

# Supply chain agility, supplier synergy and information sharing on supplier performance: Basis for supplier relationship management framework

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## Abstract

In the current context of market uncertainty and cross-border supply chain complexity in the integrated circuit industry, strengthening supplier flexibility, collaboration, and information sharing can help establish a stronger, more flexible, and efficient supply chain system. Improving supplier performance can help enterprises improve competitiveness, establish a sustainable supply chain system, and lay a solid foundation for long-term development. The aim of this study is to explore in depth the impact of supply chain agility, supplier collaboration, and information sharing on supplier performance in the integrated circuit industry, and to construct a supplier relationship management framework based on these relationships. By systematically analyzing the relationship between supply chain flexibility, supplier collaboration, information sharing, and supplier performance, combined with the special background of these three key factors in the integrated circuit industry, new theoretical and practical guidance is provided to improve supplier performance. This paper uses descriptive research methods and questionnaire surveys as the source of data collection. Perform statistical analysis using regression analysis and analysis of variance. The survey results show that the flexibility of suppliers has a moderate positive correlation with timely transmission of key information to adapt to changes in new technologies and market trends. In addition, there is a moderate positive correlation between information transmission and supplier production plan adjustments, highlighting the importance of information sharing in improving supplier flexibility and collaboration. The study further revealed a positive correlation between supplier collaboration and information transmission and sharing. This indicates that by strengthening collaboration and information sharing among suppliers, supplier synergy can be improved, thereby enhancing the flexibility and performance of the entire supply chain. However, in terms of supply chain transparency, supplier collaboration is relatively weak and may be limited by technology and intellectual property rights. For supply chain integration, research has found a weak positive correlation with information transmission and supplier information sharing. Although this relationship is weak, supply chain integration has been proven to have a positive effect on improving information sharing efficiency and supplier performance. However, the correlation between collaboration and information sharing in the entire supply chain is weak, emphasizing the crucial role of information sharing in promoting collaboration and performance improvement in the entire supply chain. Supply chain agility, supplier collaboration, and information sharing all have a direct or indirect impact on supplier performance. By improving corresponding aspects, they can bring excellent profits and competitiveness.

**Keywords:** supply chain agility, supplier synergy, information sharing, supplier performance

## **Supply chain agility, supplier synergy and information sharing on supplier performance: Basis for supplier relationship management framework**

### **1. Introduction**

Due to the escalating level of global market competitiveness, ongoing product life cycle shortening, and the quickening pace of information technology development. The quick rise of e-commerce and the steady improvement of customer expectations have led to the formation of a "chain" from suppliers to manufacturers, then to distributors, and finally to consumer groups. This "horizontal integration," which is different from the "vertical integration" management mode. Since neighboring cooperative enterprises show a relationship between supply and demand, a supply chain is formed when each cooperative enterprise is connected in turn. For the advantage of each enterprise in the chain, the cooperative supply chain businesses must work in unison and harmony. In today's increasingly globalized economy, traditional business-to-business competition will become extinct, while supply chain competition will become the dominant form of business competition in the era of economic globalization. Supply chain competition has gradually made its way onto the historical stage and grown into the dominant mode of business competition. As integrated circuit companies look for ways to differentiate themselves in today's fiercely competitive environment, they gradually come to the realization that they must look beyond their immediate surroundings, pay more attention to customer orientation, and take into account their role in the supply chain they operate, which encourages companies to pay attention to supplier performance. When businesses increase their productivity, they become more aware of the importance of considering the productivity of their suppliers and suppliers. Pay close attention to supplier performance, which is necessary to create a sustainable competitive advantage by enhancing communication between and inside businesses.

According to Paparoidamis et al. (2019), The customer's assessment of a supplier's performance is based on how well the provider performs its duties in critical areas (e.g., technical repair, sales, complaint handling, and product quality). The customers of the company are significantly influenced by these variables while choosing suppliers. Supplier performance was broken down into five categories by Maestrini et al. (2018), who saw suppliers as the crucial resources that the buying organization needs to organize effectively. These categories were quality, delivery, innovation, sustainability, and cost.

Supply chain agility, which is a higher-order dynamic skill, enables businesses to efficiently respond to tumultuous environmental changes and promptly seize possible opportunities and hazards in market competitiveness (Dubey et al., 2018). As a result, supply chain disruptions are avoided (Khan, et al., 2022). The ability of two or more individuals or groups to work together to complete tasks is known as supplier synergy. Information sharing, supplier performance, supplier trust, and supplier synergy all have an impact on the retailer-supplier relationship and can lead to improved outcomes (Pooe et al, 2015). Information sharing includes data on product specifications, costs, and other operational details from suppliers, customers, and manufacturers (Setiawan et al., 2022). Sharing information requires being open to disclosing specifics regarding manufacturing, sales, financing, and supply chain management strategies (Abdallah et al., 2021).

Through a research of 526 service and integrated circuit managers in Kuala Lumpur, Shukor et al. (2021) found that supply chain agility helps to dynamically match the company's resources and environment to improve its performance and give a crucial assurance for the effectiveness of GSCI. In South Africa, SMEs and their suppliers work together, as per Margahana, strengthens the influence of supplier performance (et al., 2019). The enhancement of supplier performance isn't always supported by SMEs and their suppliers, though. Furthermore, a study conducted in Surabaya, Indonesia on the food and beverage industry shown that supply chain synergy, one of the collaborations, might improve the company's performance (Setiabudi et al., 2021). Information sharing enhances a company's capacity to react internally to changes in the external environment (Baah et al.,

2021). Setiawan et al. (2022) found through their study and research on manufacturing companies in East Java, Indonesia, that the lack of information sharing across members of the supply chain is a relationship problem.

Juman (2019) found that supply chain agility partially mediates the association between learning orientation, financial performance, and operational success through a study of 208 Chinese manufacturing enterprises. This finding has significant ramifications for businesses looking to maintain a competitive edge in a fast-moving market. China's offshore engineering equipment manufacturing businesses were chosen as the research subject by Qiao Lin et al. (2019). The performance of cooperation among firms and opportunistic behavior in supply chain cooperation are both positively impacted by trust between supply chain enterprises. Information sharing must simultaneously interact with the mechanisms of trust between enterprises in order to successfully improve the performance of enterprise cooperation. According to Zhou et al. (2020), information sharing between manufacturers and suppliers in China would also encourage suppliers to collaborate more closely and pay attention to quality issues related to installers' roles in supplier quality management. The managers of SMEs in the Pearl River Delta, China's largest economic and manufacturing hub, were the subjects of an analysis by Saleem et al. (2020), which discovered that information exchange helps SMEs lower risks in their manufacturing process and lower production costs.

Since suppliers are viewed as essential resources by organizations, evaluating their performance is one of the most important jobs in procurement and supply management (Dobos et al., 2019). The majority of studies on supplier performance center on customer needs (Sener et al., 2019). As businesses focus more on their core competitiveness and depend on outside suppliers for parts and services, their success is becoming more and more dependent on their list of strategic suppliers (Okello et al., 2019). As a result, more academics are focusing on relevant study on the variables that affect supplier performance. Enterprise performance can be enhanced from a supply chain management perspective by implementing an agile supply chain, collaborating with other supply chains, and sharing information. These investigations, however, exclusively concentrate on the direct connection between the two structures.

This study suggests a research model that simultaneously utilizes three structures. This model looks into how information sharing, supply chain synergy, and agility impact a company's success in connection to supplier trust. Since this model has never been used before, as far as the author is aware, it is novel. The purpose of this study is to understand how supply chain agility, cooperation, and information sharing as independent variables directly relate to supplier performance. It is expected that the study's conclusions will improve the competitiveness and performance of Chinese integrated circuit manufacturers' suppliers. This study examines the intermediary role of supply chain agility, collaboration, and information sharing in the supplier performance of Chinese integrated circuit firms in an effort to elucidate the possible mechanism that impacts supplier performance. Additionally, it provides Chinese integrated circuit businesses with both theoretical and practical advice on how to increase their performance.

**Objectives of the Study** - This study explore the correlation between supply chain agility, supplier collaboration, and information sharing on supplier performance of Guangdong Integrated Circuit Company and provide a framework for improvement of SRM of Guangdong Integrated Circuit Company. Specifically, this paper determined the supply chain agility of Guangdong Integrated Circuit Company in terms of supplier flexibility, impact of agility on supplier and inventory management flexibility. It also determined the supplier synergy in terms of supplier cooperation, cooperative performance and supply chain integration. Also, information sharing in terms of information delivery, information sharing with supplier and supply chain transparency. Test the significant relationship between supply chain agility, supplier synergy and information sharing; and developed supplier relationship management framework.

## 2. Methods

**Research Design** - This study assesses how supply chain agility, synergy, and information sharing affect

supplier performance using quantitative analysis and a descriptive research methodology. A planning issue for reaching research goals and discovering research solutions is research design. Quantitative research determines the characteristic value of an object by comparing its qualities quantitatively to a predetermined standard or by computing the quantitative relationship between several variables (Zhang et al., 2020).

**Participants of the Study** - 400 employees of 23 integrated circuit businesses in the province of Guangdong took part in the survey for this study. The only requirement is that participants work in the integrated circuit sector; there are no restrictions on specialties. The goal of this study is to investigate the relationship between supply chain agility, supplier collaboration, and information sharing on supplier performance of Guangdong integrated circuit firms, which is why the researcher selected persons in the integrated circuit industry as the survey objects. As a result, every respondent to the questionnaire survey works for an integrated circuit company in the province of Guangdong. The participants' demographic data, including age, department of employment, job title, and years of service.

**Data Gathering Instrument** - To ensure the effectiveness of the measurement content, the measurement scale was created based on theoretical reviews and modified according to early supply chain management research (Li et al., 2019). There are four sections to the survey. The self-constructed first section contains basic data about the respondents, including age, department, position, and years of work experience; the second section talks about suppliers' flexibility and how it affects them; the third section talks about supply chain cooperation factors and supplier cooperation performance; and the fourth section talks about information transmission and how it affects supply chain performance.

The questionnaire describes the agility of the supply chain from the aspects of supplier flexibility, the impact of agility on suppliers, and the agility of inventory management. It evaluates supplier collaboration from the aspects of supplier cooperation, cooperation performance, and supply chain integration. Information sharing is evaluated from aspects such as information transmission, sharing information with suppliers, and transparency of the supply chain. A 4-point Likert scale, with values ranging from 1 to 4, was used to gauge the respondents' thoughts. The degree of agreement increases with a higher score, and decreases with a lower score: "4" denotes strong agreement (SA), "3" indicates agreement (A), "2" denotes dissent (d), and "1" denotes severe opposition (SD).

To guarantee the stability, consistency, and dependability of our scale and questionnaire. The internal consistency and reliability of the questionnaire sample are evaluated here using Cronbach's alpha analysis. In the current academic world, reliability coefficients are typically used to reflect dependability when utilizing Cronbach  $\alpha$  for analysis. The measurement's reliability increases with its reliability coefficient. Its coefficient has a value between 0 and 1. It is commonly accepted that the internal consistency dependability is insufficient if the coefficient is less than or equal to 0.6. When it reaches 0.7–0.8, it indicates a high degree of reliability for the scale. When it approaches 0.8–0.9, the scale's dependability is considered to be extremely good.

**Table 1**

*Summary of Reliability Analysis of Supply Chain Agility, Supplier Synergy and Information Sharing*

Variable	Cronbach's Alpha	Remarks
1A. Supplier Flexibility	0.768	Acceptable
1B. Impact of Agility on Supplier	0.738	Acceptable
1C. Inventory Management Flexibility	0.909	Excellent
2A. Supplier Cooperation	0.778	Acceptable
2B. Cooperative Performance	0.702	Acceptable
2C. Supply Chain Integration	0.862	Good
3A. Information Delivery	0.820	Good
3B. Information Sharing with Supplier	0.876	Good
3C. Supply Chain Transparency	0.762	Acceptable

Legend: 3.50-4.00=Strongly Agree;2.50-3.49=Agree;1.50-2.49=Disagree;1.00-1.49=Strongly Disagree

Table 1 shows that all of the Cronbach Alpha coefficients are more than 0.7. Inventory management flexibility is more than 0.9 among them, and the result is superb. The supply chain integration, information

delivery, and supplier information exchange are all greater than 0.8, indicating a successful conclusion. More than 0.7 is found for supplier flexibility, agility's effect on suppliers, suppliers' collaboration, cooperation performance, and supply chain transparency. With a minimum coefficient of 0.702 and a maximum value of 0.909, the conclusion is deemed acceptable. The findings show that the study data has a high degree of quality and dependability, making it suitable for inclusion in the upcoming extensive questionnaire survey.

**Data Gathering Procedure** - A questionnaire is used in this study to gather pertinent information from Chinese integrated circuit companies. The measurement scale used in this study is drawn from scales that are accepted in the body of current literature. We initially use the techniques of translation and reverse translation to make sure that linguistic expression and semantic understanding are accurate. Second, choose senior management staff to work with the research team on a long-term basis and invited four specialists to review the initial scale based on their relevant research experience. Prior to conducting the formal research, I did a preliminary test of the questionnaire in order to revise and improve it in light of prior findings and advice from experts to create the final measurement scale. To gather information for study, a questionnaire is used. Due to the fact that the research incorporated the thoughts and viewpoints of respondents, the questionnaire was employed in partnership with pertinent businesses and independent expert research platforms. The survey was distributed by email to 400 respondents, and the survey's electronic context provides a direct link to the data results. The Questionnaire Star is used to gather the data to ensure that it is only utilized for this study.

The researchers made contact with the chiefs of various departments inside each organization, including the operations and human resources management divisions. These accountable individuals presented questionnaires to the company's employees working in related industries (the address is <https://www.wjx.cn/vm/OWWcP3W.aspx#>). These people voluntarily filled out the questionnaire and it was returned. From September 13, 2023 to November 10, 2023, Four hundred surveys in all were gathered. With an effective rate of 100%, 400 valid surveys were distributed.

**Data Analysis** - The supply chain agility level of Guangdong Integrated Circuit Company was evaluated using weighted mean and rank in terms of supplier flexibility, agility's impact on supplier and inventory management flexibility, supplier synergy in terms of cooperative performance, supplier cooperation, and supply chain integration, and the degree of information sharing in terms of information delivery, information sharing with suppliers, and supply chain transparency. The data set was not regularly distributed, as indicated by the Shapiro-Wilk Test result, which revealed that all variable p-values were less than 0.05. SPSS version 28 was used to test the research hypotheses in this investigation. Multiple linear regression was used as a guide to develop an integrated framework for supply chain agility, supplier collaboration, and information sharing. Spearman rho was used as part of the non-parametric tests to determine the significant relationship between supply chain agility, supplier collaboration, and information sharing.

**Ethical Consideration** - In conducting the study, the researcher considered ethical issues such as information sharing and informed consent. When the questionnaire is delivered to respondents by email or the company's platform, they are informed about their willingness to engage in the study, and the Questionnaire Star platform's data collection process guarantees the privacy of the information they submit. Through letters and other channels, the researchers also asked the CEOs of the companies they interviewed for their consent. Verify that the people you are trying to reach can honestly respond to the required questions. It is entirely up to the participants to decline to take part or to withhold their answers from any queries that make them uncomfortable. You can fill out the questionnaire without providing your name or any other personal information. The study was carried out online using a questionnaire, and participants' anonymity was protected by not having their photos or videos taken. The respondents' privacy is completely secured, and all information provided in the questionnaire is kept completely confidential.

### 3. Results and discussion

**Table 2**

*Summary Table on Supplier Synergy*

Key Result Areas	Composite Mean	VI	Rank
Supplier Cooperation	2.50	Agree	3
Cooperative Performance	2.60	Agree	2
Supply Chain Integration	2.84	Agree	1
Grand Composite Mean	2.65	Agree	

Legend: 3.50-4.00=Strongly Agree; 2.50-3.49=Agree; 1.50-2.49=Disagree; 1.00-1.49=Strongly Disagree

Table 2 provides an overview of supplier cooperation. With an overall score of 2.65, one can still classify as "Agree". This score represents the comprehensive level of the respondent's company in various aspects of supplier collaboration, indicating that there is a certain degree of enthusiasm in the cooperative relationship. This table provides insight into different aspects of supplier collaboration, identifying strengths and room for improvement for the company. This has important research significance for formulating future collaborative strategies and improving overall supply chain efficiency.

With a score of 2.84—the highest in the "Agree" range—the Supply Chain Integration domain obtains the highest rating. It demonstrates that the respondents are more concerned with supply chain integration when it comes to supplier collaboration. Supply chain integration can be conceptualized along four dimensions: depth, scope, intensity, and duration. Despite being independent, the four dimensions must be coordinated and maintained (Budacu, et. al., 2018). While shorter lead times are seen to be preferable in order to increase supply reliability and create value for customers, longer lead times hurt the supply chain's capacity to compete.

Supply chain integration streamlines procedures and improves cooperation. Agile approaches can enable supply chains to better respond to market developments. The purpose of this study is to determine how supply chain integration and agile methodologies impact lead times that are reduced in Dubai Healthcare City (Alzoubi, et al., 2022). The Cooperative Performance score is 2.60, ranking second and falling into the "Agree" category. This indicates that information sharing has a somewhat beneficial effect on collaborative cooperation and that the respondent's organization does well in terms of cooperation performance. Businesses can learn which areas of collaboration are producing fruitful outcomes in order to inform other areas and strive toward enhancing overall synergies. With a score of 2.50, Supplier Cooperation is ranked last and falls into the "Agree" category. It demonstrates that the company's supplier partnership is somewhat consistent. A somewhat low score, even though it falls within the designated range, can indicate certain problems or areas that could use development. Businesses might concentrate on certain problems relating to supplier cooperation and take action to improve sharing, communication, and cooperation. Collaboration with suppliers is characterized by a narrow range of knowledge because the focus firm and its suppliers often work in related industries. But, the focus company has more access to this information than it does through working with clients (Radicic et al., 2020).

**Table 3**

*Summary Table on Level of Information Sharing*

Key Result Areas	Composite Mean	VI	Rank
Information Delivery	2.85	Agree	1
Information Sharing with Supplier	2.66	Agree	3
Supply Chain Transparency	2.72	Agree	2
Grand Composite Mean	2.74	Agree	

Legend: 3.50 – 4.00 = Strongly Agree; 2.50 – 3.49 = Agree; 1.50 – 2.49 = Disagree; 1.00 – 1.49 = Strongly Disagree

Table 3 summarizes the information sharing. He explained the relevant knowledge management indicators from the perspectives of supplier sharing, supply chain transparency, and information delivery. The average value of this index is 2.74. Interpreting the information exchange indicators in these three domains is reasonable. Information transmission is thought to be the most crucial aspect of information sharing in the supply chain, based on the data analysis presented in Table 14. As a result, information transmission receives the highest score

of 2.85. According to Zou Siyuan et al. (2023), inadequate information transfer could result in the wastage of resources. Inefficient information flow can cause businesses to overbuy or keep buying the same supplies, tools, or services over and over again for various projects, departments, or even periods of time. If current inventory and real demand information are not reliably obtained, the buyer could overbook supplies or equipment, wasting resources. This results in cost waste because it not only costs money but also takes up the company's storage space. By dismantling information silos and facilitating seamless information transfer throughout the supply chain, an information sharing platform can lower the risks associated with information asymmetry and boost the overall collaborative effectiveness of the supply chain.

Information transmission has become a crucial tool for adapting to the quick shifts in consumer demand as the integrated circuit industry has always been at the forefront of technological innovation and market change. Ineffective data integration can result in information silos, which make it challenging for partners or various departments to share and collaborate effectively. This information gap may affect real-time supply chain visibility and accurate demand predictions. Consequently, resolving information technology application issues is essential to raising the intelligence level of the entire supply chain, decreasing information transmission latency, and increasing information fluency, all of which have an immediate impact on how sensitive and quick an enterprise can react to the market (Zhao Jianrong, 2023). All stakeholders in the supply chain can immediately modify production plans to suit new market demands by promptly exchanging information about technology advancements, market trends, and customer feedback. Transmission of information contributes to lower inventory costs. By sharing sales information, demand projections, and production schedules, supply chain actors can reduce costs, avoid inventory backlogs, and improve the efficiency of inventory management.

The supply chain's transparency is essential for enterprise information sharing, as seen by its composite average score of 2.72, which places it in second place. Transparent supply chains can increase the visibility of the entire business ecosystem, providing a greater understanding of the entire process for all stakeholders involved—from acquiring raw materials to delivering the finished product. This speeds up the process of identifying issues, simplifies operations, and increases the overall efficiency of the supply chain. Many researchers are looking into how blockchain technology can reduce a number of risks related to supply chains, such as inadequate transparency, information infrastructure failure, processing latency, incompatibility of IT platforms among supply chain participants, and weakened online security (Tseng et al., 2018).

Supply chain management can benefit greatly from blockchain's inherently decentralized nature (Kouhizadeh et al., 2019). Every transaction made by a supply chain participant is accessible to and verifiable by every other member, maintaining transparency throughout the network (Sunny et al., 2020). By exchanging real-time data, all parties involved in the supply chain can more accurately predict and evaluate potential threats. By encouraging cooperation, trust, and learning, transparency improves an organization's ability to identify and manage risks as well as effectively address disturbances (Dubey et al., 2019). Businesses may enhance supply chain stability, prevent inventory shortages or surpluses, and plan more effectively with the aid of transparent information flow. Nonetheless, there could be a number of factors at play when ranking information is transmitted. Businesses may be worried about knowledge leaks and the preservation of intellectual property, particularly in relation to novel technology and R&D accomplishments. Additionally, some businesses could be more cautious and reluctant to divulge important information due to cultural differences and competitive pressures. Some businesses may not be willing to attain supply chain transparency due to a number of factors, including data security concerns, the difficulty of information system integration, and the existing state of technology infrastructure.

Information Sharing with Supplier came in third place with 2.66 points, falling inside the agreed-upon range. Businesses can better comprehend cutting-edge technologies and developing market demands by sharing important technologies and market trends with suppliers. This lowers demand uncertainty and intensifies competitiveness (Chang Shan et al., 2021). The design and development of new products is fueled by this information flow, which also accelerates technical innovation and promotes technological exchange between the

upstream and downstream segments of the industrial chain. Variables such as changes in customer demand and the availability of raw materials can cause uncertainty in the integrated circuit business. By exchanging information with suppliers, businesses can get information about supply chain changes and market feedback sooner. This allows them to make more flexible adjustments to their production schedules and inventory management methods, which lowers the risk of uncertainty. Nonetheless, the primary explanation for the lower ranking could be that in the integrated circuit business, an enterprise's primary competitive advantage is in its unique technology and intellectual property. Therefore, one of the main reasons why businesses would not share information is because they are worried about technological leaks and intellectual property infringement. This has to do with how to share data securely with suppliers, which can include using access rights management and cutting-edge encryption. The security concern of information sharing is the primary issue that must be resolved in order to develop a cooperative architecture for supply chain management data. Conventional supply chains handle supply chain data through outside information security companies (Xiong Qiang, 2011). The total effectiveness of supply chain operations can be negatively impacted by excessive institutional centralization, which can also subtly raise operational hazards (Sheng Qi, 2021).

In addition, intricate supply chain networks with several vendors throughout the globe are a common feature of the integrated circuit business. Consequently, some businesses may be reluctant to exchange information with suppliers due to the diversity of the technology infrastructure and the challenge of connecting information systems. Promoting industry-wide information exchange protocols and concentrating on developing breakthrough core and system integration technologies to lessen the complexity of information system integration may be necessary to address this issue. This horizontal application is focused on developing new intelligent manufacturing systems and aims to achieve data flow, integration, and fusion across the whole product lifecycle. It also promotes social collaboration, resource integration, information sharing, and process optimization across various manufacturing processes (Li Bohu et al., 2022).

**Table 4***Relationship Between Supply Chain Agility Level and Supplier Synergy*

Variables	rho	p-value	Interpretation
<b>Supplier Flexibility</b>			
Supplier Cooperation	0.375**	<.001	Highly Significant
Cooperative Performance	0.472**	<.001	Highly Significant
Supply Chain Integration	0.393**	<.001	Highly Significant
<b>Impact of Agility on Supplier</b>			
Supplier Cooperation	0.332**	<.001	Highly Significant
Cooperative Performance	0.362**	<.001	Highly Significant
Supply Chain Integration	0.358**	<.001	Highly Significant
<b>Inventory Management Flexibility</b>			
Supplier Cooperation	0.585**	<.001	Highly Significant
Cooperative Performance	0.609**	<.001	Highly Significant
Supply Chain Integration	0.302**	<.001	Highly Significant

\*\* . Correlation is significant at the 0.01 level

The association between supply chain agility and supplier synergy is seen in Table 4. Supplier agility, inventory management agility, agility's effect on suppliers, supplier cooperation, cooperation performance, and supply chain integration are all methodically examined in this article. The table displays estimated rho values ranging from 0.302 to 0.609, suggesting a direct association between the supply chain agility level and supplier synergy subvariables, showing a modest to high relationship. Every p-value that was obtained is less than 0.01  $\alpha$  horizontal. This indicates that supply chain agility and supplier synergy have a significant link. In other words, higher the supplier's agility, higher the impact on supplier agility, and higher the inventory management flexibility, the better the supplier synergy effect.

Kumar, et. al. (2020) assert that supply chain agility, the foundation of supply chain collaboration, enables companies to increase speed. This ultimately minimizes the market risks caused by market swings and helps with the timely capture of market opportunities, the introduction of new products, the resolution of issues, etc.



Supplier synergy emphasizes the need of fostering close working relationships. Through information, technology, and resource exchange, the various links in the supply chain can react and adapt to market changes more quickly. Supply chain agility depends on information exchange, supply chain visibility, and supply chain cooperation to improve quicker reaction or adaptation to market changes. Promoting cooperative efforts and initiatives can guarantee mutual benefit among all supply chain stakeholders, as supply chain cooperation significantly increases the chain's agility and flexibility. (X. Brunset, 2016). A more flexible supply chain facilitates more efficient and seamless collaboration between suppliers and businesses.

An agile supply chain can enhance supplier collaboration and the realization of supplier synergy by enabling the more efficient flow of information, resources, and innovation throughout the chain. Feizabadi et al. (2019) pointed out that cooperative planning, cooperative problem-solving, and cooperative knowledge sharing can help key enterprises and supply chain partners make quick decisions and solve problems related to price, quality, quantity, etc. in order to meet customer needs and quickly adapt to market changes. Flexibility is the fundamental element of supply chain agility. In Baah's investigation, C. The results of this analysis are consistent with et al.'s (2021) assertion that supply chain collaboration has a significant impact on supply chain agility. This can be explained by the fact that flexibility facilitates quick responses to customer demands and market developments when supply chain partners work together as a single unit. Supplier synergy can also increase efficiency, which improves an organization's capacity for swift response.

**Table 5**

*Relationship Between Supply Chain Agility Level and Information Sharing*

Variables	rho	p-value	Interpretation
<b>Supplier Flexibility</b>			
Information Delivery	0.418**	<.001	Highly Significant
Information Sharing with Supplier	0.365**	<.001	Highly Significant
Supply Chain Transparency	0.016	0.755	Not Significant
<b>Impact of Agility on Supplier</b>			
Information Delivery	0.419**	<.001	Highly Significant
Information Sharing with Supplier	0.325**	<.001	Highly Significant
Supply Chain Transparency	0.005	0.914	Not Significant
<b>Inventory Management Flexibility</b>			
Information Delivery	0.319**	<.001	Highly Significant
Information Sharing with Supplier	0.313**	<.001	Highly Significant
Supply Chain Transparency	-0.005	0.913	Not Significant

\*\* . Correlation is significant at the 0.01 level

The association between information sharing and supply chain agility is shown in Table 5. This carefully examines a number of topics, including supply chain transparency, supplier flexibility, inventory management agility, and agility's impact on suppliers. There is a moderate direct association between supplier flexibility and information transmission, as indicated by the calculated rho value of 0.418 in the table. To achieve supply chain agility, businesses can integrate internal operations and share information with key consumers and suppliers both upstream and downstream of the supply chain (Dubey, et. al., 2018). The integrated circuit industry faces two challenges: significant fluctuations in market demand and rapid technological progress. Suppliers need to be adaptable to quickly communicate critical information in response to changes in market trends and the introduction of new technology. There is a moderate direct association between information transfer and suppliers' requirement to promptly modify their production and supply plans. The computed rho value of 0.365 indicates a modest direct correlation between supplier flexibility and information sharing with suppliers. The calculated rho value of 0.016, however, indicates that the relationship between supplier flexibility and supply chain openness is only very weak.

This can be the result of some difficulties in communicating with suppliers about things like technical confidentiality and intellectual property protection. Because of the unique nature of the integrated circuit sector, suppliers might be reluctant to share too much information with businesses, which would lead to a low level of information exchange and limited flexibility. Because the p-value obtained was less than 0.01, The findings

indicate that there is a statistically significant correlation between supplier flexibility and information transmission as well as sharing with other suppliers. However, as the p-value found is higher than 0.01, the relationship between supply chain transparency and supplier flexibility is not statistically significant. This could be as a result of the integrated circuit industry's supply chain often involving highly specialized and technologically advanced production methods, which may more severely restrict supplier flexibility. Because of this professionalism, supplier flexibility may occasionally place a greater emphasis on manufacturing efficiency and technical innovation than on the traditional transparency of the supply chain.

The computed rho value of 0.419 shows a moderate direct relationship between the influence of agility on suppliers and information delivery, whereas the computed rho value of 0.325 reveals a poor direct association between agility and supplier information sharing. Because the p-value was less than 0.01, the results indicate that there is a statistically significant association between the impact of agility on suppliers and information transmission as well as between the impact of agility on suppliers and information sharing with suppliers. Strong supply chain agility makes it simpler to adjust to shifting market conditions.

The basis for supply chain flexibility, cooperation, and visibility is information sharing. A company's ability to gather and share this kind of information throughout the whole supply chain will boost supply chain performance, visibility, agility, competitive and cooperative advantages, and collaboration (Routroy, 2018). The agility of the supply chain is not significantly impacted by information sharing. This can be explained by the fact that attempts to attain agility have been less concentrated and that acquiring other benefits from the supply chain, such as visibility and collaboration, has received more emphasis. Nonetheless, the connection between indirect effects of information sharing and agility can be advantageous and significant overall, since agility is ultimately influenced by other notions or benefits of the supply chain, such as visibility and collaboration (Baah, et al., 2021). There is no statistically significant correlation between the two, despite the fact that the p-value obtained is more than 0.01 and the computed rho value of 0.005 indicates that the influence of agility on suppliers and supply chain transparency have a very weak direct relationship. This may arise from the supply chain of the integrated circuit industry, which often comprises multiple international manufacturers, suppliers, and partners (Liu Yingxia et al., 2023). Globalization has made supply networks more complicated, which could lead to problems with information integration and fragmentation and hinder the development of transparent supply chains.

The computed rho value of 0.319 shows a poor direct relationship between information delivery and inventory management flexibility, whereas the estimated rho value of 0.313 shows a weak direct association between supplier information sharing and inventory management flexibility. The results indicate a statistically significant relationship between inventory management flexibility and information sharing with suppliers as well as between inventory management flexibility and information transmission because the p-value obtained was less than 0.01. Information sharing can impact supply chain performance and foster greater flexibility and teamwork (Dubey, et al., 2018). Flexibility in inventory management typically emphasizes internal process optimization more to guarantee production flexibility and efficiency. A relatively poor direct relationship may arise from company practices that do not prioritize sharing information with suppliers. Sharing supplier information could present certain difficulties, especially if it involves sensitive data like particular inventory details (Li Baodong, et. al., 2020). On the other hand, the calculated rho value of -0.005 indicates that the indirect association between inventory management flexibility and supply chain openness is not very strong. However, there is no statistically significant relationship between supply chain transparency and inventory management flexibility, as indicated by the derived p-value of larger than 0.01. The shorter production cycles in the integrated circuit industry and the potential for more unpredictable product life cycles as a result of rapid technological improvement could be the causes of this. In a situation like this, businesses would prioritize being able to swiftly modify their production schedules while placing less of a premium on transparency.

**Table 6**  
*Relationship Between Supplier Synergy and Information Sharing*

Variables	rho	p-value	Interpretation
<b>Supplier Cooperation</b>			
Information Delivery	0.449**	<.001	Highly Significant
Information Sharing with Supplier	0.216**	<.001	Highly Significant
Supply Chain Transparency	-0.018	0.716	Not Significant
<b>Cooperative Performance</b>			
Information Delivery	0.469**	<.001	Highly Significant
Information Sharing with Supplier	0.316**	<.001	Highly Significant
Supply Chain Transparency	-0.061	0.222	Not Significant
<b>Supply Chain Integration</b>			
Information Delivery	0.397**	<.001	Highly Significant
Information Sharing with Supplier	0.340**	<.001	Highly Significant
Supply Chain Transparency	-0.022	0.661	Not Significant

\*\* . Correlation is significant at the 0.01 level

The association between Information Sharing and Supplier Synergy is displayed in Table 6. A moderate direct association between supplier cooperation and information delivery is shown by the computed rho-value of 0.449, whereas a weak direct relationship between supplier cooperation and information sharing with supplier is indicated by the computed rho-value of 0.216. Conversely, a very weak indirect association between supplier cooperation and supply chain transparency is indicated by the computed rho-value of -0.018. Since the resulting p-values were less than 0.01, it indicates that there was a statistically significant relationship between supplier collaboration and information delivery as well as between supplier cooperation and information sharing with supplier. However, because the obtained p-value was greater than 0.01, there was no statistically significant association between supplier cooperation and supply chain transparency.

A poor direct association between cooperative performance and information sharing with suppliers is indicated by the computed rho-value of 0.316, whereas the computed rho-value of 0.469 shows a moderate direct relationship between cooperative performance and information delivery. However, the calculated rho-value of -0.061 shows that there is only a very weak indirect correlation between supply chain openness and cooperative performance. Since the obtained p-values were less than 0.01, it indicates that there was a statistically significant relationship between cooperative performance and information sharing with suppliers as well as between cooperative performance and information delivery. However, while the obtained p-value was greater than 0.01, there was no statistically significant association between supply chain transparency and cooperative performance.

A weak direct link between supply chain integration and information delivery is shown by the computed rho-value of 0.397, while a weak direct association between supply chain integration and information sharing with suppliers is indicated by the computed rho-value of 0.340. Conversely, a very weak indirect association between supply chain integration and supply chain transparency is indicated by the computed rho-value of -0.022. Since the resulting p-values were less than 0.01, it indicates that there was a statistically significant relationship between supply chain integration and both information delivery and information sharing with suppliers. However, because the obtained p-value was greater than 0.01, there was no statistically significant association between supply chain integration and supply chain transparency. In general, supply chain collaboration and information exchange do not significantly correlate.

According to Feizabadi et al. (2019), information sharing promotes supply chain collaboration, which significantly affects competitive advantage. From the perspective of information exchange, all parties involved in the supply chain must collaborate to provide accurate and timely information if they hope to establish long-lasting partnerships with one another. Baah, C. et al. (2021) observed that information sharing had a favorable and significant impact on supply chain collaboration. This supports the findings of the study. Collaboration in the supply chain relies heavily on information sharing (Jimenez Jimenez et al., 2018). Baah, C.

et al. (2021) demonstrated in their study that information sharing has good and significant effects on supply chain collaboration both directly and indirectly. Collaboration is essential for information sharing in addition to data exchange (Müller, et al., 2020). Feizabadi et al. (2019) also pointed out that modern supply chain partners require ongoing information technology integration to facilitate a more substantial and timely flow of permanent information. On the other hand, the integrated circuit industry involves extremely complicated and technologically demanding manufacturing processes(Lu Fei, et. al. 2022), in which the design, manufacturing, packaging, and testing of products require precise collaborative work, and the innovation chain of the industry chain needs to be effectively connected. Due to the technical nature of these links, the efficiency of information exchange and sharing is still insufficient (Gao et al., 2023), and businesses might handle supply chain information more cautiously in order to safeguard essential technologies and intellectual property, which would slow down the flow of information.

The advantages of the domestic demand market have not yet been fully utilized, and the development of China's integrated circuit industry is currently unconnected from market demand. Additionally, the collaborative pattern of the "chip software whole machine system information service" industry chain has not yet formed (Luo Danglun et al., 2023). In this context, companies may be more inclined to autonomously control key information rather than sharing it with supply chain partners to ensure a first mover advantage in the market. In addition, due to the globalization of the integrated circuit industry, it involves suppliers and manufacturers from different countries and regions. Cultural differences, regulatory differences, and language differences between different countries may become obstacles to information flow and collaboration. Therefore, even if there is a willingness to share information, the complexity of cross-border supply chains may slow down the realization of collaboration. In addition, the integrated circuit industry chain is vast and finely divided, from upstream materials and equipment to midstream equipment Design, manufacturing, packaging and testing, and then downstream terminal applications (Yan Mei, et. al. 2023). Each link may be handled by different enterprises or partners, which further increases the difficulty of supply chain collaboration. There can be less information sharing and cooperation throughout the whole supply chain, and organizational collaboration might be restricted to particular phases.

### Supplier Relationship Management Framework

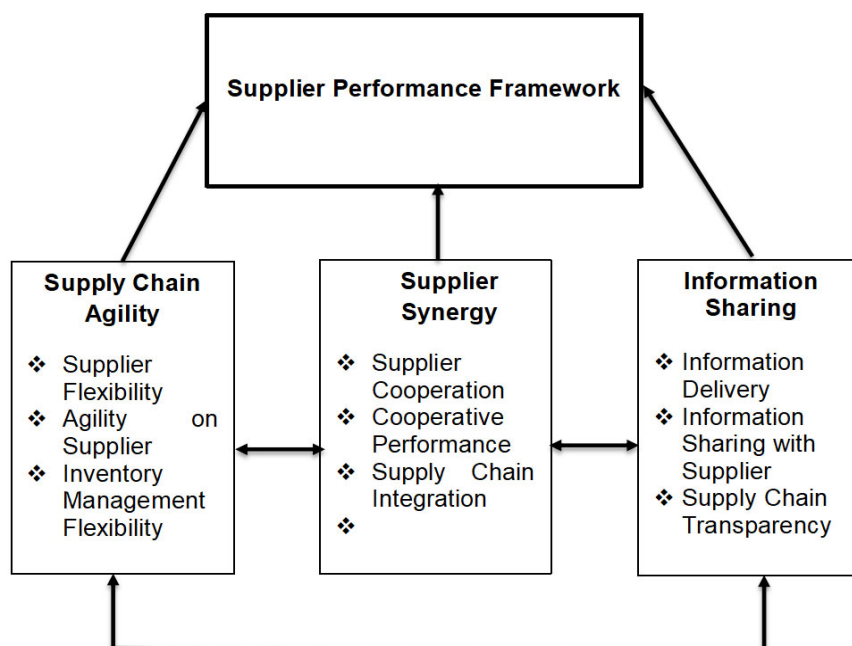


Figure 1. Framework for Supplier Relationship Management

This article constructs a supplier management framework that involves three independent variables: supply chain agility, supply chain collaboration, and information sharing, as well as the dependent variable supplier performance.

When it comes to supply chain collaboration, teamwork is essential for a productive supply chain. Better information distribution, supply chain transparency, and collaboration performance are all made possible through collaboration, and these factors are critical for raising suppliers' overall performance (Xu Fang, et al., 2020). The methodology demonstrates how cooperation has improved supply chain integration, information delivery, and exchange, all of which have raised suppliers' performance levels. As a crucial component of the whole system, information exchange is seen as a means of fostering supply chain agility and collaboration. Information sharing helps to break down internal and external information barriers, promoting real-time cooperation and communication. According to the framework, information sharing immediately affects supply chain transparency, information sharing, and supplier information delivery, all of which are critical to enhancing supplier performance. This framework provides guidance for enterprises to optimize performance in supplier relationship management. Emphasizing the establishment of a flexible and adaptable supply chain, promoting internal and external collaboration, and strengthening information sharing mechanisms will help improve the overall performance level of suppliers. By making improvements and investments in these crucial areas, businesses may increase their competitiveness, better meet market demands, and guarantee greater long-term and sustainable success in the supply chain.

#### **4. Conclusion and recommendations**

Respondents moderately agreed that Guangdong Integrated Circuit Company has a flexible supply chain in terms of supplier flexibility and the impact of agility on supplier and inventory management flexibility. Respondents moderately agreed in the supplier synergy in terms of supplier cooperation, cooperative performance and supply chain integration. Respondents moderately agreed that there is information sharing in terms of information delivery, information sharing with supplier and supply chain transparency. There is strong relationship between supply chain agility, supplier synergy and information sharing. Supplier relationship management framework has been developed.

To enhance supplier collaboration, the company may implement collaborative planning, problem-solving, and knowledge-sharing strategies. The company may implement modern information technology integration that may motivate suppliers to engage in more active information sharing. The company may provide frequent training and technical support to suppliers to help them better adapt to new technology and market trends and encourage the creation of more adaptable production and supply schedules in order to react swiftly to shifts in consumer demand. The proposed framework that was developed may be adopted to improve supplier relationship management. Future researchers may conduct similar studies on the variables mentioned and may consider adding sustainability and ethics as one of the main variables.

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