



## Research on Supply Chain Optimization of the Tianfu Convenience Store

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### Abstract

In recent years, with the continuous development of the market economy and the continuous improvement of people's income levels, the retail industry has been growing day by day, and the convenience store industry has also entered a period of rapid development, attracting many domestic and foreign competitors to enter the Chinese market. As an early retail enterprise in China, Tianfu Convenience Store benefits from the continuous development and expansion of the market but also faces the impact of competitors in the industry. Tianfu Convenience Store is seeking new ways to optimize the competitiveness of its supply chain, and supply chain integration has long been recognized by many enterprises as a strategy and way to improve their performance and competitiveness. According to research findings, supply chain integration is not only beneficial for enhancing the competitiveness of macro supply chains but also for improving the efficiency and performance of enterprises themselves. This study first introduces the theoretical basis of supply chain management and supply chain research literature, summarizes the connotations of supply chain integration, supply chain collaboration, and supply chain performance, and proposes research questions. Secondly, the main concepts were defined, the impact of supply chain integration on supply chain performance was explored, as was the mediating mechanism of supply chain collaboration, and research hypotheses were proposed. Finally, using a questionnaire survey method and Tianfu Convenience Store as the research sample, the impact of supply chain integration on supply chain performance was tested by establishing a structural equation model. Information sharing, joint decision-making, and incentive alliances in supply chain collaboration were introduced as mediating variables to further reveal the mechanisms of supplier integration, customer integration, and internal integration on supply chain performance. This enriches the research on the path to improving supply chain performance in academia and provides optimization suggestions for Tianfu Convenience Store and other retail enterprises to promote supply chain collaboration and improve supply chain performance by leveraging supply chain integration mechanisms.

**Key words:** *Supply Chain Integration, Supply Chain Collaboration, Supply Chain Performance*

### 1. Introduction

The complex and ever-changing external environment, as well as the differences in goals between enterprises, have caused information asymmetry and matching problems, increasing the probability of supply chain failure. By optimizing and effectively integrating, enterprises can achieve interconnection among all parties in the supply chain, promote efficient operation among members, maintain connections with various stakeholders, and effectively improve the performance of the entire supply chain. For supply chain optimization, the academic community has conducted a lot of research, but there are still phenomena such as insufficient in-depth research and inconsistent viewpoints on supply chain optimization. Therefore, this project focuses on the core issue of the impact mechanism of supply chain integration on supply chain performance. What is supply chain integration, and what is the content of integration? Through the sorting and summarization of research literature on supply chain integration at home and abroad, it is not difficult to see that many scholars or experts believe that research on supply chain integration is mostly conducted from both qualitative and quantitative perspectives. Its overall content includes the definition of supply chain

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integration, supply chain integration dimensions, supply chain integration content, and supply chain integration results. Therefore, this study will be based on the perspective of supply chain integration, studying the content of core enterprises in formulating and implementing integration behaviors in supply chain optimization activities, and clarifying the essence and integration objects of supply chain integration. Will supply chain integration have a negative or positive impact on supply chain performance? This article summarizes the perspectives of different scholars on the dimensions of supply chain integration, and summarizes them from two aspects: structure and mechanism. Deconstruct supply chain integration from the perspective of optimization mechanisms, dividing it into supplier integration, customer integration, and internal integration, and explore the different impacts of these three factors on supply chain performance. How does supply chain collaboration play a role in the impact mechanism of supply chain integration on supply chain performance? The ability of supply chain collaboration can enable enterprises at various nodes in the supply chain to share various types of information, thereby obtaining complementary heterogeneous resources and capabilities among enterprises, and bringing positive effects. This positive feedback helps to coordinate and communicate between enterprises, effectively reducing conflicts in cooperation. This article is based on the research results of Huang Jiaying (2019) in the field of supply chain collaboration. From the perspective of enterprise optimization, supply chain collaboration is divided into three dimensions: information sharing, joint decision-making, and incentive alliances. They are introduced as mediating variables between supply chain integration and supply chain performance to explore how these three elements will affect supply chain integration and improve supply chain performance.

## 2. Related research

Supply chain integration is an important component of supply chain management. "Supply chain" emerged with the advancement of technology and industrialization, and was defined by many scholars in the early 20th century. One of the most representative ones is Stevens, who views the supply chain as the entire process from raw material suppliers to end customers, which includes added value in each link and the entire process of product distribution. Supply chain management is proposed based on supply chain theory, which regards the production and operation of enterprises as a dynamic process of continuous growth and requires the participation of suppliers and customers. Different scholars have different definitions of supply chain integration. Stevens (1989) reports that the development of supply chain integration goes through four stages. The first stage is independent integration between enterprises, the second stage is functional integration, the third stage is internal integration within enterprises, and the fourth stage is external integration between enterprises. From a subjective perspective, researchers like Stank (2007) divide supply chain integration into three categories: supplier integration, customer integration, and internal integration. Its content includes technical cooperation and joint planning between enterprises, as well as establishing good relationships with each other. Westbrook and Frohlich (2001) categorized supply chain integration as the flow of information from customers to suppliers and the flow of materials from suppliers to customers, based on the direction of information flow and logistics in the supply chain.

The concept of supply chain collaboration first appeared in the 1970s, and it was proposed by German physics professor Herman Haken in 1971. It states that in complex, large-scale systems, subsystems interact with each other through collaborative behavior, thereby surpassing the influence of individual elements to form a unified overall effect, which is called synergy. Subsequently, American management scholar Ansoff (1988) introduced the concept of collaboration into business activities from the perspective of enterprise management, that is, how to connect the diversified businesses of enterprises like a bond so that enterprises can more fully utilize existing advantages to explore new development space. Based on the

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economic measurement of the return on investment of collaborative management, the viewpoint of the "1+1>2" synergy effect was derived. Many enterprises now realize the importance of collaborative supply chain management. Through continuous practice and research, it has been found that supply chain collaboration is a supply and demand network divided into two layers: internal and external. Internal supply chain collaboration, as the name suggests, refers to the supply and demand network within an enterprise, which requires collaboration and cooperation among departments such as procurement, research and development, production, and sales to achieve coordinated development of business, goals, and resources in order to ensure the normal production and operation of the enterprise. External supply chain collaboration refers to a chain-based supply and demand network composed of upstream raw material suppliers, core production enterprises, downstream distributors, downstream retailers, and end customers. The external supply chain often revolves around manufacturers as the core enterprise, dividing the entire supply chain into three parts: upstream, midstream, and downstream, with collaborative cooperation among various node enterprises.

Improving supply chain performance and effective supply chain management are critical for enhancing an enterprise's competitiveness. The performance of the supply chain is a systematic and holistic analysis and evaluation of each link in the supply chain, centered on the ultimate goal of the supply chain, before production, during production, and after-sales. Specifically, it refers to the evaluation of the overall operational performance of the entire supply chain and the cooperative relationships between enterprises in various links of the supply chain. In today's rapidly developing manufacturing industry, supply chain management has become an important component of manufacturing enterprises, and supply chain performance has also become a content of supply chain management, playing a crucial role in the operation and management of the supply chain. This is critical for assessing the achievement of supply chain goals and providing support for business decision-making. Scholars at home and abroad have provided their own explanations for the concept of supply chain performance. Zeng Wenjie and Ma Shihua (2011) divide supply chain performance into three aspects: external performance, internal performance, and comprehensive performance. External performance is reflected in factors such as optimal implementation benchmarks and user satisfaction. Internally, it mainly manifests in aspects such as cost performance, production performance, service performance, and operational performance. The overall performance is reflected in the overall effectiveness of supply chain operations.

In summary, the research on the mechanisms by which supply chain integration improves supply chain performance at home and abroad still needs to be supplemented. Furthermore, scholars from diverse countries around the world hold varying opinions and methods regarding the evaluation indicators of supply chain performance, and a relatively unified standard indicator remains undeveloped. There is also no unified understanding of how to measure the impact of supply chain integration on supply chain performance. Compared with the current state of theoretical research, Chinese enterprises have entered a new era of global competition, especially in the retail industry, where competition is more intense. There is an urgent need to find an effective way to enhance their competitiveness. Therefore, studying how to effectively integrate the supply chain and have a positive impact on the overall performance of the supply chain is an urgent issue that needs to be addressed. This study selected Tianfu Convenience Store as the exploratory case study object. Tianfu Convenience Store is a well-known retail enterprise from China, founded and developed in 2004. With unique experience and marketing models, it has developed more than 7,000 stores in Guangdong, Hunan, Jiangxi, Guangxi, Guizhou, Fujian, and other regions. Tianfu has created a miracle in the history of Chinese convenience store entrepreneurship. The products sold under the brand are widely popular nationwide and also recognized by the public.

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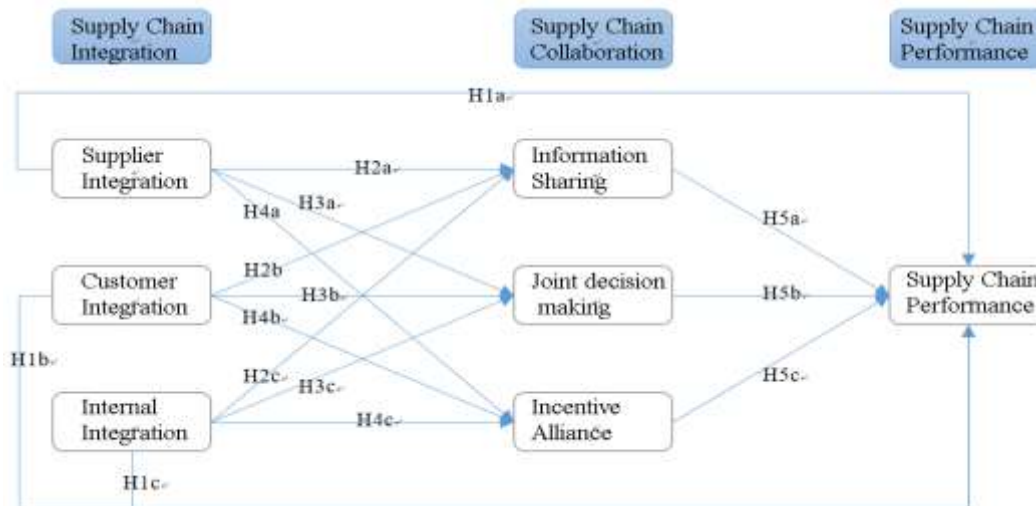


Tianfu Convenience Store is one of China's top ten local chain convenience stores. According to the "China Chain Top 100" data released by the China Chain Management Association in 2021, the sales scale of the Top 100 chain enterprises in 2021 was nearly 2.3 trillion yuan, a year-on-year decrease of 2.8%. The total number of stores is nearly 190000, an 8.9% increase year over year. More than 80% of the Top 100 chain enterprises are expected to achieve sales growth in 2022, with half of them believing a growth rate of over 5%. In terms of online sales, more than 90% of the Top 100 chain enterprises are expected to further grow, and nearly 60% of enterprises are expected to grow by more than 10%. Among them, Tianfu Convenience Store ranks fourth in the number of stores on the 2021 Top 100 Chinese Chain Convenience Stores list and second in the Guangdong Chain Convenience Store Value Brand List.

### 3. Conceptual models

This study refers to the division method of supply chain integration by Ni Wenbin and Zhang Huaixiu (2010), and measures it from three dimensions: supplier integration (X1 to X4), customer integration (X5 to X6), and internal integration (X7 to X12) from a mechanism perspective. On the basis of Xu Fang (2020) research on the mediating effect of supply chain collaboration, the dimensions were divided into information sharing (M1 to M4), joint decision-making (M5 to M8), and incentive alliances (M9 to 12), referring to Chen Luyan's (2023) scale; extracting the measurement items of supply chain performance (Y1 to Y4) based on Wang Sai's (2022) scale and making slight modifications to the expression in combination with the research content.

This study selected Tianfu Convenience Store as the research object for investigation. As this study involves the supply chain integration, supply chain collaboration, and supply chain performance of Tianfu Convenience Store, in order to make this task more practical, analytical, and practical, a questionnaire -based survey analysis was conducted. The selected audience group includes all parties involved in the convenience store supply chain. This questionnaire adopts the most commonly used Likert five level scale method. Using the number "1-5" to represent the respondents' perception of the issue, from "completely agree" to "completely disagree". This questionnaire consists of two parts. The first part collects basic information about the research subjects and their working companies through selection or filling in the blanks. The second part is a five-level scale question, focusing on supply chain integration, supply chain collaboration, and supply chain performance. This study used a combination of online and offline methods to distribute survey questionnaires, with electronic questionnaires as the main method and paper questionnaires as a supplement. The specific channels for distributing questionnaires include: distributing paper questionnaires to Tianfu convenience store stores, preparing and generating questionnaire filling links and QR codes through the Questionnaire Star platform. This questionnaire distribution method aims to avoid the singularity of the respondents, ensure the diversity of the filling group, minimize the adverse effects of regional issues on the research, and thus improve the quality of the data obtained from the survey questionnaire. The survey lasted for one month, from December 25, 2023, to January 24, 2024, from the design of the questionnaire to its distribution. During the distribution of the survey questionnaire, the author provided detailed information to the respondents about the purpose and significance of this study, the potential value this study may bring to enterprises, and the anonymity of this study. A total of 470 survey questionnaires were distributed in this study, and the collected questionnaires were screened. After removing invalid questionnaires, 454 valid questionnaires were obtained, with an effective questionnaire response rate of 96.5%.



**Figure 1:** Conceptual Model Diagram

This chapter is based on previous scholars' research findings, summarizing and describing the dimensions of each variable. Through the preliminary framework of exploratory case studies, a conceptual model of "supply chain integration, supply chain collaboration, and supply chain performance" is proposed, as shown in Figure 1. Further analyze the interrelationships between various dimensions and form 8 major hypotheses and 24 minor hypotheses, totaling 32 hypotheses. \*\*The methods used in this study include the following parts: Literature analysis: make full use of the modern Internet, local libraries, and other channels, consult relevant books, periodicals, and other paper and electronic literature and other resources, search for and sort out a sufficient number of pieces of literature related to supply chain management. This process helps to determine the research focus of this study, build the theoretical framework of the article, and lay a theoretical foundation for further research. Structural equation modeling: Structural equation modeling is an important statistical method for quantitative research in contemporary social and behavioral fields. It combines the factor analysis methods of traditional multivariate statistical analysis with the statistical techniques of linear models, and can identify, estimate, and verify various causal models. This method focuses on verifying the relationship between latent variables of hypotheses, which can be measured by explicit indicators. This study aims to explore the impact of supply chain integration on supply chain performance. Questionnaire survey method: Based on the theoretical research results of scholars and the organizational theory and design of the supply chain of Tianfu convenience stores, the questionnaire survey method is used to collect data from employees and consumers of Tianfu, investigate the perception of supply chain integration, collaboration, and performance development of the enterprise, empirically analyze the relationships among them, and provide supplementary materials and data for this study, providing effective assistance for the next optimization strategy.

#### 4. Research hypotheses

Supplier integration is widely regarded as the result of the further development of long-term partnerships between enterprises and suppliers. This mainly includes the degree of coordination between producers and suppliers when facing decisions such as new product development, manufacturing planning, market demand forecasting, inventory management, supply of goods, and material flow. The improvement of enterprise performance can be achieved by strengthening integration with supply chain partners. Vanpucke

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(2017) discovered that supplier integration can improve visibility in the upstream supply chain and reduce manufacturers' uncertainty. Supplier integration can improve a company's response speed and sensitivity, save time and costs, enhance its competitive advantage, and also enhance its performance by reducing uncertainty and production costs. Customer integration refers to the process in which a company actively collaborates and interacts with customers to ensure timely delivery of products and improve customer satisfaction. Customer integration often involves frequent contact with customers, obtaining and correcting demand information, effectively predicting customer needs, and other cooperative business-related tasks. Flynn (2010) selected China's manufacturing industry as the research object according to the research needs, and the research results showed significant differences from the research conclusions drawn from the sample of American companies. They found that there is no positive correlation between the degree of supply chain integration and corporate performance in China. Only through the interaction between supplier integration and customer integration can a significant impact be made on corporate financial performance. Song Hua divided supply chain integration into two levels: internal and external, and conducted empirical research on data from both internal and external levels of technology-based small and medium-sized enterprises. He discovered that integrating internal and external aspects can improve enterprises' financing ability and financial performance. Tarigan (2021) explores the impact of enhanced enterprise resource planning on corporate performance through three aspects: internal integration, supplier integration, and green supply chain management. The results show that internal integration and supplier integration have a positive impact on corporate performance. Based on this, this article proposes the following hypothesis: H1: Supply chain integration directly has a positive impact on supply chain performance; H1a: Supplier integration directly has a positive impact on supply chain performance; H1b: Customer integration directly has a positive impact on supply chain performance; H1c: Internal integration directly has a positive impact on supply chain performance.

Danese and Romano (2011) analyzed the impact of implementing supplier integration and customer integration simultaneously on supply chain collaboration performance in enterprises. The research conclusion indicates that optimizing the performance of supply chain collaboration is not only based on a single perspective of customer integration, but also requires simultaneously improving the degree of integration between customers and suppliers to enhance their interaction. Although supplier integration has a positive impact on improving customer integration and efficiency, unfortunately, the research findings do not support the widely believed hypothesis that customer integration has a positive impact on supply chain efficiency. The final result also indicates that when supplier integration is at a low level, customer integration can even lead to lower efficiency. Jiang Yunfeng believes that efficient supply chain collaboration can maximize the satisfaction of the consumption needs of downstream customers in the supply chain, and this consumption demand information can help supply chain products and technologies have a positive guiding effect, mainly reflected in targeted product innovation, while reducing the risk of failure of innovative products, ultimately improving the overall performance level of the supply chain. In his research on optimizing customer information management, Zhang Jijing believes that by establishing a customer database and integrating specific analysis of customer product demand characteristics and sales situations, enterprises can better achieve collaborative management of customer information and improve supply chain management efficiency. Through effective integration of internal information and resources, enterprises can achieve efficient interaction and collaboration between various links. This collaborative sharing can span the entire supply chain, from raw material procurement to finished product delivery, involving multiple enterprise partners such as manufacturers, suppliers, and logistics distribution. Pan Wen'an believes in his research on knowledge efficiency transfer in the supply chain that there is a positive relationship between internal integration and supply chain collaborative and innovative knowledge. Based on this, this article proposes the following hypothesis: H2: Supply chain integration directly has a positive impact on information sharing; H2a: Supplier integration directly has a positive impact on information sharing; H2b: Customer integration

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directly has a positive impact on information sharing; H2c: Internal integration directly has a positive impact on information sharing; H3: Supply chain integration directly has a positive impact on joint decision-making; H3a: Supplier integration directly has a positive impact on joint decision-making; H3b: Customer integration directly has a positive impact on joint decision-making; H3c: Internal integration directly has a positive impact on joint decision-making; H4: Supply chain integration directly has a positive impact on incentive alliances; H4a: Supplier integration directly has a positive impact on incentive alliances; H4b: Customer integration directly has a positive impact on incentive alliances.

Based on research data from Chinese manufacturing enterprises, Wang Ke and Zhou Yana (2019) analyzed the relationship between enterprise informatization construction, information sharing, and enterprise performance. She believes that promoting informatization construction is beneficial for the timely sharing of key information in the supply chain, and information sharing in these supply chains can promote higher performance returns for enterprises. Based on empirical survey data from Korean manufacturing enterprises, Um K-H (2019) studied the impact of supply chain collaboration on enterprise performance and transaction cost advantages under the moderating effect of integration mechanisms. The final research results found that supply chain collaboration can promote the improvement of enterprise performance and transaction cost advantages. Based on this, relevant enterprises proposed appropriate and efficient collaborative cooperation with supply chain partners, being able to obtain performance related recommendation information from it. The goal of incentivizing alliances in supply chain collaboration is to stimulate positive interaction among partners, improve operational efficiency, reduce costs, and ultimately improve overall business performance. Kang Gaojie (2020) used a hierarchical regression analysis method to verify the impact of supply chain collaboration on supply chain performance, and concluded that incentive alliances, joint decision-making, and information sharing in supply chain collaboration have a significant positive impact on supply chain performance. Huang Jiaying (2019) pointed out that the connotation of supply chain collaboration includes three aspects: incentive alliances, information sharing, and joint decision-making. Research has found that information sharing can directly affect supply chain performance, while incentive alliances and joint decision-making can only improve supply chain performance under high-quality information sharing environmental conditions. However, trust and incentive alliances are interrelated and work together to facilitate joint decision-making and information sharing. Effective incentive alliances can fully share supply chain information. Only when the information sent out can flow freely within the supply chain, can information sharing be promoted and joint decision-making be influenced to improve supply chain performance. Xu Xuejun has confirmed through empirical research that the degree of information sharing has a significant positive impact on supply chain performance. At the same time, enterprises can achieve more efficient decision-making coordination through collaborative sharing, avoiding decision-making errors caused by information silos and information asymmetry. Based on this, this article proposes the following hypothesis: H5: Supply chain collaboration has a direct positive impact on supply chain performance; H5a: Information sharing has a direct positive impact on supply chain performance; H5b: Incentive alliances have a direct positive impact on supply chain performance; and H5c: Joint decision-making has a direct positive impact on supply chain performance.

Supply chain collaboration is an indispensable part of supply chain management, especially in complex supply chains composed of diversified retailers, suppliers, and manufacturers. Supply chain collaboration plays a role in reducing costs, improving efficiency, and improving customer satisfaction. Xu Fang (2020), based on resource-based theory and IT capability theory, explores the impact mechanism of big data application capability on enterprise innovation performance, reveals the moderating effect of supply chain collaboration on the impact of big data application capability on enterprise innovation performance,

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and plays a partial mediating role in this process. Wang (2013) believes that supply chain integration provides a prerequisite for establishing partnership relationships among enterprises. Node enterprises actively maintain and optimize good relationships between enterprises through different forms of integration methods, and strive to reduce the risk of supply chain interruption. However, close relationships and high stability do not necessarily lead to high performance levels, and supply chain collaboration capabilities play a bridging role in this process. With the help of supply chain collaboration, node enterprises can share various types of information, thereby obtaining positive and beneficial effects brought by heterogeneous resources and complementary capabilities among enterprises. Based on this, this article proposes the following hypothesis: H6: Information sharing plays a mediating role in the mechanism of supply chain integration affecting supply chain performance; H6a: Information sharing plays a mediating role in the mechanism of supplier integration affecting supply chain performance; H6b: Information sharing plays an intermediary role in the mechanism of customer integration affecting supply chain performance; H6c: Information sharing plays a mediating role in the mechanism of internal integration affecting supply chain performance; H7: Joint decision-making plays an intermediary role in the mechanism of supply chain integration, affecting supply chain performance; H7a: Joint decision-making plays a mediating role in the mechanism of supplier integration, affecting supply chain performance; H7b: Joint decision-making plays an intermediary role in the mechanism of customer integration, affecting supply chain performance; H7c: Joint decision-making plays a mediating role in the mechanism of internal integration, affecting supply chain performance; H8: Incentive alliances play an intermediary role in the mechanism of supply chain integration, affecting supply chain performance; H8a: Incentive alliances play an intermediary role in the mechanism of supplier integration, affecting supply chain performance; H8b: The incentive alliance plays a mediating role in the mechanism of customer integration, affecting supply chain performance; H8c: Incentive alliances play a mediating role in the mechanism of internal integration, affecting supply chain performance.

## 5. Data analysis

5.1 The reliability test results are first analyzed. Cronbach  $\alpha$  If the coefficient is greater than 0.8, it indicates high reliability; if this value is within the range of 0.7 to 0.8, it indicates good reliability; if this value is within the range of 0.6 to 0.7, it indicates acceptable reliability; if this value is less than 0.6, it indicates poor reliability. From Table 1, it can be seen that the overall reliability of the scale and the reliability of each dimension in this study are both greater than 0.6, indicating that the scale and dimension in the study have high reliability and good stability. Total variables  $\alpha$  the coefficient is 0.922, where the independent variable is supplier integration under the dimension of supply chain integration  $\alpha$  the coefficient is 0.840, customer integration  $\alpha$  the coefficient is 0.851, internal integration  $\alpha$  the coefficient is 0.855; information sharing falls under the dimension of mediating variable supply synergy  $\alpha$  the coefficient is 0.851, joint decision-making  $\alpha$  the coefficient is 0.854, which motivates the alliance  $\alpha$  the coefficient is 0.848; the dependent variable is a single dimension of supply chain performance  $\alpha$  the coefficient is 0.869. The independent variable, mediator variable, and outcome variable  $\alpha$ . The coefficients are all greater than 0.6, which proves that the reliability of the data is high. Under the same measurement conditions, the questionnaire can produce consistent results, and the results measured by the questionnaire have high accuracy and reliability. This can increase the credibility and accuracy of the research, thereby better supporting the study's conclusions and decisions.

**Table 1:** Reliability test results

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Variables				Item	Cronbach's a	
				s		
Independent variable	Supply integration	chain	Supplier Integration	4	0.84	0.861
			Customer Integration	4	0.851	
			Internal Integration	4	0.855	
Mediating variable	Supply collaboration	chain	Information sharing	4	0.851	0.922
			Joint decision making	4	0.854	
			Incentive Alliance	4	0.848	
Dependent variable	Supply Performance	Chain	Supply Chain Performance	4	0.869	

5.2 This study used AMOS software for validity analysis. CFA analysis mainly tests the structural validity and convergent validity data in the structural equation model, and selects fitting indicators such as the chi square degree of freedom ratio (CMIN/DF), value-added fitting index (IFI), comparative fitting index (CFI), and root mean square error of approximation (RMSEA) to test whether the model structure works as expected. This study conducted confirmatory factor analysis on the independent variable "supply chain integration". The values of the fit test were RMSEA=0.017<0.08, CMIN/DF=1.125<3.0, CMIN=57.397, IFI=0.997>0.9, CFI=0.997>0.9, and the coefficients of all paths were significant at the P<0.001 level. The test shows that all indicators meet the testing standards, and the model's adaptability is good. Therefore, the dimension division and measurement of supply chain integration are effective. A confirmatory factor test was conducted on the mediating variable "supply chain collaboration", where the values of the fit test were: RMSEA=0.027<0.08, CMIN/DF=1.329<3.0, CMIN=67.787, IFI=0.993>0.9, and CFI=0.993>0.9. At the same time, all path coefficients were significant at the P<0.001 level, indicating that all indicators met the testing criteria and the model's adaptability was good. Therefore, the dimension division and measurement of supply chain collaboration are effective. A confirmatory factor test was conducted on the dependent variable "supply chain performance", where the values of the fit test were RMSEA=0.000<0.08, CMIN/DF=0.263<3.0, CMIN=0.525, IFI=1.002>0.9, and CFI=1.002>0.9. At the same time, the coefficients of all paths were significant at the P<0.001 level. This situation occurred according to Hou Jietai's book "Structural Equation Modeling", which mentions that if the model has 0 degrees of freedom, it is called a saturation model or a precisely recognized model. The chi square value of this model is also 0, and the degree of freedom of the supply chain performance is 2, indicating that it is very close to the saturation model. At this point, CFI and IFI can be equal to 1, and a value of 1 indicates that the model is fully adapted. All indicators have met the testing standards, and the model's adaptability is relatively good, so it is effective for measuring the dimensions of supply chain performance.

**Table 2:** Validity testing based on SPSS

KMO sampling suitability quantity		0.914
Bartlett's sphericity test	6280.417	6280.417
	378	378
	0	0.000



5.3 Conducting correlation analysis is to test whether there is correlation between variables, which is a necessary condition for fully analyzing data. Pearson correlation coefficient is often used as a statistical analysis method, and this study also uses this coefficient to measure the strength of the correlation between variables. According to the inspection results, it can be seen that under the dimension of supply chain integration, supplier integration X1 to X4, customer integration X5 to X7, and internal integration X8 to X12 are integrated; information sharing M1 to M4, joint decision-making M5 to M8, and incentive alliances M9 to M12 are in the dimension of supply chain collaboration; and under a single dimension of supply chain performance, Y1 to Y4, there is a correlation between these variables pairwise or cross ( $P < 0.05$ ). It fully demonstrates that supply chain integration and supply chain collaboration have a significant impact on supply performance and preliminarily verifies hypotheses H1-H5 in this article. In addition, based on the diagonal values in the test as the discriminant validity of the model, which is the square root of the average variance extraction (AVE), it is easy to see that the correlation coefficients between each variable are smaller than the discriminant validity. This indicates that the overall structural validity of the scale is relatively good, and the tested model does not have serious multicollinearity problems.

5.4 This study conducted a regression analysis to verify the impact of the three mechanisms of supply chain integration on supply chain performance. Supplier integration, customer integration, and internal integration were used as independent variables, while supply chain performance was used as the dependent variable. Based on this, a regression model was established and analyzed. Indicating that supplier integration, customer integration, and internal integration all have a significant positive impact on supply chain performance. Therefore, it is assumed that H1a, H1b, and H1c are all valid simultaneously. The regression analysis of supply chain integration on supply chain collaboration is to verify the impact of the three mechanisms of supply chain integration on the three capabilities of supply chain collaboration. This article sequentially considers supplier integration, customer integration, and internal integration as independent variables, as well as information sharing, joint decision-making, and incentive alliances as dependent variables. Based on this, a regression model is established and analyzed. Indicating that supplier integration, customer integration, and internal integration all have a significant positive impact on information sharing, joint decision-making, and incentive alliances. Therefore, it is assumed that H2a, H2b, H2c, H3a, H3b, H3c, H4a, H4b, and H4c are all valid simultaneously. The regression analysis of supply chain collaboration on supply chain performance is conducted to verify the impact mechanism of the three capabilities of supply chain collaboration on supply chain performance. This article sequentially considers information sharing, joint decision-making, and incentive alliances as independent variables, with supply chain performance as the dependent variable. Based on this, a regression model is established and analyzed. which shows that information sharing, joint decision-making, and incentive alliances have a positive impact on supply chain performance simultaneously. According to the test results of the data, it has been proven that hypotheses H5a, H5b, and H5c are all valid simultaneously.

5.5 In order to further verify the mediating role of supply chain collaboration, this study used a combined process model to effectively test the mediating role of supply chain collaboration. Using supplier integration, customer integration, and internal integration as independent variables, supply chain performance as the dependent variable, and information sharing, joint decision-making, and incentive alliances as mediating variables, a process model was established and analyzed using the Bootstrap method. The partial analysis results are shown in Table 3. This section refers to the mediation effect judgment process proposed by Ye Baojuan and Wen Zhonglin. If the confidence interval of the upper and lower limits of BootLLCI includes the number 0, it indicates that the indirect effect is not significant; When introducing intermediary variables, if the independent variable supply chain integration has a significant relationship with the

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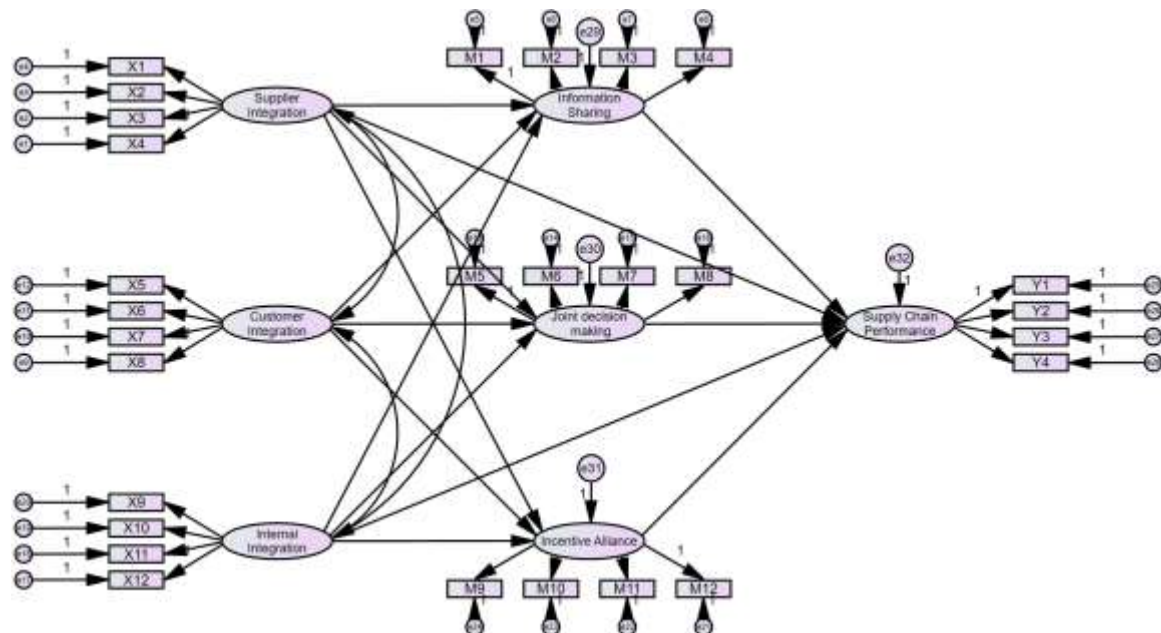


dependent variable supply chain performance, it indicates a significant correlation between the direct effect; If the symbols of paths a, b, and c 'are equally significant, it indicates the existence of partial mediating effects. The validation data results of this study show that the confidence intervals for each upper and lower limit of BootLLCI do not include the number 0, which fully demonstrates the significant mediating effect of the mediating variables in the model. It is then determined that there is a significant partial mediating effect of supply chain collaboration between supply chain integration and supply chain performance. Therefore, it is assumed that H6a, H6b, H6c, H7a, H7b, H7c, H8a, H8b, and H8c all hold simultaneously.

**Table 3:** Bootstrap analysis of the mediating effect of supply chain collaboration on supply chain performance

(Y) Supply Chain Performance	(X) Supplier Integration	(M) Information sharing	Joint decision making		Incentive Alliance	
			BootULC	BootLLC	BootULC	BootLLC
			I	I	I	I
Customer Integration	0.1541	0.0757	0.1298	0.0549	0.1566	0.0732
Internal Integration	0.2085	0.1026	0.1554	0.069	0.1461	0.0707

5.6 Structural equation model validation. To ensure the accuracy of regression analysis results, this article also used AMOS software to draw a structural equation model and conduct robustness tests on the proposed conceptual model. At the same time, the number of samples collected in this study reached 454, which is in line with the basic requirements of using the method of maximum likelihood to calculate the structural model. Firstly, consider the direct effect of the independent variable supply chain integration on the dependent variable supply chain performance. At this time,  $RMSEA=0.000<0.08$ ,  $CMIN/DF=0.983<3.0$ ,  $CMIN=96.261$ ,  $IFI=1.00>0.9$ ,  $CFI=1.00>0.9$ . The model fitting effect is relatively good. The various path coefficients of supplier integration and customer integration on supply chain performance are significant at the  $P<0.001$  level, However, the path coefficient of internal integration of enterprises on supply chain performance is 0.004, and its P-value is significant at the level of  $<0.05$ . All indicators in the direct effect model meet the testing standards, indicating that the model's fitting value is acceptable. After passing the direct effect test of "supply chain integration supply chain performance", based on the initial conceptual model proposed in this article, the intermediate variable supply chain collaboration is introduced for testing, and a structural equation model diagram of "supply chain integration supply chain collaboration supply chain performance" is drawn using AMOS draw a structural equation model diagram of "supply chain integration, supply chain collaboration, supply chain performance".



**Figure 2:** Structural Equation Model Diagram

As shown in the fitting diagram of the indirect effects model in Figure 2, the fitting results of the model are shown in Table 4.  $RMSEA=0.019 < 0.08$ ,  $CMIN/DF=1.164 < 3.0$ ,  $CMIN=386.563$ ,  $IFI=0.991 > 0.9$ ,  $CFI=0.991 > 0.9$ ,  $GFI=0.943 > 0.9$ . Although the models all passed the fitting indicators, the path of "supply chain performance ← internal integration" is still not significant enough at this time. After multiple revisions of adding or changing routes, they are all ineffective, and can only be gladly accepted. The detailed fitting values of the model are shown in Table 5.

**Table 4:** Structural Equation Modeling Structural Validity

Indicator	recommended value	Fitting value	Parameter judgment	Whether standard
CMIN	Smaller is better	386.563		
CMIN/DF	<3.00	1.164	Excellent	Yes
RMSEA	<0.08	0.019	Excellent	Yes
NFI	>0.9	0.940	Excellent	Yes
IFI	>0.9	0.991	Excellent	Yes
TLI	>0.9	0.990	Excellent	Yes
CFI	>0.9	0.991	Excellent	Yes
GFI	>0.9	0.943	Excellent	Yes
AGFI	>0.8	0.930	Excellent	Yes

From the summary data in Table 5, it can be seen that the direct effects of supply chain integration on supply chain performance across various dimensions are significant at the  $P < 0.01$  level for both supplier integration and customer integration, indicating a direct positive correlation. It is assumed that both H1a and H1b hold true. Unfortunately, assuming that the direct effect of internal integration of H1c enterprises on supply chain performance is  $0.462 > 0.1$ , it did not pass the significance test standard.

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**Table 5:** Structural model fitting table

Path relationship verification	Estimate	S.E.	C.R.	P
Information sharing <--- Supplier integration	0.248	0.063	4.248	***
Joint decision making <--- Supplier integration	0.165	0.059	2.794	0.005**
Incentive Alliance <--- Supplier integration	0.225	0.059	3.764	***
Information sharing <--- customer integration	0.156	0.066	2.635	0.008**
Joint decision making <--- customer integration	0.229	0.064	3.725	***
Incentive Alliance <--- customer integration	0.325	0.064	5.145	***
Information sharing <--- Internal Integration	0.365	0.061	6.323	***
Joint decision making <--- Internal Integration	0.305	0.058	5.22	***
Incentive Alliance <--- Internal Integration	0.156	0.055	2.739	0.006**
Supply Chain Performance <--- Joint decision making	0.095	0.061	1.661	0.097*
Supply Chain Performance <--- Information sharing	0.185	0.062	3.003	0.003**
Supply Chain Performance <--- Incentive Alliance	0.144	0.064	2.464	0.014**
Supply Chain Performance <--- Supplier integration	0.182	0.066	2.973	0.003**
Supply Chain Performance <--- Internal Integration	0.046	0.066	0.736	0.462
Supply Chain Performance <--- customer integration	0.199	0.071	3.113	0.002**

## 6. Research conclusion

### 6.1 Optimization inspiration

This study found that supply chain integration in retail enterprises has a significant positive effect on their supply chain performance in the context of the new era, which is consistent with the conclusions of most scholars. In terms of the direct effect of supply chain integration on supply chain performance, according to the test results of the structural equation model mentioned above, at the  $P < 0.05$  level, the standardized path coefficients that directly affect supply chain performance within the supply chain enterprise, supplier integration, and customer integration are 0.462, 0.003, and 0.002, respectively. Supplier integration provides guarantees for the maintenance of relationships among various partners in the supply chain through the implementation of integrated management between enterprises and suppliers, the establishment of supply chain strategic alliances with suppliers, and the establishment of communication and sharing mechanisms, thereby improving the overall performance level of the supply chain; Customer integration aims to create a high-quality customer relationship management system tailored to the development of the enterprise by gaining a deep understanding of customer needs, recommending resources to customers, utilizing online tools for real-time information dissemination and resource matching, and contributing to the performance of the enterprise. The impact of both on supply chain performance is at the same level, supporting each other and working together. The standardized path coefficient of internal integration, which directly affects supply chain performance, is 0.462 and does not reach a significant level.

Research has shown that supply chain integration can promote supply chain collaboration. In terms of the direct impact of supply chain integration on supply chain collaboration, at the level of  $P < 0.05$ , the standardized path coefficient of supplier integration on joint decision-making is 0.005, while the impact of supplier integration on information sharing and incentive alliances is significant at the level of  $P < 0.001$ , indicating that supply chain integration has a significant promoting effect on supply chain collaboration. Supply chain integration brings the partnership at all levels of the supply chain closer, builds trust, promotes the transmission and sharing of information between both parties, and formulates relatively synchronous decisions to achieve common goals. At the level of  $P < 0.001$ , customer integration shows a significant positive

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effect on joint decision-making and incentive alliances, respectively. The standardized path coefficient of customer integration on information sharing is 0.008, indicating that customer integration has a significant promoting effect on supply chain collaboration. The internal integration of supply chain enterprises is significant at the  $P < 0.001$  level for information sharing and joint decision-making, and only at the  $P < 0.05$  level for incentivizing alliances. This indicates that internal integration also has a significant positive effect on supply chain collaboration, and they interact with each other. The enterprise shares inventory levels with major franchise customers, predicts market demand, and makes decisions together. At the same time, the enterprise provides certain concessions to franchise customers, which helps to improve the performance of both companies.

The positive supply chain collaboration process will have an effective impact on continuous performance improvement. According to the results of the structural equation model mentioned above, at the levels of  $P < 0.05$  and  $P < 0.1$ , the standardization coefficients of information sharing, joint decision-making, and incentive alliances for supply chain performance are 0.003, 0.097, and 0.014, respectively, indicating that supply chain collaboration has a good promoting effect on supply chain performance. The promotion effect of information sharing and incentive alliances on supply chain performance is stronger than that of joint decision-making. This is because supply chain enterprises often update and share information and knowledge in a timely manner, transmit and exchange market demand changes, achieve technological iteration of production, increase each other's knowledge and experience, and optimize and enrich the enterprise knowledge system. Motivating alliances to coordinate and cooperate with cooperative enterprises in the production and manufacturing process, stimulating positive interaction among partners, thereby improving production efficiency, reducing costs, and improving overall enterprise performance; Joint decision-making is the process in which enterprises within the supply chain make relatively synchronous decisions on their strategic plans and production plans, based on their own and partner information and experience, in order to achieve common goals, thereby improving the performance of the supply chain.

The research data found that all three dimensions of supply chain collaboration play a partial mediating role in the relationship between supply chain integration and supply chain performance. This further indicates that supply chain integration can not only improve the performance of the supply chain but also indirectly affect the overall performance of the supply chain through the intermediary effect of supply chain collaboration. Therefore, in order for new retail enterprises to improve the overall performance of their supply chain, they should not only focus on the continuous optimization and integration of the enterprise itself but also enhance the strength of supply chain collaboration. Although optimizing, integrating, updating, and iterating the supply chain can provide enterprises with unique competitive advantages, more effective measures related to supply chain collaboration are still needed to transform these competitive advantages into supply chain performance for enterprises.

## **6.2 Research Shortcomings and Prospects**

This study is still incomplete in terms of construction dimensions and considerations for the performance improvement path through supply chain integration. In empirical research, limited by the availability of data and the operability of concepts, the study only tested the paths proposed in the theoretical construction part, such as internal integration of enterprises, supplier integration, and customer integration. Further research is needed to determine whether other factors that have not been considered, such as carriers, will have an impact on supply chain performance. The author hopes that future research can combine more relevant research results at home and abroad to further improve the theoretical framework for promoting supply chain performance through supply chain integration. Based on previous research, a comprehensive

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research method combining quantitative and qualitative analysis was used to conduct the study. Other first-hand data can also be obtained through on-site inspections, interviews, and other methods to gain a deeper understanding of the path and considerations for improving supply chain performance through supply chain integration.

## 7. References

- Ansoff H I, McDonnell E J. (1988) *The New Corporate Strategy*[M]. Wiley.
- Asif, F. C., & Saha, G. C. (2023). Graphene-like Carbon Structure Synthesis from Biomass Pyrolysis: A Critical Review on Feedstock–Process–Properties Relationship. *C*, 9(1), 31. <https://doi.org/10.3390/c9010031>
- \*\*Chen Luyan. (2023) Research on the Relationship between Digital Capability and Supply Chain Robustness [D] Shanxi University. <https://link.cnki.net/doi/10.27284/d.cnki.gsxiu.2023.000732>doi:10.27284/d.cnki.gsxiu.2023.000732. \*\*
- Danese, P., & Romano, P. (2011). Supply chain integration and efficiency performance: a study on the interactions between customer and supplier integration. *Supply Chain Management*, 16(4), 220–230. <https://doi.org/10.1108/13598541111139044>
- Flynn, B. B., Huo, B., & Zhao, X. (2010). The impact of supply chain integration on performance: A contingency and configuration approach. *Journal of operations management*, 28(1), 58–71.
- Frohlich, M. T., & Westbrook, R. (2001). Arcs of integration: an international study of supply chain strategies. *Journal of Operations Management*, 19(2), 185–200. [https://doi.org/10.1016/s0272-6963\(00\)00055-3](https://doi.org/10.1016/s0272-6963(00)00055-3)
- \*\*Huang Jiaying. (2019) Research on the Impact of Relationship Capital on Innovation Performance of Enterprises in the Supply Chain Environment Harbin Engineering University. <https://link.cnki.net/doi/10.27060/d.cnki.ghbcu.2019.000394>doi:10.27060/d.cnki.ghbcu.2019.000394.
- Kang Gaojie. (2020) Research on the Impact of Supply Chain Collaboration on Performance - The Regulatory Role of Supply Chain Culture Taiyuan University of Technology. <https://link.cnki.net/doi/10.27352/d.cnki.gylgu.2020.000147>doi:10.27352/d.cnki.gylgu.2020.000147.
- Ni Wenbin, Zhang Huaixiu. (2010) A review of research on supply chain integration. *Business Economics*, (20),68-70.\*\*
- Stevens, G. C. (1989). Integrating the supply chain. *international Journal of physical distribution & Materials Management*, 19(8), 3-8.
- Stank, T. P., Keller, S. B., & Closs, D. J. (2001). Performance benefits of supply chain logistical integration. *Transportation Journal*, 41(2), 32–46. <https://trid.trb.org/view/727291>
- Tarigan, Z. J. H., Siagian, H., & Jie, F. (2021). Impact of Enhanced Enterprise Resource Planning (ERP) on Firm Performance through Green Supply Chain Management. *Sustainability*, 13(8), 4358. <https://doi.org/10.3390/su13084358>
- Um, K., & Kim, S. (2019). The effects of supply chain collaboration on performance and transaction cost advantage: The moderation and nonlinear effects of governance mechanisms. *International Journal of Production Economics*, 217, 97–111. <https://doi.org/10.1016/j.ijpe.2018.03.025>



- Vanpoucke, E., Vereecke, A., & Muylle, S. (2017). Leveraging the impact of supply chain integration through information technology. *International Journal of Operations & Production Management*, 37(4), 510–530. <https://doi.org/10.1108/ijopm-07-2015-0441>
- Wang, E. T. G., Tai, J. C. F., & Grover, V. (2013). Examining the relational benefits of improved interfirm information processing capability in Buyer-Supplier DYAds. *Management Information Systems Quarterly*, 37(1), 149–173. <https://doi.org/10.25300/misq/2013/37.1.07>
- \*\*Wang Ke, Zhou Yana. (2019) Informatization construction, supply chain information sharing, and enterprise performance: an empirical study based on Chinese manufacturing enterprises [J] *Chinese Management Science* (10), 34-43.doi:10.16381/j.cnki.issn1003-207x.2019.10.004.\*\*
- Wang Sai. (2022) Research on the Impact of Supply Chain Relationship Governance Mechanism on Supply Chain Performance [D] Shihezi University.
- Xu Fang, Tian Meng, Xu Guohu. (2020) Research on the Impact of Big Data Application Capability on Enterprise Innovation Performance: The Mediating Effect of Supply Chain Collaboration and the Regulating Effect of Strategic Matching [J] *Macroeconomic Research*: 101-119.
- Zeng Wenjie, Ma Shihua. (2011) An Empirical Study on the Impact of Trust and Power on Supply Chain Collaboration [J] *Journal of Wuhan University of Technology: Information and Management Engineering Edition*, 33 (2): 7.