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The Impact of Information Sharing on Supply Chain Performance through Supplier Quality Management, Supply Chain Agility, and Supply Chain Innovation

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Abstract

The study investigated the impact of information sharing on supply chain performance through supplier quality management, supply chain agility, and supply chain innovation. The data collection used a questionnaire designed with a 7-point Likert scale in GoogleForm and printed format and distributed through social media, email, WhatsApp, and mail posts. Of the 266 population, as many as 112 responses were received and were considered valid for further processing. The data analysis used the partial least square technique (PLS) utilizing SmartPLS. The analysis showed that information sharing directly affects supplier quality management, supply chain agility, and supply chain innovation. Furthermore, supply chain agility, supplier quality management, and supply chain innovation directly affect operational performance. The exciting result of this study is the indirect effect of information sharing on operational performance through the mediating role of supply chain agility, supplier quality management, and supply chain innovation. This result offers solutions to practitioners to pursue information sharing, supplier quality management, supply chain agility, and supply chain innovation in improving operational performance. The main theoretical contribution of this research is the mediating role of supply chain agility, supply chain innovation, and supplier quality management toward the relationship between information sharing and operational performance.

Keywords: Information Sharing; Supplier Quality Management; Supply Chain Agility; Supply Chain Innovation; Operational Performance.

1. Introduction

The Covid-19 pandemic has impacted various countries and industry sectors in developed and developing countries (Purwanto, 2021). Supply and demand are disrupting both the local and global markets. In addition, no one can predict when the Covid-19 outbreak really ends (Fikri, 2021). In anticipation, the Indonesian government has taken steps to reduce the spread of Covid-19 viruses, such as Large-Scale Social Restrictions (PSBB), the Implementation of Community Activity Restrictions (PPKM), and the procurement of mass vaccine activities. The government policy has caused a bullwhip effect on the supply chain due to restrictions on these activities (Tarigan, Siagian, et al., 2021). As a result, the company has experienced a decline in profits and was forced to impose employee layoffs (Muhammad, 2021). People also performed panic-buying to hoard their stock at home, thus impacting supply and demand problems (Purwanto, 2021). In the manufacturing industry sector, the impact of the Covid-19 pandemic is indicated by the Purchasing Manager Index (PMI) which has decreased dramatically starting in early 2020, at a time when the spread of Covid-19 has become a global concern. It was recorded based on data from the Purchasing Managers' Index of Indonesian Manufacturing plummeted at the level of 40.1 in July 2021 (Damara, 2021). This is the lowest level in 2021. This situation has forced the Indonesian manufacturing companies to find out proper solutions to survives during the Covid-19 pandemic.

Purchasing Managers' Index (PMI) is one indicator that shows the performance or achievement of manufacturing companies. PMI is measured based on five factors: cost, new product, time to market, flexibility, and delivery (Jabbour et al., 2013). PMI can also be used to reflect the achievements of the performance of the manufacturing company sector, such as Supply Chain Performance (SCP) in an enterprise. SCP is measured based on delivery reliability, responsiveness, lead time reduction, conformance to specifications, volume flexibility, product-mix flexibility, and time to market (Abdallah et al., 2021). SCP can be interpreted as the company's ability to meet customer demands quickly, according to the specified time, and lower costs. This increased logistics cost indicates that SCP is still low. Competition has shifted to competition between supply chains, a

challenge for companies facing an uncertain situation like today (Baah et al., 2021). The company must agilely adjust the product and delivery to follow the customer's demand. This is pursuing research from (Abdallah et al., 2021) which said that Supply Chain Agility (SCA) and Supply Chain Innovation (SCI) proved to be able to increase SCP in 1793 manufacturing companies in Jordan. The role of SCA and SCI is highly expected to be able to advance and improve SCP, especially in this uncertain business world (Chen, 2019). Companies that can adapt to external (agile) changes will be able to improve their supply chain performance quickly. In addition, the update of innovations carried out by the company is also one of the parts that describe the performance of the supply chain in the company (Setiabudi et al., 2021). Ayoub & Abdallah (2019) also argues that SCA and SCI are needed by manufacturing companies in facing challenges in unexpected conditions such as the Covid-19 pandemic, which can further improve the company's supply chain performance.

The active involvement of suppliers can achieve the best supply chain performance in an enterprise. Supplier quality management is defined as solid communication and cooperation between manufacturers and suppliers regarding product quality. The company's implementation of supplier quality management will positively impact supply chain performance, namely, reduced lead time, timely delivery of raw materials from suppliers, and the correct quantity. Besides, the quality of raw materials is guaranteed, customers become satisfied, and sales increase (Zhou & Li, 2020. Through supplier quality management, the company can also be helped in adjusting to customer needs. In addition, it can more quickly act in innovations (supply chain innovation) developed by manufacturing companies (Abdallah et al., 2021).

In addition, information sharing through its openness to sharing relevant, accurate, and reliable information improves agility (supply chain agility). It improves the capabilities of a company for internal adjustment to changes in its external environment (Abdallah et al., 2021; Baah et al., 2021; Ahmed et al., 2019). The sharing of information between the manufacturer, its suppliers, and customers will encourage the company to make easier internal changes. Technological advances and the human desire to continue to advance also require manufacturing companies to continue to innovate in the processes and products produced (Zhang et al., 2017). Successful innovation cannot be realized without the role of information sharing between producers and suppliers and producers with their customers (Abdallah et al., 2021; Saleem et al., 2020) (Saleem et al., 2020). The absence of information sharing between members will cause problems in supply chain relations (Kurniawan et al., 2021; Setiawan et al., 2022). This shows that information sharing is needed in various processes in supply chain innovation (Setiawan et al., 2022). In addition, Zhou & Li (2020) stated that the existence of information sharing between manufacturers and suppliers would also encourage suppliers to cooperate more and focus on the quality issues produced related to the role of the installer in supplier quality management.

Previous research has shown that supply chain performance can be improved through several approaches, such as information sharing, supplier quality management, innovation capability, and supply chain agility. However, previous research has only focused on the direct relationship between the two constructs. This research builds a research model involving all five constructs, namely the influence of information sharing on supply chain performance through supplier quality management, supply chain agility, and supply chain innovation. The update of this study is a model built to test the interaction of the five variables mentioned above because, to the extent of the researcher's knowledge, no research has discussed the exchange of the five constructs mentioned simultaneously. This research is expected to answer two main questions. First, whether pre-existing studies can also apply to the Food and Beverage manufacturing population in East Java, Indonesia. Second, intervening variables, namely supplier quality management, supply chain agility, and supply chain innovation, mediate the relationship between information sharing as a free variable and supply chain performance as a dependent variable. The results of this study are expected to provide supply chain performance improvement for practitioners. The results of this study are also likely to contribute to supply chain management theory, especially the mediating role of intervening variables.

2. Literature Review

2.1. Supply Chain Management

The supply chain network is inseparable from the involvement of suppliers and customers who cooperate in controlling, managing, and improving the flow of materials, information, services, and finance (Felea & Albăstroiu, 2013). Supply Chain Management (SCM) is defined as the management of relationships within the supply chain network to create added value for all stakeholders (Rebelo et al., 2021). SCM also describes coordination and collaboration between suppliers, intermediaries, and customers to integrate supply and demand inside and outside the company. SCM comes as management that can measure performance between suppliers, manufacturers, distributors, sellers, and customers (Hermawan, 2021).

2.2. Information Sharing

Information sharing refers to product quality information, prices, and general information relating to operating activities ranging from manufacturers, suppliers, and customers (Zhou & Li, 2020; Setiawan et al., 2022). M. Kim & Chai (2017) taking information sharing refers to the openness of information sharing in the supply chain. Information sharing requires the willingness to share information about finance, sales, and production, including supply chain strategies (Abdallah et al., 2021) (Wong et al. 2015) (Wong et al., 2015). The information-sharing indicator adopts research from M. Kim & Chai (2017), namely: 1) The company has an integrated information system throughout the supply chain (ISH1), 2) Has an information system that is integrated with the company's internal (ISH2), 3) the existence of an information system with customers (ISH3) , 4) The existence of an information system relationship with a supplier (ISH4), 5) existence of communication systems between partners in supply chain (ISH5), 6) an existence of willingness to share information (ISH6).

2.3. Supplier Quality Management

Poor relations between manufacturers and their suppliers can cause serious problems related to quality (Hong et al., 2020). Supplier quality management is an organization's emphasis on fulfilling the quality produced by suppliers ((Abdallah et al., 2021) D. Y. Kim et al., 2012) (Abdallah et al., 2021). Supplier quality management indicators are taken from Abdallah et al. (2021): 1) Regularly conduct supplier quality audits (SQM1), 2) Have detailed information about supplier performance (SQM2), 3) Provide feedback on supplier product quality (SQM3), 4) Participate in supplier activities related to quality (SQM4), 5) Have a formal program to evaluate and recognize suppliers (SQM5), 6) Conduct face-to-face communication with major suppliers (SQM6), 7) Establish product quality as the most important factor for choosing suppliers (SQM7).

2.4. Supply Chain Agility

Supply Chain Agility (SCA) is the company's ability to adjust its internal operating conditions against uncontrollable changes in the external environment (Ayoub & Abdallah, 2019). Supply chain agility can also be interpreted as the company's ability to respond quickly to changes (Tarigan et al., 2021). Jha et al. (2021) define supply chain agility as the ability of a supply chain to quickly and effectively align its systems and operations against the ever-changing needs of consumers (Abdallah et al., 2021). Variable supply chain agility indicator is taken from Ayoub & Abdallah (2019): 1) able to reduce manufacturing lead time (SCA1), 2) Fast in reducing product development cycle time (SCA2), 3) increasing frequency of new product introduction (SCA3), 4) increasing product adjustment to customer needs (SCA4), 5) Draw up an emergency plan and develop a crisis management team in the organization (SCA5).

2.5. Supply Chain Innovation

Supply Chain Innovation (SCI) refers to the complex process of providing solutions to customer needs in the midst of uncertain environmental conditions and finding new ways in an organization to use new methods or technologies (Ayoub & Abdallah, 2019) Abdallah et al. (2021) define SCI as an additional change in the company's functions, both internal and external in the supply chain to create something of new value for stakeholders. Implementing SCI implies the exchange of skills, expertise, and resources among supply chain members because the company may not have all the resources and capabilities necessary for the innovation process (Abdallah et al., 2021). supply chain innovation indicators are adopted from Ayoub & Abdallah (2019) and Husada Tarigan et al. (2019): 1) Companies try new ideas (SCI1), 2) Companies look for new ways or processes (SCI2), 3) Creative companies in operating methods (SCI3), 4) Companies develop new products (SCI4).

2.6. Supply Chain Performance

The growth of a manufacturing company's performance aims to improve the supply chain's performance by focusing on efficient and effective (Kristianto & Tarigan, 2019; Setiabudi et al., 2021). Stock costs can measure SCP, meet proper delivery schedules, meet customer demands, and avoid stock shortages (Kurniawan et al., 2021). There are five indicators to measure supply chain performance: reducing lead time, increasing inventory turnover, reducing product defects, reducing production costs, and adjusting to customer demand (Kristianto & Tarigan, 2019). Supply chain performance indicators are adopted from Abdallah et al. (2021): 1) Delivery of orders following promised SCP1), 2) Responsiveness in changes in customer demand (SCP2), 3) Reduction of lead time (SCP3), 4) Adjustment to the requested product specifications (SCP4), 5) Flexibility of production volume (SCI5), 6) Flexibility of product variation types (SCI6), 7) Introducing new products faster (SCI7), 8) Reduction of production costs (SCI8).

2.7. Information Sharing and Supplier Quality Management Relationship

Wong et al. (2015) show that information sharing is needed in coordinating among supply chain members. Information sharing will also encourage manufacturers to involve departments and employees within the company to work on quality issues (Zhou & Li, 2020). Companies need closer coordination with suppliers for effective material flow and information exchange (Rebelo et al., 2021). Based on the explanation above, it can be formulated as a research hypothesis:

H_1: Information sharing affects supplier quality management.

2.8. Relationship between Information Sharing and Supply Chain Agility

A sense of trust in the relationship between the buyer and its suppliers will result in openness between the two sides (Yang, 2014). (Ahmed et al., 2019) In addition, the success of supply chain agility depends heavily on the ability to see, access, and utilize the information available (Jha et al., 2021) (Baah et al., 2021) (Baah et al., 2021). Companies can send accurate and timely information through information sharing and minimize lead time (Abdallah et al., 2021). Based on the above explanation, research hypotheses can be formulated:

H_2: Information sharing affects supply chain agility.

2.9. Information Sharing and Supply Chain Innovation Relationship

Information sharing through its role in information disclosure with suppliers and customers will help the company forecast current customer needs and future needs (Abdallah et al., 2021). Sharing information through its role in information systems will also improve process innovation (Tarigan et al., 2019). In other studies, it has been shown that the role of information sharing positively impacts products and innovation processes (Saleem et al., 2020). Thus can be formulated research hypothesis:

H_3: Information sharing affects supply chain innovation.

2.10. Relationship between Supplier Quality Management and Supply Chain Agility

Supplier involvement in product development can provide the company with suggestions or solutions to meet customers' changing needs. (Abdallah et al., 2021). Relationships with suppliers in production will provide accurate information regarding changes or uncertainties in customer demand, especially during the Covid-19 pandemic, which will further improve the agility capabilities of the company (Siagian et al., 2021). Supplier involvement in the product design team can also help provide important information about components that correspond to changing customer demands (D. Y. Kim et al., 2012). Based on the explanation of the relationship between supplier quality management and supply chain agility, it can be formulated as a research hypothesis:

H_4: Supplier quality management has an impact on supply chain agility.

2.11. Relation between Supplier Quality Management and Supply Chain Performance

Collaboration with external management, namely suppliers, will positively impact supply chain performance (Kristianto & Tarigan, 2019). This increased quality will satisfy customers and increase sales (Zhou & Li, 2020). (Rebelo et al., 2021). In addition, it is proven in the research conducted by (Hong et al., 2020) that supplier Quality management will improve the company's sales performance figures. Based on the explanation above, it can be formulated the research hypothesis:

H_5: Supplier quality management impacts supply chain performance.

2.12. Supplier Quality Management and Supply Chain Innovation Relationship

This close relationship with suppliers will encourage the manufacturer's company to create new products (Siagian et al., 2021). In addition, Zeng et al. (2015) showed that quality management, both in terms of operational and control processes, has a direct positive effect on innovation perfor-mance. These are also supported by research conducted by Hong et al. (2019) that supply chain quality management positively affects innovation performance. Based on the explanation above, it can be formulated as a research hypothesis:

H_6: Supplier quality management has an impact on supply chain innovation.

2.13. Relationship between Supply Chain Agility and Supply Chain Performance

Supply chain agility is important for companies to gain a competitive advantage to differentiate themselves from their competitors (Chen, 2019). Supply chain agility will positively impact organizations, increasing market share, customer satisfaction, and

demand (Ahmed et al., 2019). Supply chain agility in logistic activities can provide more value for companies in increasing profits (Yang, 2014. Based on the explanation above, it can be formulated as a research hypothesis:

H_7: Supply chain agility has an impact on supply chain performance.

2.14. Relationship between Supply Chain Innovation and Supply Chain Performance

The more a company innovates, the more it creates value for the company itself. It helps the company respond to customer needs and develop new capabilities for employees to achieve and maintain better company performance (Chen, 2019). Introducing innovation to production materials, machinery, and equipment will reduce operational costs and improve quality, flexibility, speed, and delivery efficiency (Zhang et al., 2017). Innovation-oriented Supply chain positively impacts supply chain performance or company performance (Saleem et al., 2020). Based on the explanation above, it can be formulated as a research hypothesis:

H_8: Supply chain innovation has an impact on supply chain performance.

2.15. Information Sharing and Supply Chain Performance Relationships through Supply Chain Agility

Companies can provide rapid responses to ever-changing and uncertain customer demands through the role of information sharing (Abdallah et al., 2021). Furthermore, production costs decrease, and customer satisfaction increases (Chen, 2019). In addition, supply chain agility will also increase sales and profits, and partner satisfaction will also increase (Yang, 2014).

H_9: Supply chain agility mediates the relationship between information sharing and supply chain performance.

2.16. Information Sharing and Supply Chain Performance through Supplier Quality Management

The exchange of information between manufacturers and their suppliers will allow companies to focus more on cooperation related to the quality produced (Zhou & Li, 2020). The good quality produced by its supplier manufacturers will also increase customer satisfaction. Furthermore, sharing information with suppliers will assist suppliers in providing quality raw materials in accordance with the predetermined lead time (Tarigan, Mochtar, et al., 2021).

H_{10}: Supplier Quality Management mediates the relationship between information sharing and supply chain performance.

2.17. Information Sharing and Supply Chain Performance through Supply Chain Innovation

The right innovations gained from accurate information sharing will impact better company performance (Chen, 2019). In addition, innovation driven by information disclosure will reduce operational costs and improve quality, flexibility, speed, and more efficient delivery (Zhang et al., 2017). Saleem et al. (2020) research on SMEs in the "Pearl River Delta" in China also showed that information sharing positively impacts products and innovation processes.

H_{11}: Supply chain innovation mediates the relationship between information sharing and supply chain performance.

2.18. Information Sharing and Supply Chain Performance Relationships through Supplier Quality Management and Supply Chain Agility

Suppliers need information exchange to facilitate quality control (Zhou & Li, 2020). The exchange of quality-related information involving these suppliers is necessary to deal with changing customer demand (D. Y. Kim et al., 2012). The involvement of these suppliers will provide quick advice or solutions in the dynamics of customer demand (Abdallah et al., 2021). Implementing quality management will encourage agility capabilities in companies, ultimately improving supply chain performance (Ahmed et al., 2019; Yang, 2014).

H_{12}: Supplier quality management and supply chain agility mediate the relationship between information sharing and supply chain performance.

2.19. The Influence of Information Sharing on Supply Chain Performance through Supplier Quality Management and Supply Chain Innovation

Companies need information sharing to coordinate between members in the supply chain flow (Wong et al., 2015). Information sharing is a form of coordination for companies to produce quality products with supplier support (D. Y. Kim et al., 2012). The quality management obtained will determine rapid innovation in the company to improve supply chain

performance (Zhang et al., 2017) (Siagian et al., 2021). Thus the hypothesis can be formulated as follows.

H_{13}: Information sharing affects supply chain performance through Supplier quality manage-ment and supply chain innovation.

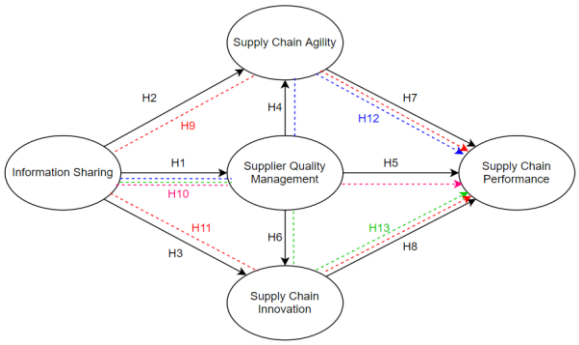

Figure 1. Research Model and Construct Relationship
Note:
1. Black lines indicate a direct relationship,
2. Dotted cloured lines indicate an indirect relationship

The research model and relationships between constructs are demonstrated in Figure 1.

3. Methods

3.1. Population and Sampling

This study used quantitative methods to explain the causal relationships between variables. This research population focused on food and beverage manufacturing companies located in East Java. The population of food and beverage companies in East Java is as many as 266 (BPS, 2020). Of the 266 companies, 109 samples were selected at random using online software https://numbergenerator.org/. Using the Slovin formula with a margin of error of 10% and a population of 266 companies, the minimum number of samples is 81 companies. Data collection uses a questionnaire designed with 7 points on the Likert scale, with 1: strongly disagree and 7: strongly agree. The respondent profile is the company employee in charge in a managerial position, such as supervisor, manager, general manager, or director. Questionnaires are distributed using a Google form link and printed copies, which are sent via social media, email, and mail. Questionnaires were distributed to as many as 140 and received as many as 114 in response. After validating the incoming data, 112 questionnaires were considered valid for analysis.

3.2. Data Analysis

Data analysis used the Partial Least Square (PLS) technique. The analysis is performed in two steps, namely, the outer model and inner model assessment. Outer model assessment includes validity and reliability test. At the same time, the inner model test includes R-square, Q-square, and hypothesis testing. Hypothesis testing is performed by a bootstrapping process automatically conducted by the software. Bootstrapping is a process of calculating the t-statistic and probability values to examine whether the hypothesis is supported or not.

3.3. Measurement Items

This study involves five constructs: supply chain integration, supply chain responsiveness, innovation capability, and operational performance. The measurement item for each construct has been explored in the previous literature review. Information sharing is measured using six indicators (ISH1-ISH6), Supplier quality management with seven items (SQM1-SQM7), Supply chain agility with five things (SCA1-SCA5), Supply chain innovation with four items (SCI1-SCI4, and supply chain performance with eight items (SCP1-SCP8)

4. Result

Data collection is carried out at East Java Food and Beverage manufacturing companies. Each company will be represented by one representative only with a minimum supervisory position and above. The total questionnaires distributed were 140 and 112 questionnaires that received responses or feedback from respondents.

4.1. Respondent Profile

The respondents are from companies engaged in food and beverage according to the predetermined criteria of this study. The total number of respondents involved in the food industry sector amounted to 84 companies, the beverage industry amounted to 25 companies, and the industrial sector engaged in the food and beverage industry sector amounted to 3 companies.

Table 1. Industry Sector Profile

Industrial Sector	Frequency	Percentage
Food	84	75%
Drink	25	22,3%
Food and drink	3	2,7%
Total	112	100%

Table 2 shows respondents' characteristics based on the company's current respondent department. All respondents are engaged in activities related to supply chain management.

Table 2. Respondent Department Profile

Department	Frequency	Percentage
Purchasing	13	11,6%
Warehouse	10	8,9%
PPIC	12	10,7%
IT	8	7,1%
QC	17	15,2%
Logistics/Distribution	9	8,1%
Production	24	21,4%
Marketing	19	17%
Total	112	100%

Table 3 shows all respondents have a position in the managerial level and are considered to have sufficient knowledge in strategic decision making.

Table 3. Profil Respondent Department

Position	Frequency	Percentage
General Manager	1	0,9%
Manager	47	42%
Supervisor	63	56,2%
Director/CEO	1	0,9%
Total	112	100%

4.2. Convergent Validity Test

Data analysis is carried out in two stages: measurement model assessment and hypothesis testing. Measurement model assessments include convergent validity, discriminant validity, multi-collinearity, and reliability of measurement indicators.

Table 4 indicates the outer loading value for each indicator, greater than 0.5 (ranging from 0,659 to 0,900). Thus, all indicators are considered satisfied for convergent validity (Hair et al., 2017). Table 4 also shows a VIF value of less than 5, meaning no multi-collinearity among indicators.

4.3. Discriminant Validity

The discriminant validity tests the correlation of indicators with other variables. Table 5 shows the results of the Fornell-Larcker analysis, which shows the square root results of the AVE of the four research variables (written bold) are greater than the correlation among constructs. This result satisfies the criteria for discriminant validity (Hair et al., 2017).

Table 4. Convergent Validity Test Results

Items	Indicators	Outer Loading	VIF	Validity
ISH1	Have an integrated information system with partners	0,885	3,332	Valid
ISH2	Have an internally integrated information system	0,737	1,801	Valid
ISH3	The existence of a customer information system	0,772	2,297	Valid
ISH4	The relationship of information systems with suppliers	0,707	1,801	Valid
ISH5	Communication systems with adequate suppliers	0,706	1,532	Valid
ISH6	Have the willingness to share information	0,665	1,633	Valid
SQM1	Regularly conduct supplier quality audits	0,713	1,806	Valid
SQM2	Have detailed information about supplier performance	0,778	3,192	Valid
SQM3	Provide feedback to suppliers	0,708	1,840	Valid
SQM4	Participate in quality-related activities	0,675	1,693	Valid
SQM5	Evaluate and recognize suppliers	0,659	1,471	Valid
SQM6	Communicating with major suppliers	0,674	1,586	Valid
SQM7	Quality is the main factor in choosing a supplier	0,900	4,968	Valid
SCA1	Fast in reducing manufacturing waiting times	0,828	2,087	Valid
SCA2	Fast in reducing development cycle time	0,818	2,068	Valid
SCA3	Fast in the introduction of new products	0,763	1,747	Valid
SCA4	Fast product customization by customers	0,860	2,355	Valid
SCA5	Draw up an emergency plan and crisis management	0,796	1,858	Valid
SCI1	Companies trying new ideas	0,811	1,800	Valid
SCI2	Companies looking for new ways or processes	0,787	1,639	Valid
SCI3	Creative enterprises in operating methods	0,777	1,597	Valid
SCI4	The company develops new products	0,833	1,826	Valid
SCP1	Delivery of orders as promised	0,758	2,877	Valid
SCP2	Responsiveness in changing customer demand	0,885	4,905	Valid
SCP3	Lead time reduction	0,712	1,767	Valid
SCP4	Adjusting to the requested product specifications	0,786	2,701	Valid
SCP5	The flexibility of production volume	0,738	2,340	Valid
SCP6	The flexibility of product variety types	0,730	1,842	Valid
SCP7	Introducing new products faster	0,790	2,772	Valid
SCP8	Reduction in production costs	0,804	2,268	Valid

Table 5. Fornell-Larcker Analysis Result

	Information Sharing	Supplier Quality Management	Supply Chain Agility	Supply Chain Innovation	Supply Chain Performance
Information Sharing	**0,749**				
Supplier Quality Management	0,439	**0,734**			
Supply Chain Agility	0,729	0,604	**0,814**		
Supply Chain Innovation	0,718	0,515	0,724	**0,802**	
Supply Chain Performance	0,586	0,625	0,764	0,764	**0,777**

Table 6. Reliability Test Results

Variable	Cronbach's Alpha	rho_A	Composite Reliability	AVE
Information Sharing	0,841	0,853	0,884	0,561
Supplier Quality Management	0,858	0,887	0,890	0,538
Supply Chain Agility	0,872	0,877	0,907	0,662
Supply Chain Innovation	0,815	0,818	0,878	0,644
Supply Chain Performance	0,906	0,909	0,924	0,604

4.4. Reliability Test

A reliability test was conducted to assess the consistency of the indicator of each research variable by calculating Cronbach's alpha, rho A, composite reliability, and average variance extracted (AVE). Those values satisfy the minimum recommended value of 0.70 except for AVE of 0.50. Table 6 shows that all Cronbach's alpha, rho_A, composite reliability, and average variance extracted values are greater than 0.7 and 0.5. This finding implies that measurement items are reliable (Hair et al., 2017), and further analysis can proceed.

4.5. R square and Q square

In this stage will see the values of R-square and Q-square. The values of R-square and Q-square can be seen in Table 7.

Table 7. R-square and Q-square Analysis Results

Construct	R Square	Q Square
Supplier Quality Management	0,193	0,087
Supply Chain Agility	0,631	0,410
Supply Chain Innovation	0,565	0,349
Supply Chain Performance	0,704	0,408

The R-square of supplier quality management is 0.193, which means information sharing can explain the variance of supplier quality manage-ment by 19.3%. The value of the R-square of Supply chain agility is 0.631, which means that information sharing and supplier quality manage-ment can explain the variance in supply chain agility by 63.1%. While the R-square value for supply chain innovation is 0.565, which means information sharing and supplier quality management can explain the variant of supply chain innovation by 56.5%. Operational performance has an R square of 0.704 which means that supplier quality management, supply chain agility, and supply chain innovation can explain the variant of operational performance by 70.4%. Q-square is required to know the suitability of the research model with existing data and show the research model's predictive relevance level. If the Q-square value is greater than 0, then it is said that the model has good predictive relevance. (Henseler & Sarstedt, 2013). Based on Table 7, the value of the Q square is greater than zero. Therefore, it can be said that the research model has good predictive relevance. The goodness of fit (GoF) calculation uses the square root of the multiplication between the mean coefficient of determination (R-Square) and the AVE, as shown in the result shows a value of 0.612, which is a good fit > 0.36 (Tenenhaus et al., 2005).

$$\text{GoF} = \sqrt{\text{R}^2 \text{x AVE}} = \sqrt{0{,}523 \text{ x } 0{,}601} = 0{,}561$$

4.6. Hypothesis Test

Table 8 shows the results of the direct hypothesis test, namely H_1 to H8, where all hypotheses are supported by empirical data collected from respondents.

Based on Table 8, all H1-H8 hypotheses have a p-value below 0.05 with a t-statistical value above 1.96. This suggests that all direct hypotheses of the relationship (H1-H8) are accepted. All path coefficient values show a positive value which means that the relationship between the two variables is mutually constructive. In addition to the direct relationship between the two variables, researchers also conducted tests between three or four variables.

Based on Table 9, the p-value for H9-H13 is below 0.05, or t-statistical values are above 1.96. This finding suggests that the indirect hypothesis are accepted. All path coefficient values indicate a positive value, meaning that the relationship mutually constructive.

Table 8. Direct Path Coefficient Results of Direct Hypothesis

Variable Relationships	Path Coefficient	T Statistics	P Values	Remark
Information Sharing → Supplier Quality Management (H1)	0,439	5,999	0,000	Accepted
Information Sharing → Supply Chain Agility (H2)	0,575	8,551	0,000	Accepted
Information Sharing → Supply Chain Innovation (H3)	0,609	8,236	0,000	Accepted
Supplier Quality Management → Supply Chain Agility (H4)	0,352	4,156	0,000	Accepted
Supplier Quality Management →Supply Chain Performance (H5)	0,207	2,104	0,036	Accepted
Supplier Quality Management → Supply Chain Innovation (H6)	0,248	2,767	0,006	Accepted
Supply Chain Agility → Supply Chain Performance (H7)	0,343	2,895	0,004	Accepted
Supply Chain Innovation → Supply Chain Performance (H8)	0,409	4,630	0,000	Accepted

Table 9. Indirect Path Coefficient

Variable Relationships	Path Coefficient	T Statistics	P Values	Remark
Information Sharing → Supply Chain Agility → Supply Chain Performance (H9)	0,197	2,568	0,011	Accepted
Information Sharing → Supplier Quality Management → Supply Chain Performance (H10)	0,091	2,047	0,041	Accepted
Information Sharing → Supply Chain Innovation → Supply Chain Performance (H11)	0,249	3,685	0,000	Accepted
Information Sharing → Supplier Quality Management → Supply Chain Agility → Supply Chain Performance (H12)	0,053	2,345	0,019	Accepted
Information Sharing → Supplier Quality Management → Supply Chain Innovation → Supply Chain Performance (H13)	0,045	2,418	0,016	Accepted

Table 10. Total Effect

	Supplier Quality Management	Supply Chain Agility	Supply Chain Innovation	Supply Chain Performance
Information Sharing	0,439	0,729	0,718	0,634
Supplier Quality Management		0,352	0,248	0,429
Supply Chain Agility				0,343
Supply Chain Innovation				0,409
Supply Chain Performance				

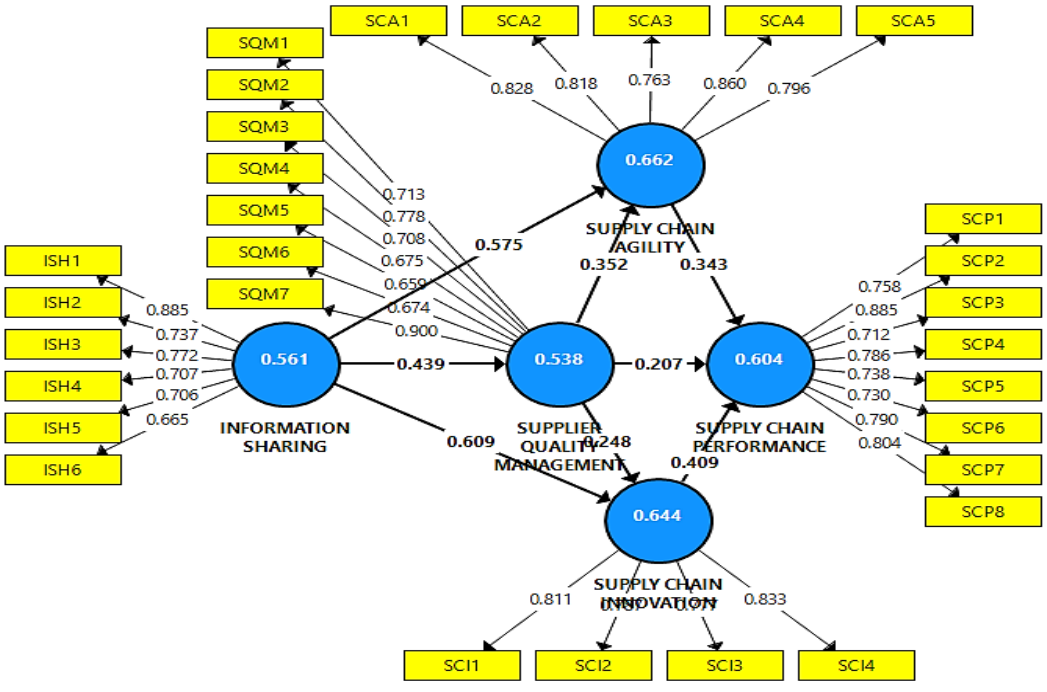

Figure 2. Research Model Test Results

In addition, Table 10 shows the total effect magnitude of one variable to another. The total effect is the sum of direct effects and indirect effects. The greater the number is shown in the total effect, the more significant the variable's impact on other. Figure 2 shows the results of a test of relationships between variables using SmartPLS software.

5. Discussion

The results of the first hypothesis test show that information sharing has a positive effect on supplier quality management. Information systems integrated throughout the supply chain and customers will enable the company to monitor the performance of its suppliers. Sharing product quality and price information related to production activities will enable the company to adjust its internal operations to uncontrollable changes in the external environment (supply chain agility). Integrated information sharing across the supply chain and for communication with customers is proven to support the company in adjusting internal conditions to its external changes. The results of research on information sharing can improve the ability of supply chain agility in this company is also in line with previous research (Ahmed et al., 2019; Baah et al., 2021; Jha et al., 2021; Abdallah et al., 2021).

The most significant influence of the eight direct hypotheses between the two variables lies in the relationship of information sharing to supply chain innovation. This demonstration shows that information sharing will improve the ability to innovate in the supply chain. The level of information sharing can be seen from the information systems integrated throughout the supply chain, including customers. In addition, customers will provide constructive advice or input regarding the products produced by the company so that the company's ability to develop new products increases. This finding is in line with previous research related to the role of information sharing in improving supply chain innovation in companies (Abdallah et al., 2021; Husada Tarigan et al., 2019).

The positive relationship between supplier quality management and supply chain agility shows that supplier quality management application makes the company more agile (agile). Supplier quality management in a company can be seen from the company's detailed information about its suppliers' performance and the company's priority regarding product quality as the most important factor in the selection of suppliers. This supports the company in adjusting internal conditions to its external changes. The results of this study are also in line with previous research on supply quality management's positive impact on supply chain agility within the company (Abdallah et al., 2021; Siagian et al., 2021; D. Y. Kim et al., 2012).

Implementing supplier quality management, such as detailed information about the performance of its suppliers, has a significant and positive impact on supply chain performance. As a result, supply chain performance responds to changing customer demands and reduces production costs. This result is also in line with previous research on the positive impact of SQM on SCP on companies (Hong et al., 2020; Kristianto & Tarigan, 2019; Zhou & Li, 2020). Supplier quality management in a community positively impacts supply chain innovation. This finding means that when supplier quality management in a company increases, the supply chain's ability to innovate will also increase. The close relationship between the manufacturer and its suppliers will allow the company to act more quickly and effectively in answering customers' evolving needs in innovation. This result is also in line with previous research related to the positive impact of supplier quality management on supply chain innovation (Abdallah et al., 2021; Siagian et al., 2021; Hong et al., 2019).

Furthermore, supply chain agility has a positive effect on supply chain performance. The ability of supply chain systems to improve product adjustments and reduce waiting times can improve supply chain performance in the form of rapid response to changing customer demand and reduce production costs. Supply chain agility will increase market share, customer satisfaction, and market demand. The results of this study are in line with previous research related to the positive impact of SCA on SCP (Ahmed et al., 2019; Chen, 2019; Yang, 2014) (Chen, 2019) (Yang, 2014). New product development capabilities affect supply chain performance and reduce production costs. This is also in line with previous research related to the positive impact of SCI on SCP (Zhang et al., 2017; Saleem et al., 2020) (Saleem et al., 2020).

In that regard, supply chain agility also mediates the effect of information sharing on supply chain performance. Sharing information can increase supply chain agility, and then supply chain agility will increase supply chain performance. An integrated information system across the supply chain will improve the to adjust product changes and respond to changing customer demands. This finding is also in line with the results of previous research related to the role of SCA mediation in information sharing and SCP relations (Abdallah et al., 2021; Kurniawan et al., 2021; Ahmed et al., 2019; Chen, 2019; Yang, 2014(Kurniawan et al., 2021) (Ahmed et al., 2019) (Chen, 2019) (Yang, 2014);. The influence of indirect information sharing through supplier quality management on supply chain performance is supported in this study. These results

show that supplier quality management can mediate between information-sharing relationships and supply chain performance. This means that the greater the information sharing in the company, the greater the performance of the supply chain through supplier quality management. An integrated information system across the supply chain makes it easier for companies to select suppliers and increase customer satisfaction. This is also in line with the results of previous research related to the role of supplier quality management mediation in information sharing and SCP relationships (Wong et al., 2015; Zhou & Li, 2020 (Zhou & Li, 2020); Rebelo et al., 2021; Abdallah et al., 2021; Siagian et al., 2021; Hong et al., 2019) (Abdallah et al., 2021) (Siagian et al., 2021) (Hong et al., 2019).

Proper innovation through accurate information sharing will impact better company performance. This result shows that information sharing improves the performance of its supply chain through supply chain innovation. Information systems integrated throughout the supply chain will make it easier for companies to develop new products. Furthermore, these new products will increase customer satisfaction and the ability to respond to changing customer demands. This finding also aligns with previous research on supply chain innovation mediation in information sharing and SCP relationships (Abdallah et al., 2021; Saleem et al., 2020(Saleem et al., 2020). This study's mediation of supplier quality management and supply chain agility proved significant. This relationship is also positive, meaning that sharing integrated information improves product quality, customization, and overall supply chain performance. The results of this study are also in line with previous research on the role of supplier quality management mediation and supply chain agility in information sharing and supply chain performance relationships (Zhou & Li, 2020; D. Y. Kim et al., 2012; Abdallah et al., 2021; (D. Y. Kim et al., 2012) (Abdallah et al., 2021); Yang, 2014; Baah et al., 2021).

The latest finding is that this study's role in supplier quality management and supply chain innovation proved significant in the relationship between information sharing and supply chain performance. This relationship is also positive, meaning that sharing information is integrated to improve quality, boost innovation, and improve supply chain performance. The results of this study are also in line with previous research on the role of supplier quality management mediation and supply chain innovation in information sharing and supply chain performance (D. Y. Kim et al., 2012; Wong et al., 2015; Zhang et al., 2017; Siagian et al., 2021) (Wong et al., 2015) (Zhang et al., 2017) (Siagian et al., 2021).

5.2. Managerial Implications

Based on the research result, information sharing is essential in improving the company's operational performance. Supplier quality management ensures that suppliers deliver the product on time, in good quality, and in the right quantity. Besides, the company can practice supply chain agility with information sharing between partners in the supply chain. Supply chain agility enables the company to respond to external changes quickly. Furthermore, information sharing allows the company to enhance supply chain performance by implementing supply chain agility, supplier quality management, and supply chain innovation. Therefore, the manufacturing company's management needs to consider this study result to pursue improved operational performance.

5.3. Theoretical Contributions

This study contributes to the existing theory, namely the mediation of supply chain agility, supply chain innovation, and supplier quality management toward the relationship between information sharing and operational performance.

5.4. Limitation

This study has a limitation, particularly the limited coverage of the population focusing on the East Java Region. This study also focuses on limited constructs: information sharing, supplier quality management, supply chain innovation, and operational performance. For this reason, future research will cover other industries, such as hotel and automotive. It is also suggested to involve other recently trending constructs, such as green environmental and digital supply chains.

6. Conclusions

This study aims to answer two main questions: whether previous research applies to Indonesia's manufacturing industry population. Second, supplier quality management, supply chain agility, and innovation mediate the relationship between information sharing and operational performance. Researchers formulated 13 hypotheses, of which eight were direct, and 5 were indirect hypotheses. Here are the results of the thirteen hypotheses that have been carried out as follows. Information sharing affects supplier quality management (H1), supply chain agility (H2), and supply chain innovation (H3). Furthermore, operational performance is directly influenced by supplier quality management (H5), Supply chain agility (H7), and supply chain innovation (H8). In addition, supplier

quality management directly affects supply chain agility (H4) and supply chain innovation (H6). The indirect hypothesis, namely, information sharing has an indirect effect on supply chain performance through supply chain agility (H9), supplier quality management (H10), supply chain innovation (H11), supplier quality management, and supply chain agility (H12), and supplier quality management and supply chain innovation (H13).

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