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Agile Supply Chain Management Collaboration Based on Artificial Intelligence Traceability System

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With the rapid development of the market economy and the manufacturing industry, the market has already reached saturation. The fierce competition between enterprises is reflected in their products and services, which is fundamentally a matter of the competition between supply chain management modes. In recent years, artificial intelligence (AI) has developed rapidly. The application of human-computer interaction technology to supply chain management (SCM) systems can improve the efficiency of SCM. Although the traditional SCM mode is adequate for product manufacturing, transportation and sales, it is unable to rapidly customize the customer's product demand. The traceability function is a production control system that can track companies' products. This paper compared the collaboration mode of agile SCM based on AI traceability system with the traditional SCM mode. The experimental results showed that the responsiveness of the traditional SCM mode and the agile SCM collaboration mode based on AI traceability system were 76% and 89.8% respectively in a small supply chain. In large supply chains, the responsiveness of the traditional SCM mode and the agile SCM collaboration mode based on AI traceability system were 70.8% and 87.6% respectively. Therefore, human-computer interaction in the collaboration mode of agile SCM based on AI traceability system can improve the responsiveness of the supply chain to customer needs.

Keywords: Supply chain (SC), agile supply chain, manage collaboration, traceability system, artificial intelligence, multimodal learning

1. INTRODUCTION

Before the 1990s, the seller's market was the main trading system. At that time, the product manufacturing industry was still quite under-developed and the speed of product manufacturing was relatively slow, which led to the supply of products being far less than customer demand. In the traditional supply chain (SC), customer orders drive the manufacturing of products. The manufacturer only needs to ensure the quality of its own products to ensure the steady growth of the business. In the 21st century, the manufacturing industry has developed rapidly, and the competition between enterprises has become very fierce. The supply of products is far greater than the customer demand, leading to problems such as product surplus. The traditional seller's market system has gradually changed into the buyer's market system. Under this latter system, enterprises need to adjust their marketing strategies. Hence, products must be competitively priced and manufacturers need to respond quickly to customers' changing needs. Therefore, manufacturers need to transition from the traditional SCM mode to the proposed agile SCM cooperation mode. The core of the agile SCM cooperation mode is its sensitivity to the market and its rapid response ability. With the development of the Internet of Things and AI technology, the logistics, manufacturing and information systems of enterprises can be tracked and traced. Through rapid positioning and intelligent analysis of changing needs, the current changing economic market is adapted to improve the core competitiveness of enterprises. Therefore, this paper has research significance.

With the rapid development of market economy and the increasingly fierce competition between enterprises, the traditional SCM cannot respond rapidly to customer demands.

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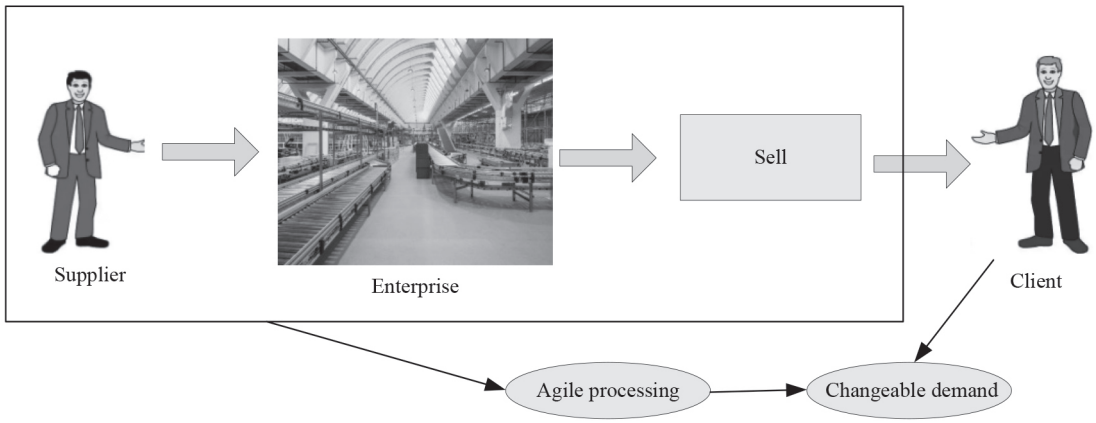


Figure 1 Depiction of enterprise application of agile SCM collaboration mode.

Many people have studied agile SCM collaboration. Among them, Piya Sujan conducted a questionnaire survey on the supply chain of the oil and gas industry. He believed that the agile supply chain was the key factor in ensuring the flexible operation of the logistics in this industry sector [1]. Tarafdar Monideepa investigated the agile supply chain industry and determined the factors that affected the performance of the SC. His research found that supply chain practice and information system capability had complementary effects on agility [2]. Zhu Xiang Ning's research found that the Internet of Things was used to identify, locate and track the products of the agile supply chain to obtain the complete information of the SC products [3]. Kawa Arkadiusz's research revealed that e-commerce was the mainstream SC platform. The characteristics of customers purchasing goods in e-commerce were: large demand, variable demand, fast demand, etc. Agile supply chains could efficiently deal with the changing demands for e-commerce products [4]. Although agile SCM collaboration can quickly respond to and manage diverse customer needs, it lacks AI technology to trace the products throughout the entire SC.

The AI traceability system can be used to control the production process and monitor the status of various products, and can respond to changes in product requirements in a timely manner. Relevant researchers have applied the AI traceability system to agile SCM collaboration. Among them, Dora Manoj stated that the management of product information should be substantially strengthened in the food SC. He used AI technology to intelligently track the production date, expiry date and model of products, so as to timely meet the rapidly changing market demand [5]. Nozari Hamed used the Internet of Things technology to obtain information about the entire product production process and build a traceability system, which ensured the safety of product data. It helped to optimize data performance and strengthen the collaboration capability of agile SCM [6]. Oh Am-Suk used AI and IoT technology to build a traceability system to achieve efficient inventory management and timely product supply. The management ability of agile supply chain has been effectively improved, which furthered the development of enterprise economy [7]. Liu Ming's research discovered that in the low-carbon economic environment, the demand of the market economy was constantly changing, and the changing customer demand could be met by dynamically controlling the production process [8]. An AI traceability system is applied to the agile SCM collaboration mode to improve the control ability of enterprise products and strengthen the collaboration ability of agile SCM. However, there is a lack of analysis that compares the performance of an AO traceability system with that of the traditional SCM system.

The development of economic globalization, the fluctuations in customers' demands for products, and the rapid development of intelligent information force enterprises to improve agility in SCM. With the AI tracing system, the manufacturing process is intelligently controlled and tracked to meet the changing market demands. In this paper, the AI traceability system was applied to the agile SCM collaboration model and its performance was compared with that of the traditional supply chain model. The results showed that the agile SCM model can bring more economic benefits to businesses within a supply chain.

2. AGILE SCM COLLABORATION METHOD

The acceleration of economic integration has pushed the economic development of enterprises into the era of "supply chain competition". However, the rapidly changing market demand has seriously restricted the development of the traditional supply chain model [9–10]. Enterprises need to carry out agile management of the entire SC, including product material procurement, product manufacture, service and sales, in order to improve the core competitiveness of enterprises in a business environment characterized by changing demand. The process that enterprises undertake to apply agile SCM collaboration mode is shown in Figure 1.

Figure 1 depicts the application of the collaboration mode of agile SCM. As shown, when the customer's needs change, the agile SCM collaboration mode communicates rapidly with the customer so as to timely determine the customer's needs and quickly develop solutions.

To deal with the changing demands in the agile SCM collaboration mode, it is necessary to establish a complete and accurate SC information record. Each product manufacturing process is identified to determine the relationship between

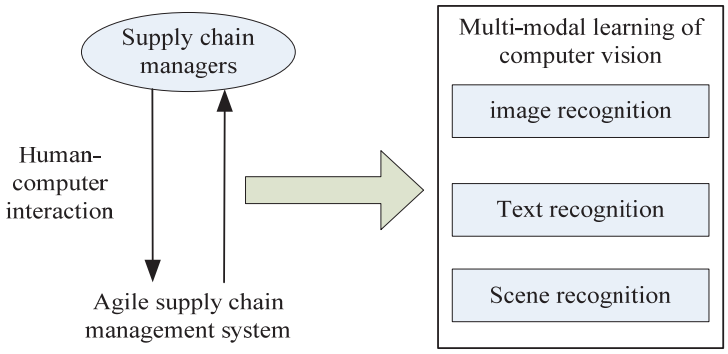


Figure 2 Computer vision multimodal learning process of human-computer interaction.

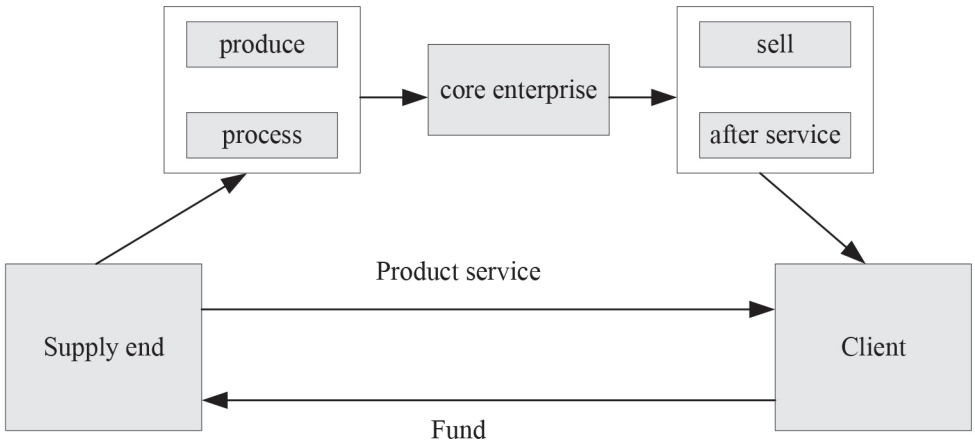


Figure 3 Structural model of supply chain.

products and data [11]. The AI tracing system can trace the whole supply chain information and provide accurate product data information for the agile supply chain.

2.1 Computer Vision Multimodal Learning of Human-computer Interaction

Human computer interaction is a study of the interaction between systems and users. The system can comprise several machines, or a computerized system and software [12–13]. In agile SCM collaboration, enterprises can store, update and obtain supply chain information through a human-computer interaction system.

Every day, people are exposed to information from different sources and in different formats, just as human beings have individual vision, hearing, smell and touch. Among them, vision is the most important source of information. There are many ways to transfer information in computer vision, such as images, videos, and text. Through computer vision multimodal learning, the diversity of information interaction modes in human-computer interaction can be improved, which is conducive to the management of node data in agile supply chain.

The computer vision multimodal learning process of human-computer interaction is shown in Figure 2.

In Figure 2 depicts the computer vision multimodal learning process of human-computer interaction in the agile supply chain. Supply chain managers obtain information about supply chain products from images, texts and scenes, and interact with the agile SCM system.

2.2 Agile Supply Chain

The traditional enterprise management mode mainly achieves the business purpose of the enterprise by increasing the sales volume. The supply chain enterprise management mode is an integrated system. The supply chain consists of a number of core enterprises. A variety of related enterprises are integrated into a whole, including logistics, sales, processing plants, etc., so that each department can efficiently complete all the processes related to product manufacture and distribution [14]. Each enterprise in the supply chain is dependent on its supply chain partners. Information sharing among enterprises has improved their overall production efficiency.

The structural model of the supply chain is shown in Figure 3.

Figure 3 shows the structural model of the supply chain consisting of: supply side, core enterprise and client side. The supply chain has the following characteristics:

Intersection: The same enterprise can be a node on various supply chains. For example, a clothing enterprise can be a supply source both in supply chain A and in supply chain B.

Polymorphism: The SC can adapt to changes in the market environment, and can manage the weight of each enterprise from within the SC [15–16].

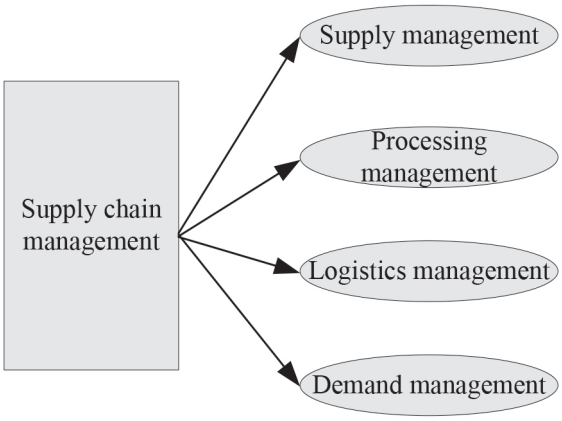


Figure 4 Structure of SCM.

SCM is the process of controlling products from the supply side to the client side, which aims to make the supply chain run optimally. The structure of SCM is shown in Figure 4.

The purpose of SCM is to improve the economic benefits of the supply chain and the level of service to customers. The actual operation of SCM also includes: Relevant management strategies are formulated to meet the needs of customers as much as possible. The operation process of supply chain products is monitored and tracked in real time to ensure the safe and accurate delivery of products to customers. The supply side and the client side are connected, so that the main body of the supply chain has a continuous supply of sustainable customers.

SCM meets the needs of users through systematic management and controls and coordinates the information exchange between related nodes in the supply chain, bringing maximum benefits to enterprises. Agile refers to the ability of the system to respond to changes in external things. In the supply chain, it refers to the ability of enterprises to respond to changing demands when customers' demands change.

Agile supply chain refers to that the SCM system quickly responds to the changing needs of customers by controlling the industrial information, logistics and capital flow [17–18]. Taking the apparel industry chain as an example, the products in the apparel market are affected by seasons. In addition, the products are updated rapidly, which requires that apparel enterprises should not accumulate excessive inventory when meeting customers' clothing needs. It also needs to design clothes with different needs for different seasons, cultures and people in a timely manner. Therefore, the agile supply chain can grasp and transmit the changing needs of customers in a timely manner and make management decisions quickly by enhancing the adaptability of enterprises to market changes.

Agile SCM has the following characteristics:

Sensitive to market information: In the agile supply chain, enterprises can quickly feel the changes of market information, and respond to the needs of personalized customers with the fastest speed to maintain the sustainable development of the supply chain.

Data sharing: In the traditional supply chain, the operation of the supply chain is driven by orders, which leads some enterprises to obtain the real needs of customers and blindly make according to orders. The information sharing of each node in the agile supply chain can be adjusted according to the changing needs of customers.

Network structure: The enterprises in the agile supply chain are closely connected. The competition between enterprises is also transformed into the competition between supply chains.

Agile supply chain improves the core competitiveness of enterprises by changing management thinking. It has the following advantages:

Agility: The traditional supply chain operation mode has to wait for a long time in a procedural manner from the moment of receiving an order, and it is unable to respond quickly to the needs of customers. However, all enterprises in the agile supply chain can receive customers' demands and complete them in parallel.

Meet changing demands: Agile supply chain has flexible management technology, which can respond to customers' changing demands at the fastest speed.

Cost advantage: In the agile supply chain, due to the quick response to customer demand, it is not necessary to stack too much inventory in advance, which reduces the cost of products and effectively reduces the risk of products.

2.3 AI Tracing System

With the continuous development of information science and technology, AI and the Internet of Things have been comprehensively applied to social production and people's lives. AI and the Internet of Things have been widely used in the agile supply chain [19–20]. The Internet of Things can collect product transportation information in the agile supply chain, which improves the information technology level of the logistics process in the agile supply chain and improves the speed of product circulation. The Internet of Things technology can be applied at each node of the agile supply chain according to customers' needs. The circulating products can be tracked using AI. The processing and transportation of products can be intelligently optimized according to changing needs, so as to achieve the traceability of supply chain products.

AI traceability system is a kind of production control system that can conduct forward or backward intelligent tracking of products, which can be well applied to the agile supply chain.

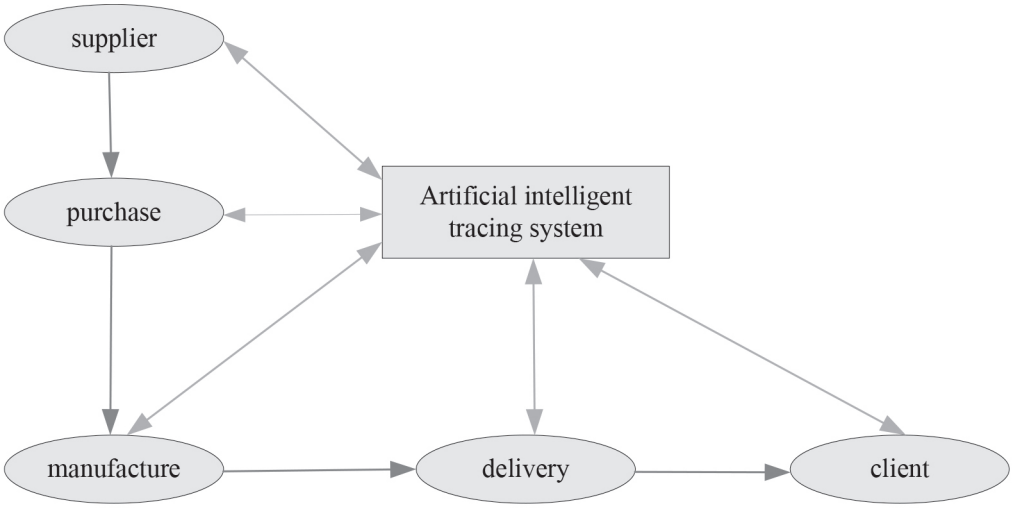


Figure 5 Application model of AI traceability system in agile supply chain.

The application model of AI traceability system in agile supply chain is shown in Figure 5.

In Figure 5, the application model of AI traceability system in agile supply chain is described. During the transportation of products and services from suppliers to customers in the agile supply chain, each node in the agile supply chain needs to communicate with the AI system.

The AI traceability system can realize information sharing in the agile supply chain and intelligent analysis of customer needs. When the customer provides a product name, it can respond quickly. When the customer's requirements change, it can quickly trace the enterprises related to the original requirements and the points to be improved.

The application process of AI traceability system in agile supply chain is as follows:

In an agile supply chain, if there are k nodes in the agile supply chain, the node information of the agile supply chain is expressed as $(u_1, u_2, \cdots, u_k)$. However, when the customer's demand changes, the node information of the agile supply chain is transferred into the artificial neural network as input data to optimize the product according to the customer's demand. Let the connection weight between the artificial neuron and each node be $(v_1, v_2, \cdots, v_k)$. The optimization process of each node in the agile supply chain is as follows:

$$S = \sum_{i=1}^{k} u_i v_i \tag{1}$$

In Formula (1), u_i represents the information of the ith node in the agile supply chain. v_i represents the connection weight value between the ith node and artificial neuron in the agile supply chain.

The results of artificial neural network processing are processed. Through the activation function, the input of the artificial neuron is mapped to the output [21]. The common activation function is:

$$f(x) = \frac{1}{1 + e^{-x}} \tag{2}$$

The optimization results of each node in the agile supply chain are substituted into Formula (2) to get:

$$f(s) = \frac{1}{1 + e^{-s}} \tag{3}$$

In the agile supply chain, when the customer's demand changes frequently, it is necessary to communicate with the customer in time to make the products produced by the enterprise close to the customer's expected demand. The back propagation neural network can be used to adjust the product output of the enterprise through error analysis. The specific steps are as follows:

The error between the products output by the enterprise and the products required by customers is calculated:

$$E = \frac{1}{2} \sum_{j=1}^{n} (a_j - b_j)^2 \tag{4}$$

In Formula (4), n represents the number of output layer neurons in the back-propagation neural network. a_j and b_j represent the actual product output and customer expected demand of the jth neuron in the output layer respectively.

The error is analyzed. When the calculated error E is within the acceptable range of the customer, the product optimization is successful. The formula is expressed as follows:

$$E \leq e \tag{5}$$

3. EXPERIMENT OF AGILE SCM COLLABORATION

3.1 Data Source of Agile SCM Collaboration

The supply chain is a highly competitive area among enterprises. Customers' demand for products is increasing, and their demand can fluctuate. The agile SCM mode can detect the operation status of the supply chain in real time, and continuously optimize the performance indicators of each node to ensure that the rapid response requirements of the changing market are met. In order to analyze the performance and outcomes of the collaboration mode of the proposed

Table 1 Results of supply chain performance evaluation indicators surveyed.

Evaluation system	Evaluation index	Number of people (persons)	Percentage
Supply chain performance evaluation system	Response ability	104	26%
	Product flexibility	48	12%
	Conformity of product standards	72	18%
	Economic benefits	64	16%
	Customer satisfaction	56	14%
	Operating costs	56	14%

Table 2 Results of correlation analysis of supply chain performance evaluation indicators.

Evaluation system	Evaluation index	Correlation
Supply chain performance evaluation system	Response ability	0.28
	Product flexibility	0.20
	Conformity of product standards	0.24
	Economic benefits	0.18
	Customer satisfaction	0.04
	Operating costs	0.06

agile SCM, this study constructs a supply chain performance evaluation system. By means of a questionnaire survey of 400 SC managers, the supply chain performance evaluation indicators were obtained. Table 1 shows the results of the supply chain performance evaluation indicators derived from the questionnaire survey.

Table 1 presents the results of the survey of SC managers. In all, six evaluation indicators were used to evaluate the supply chain's performance. Among them, the highest percentage of the responsiveness index is 26%, and the lowest percentage of the product flexibility index is 12%.

The evaluation indicators obtained through questionnaires suffer from a significant subjectivity issue. Therefore, the supply chain performance evaluation indicators are analyzed for correlation. The results of correlation analysis are shown in Table 2.

Table 2 presents the correlation analysis results of supply chain performance evaluation indicators. As shown, the highest correlation of responsiveness index is 0.28, and the correlation of product standard compliance index is 0.24. The correlation between the customer satisfaction index and the operating cost index is 0.04 and 0.06 respectively. Because the correlation between the customer satisfaction index and the operating cost index is too low compared with other indexes, the customer satisfaction index and the operating cost index are not analyzed in the subsequent comparative experiment involving the SCM model.

3.2 Experimental Design for Comparison of Different SCM Modes

In order to determine the application effect of AI based traceability system in agile SCM collaboration, this paper compares it with the traditional SCM mode by using a control group. The comparison points are: responsiveness, product flexibility, product standard compliance and economic benefits.

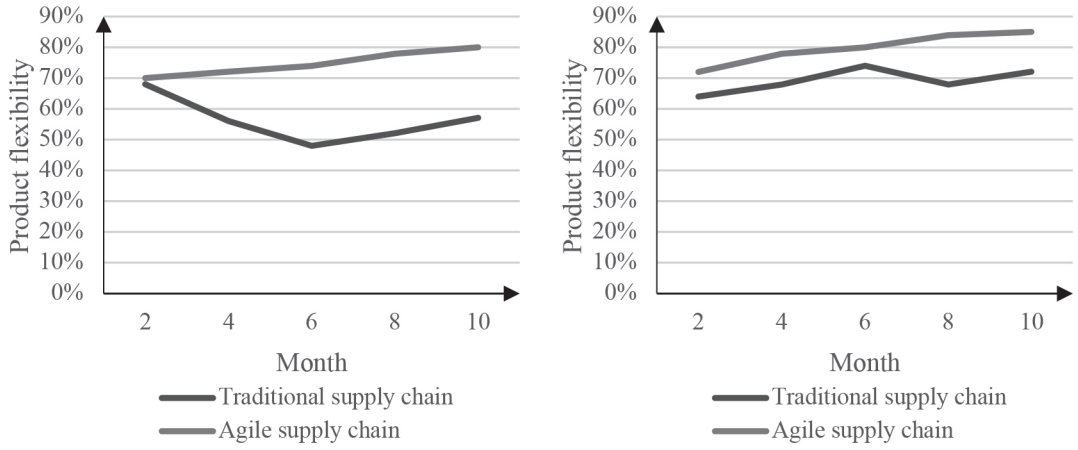
Because the size of the supply chain affects the operation effect of the supply chain, this paper discusses small supply chain and large supply chain respectively. The subjects used for the experiment are 10 supply chains randomly selected from the Chinese market. Half of them adopted the SCM mode, and the remainder adopted the proposed agile SCM cooperation mode.

During the experiment, testers tracked the whole process information of the experimental SC to obtain the products journey along the supply chain and the responsiveness of enterprises in the supply chain. In order to fully analyze the comparison effect between the agile SCM collaboration mode based on the AI traceability system and the traditional SCM mode, the comparison time between the two SCM modes should be slightly longer. This is because it usually takes several months for the supply chain to meet the demand for a set of products. Therefore, the comparison time is set as 10 months in the collaboration mode of agile SCM based on AI traceability system and the traditional SCM mode.

4. RESULTS OF AGILE SCM COLLABORATION

4.1 Product Flexibility

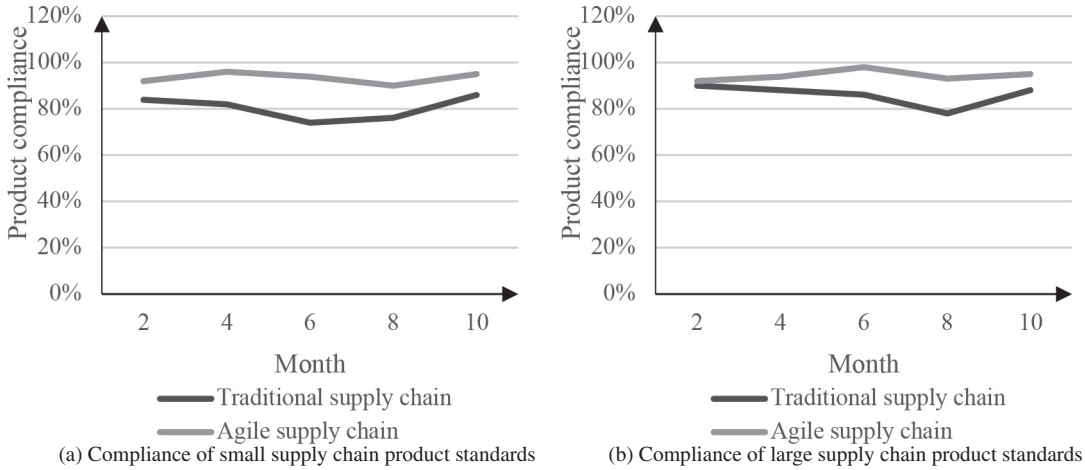
Product flexibility refers to the ability of products to meet customers' needs as much as possible during production and processing. For instance, regarding the time of product delivery, consider that a customer needs the product within one month. When an enterprise is able to deliver products within two weeks or two months, this indicates that the delivery time of its products is flexible. The flexibility of products determines the extent to which enterprises can adapt to their customers' needs. The proposed agile SCM collaboration mode based on the AI traceability system is compared with the traditional SCM mode in terms of product flexibility. The results for comparison are shown in Figure 6.



(a) Product flexibility of small supply chain

(b) Product flexibility of large supply chain

Figure 6 Comparison results for product flexibility.



(a) Compliance of small supply chain product standards

(b) Compliance of large supply chain product standards

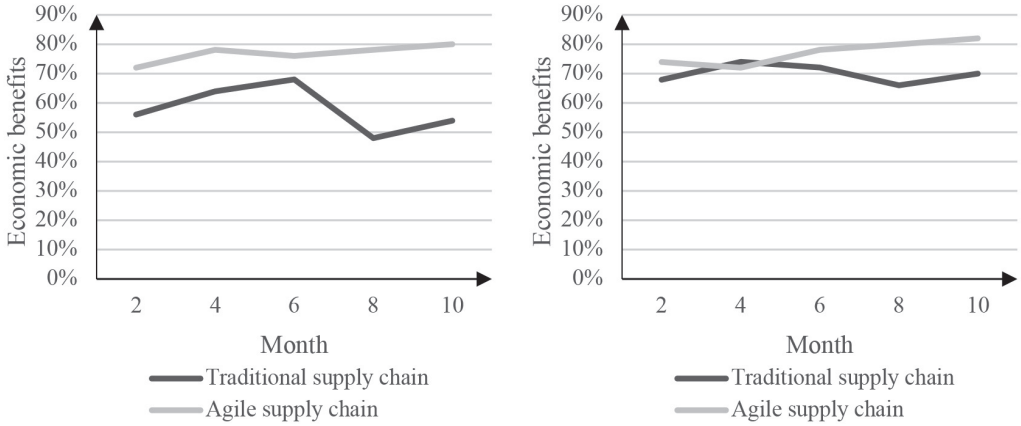
Figure 7 Comparison results for product standard compliance.

Figure 6 (a) allows the comparison of product flexibility of two SCM models in a small supply chain. Among them, the product flexibility of the traditional SCM mode decreases first and then increases. It has reached a minimum of 48% in the sixth month and a maximum of 68% in the second month. The product flexibility of agile SCM collaboration mode based on AI traceability system is constantly improving. It has increased from 70% in the second month to 80% in the tenth month. In Figure 6 (b), it describes the comparison of product flexibility between two SCM models in a large supply chain. Among them, the product flexibility of traditional SCM mode has reached a minimum of 64% in the second month and a maximum of 74% in the sixth month. The product flexibility of the agile SCM collaboration model based on the AI traceability system has increased from 72% in the second month to 85% in the tenth month.

4.2 Conformity of Product Standards

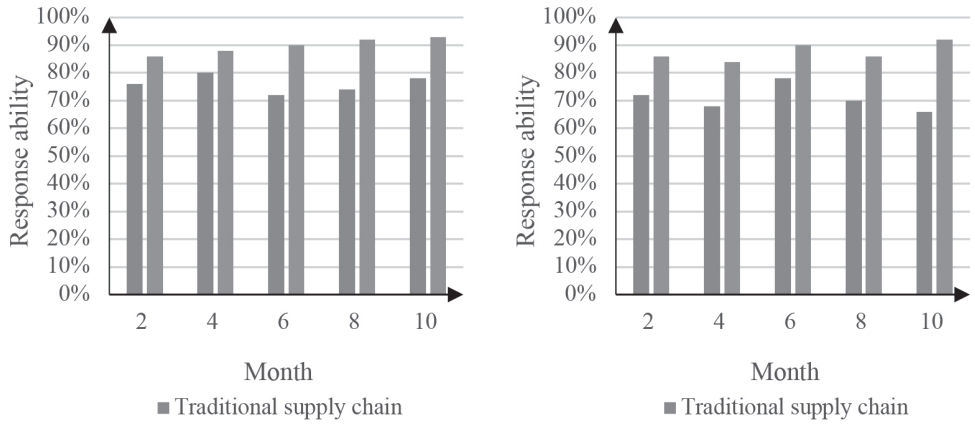
Both the traditional SCM mode and the proposed agile SCM collaboration mode based on the AI traceability system aim to shorten the time required for product processing and provide customers with products that meet the standards. In the actual product processing process, customer demand often changes, which requires relevant enterprises to produce products with standard quality according to changes. The collaboration mode of agile SCM based on AI traceability system is compared with the traditional SCM mode in terms of product standard compliance. The results for comparison are shown in Figure 7.

Figure 7 (a) allows the comparison of product standard compliance of two SCM models in small a supply chain. As shown, the product standard compliance of the traditional SCM mode has reached a minimum of 74% in the sixth month and a maximum of 86% in the tenth month. The product standard compliance of the agile SCM collaboration model based on the AI traceability system reached a minimum of 90% in the eighth month and a maximum of 96% in the fourth month. Figure 7 (b) allows the comparison of product standard compliance of two SCM models in a large supply chain. Here, the product standard compliance achieved by the traditional SCM mode has reached a minimum of 78% in the eighth month and a maximum of 90% in the second month. The average product standard compliance is 86%. The average product standard compliance achieved by the agile SCM collaboration model based on the AI traceability system is 94.4%. Therefore, the collaboration mode of an agile



(a) Economic benefits of small supply chain (b) Economic benefits of large supply chain

Figure 8 Comparison results for economic benefits.



(a) Responsiveness of small supply chain (b) Responsiveness of large supply chain

Figure 9 Comparison results for responsiveness.

SCM based on the AI traceability system can significantly improve the compliance of product standards by controlling the production process of products through human-computer interaction.

4.3 Economic Benefits

Economic efficiency is an important indicator used to measure the effectiveness of SCM. In today's economic market, SC competitiveness is fierce. In this environment, a supply chain needs to obtain more economic benefits in order to survive. The paper compares the economic benefits obtained by the collaboration mode of agile SCM based on the AI traceability system and those obtained using the traditional SCM mode. The results for comparison are shown in Figure 8.

Figure 8 (a) allows the comparison of the economic benefits of two SCM models in small supply chains. As shown, the economic benefits of the traditional SCM model have reached a minimum of 48% in the eighth month and a maximum of 68% in the sixth month. The economic benefits of the agile SCM collaboration model based on the AI traceability system has reached a minimum of 72% in the second month and a maximum of 80% in the tenth month. Figure 8 (b) describes the comparison of the economic benefits of two SCM models in large supply chains. Among them, the economic benefits of the traditional SCM mode have reached the lowest of 66% in the eighth month and the highest of 74% in the fourth month. The economic benefits of the agile SCM collaboration model based on the AI traceability system has reached a minimum of 72% in the fourth month and a maximum of 82% in the tenth month. Therefore, the collaboration mode of the agile SCM based on the AI traceability system can substantially improve the economic benefits of the supply chain.

4.4 Responsiveness

In the economic market, customer demands can change according to perceived business opportunities, which requires the SCM to respond quickly to the changing needs of customers. The agile SCM collaboration mode based on the AI traceability system is compared with the traditional SCM mode in terms of responsiveness. The results for comparison are shown in Figure 9.

Figure 9 (a) allows the comparison of the responsiveness of two SCM models in small supply chains. As evident, the responsiveness of the traditional SCM model has reached a

minimum of 72% in the sixth month and a maximum of 80% in the fourth month, with an average responsiveness of 76%. The responsiveness of the agile SCM collaboration model based on the AI traceability system has reached the minimum of 86% in the second month and the maximum of 93% in the tenth month, with an average responsiveness of 89.8%. Figure 9 (b) allows the comparison of the responsiveness of two SCM models in large supply chains. The average response capacity of the traditional SCM model is 70.8%. The average responsiveness of the collaboration mode of the agile SCM based on the AI traceability system is 87.6%. Therefore, the application of the proposed AI traceability system in the agile SCM collaboration mode can improve the responsiveness of the supply chain.

5. CONCLUSIONS

A supply chain links together the enterprises involved in supplying a particular product or products, which improves the viability of all the firms in the SC. However, the traditional SCM model cannot cope with the rapidly changing customer demands. In this paper, an AI traceability system was applied to ensure an agile supply chain. The production process can be tracked and controlled through the traceability system. When a customer's demand changes, the agile supply chain can quickly respond to the changed demand by using the artificial neural network and adjusting the status of each node in the supply chain. This paper constructed a supply chain performance evaluation system by utilizing a questionnaire survey. The collaboration mode of agile SCM based on AI traceability system was compared with the traditional SCM mode. The results showed that the collaboration mode of agile SCM based on AI traceability system could effectively improve product flexibility, product quality and economic benefits. The proposed agile SCM cooperation mode can overcome the challenges posed by a rapidly-evolving economic market. Results show that it can substantially improve the core competitiveness of the supply chain partners and help to determine the long-term development strategy of enterprises. However, when comparing the two SCM models, this paper compared and analyzed only small supply chains and large supply chains; it did not discuss medium-sized supply chains.

Declaration of Conflicting Interests

The authors declare that there is no conflict of interest regarding the publication of this work.

Data availability statement

The data used in this paper can be obtained by emailing the authors.

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REFERENCES

1. Piya, Sujan (2020). "Identification of critical factors and their interrelationships to design agile supply chain: Special focus to oil and gas industries". Global Journal of Flexible Systems Management, 21(3) 263–281.
2. Tarafdar, Monideepa, and Sufian Qrunfleh. "Agile supply chain strategy and supply chain performance: complementary roles of supply chain practices and information systems capability for agility". International Journal of Production Research 55.4 (2017): 925–938.
3. Zhu, Xiang Ning. "Blockchain-based agile supply chain framework with IoT". Information Systems Frontiers 24.2 (2022): 563–578.
4. Kawa, Arkadiusz, and Anna Maryniak. "Lean and agile supply chains of e-commerce: empirical research". Journal of Information and Telecommunication 3.2 (2019): 235–247.
5. Dora, Manoj. "Critical success factors influencing artificial intelligence adoption in food supply chains". International Journal of Production Research 60.14 (2022): 4621–4640.
6. Nozari, Hamed, and Javid Ghahremani Nahr. "The Impact of Blockchain Technology and The Internet of Things on the Agile and Sustainable Supply Chain". International Journal of Innovation in Engineering 2.2 (2022): 33–41.
7. Oh, Am-Suk. "Development of a smart supply-chain management solution based on logistics standards utilizing artificial intelligence and the internet of things". Journal of information and communication convergence engineering 17.3 (2019): 198–204.
8. Liu, Ming, Ting Yang, and Qingjun Li. "Dynamic Production Control and Optimization under Low Carbon Economy considering Delivery Time Demand". Computational Intelligence and Neuroscience 2022 (2022), 4535383.
9. Chauhan, Chetna, and Amol Singh. "A review of Industry 4.0 in supply chain management studies". Journal of Manufacturing Technology Management 31.5 (2019): 863–886.
10. Ghazal, T. M., and H. M. Alzoubi. "Fusion-based supply chain collaboration using machine learning techniques". Intelligent Automation & Soft Computing 31.3 (2022): 1671–1687.
11. Pool, Javad Khazaei. "The effect of business intelligence adoption on agile supply chain performance". International Journal of Productivity and Quality Management 23.3 (2018): 289–306.
12. Shilton, Katie. "Values and ethics in human-computer interaction". Foundations and Trends in Human–Computer Interaction 12.2 (2018): 107–171.
13. Diederich, Stephan. "On the design of and interaction with conversational agents: An organizing and assessing review of human-computer interaction research". Journal of the Association for Information Systems 23.1 (2022): 96–138.
14. Negri, Marta. "Integrating sustainability and resilience in the supply chain: A systematic literature review and a research agenda". Business Strategy and the environment 30.7 (2021): 2858–2886.
15. Wieland, Andreas. "Dancing the supply chain: Toward transformative supply chain management". Journal of Supply Chain Management 57.1 (2021): 58–73.
16. Wieland, Andreas, and Christian F. Durach. "Two perspectives on supply chain resilience". Journal of Business Logistics 42.3 (2021): 315–322.

17. Xuemei Chen, Ting Li, "Building a Low Carbon Supply Chain Energy Conservation and Emission Reduction System for Logistics Enterprises Based on Autonomous Decision Intelligence", Engineering Intelligent Systems 32.3 (2024): 203–211.
18. AlKahtani, Mohammad. "Agile supply chain assessment: an empirical study on concepts, research and issues". Arabian Journal for Science and Engineering 44.3 (2019): 2551–2565.
19. Gupta, Rohan. "Artificial intelligence to deep learning: machine intelligence approach for drug discovery". Molecular Diversity 25.3 (2021): 1315–1360.
20. Yanyan Zhang, Ying Meng, "Investigation of Economic Financing Mode Management of Supply Chain in Pharmaceutical Enterprises", Engineering Intelligent Systems 27.4 (2019): 213–220.
21. Matel, Erik. "An artificial neural network approach for cost estimation of engineering services". International journal of construction management 22.7 (2022): 1274–1287.