daultani Y. Mapping the Role and Impact of AI and Machine Learning Applications in Supply Chain Digital Transformation: A Bibliometric Analysis[J]. Operations Management Research, 2022, 15(11):10-20.
- [3] Yerpude S, Singhal T K. Value Enablement of Collaborative Supply Chain Environment Embedded With the Internet of Things: Empirical Evidence From the Automotive Industry in India [J]. International Journal of Intelligent Information Technologies (IJIIT), 2020, 16(14):18-22.
- [4] Huan-Bin X, Liang-Yong C, Yun-Min L, et al. Application of AI Technology in Logistics and Supply Chain[J]. Value Engineering, 2019, 28(11):36-45.
- [5] Ran H. Construction and optimization of inventory management system via cloud-edge collaborative computing in supply chain environment in the Internet of Things era.[J]. PLoS ONE, 2021, 19(11):13-22.
- [6] Singh R K, Kumar P, Chand M. Evaluation of supply chain coordination index in context to Industry 4.0 environment [J]. Benchmarking An International Journal, 2019, 18(4):10-24.
- [7] Kaur S D. SOA Cloud Computing: Modernized the Supply Chain Management Applications[J]. International, Organization of Scientific Research, 2019, 9(3):22-30.
- [8] Song H, Lu X, Zhang X, et al. Collaborative optimization for energy saving and service composition in multi-granularity heavy-duty equipment cloud manufacturing environment [J]. Journal of Industrial and Management Optimization, 2023, 19(4):2742-2771.
- [9] Lechtenberg S, Hellgrath B. Applications of AI in supply chain management: Identification of main research fields and greatest industry interests[J]. ERCIS Working Papers, 2021, 17(5):36-44.
- [10] Sang Y, Tan J. Intelligent factory many-objective distributed flexible job shop collaborative scheduling method[J]. Computers & Industrial Engineering, 2022, 164(55):107884-107892.