

# THE IMPACT OF SCM INTEGRATION ON BUSINESS PERFORMANCE THROUGH INFORMATION SHARING, QUALITY INTEGRATION AND INNOVATION SYSTEM

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# <sup>1</sup> THE IMPACT OF SCM INTEGRATION ON BUSINESS PERFORMANCE THROUGH INFORMATION SHARING, QUALITY INTEGRATION AND INNOVATION SYSTEM

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## ABSTRACT

Integration with external supply chain partners can reduce the risk of process and product development disruptions. Hence, the companies should anticipate and prepare for any risk that could emerge in the supply chain network. This study aims to analyze the role of supply chain integration, information sharing, supply chain quality integration, and innovation systems in improving business performance in the manufacturing industry. The study surveyed manufacturing companies located in East Java, as many as 258 companies. Data was collected using questionnaires designed with a five-point Likert scale and distributed through Google Forms and company visits. 222 questionnaires were distributed through Google Forms, and 36 were distributed during company visits. The smartPLS software version 4.0 was used for descriptive analysis and hypothesis testing. The results showed that supply chain integration positively impacts information sharing, quality integration, and innovation systems. Information sharing significantly supports the implementation of quality integration and innovation systems. However, quality integration does not affect the innovation system. Likewise, innovation systems have no impact on improving business performance. Many manufacturing companies in East Java had not done innovation systems appropriately after the COVID-19 disruption as the company still focused on current processes and products to maintain company sustainability. Furthermore, information sharing, and supply chain quality integration significantly improve business performance. The results of this study could contribute to managers building close partnerships with external parties to maintain the quality of processes and products. Business owners must also consider using the latest technology for process and product innovation. These findings enrich the current supply chain management theory, particularly with quality integration and innovation systems.

Keywords: Business performance, innovation systems, SCM integration, SC quality integration, sharing information

## 1. Background

Today, most companies interact and seek to build good relationships with other companies globally (Partyka, 2022). The relationship is essential as the companies could attain market access and distribution in supplying the demand abroad (Chong et al., 2011). The company's ability to set up a broader market will provide growth and development. At the same time, the company also strives to integrate with other companies to increase the efficiency of its processes in producing products and distributing them to users quickly (Ayoub et al., 2017). The integration makes it easier for companies to respond quickly to the market. Besides, communication and coordination with external partners are encouraged and required in serving the demand, particularly in the era of globalization (Amoako et al., 2022), and facilitating the innovation process in fulfilling products following market trends (Pratono, 2022). The company and its customers build exemplary communication and gradually build integration to provide information related to their respective needs in improving performance (Tarigan et al., 2021a).

Integration with external parties can enhance product and process innovation using digital technology (Agostini et al., 2020; Tarigan, 2018). In addition, integration with upstream and downstream built partners can help companies optimize supply chain performance and quickly

overcome uncertainties (Shukor et al., 2021). Upstream integration allows companies to access the resources needed, including procuring materials according to the specifications needed as a form of partnership (Tarigan & Siagian, 2021). Meanwhile, downstream integration can make it easier for companies to access wider distribution channels and markets. Finally, downstream and upstream integration starts from the procurement of raw materials, the process of forming finished goods, to the stage of delivering products according to customer needs, which is said to be supply chain integration (Basana et al., 2022).

Furthermore, supply chain integration allows companies to increase cooperation with external parties to solve problems and share risks (Qiao & Zhao, 2023). Research indicated that the company's ability to adopt supply chain integration with its suppliers has enabled it to provide quality raw materials following the specifications needed (Li et al., 2023). Besides, supplier integration can reduce the resistance to economic instability in the company in providing the products (Huo et al., 2019). Moreover, sudden changes outside the company can mitigate their influence on the production process in the internal company. On the other hand, customer integration can help companies understand customer needs and change global market trends (Zhang et al., 2019). Companies can receive input from customers related to changes in the market, enabling the companies to make changes in the company's internal process areas quickly (Ayoub et al., 2017). Therefore, companies applying supply chain integration can use globalization to understand better the dynamics of uncertainty in material suppliers and markets. Finally, the supply chain integration makes the company's internal process business collaborate with external process businesses in an integrated manner (Dhaigude et al., 2021).

Nevertheless, suppliers involved in the integration will support the company in providing materials, production processes, and distributing products to users (Chong et al., 2011). The products that practically match customer specifications are closely related to product quality determined by the customer (Machado et al., 2019). However, the quality of the products produced by the company is determined mainly by raw materials that have high quality in maintaining the accuracy of the process and product specifications for customers (Tarigan et al., 2018). Hence, close cooperation between companies with suppliers and customers in the supply chain is mandatory to improve product quality (Tarigan & Siagian, 2021). Companies can match the product required by the customer by assuring the quality of material, product design, and production process (Liu et al., 2023). The customer's specifications can be informed directly by the company to suppliers by sharing information between companies and external supplier partners (Feng et al., 2023). Adequate quality materials can provide good final product quality (Tarigan et al., 2018). The use of technology enables internal integration resilience so that it can be improved by integration with external parties (Kannan & Garad, 2021). External information helps ensure a standard and strict production process in maintaining product quality. Quality control in the production area can be carried out strictly when there is adequate internal and external integration (Zhao et al., 2021). Quality constraints on the production floor can be communicated directly to the relevant departments in the company when the integration system is running well (Basana et al., 2023). Inspections carried out as stages in the production process can be informed and communicated quickly to all relevant departments to eliminate early risks that interfere with production quality.

The involvement of external partners in maintaining product quality is a good innovation process in producing products (Bui et al., 2022). Companies building integration with suppliers can run well, conveying information on product specifications, product quality standards, product design, and even design changes (Zhang & Ma, 2023). Involving suppliers in overcoming problems in the company's production department can reduce product defects because suppliers understand the characteristics of the materials supplied (Tarigan & Siagian, 2021). When a defect occurs during the process, getting feedback from the relevant department should be easy so it is quickly communicated to suppliers and customers. The company builds an adequate information system to enable information sharing to be shared with various internal and external parties so that communication can run quickly and effectively using information technology (Yu et al., 2021). Supply chain integration can impact increasing information sharing for companies related to their

operational conditions (Wang et al., 2023). Information sharing in supply chain flows allows managers to identify vulnerabilities (Riley et al., 2016). The company easily captures data about events in the operational department (Basana et al., 2023). The organization transforms the data into useful information to share with partners (Obonyo et al., 2023). The company's ability to share information with partners per external conditions can ensure the sustainability of the manufacturing company's production process running well (Zhang et al., 2023). Consistency in sharing good information between companies and partners in determining the demand can improve process stability on an ongoing basis (Hong et al., 2023).

The company strives to build an adequate integration system to maintain the resilience of an increasingly resilient production process (Shukor et al., 2021). Supply chain integration can impact supply chain quality by continuously maintaining processes, starting from the downstream and upstream supply chains (Zhong et al., 2016). The quality of products produced by manufacturing companies is determined by internal companies in the production process and external parties (Caniato & Größler, 2015). The resulting quality is primarily determined by the involvement of suppliers and customers (Tarigan et al., 2021b). The company's ability to maintain stability improves the quality of the supply chain. Stability that occurs will reduce raw material defects, raw material shortages, and changes that occur in suppliers so that the quality of products or services is well maintained (Tarigan et al., 2018). The company involves external partners to get a new production system by producing high-quality products and minimal resources (Kannan & Garad, 2021). The company's ability to build quality integration improves the quality of products and services. Quality integration is essential for companies to monitor the quality of processes that produce products to get the right and efficient processes (Zhang et al., 2019). Quality integration makes companies efficiently respond to rapid changes in product demand to match customer criteria.

The company's ability to use resources by implementing new programs as a new system can improve operational performance (Tian et al., 2018). The company owns an innovation system to develop new products and services to meet customers' expectations (Afraz et al., 2021). The results of the company's continuous innovation can increase competitiveness by implementing new ways to improve the company's operational efficiency using technology (Botha, 2019). The innovation system formed can improve the company's response to changes in regulations and market trends with rapid changes (Prajogo & Sohal, 2006). An innovation system is driven by using suitable and relevant data so that companies can build resilient and flexible systems (Dutta & Sarma, 2023).

The abovementioned argument indicated that many factors, such as supply chain integration, information sharing, quality integration, and innovation systems, could affect business performance. Many studies have elaborated on the impact of each factor on business performance. However, there has been no study on the relationship of all the five constructs in improving business performance. The authors still consider a need to examine the relationship of the five constructs simultaneously. This study examines the impact of supply chain integration, information sharing, quality integration, and innovation systems in improving business performance in the manufacturing industry. Hence, this study raised the central question to answer in this study as follows: whether supply chain integration, information sharing, quality integration, and innovation systems improve business performance in the manufacturing industry; whether supply chain integration enhances information sharing, quality integration, and innovation systems; whether supply chain integration indirectly improves business performance through the information sharing, quality integration, and innovation system. The rest of the paper is organized as follows. Section two, the literature review, addresses the past research relevant to the study topics and develops the research hypotheses. The research method is described in section three, and section four deals with the analysis and result of hypotheses testing. Section five discusses the analysis result and its relevancy with the past studies. Finally, section 6 addresses the conclusion, where the findings are summarized and its contribution to practitioners and researchers.

## 2. Literature Review

### **2.1. Supply Chain (SC) Integration**

Supply chain (SC) integration is an alignment between internal company goals that must be adjusted to the company's external conditions to improve joint performance (Partyka, 2022). Supply chain integration is essential for companies when coordinating with downstream and upstream on an ongoing basis (Jafari et al., 2023). Integration between companies and external parties combines joint business activities (Basana et al., 2022). Supply chain integration provides good benefits for companies to produce the initial process of raw materials to finished products efficiently and effectively (Zhao et al., 2021). Supply chain integration can combine the company's internal and external business processes (Dhaigude et al., 2021).

Supply chain management allows companies to build integration using information technology to share the information within the company, and external partners can be done in real-time (Shukor et al., 2021). The company's ability to share information can overcome problems and mitigate problems that will arise (Riley et al., 2016). Supply chain integration can connect companies with external partners in coordinating and collaborating to produce efficiently and effectively (Tarigan et al., 2021a; Sundaram et al., 2020). Supply chain integration is a business strategy companies set to coordinate between companies and external parties using information technology (Amoako et al., 2022; Yu et al., 2021). The integration formed is the result of continuous cooperation and coordination between the two parties to carry out cooperation and coordination on an ongoing basis (Jafari et al., 2023). The research of Sautma et al. (2022) establishes internal integration with measurement items, integration of data between internal functions, real-time integration data of accuracy, and coordination between functions. Research by Jafari et al. (2023) shows that indicators for supply chain integration are joint decision-making, standardized communication between internal and external, long-term relationships with external partners, providing input to partners to make improvements, and participating in solving problems faced by partners. Shukor et al. (2021) stated that supply chain integration consists of internal, supplier, and customer integration in building supply chain agility and organizational flexibility.

### **2.2. Information Sharing**

Information Sharing is an activity where members in the Supply Chain give each other and share crucial information (Obonyo et al., 2023). Information sharing is something that companies do to be known and understood by company partners (Feng et al., 2023). Sharing information between companies and customers through planning to suit needs is needed by building cooperation and coordination between supply chain components in producing innovative products (Mak & Shen, 2021; Qiao & Zhao, 2023). Information sharing aims to convey information in the form of data in the company, facts that occur in the company, and knowledge to company partners so that they can respond as needed (Zhang & Ma, 2023). Companies can share information related to payment systems with distribution partners, and under certain conditions, companies can provide payment convenience specifically (Zhang et al., 2023). Companies use technology to share information with partners to build continuous communication and coordination to understand each other (Wang et al., 2023). Important information in the company can be about production process procedures, the amount of inventory, the number of customer requests, and others according to their respective departments. Manufacturing companies are trying to build transparent information sharing with upstream suppliers (Li et al., 2023). Company activities can run well if they build smooth information delivery (Riley et al., 2016). Communicating and conveying information to each other will form a good relationship and provide information appropriately (Sundram et al., 2020). Companies can form long contracts with demand parties in creating information sharing related to company profits (Hong et al., 2023).

### **2.3. Supply Chain Quality Integration**

Supply chain quality integration includes internal departments, suppliers, customer integration, and supply chain quality (Zhang et al., 2019). The quality supply chain is essential for

companies to meet customer demands following set criteria (Bui et al., 2022). The quality supply chain is related to all functions and processes in producing products that meet criteria (Machado et al., 2019). Supply chain quality focuses on implementing product manufacturing and produces products according to the criteria set as quality products and can be directly distributed to customers to provide satisfaction excellence (Liu et al., 2023). Companies can collaborate strategically with external partners to manage activities to improve the quality of products and processes in continuous improvement (Huo et al., 2019).

The company could involve internal functions and external roles (upstream and downstream partners) to maintain quality (Zhong et al., 2016). The company does not focus on product defects or correcting nonconformities in the product process but maintains the quality of all components in the supply chain flow. Supply chain quality shows the quality of the products produced with the participation of suppliers in providing materials that meet the criteria (Zhao et al., 2021) and the role of customers in determining the design, specifications, and durability of finished products (Tarigan et al., 2021b). Manufacturing companies also involve suppliers to understand the process characteristics and provide new production systems with quality products and minimal resources (Kannan & Garad, 2021). Zhong et al. (2016) stated that hotel supply chain quality is a coordination process between all partners to produce products/services that meet customer needs. Manufacturing companies in Vietnam have paid attention to practical quality management control internally and built good relationships with customers and suppliers to maintain quality stability (Phan et al., 2016).

#### **2.4. Innovation System**

The innovation system addresses the capability of companies to create or innovate the product and process, which is essential for creativity and for producing unique new products (Tian et al., 2018). The company sets innovation in managing the resources used to achieve goals more efficiently, effectively, and sustainably (Siagian et al., 2019). The innovation system is adopted by a company that is used by the entire process of producing a product that increases the company's competitiveness (Agostini et al., 2020; Ayoub et al., 2017). The innovation system makes the process more productive and efficient, affecting the company's development and growth to improve operational performance (Tarigan, 2018). The speed of innovation results from a continuous learning process set at the company (Li, 2021). The innovation system is management's commitment to implementing (Dutta & Sarma, 2023). The innovation system is not only related to the products or services formed by the company. Still, it shows the company's ability to manage and organize its system to interact with its environment, increasing competitiveness (Botha, 2019). Management innovation is something that companies must do to develop an organization for the better (Pratono, 2022). A company must constantly innovate to develop and be competitive (Afrizal et al., 2021). Innovation is essential to some business processes because it can create a competitive advantage (Caniato & Größler, 2015). System innovation uses technology to produce new processes and products (Ayoub et al., 2017). The company can create a new process more efficiently and create quality according to market needs (Wahyono & Hutahayan, 2021; Chong et al., 2011). Companies can use technology to be more efficient and produce more products (Novijanti et al., 2023). Companies are carrying out innovation systems that have been practiced by conducting innovation processes and product innovations to build competitiveness (Prajogo & Sohal, 2006; Tarigan, 2018).

#### **2.5. Business Performance**

Company performance is one of the essential things for companies to produce the maximum possible output to increase competitiveness. In addition, organizational flexibility is a strategy companies build to increase company competitiveness (Shukor et al., 2021). Performance within the company itself is a process used by companies in identifying, measuring, evaluating, and improving the resulting performance (Tarigan & Siagian, 2021). Company performance is the main goal for managers to be able to compete in current conditions. The existence of company performance is an

important part that can be relied on if the company wants to achieve excellence (Yu et al., 2021). Company performance is the result obtained by businesses in a certain period in utilizing the resources used to be efficient (Dhaigude et al., 2021). Business performance is formed in financial and operational performance (Yuen & Thai, 2017). Business performance is a benchmark used to determine projected business development. Business performance determined by management is an early detection related to company achievements (Tarigan et al., 2021b). Business performance is a dashboard for management to know the achievements of the entire organization. Business performance is a process carried out by management to know and ensure the business optimally achieves the goals that have been set. Business performance can also be expressed as the company's ability to manage resources to achieve goals efficiently and effectively (Basana et al., 2023).

## **2.6. The Relationship Between Research Concepts**

### **2.6.1. The Relationship of Supply Chain (SC) Integration and Information Sharing**

Information sharing is essential because it impacts supply chain integration (Jafari et al., 2023). The company's partners should receive company information following a predetermined timeline to avoid sudden requests. Information can also be used as a vital consideration in making decisions within the company appropriately. Information-sharing allows companies to build competitiveness (Riley et al., 2016). Supply chain integration consisting of internal integration has no impact on information sharing, while customer integration and supplier integration have a positive and significant impact (Qiao & Zhao, 2023). The integration between partners impacts the company in coordinating and collaborating well and regularly. The company's success in determining the proper steps for development is determined by internal and external integrated information systems and is related to information sharing (Sundram et al., 2020). Companies that get quick information about external uncertainties can determine responsive decisions adequately by customizing the company's internal to be able to anticipate the impact (Basana et al., 2023). Information sharing can allow every member of the supply chain to maintain every piece of information or store it in a good way and convey the information needed by the company in making decisions effectively.

H1: SCM integration has an impact on improving information sharing.

### **2.6.2. The Relationship of SC Integration and Quality Integration**

SCM and quality integration are two things that are closely related and difficult for managers when carrying out practically due to the relationship between different functions or departments in the company (Machado et al., 2019). SC integration and quality integration with downstream and upstream partners are essential for companies to increase competitiveness in all supply chain components (Zhong et al., 2016). Quality management set by the company and conducting practical monitoring so that the products produced are of high quality and according to customer wishes is the role of upstream and downstream integration (Phan et al., 2016). SCM integration in companies can be used to coordinate with company suppliers so that companies can monitor product quality from suppliers (Tarigan et al., 2021b). Companies can utilize SCM integration formed in the company to improve quality integration by controlling the accuracy of raw material delivery from suppliers. SCM integration provides direct benefits for company inventory control, so it is needed so that product quality is maintained (Zhao et al., 2021). The company's ability to build integration with suppliers so that product failures can be delivered quickly, while with the customer, benefits the company in tracking the quality of products processed by each production unit (Tarigan et al., 2018).

H2: SC integration has an impact on improving quality integration.

### **2.6.3. The relationship between SC Integration and Innovation Systems**

4 The innovation system is crucial in SC integration because companies have much to do along the supply chain flow (Afraz et al., 2021). The innovation system will affect the direction and speed of company innovation in creating value for customers (Pratono, 2022). The integration by the company with partners has used adequate information technology inefficient processes (Agostini et al., 2020). Innovations set by companies using technology will expose companies to increase transparency in supply chain processes (Botha, 2019). Companies can quickly find out the ability and constraints of suppliers in supplying goods, and vice versa; suppliers can find out the problems the company faces quickly (Siagian et al., 2019). Integrating companies and partners results in innovation in creating market-oriented products (Wahyono & Hutahayan, 2021). Innovation set in new services and 4 products requires the role of corporate partners who quickly understand company conditions, so supply chain integration is needed (Li, 2021). The company's ability to build supply chain integration has a more responsive impact on customers following existing trends after increasing innovation for companies in product planning and innovation inventory management (Caniato & Größler, 2015). SCM integration consisting of customer integration and supplier integration in manufacturing companies has an impact on increasing technical 4 innovation, except internal integration does not have an impact (Ayoub et al., 2017).  
H3: SC integration has an impact on improving innovation systems.

#### 2.6.4. The Relationship of Information Sharing and Quality Integration <sup>7</sup>

The company's ability to share information with suppliers can achieve high-quality products (Feng et al., 2023). Information shared by companies with partners as a form of solid relationships to be conducive requires a stable supply chain quality (Liu et al., 2023). Information sharing internally makes it easy to convey information to external supply chain parties (Sundram et al., 2020). Sharing information carried out by companies about production planning, raw material needs, and customer demand makes it easier to monitor product quality on an ongoing basis. When companies communicate their needs with external parties through information sharing, all parties understand the required product quality requirements (Tarigan et al., 2021b). Companies can ensure product or service quality can be achieved with adequate supply chain quality integration. Information sharing also allows companies to collaborate with various parties in maintaining product quality by using technology practically and total quality management practices (Prajogo & Sohal, 2006).

H4: Information sharing has an impact on improving quality integration.

#### 2.6.5. The Relationship of Information Sharing and Innovation Systems

Information sharing between manufacturing companies and retail partners can impact the innovation environment in product design related to product differentiation and functionality (Zhang et al., 2023). Companies can move faster and adjust faster thanks to information technology (Yu et al., 2021), making sharing information easier to produce new systems according to company needs (Botha, 2019). Relevant information sharing related to real problems companies face is essential in creating an environment supporting innovation (Riley et al., 2016). Information sharing can be central in providing discussion and coordination for company components in innovating (Siagian et al., 2019). The container formed can be used to share new ideas to produce new service processes or products as a form of company innovation (Li, 2021; Cho et al., 2022). Information sharing between departments is related to new experiences and knowledge in creating innovative ideas to produce product innovations (Falahat et al., 2020). Companies can use information sharing to identify innovation opportunities to increase competitiveness (Afraz et al., 2021). Adequate communication and information sharing in the company make innovation add value to the company (Prajogo & Sohal, 2006). Information sharing formed in manufacturing companies in Malaysia can impact the innovation system, namely the innovation process, innovation services, and innovation products (Chong et al., 2011).

H5: Information sharing has an impact on improving innovation systems.

### 2.6.6. The relationship of Quality Integration and Innovation System

Supply chain quality integration is essential in maintaining the innovation system for the company. Quality integration formed in the company will practically produce a continuous improvement and innovation program as a system that is maintained to be sustainable (Machado et al., 2019). Quality integration is vital for companies when producing superior products according to market criteria (Tarigan et al., 2021b), but companies also need to innovate to remain able to compete with competing products and meet market demands that are changing rapidly (Wahyono, & Hutahayan, 2021). Implementing information technology in manufacturing companies can improve quality performance for company products and process innovation set (Phan et al., 2016). The company's ability to create innovation by being able to identify processes to conform to standards in the form of system documents (Li, 2021) and make continuous improvements to produce quality products (Prajogo & Sohal, 2006; Tarigan, 2018). The innovation system formed in the company can support supply chain quality integration by monitoring quality performance by collecting data on the quality of products or services so that improvement can be made (Yuen & Thai, 2017). Performance innovation in processes and products that are the company's goal will be able to implement total quality management practice by identifying quality problems early and directing efforts to overcome these problems (Prajogo & Sohal, 2006).

H6: Quality integration has an impact on improving innovation systems.

### 2.6.7. The Relationship of Quality Integration and Business Performance

The commitment formed by the company's functional managers to implement a quality system to build a continuous improvement mindset can impact quality management practices to improve operational performance (Machado et al., 2019). The company's ability to involve all components to produce supply chain quality management is capable of operational performance in product design and quality improvement (Phan et al., 2016). Supply chain quality integration in companies cannot improve organizational performance but can increase operational capability (Tarigan et al., 2021b). Product quality produced by companies by integrating internal and external processes to focus on quality impacts financial performance (Zhao et al., 2021). Supply chain quality integration, namely internal quality integration and supplier quality integration, impacts improving performance to increase company competitiveness, but customer quality integration does not have a significant effect (Zhang et al., 2019). Supply chain quality integration impacts improving operation performance by increasing product quality, product delivery, cost of quality, and flexibility (Huo et al., 2019).

H7: Quality integration has an impact on improving business performance.

### 2.6.8. The Relationship of Information Sharing and Business Performance

Hotels in Surabaya carry out information sharing as a measurement item in internal and external integration as a form of supply chain integration that significantly influences hotel performance (Basana et al., 2022). Information sharing formed in agri-food products companies impacts supply chain performance (Obonyo et al., 2023). Strategic information sharing impacts company performance in 247 third-party logistics companies in China (Wang et al., 2023). Information sharing carried out by companies with demand in the form of profit can improve better performance (Hong et al., 2023). Information sharing integrated into the company can produce appropriate and relevant information to the actual condition of the company so that it can help management make decisions (Riley et al., 2016). Companies have accurate and up-to-date information systems that facilitate coordination between departments to produce efficiency and effectiveness (Qiao & Zhao, 2023). Information sharing allows companies to respond to the market quickly through adequate inventory to reduce costs (Yu et al., 2021). Information sharing carried out by companies is closely related to company performance (Sundram et al., 2020).

H8: Information sharing has an impact on improving business performance.

### 2.6.9. The Relationship of Innovation System and Business Performance

Companies that strive to form an organizational structure and administrative system carry out new plans in the form of programs to improve operational performance (Tian et al., 2018). Product innovation by producing new product development in companies can improve supply chain performance (Novijanti et al., 2023). A well-organized corporate innovation system can encourage companies to produce new products (Caniato & Größler, 2015) to meet customer demand and follow fast-changing market trends (Siagian et al., 2019). Companies can also understand existing market needs (Li, 2021) to adjust user needs according to their respective segments as a form of market orientation (Wahyono & Hutahayan, 2021). The company's ability to maintain an innovative atmosphere for its employees will continuously generate new ideas (Cho et al., 2022). The results of continuous innovation for companies impact increasing company competitiveness (Afraz et al., 2021). A sound innovation system can help companies develop new product production methods (Falahat et al., 2020). The innovation system makes companies produce efficient and effective processes and new products continuously (Prajogo & Sohal, 2006; Chong et al., 2011). Process innovation and product innovation in small and medium enterprise companies can improve operational performance (Tarigan, 2018).

H9: Innovation system has an impact on improving business performance.

Based on the introduction and literature review explanation, the research concept framework can be set in Figure 1.

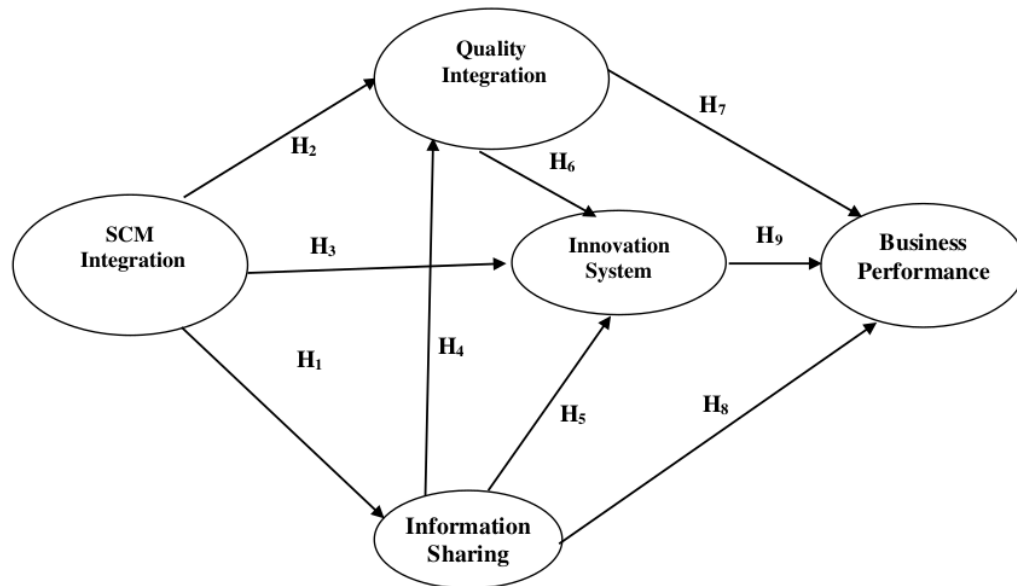


Figure 1. Research concept framework

## 4. Research Methods

The measurement items for the constructs in this study are adopted from previous studies discussed in the Literature review. SC integration is an integrated activity jointly carried out by the company with external partners. The measurement items used are adopted from previous studies stating that SC integration is the ability to solve problems together (SCMI1), join in creating new products (SCMI2), join in creating new services (SCMI3), companies share demand with partners

(SCMI4), companies share progress process progress with partners (SCMI5), and companies commit to long-term relationships (SCMI6). Information sharing is an activity carried out by companies to communicate and coordinate so that external partners in manufacturing companies in East Java understand them. The measurement items used for information sharing are companies and partners sharing information when things change (IS1), companies and partners can share facilities (IS2), companies and partners share knowledge (IS3), companies and partners share planning effectively (IS4), and finally, companies and partners share risk (IS5).

Meanwhile, supply chain quality integration is a company's joint activity with external partners in producing quality processes, products, and services. Measurement items set for supply chain quality integration implementation of a continuous improvement quality system (Q.In1), mutual assistance in solving quality problems (Q.In2), process control per quality standards (Q.In3), responsibility for achieving product quality (Q.In4), commitment to producing quality products (Q.In5) and actively involve external partners in maintaining quality (Q.In6). Further, the innovation system covers the entire process in the company to produce ideas, processes, or products to increase company competitiveness. The innovation system in manufacturing companies is divided into two dimensions: process innovation and product innovation. Measurement items for process innovation are consistently adjusting the latest technology in the production process (Inn.Sy1), conducting research and development of production processes (Inn.Sy2), and continuous process changes in support of new products (Inn.Sy3). The dimensions of product innovation are the speed of the company in producing new products (Inn.Sy4), the number of new products produced by the company (Inn.Sy5), and the use of technology in producing new products (Inn.Sy5). Finally, business performance is a process used by companies in identifying, measuring, evaluating, designing, and improving the performance produced in a certain period by utilizing the resources used. The measurement items used for business performance are focused on operational performance, namely reducing production costs (Bu.P1), product quality (Bu.P2), delivery on time (Bu.P3), flexibility in production system (Bu.P4), demand fulfillment (Bu.P5) and customer satisfaction (Bu.P6).

Data collection using questionnaires distributed to manufacturing companies in East Java that have been integrated with external partners. Existing manufacturing companies have committed to monitoring and controlling the raw material procurement process, production process, and product distribution process that focuses on meeting established quality criteria. The questionnaires were distributed online through a Google form whose link was given to practitioners in East Java. Questionnaires are also distributed directly to manufacturing practitioners to obtain the implementation conditions in the company in controlling the quality of processes and products according to customer expectations. The questionnaire obtained can be processed by as many as 258 respondents (site visited companies, as many as 36 companies, the rest through Google form). Research data processing uses smartPLS version 4 by getting outer model and inner model tests. Validity and reliability tests as a form of outer model test are shown in Table 1.

Table 1. Outer Model Test Result

Item measurement	Factor Loading	Composite reliability	Cronbach alpha	AVE
<b>SC Integration</b>		0.813	0.787	0.503
SCMI1	0.801			
SCMI2	0.677			
SCMI3	0.795			
SCMI4	0.832			
SCMI5	0.797			
SCMI6	0.696			
<b>Information Sharing</b>		0.816	0.790	0.542
IS1	0.848			
IS2	0.725			
IS3	0.754			

IS4	0.601			
IS5	0.732			
SC Quality Integration		0.860	0.857	0.583
Q.In1	0.704			
Q.In2	0.741			
Q.In3	0.808			
Q.In4	0.725			
Q.In5	0.808			
Q.In6	0.789			
Innovation System		0.849	0.833	0.550
Inn.Sy1	0.768			
Inn.Sy2	0.754			
Inn.Sy3	0.854			
Inn.Sy4	0.757			
Inn.Sy5	0.727			
Inn.Sy6	0.558			
Business Performance		0.813	0.797	0.503
Bu.P1	0.534			
Bu.P2	0.623			
Bu.P3	0.790			
Bu.P4	0.758			
Bu.P5	0.690			
Bu.P6	0.818			

Table 1 above shows the results of the outer model test, including validity and reliability. Validity is assessed using the factor loading value as indicated in Table 1. All constructs indicators are valid based on the minimum recommended value of 0.50. The test result indicated that factor loading values are between 0.534 and 0.854. Hence, all indicators are considered valid. Test validity is shown in Table 1, with loading factor values above 0.5. The SCM integration variable with the minimum loading factor is the SCMI2 item of 0.677 and has met the validity test. The outer model for the variables is done with the same calculation: the information sharing with the smallest item is IS4 with a value of 0.601, SC quality integration with item Q.In1 with a value of 0.704, and innovation system in item Inn.Sy6 of 0.558, and business performance with item Bu.P1 of 0.534. Items in each variable have met the validity test with a loading factor above 0.5. The outer model is also assessed for reliability using composite reliability value and Cronbach alpha above 0.70. Table 1 shows the values for composite reliability and Cronbach alpha of each variable, respectively: SC integration of 0.813 and 0.787, information sharing of 0.816 and 0.790, SC quality integration of 0.860 and 0.857, innovation system of 0.849 and 0.833, business performance of 0.813 and 0.797. The reliability test has met the specified requirements. Based on this result, the measurement model is considered valid and reliable, and further analysis can proceed. The inner model test is discussed in the research analysis.

## 5. Data Analysis and Discussion

### 5.1. Data analysis

The inner model is examined to find out how well the model matches with the empirical data. The coefficient of determinant, defined as R-square, measures how strongly the independent variable's variance explains the dependent variable's variance. The values range from 0.412 and 0.593, which are considered as medium scores. Besides the R-square, the Q-square also needs to assess which reflects the predictive relevance of the model. Q-square helps assess the model's goodness of fit when using the partial least square (PLS) technique. The model has an excellent predictive relevance value if the Q-square exceeds zero.

Table 2. R-square value

Construct	R-square
Information Sharing	0.412
SC Quality Integration	0.549
Innovation System	0.583
Business Performance	0.593

Table 2 shows the R-square value of each variable in the study. The R square value is between 0.412 and 0.593, acceptable as medium level. The predictive relevance is obtained using the formula  $Q\text{-square} = (1 - (1 - R\text{-square information sharing}) (1 - R\text{-square SC quality integration}) (1 - R\text{-square innovation system}) (1 - R\text{-square business performance})) = (1 - (1 - 0.412) (1 - 0.549) (1 - 0.583) (1 - 0.593)) = 1 - 0.045 = 0.955$ . This result shows that the model can explain the business performance of manufacturing companies by 95.5%.

Further analysis examines the hypotheses; the result is shown in Figure 2 and Table 3.

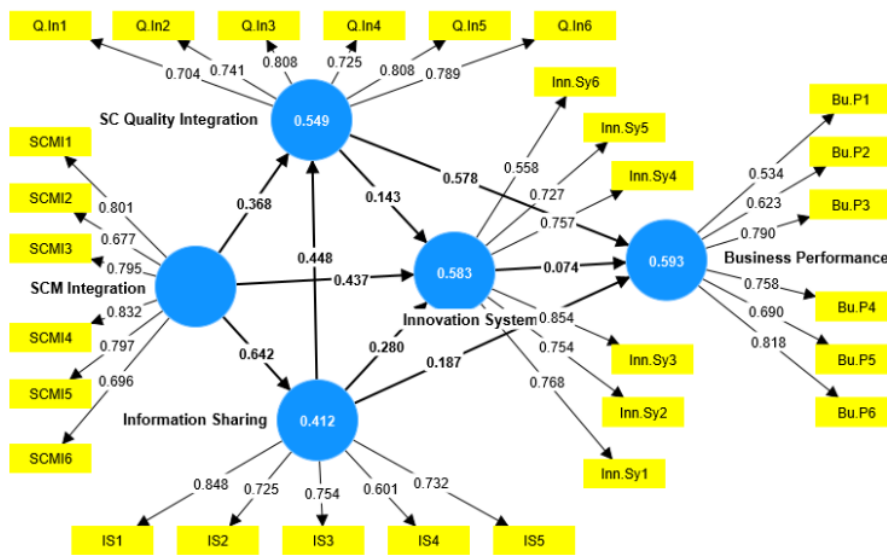


Figure 2. Research Model and Analysis Result

Table 3. Hypothesis Testing Result

Hypothesis	Path Coefficient	T statistics	P values	Remarks
SC Integration -> Information Sharing (H1)	0.642	18.636	0.000	supported
SC Integration -> SC Quality Integration (H2)	0.368	6.275	0.000	supported
SC Integration -> Innovation System (H3)	0.437	6.110	0.000	supported
Information Sharing -> SC Quality Integration (H4)	0.448	7.379	0.000	supported
Information Sharing -> Innovation System (H5)	0.280	3.300	0.001	supported
SC Quality Integration -> Innovation System (H6)	0.143	1.486	0.137	Rejected
SC Quality Integration -> Business Performance (H7)	0.578	8.366	0.000	supported
Information Sharing -> Business Performance (H8)	0.187	2.503	0.012	supported
Innovation System -> Business Performance (H9)	0.074	1.012	0.312	Rejected

SC Integration -> Business Performance (H10)	0.552	16.305	0.000	supported
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As shown in Table 3, eight of ten hypotheses were supported, and two were rejected. A hypothesis is supported for the t-statistic value exceeding 1.96 or p-value less than 0.05. The first hypothesis (H1) is empirically supported that supply chain integration affects information sharing by a coefficient value of 0.642, t-statistics values of 18.636 ( $> 1.96$ ), and p-values of 0.000 ( $< 0.05$ ). Supply chain integration has an effect on supply chain quality integration (H2) by coefficient value of 0.368, t-statistic of 6.275 ( $> 1.96$ ), and p-value of 0.000 ( $< 0.05$ ). SC integration has an effect of 0.437 in improving the innovation system (H3) with a t-statistics value of 6.110 ( $> 1.96$ ) and a p-value of 0.000 ( $< 0.05$ ) acceptable. Information sharing has an effect on SC quality integration (H4) of 0.448 with t-statistics values of 7.379 ( $> 1.96$ ) and p-values of 0.000 ( $< 0.05$ ). Information sharing has an influence on innovation systems (H5) of 0.280 with t-statistics values of 3.300 ( $> 1.96$ ) and p-value of 0.001 ( $< 0.05$ ) acceptable. SC quality integration has no impact on the innovation system (H6) of 0.143 with a t-statistics value of 1.486 ( $< 1.96$ ) and a p-value of 0.137 ( $> 0.05$ ). SC quality integration gives an impact of 0.578 on business performance (H7) with a t-statistics value of 8.366 ( $> 1.96$ ) and a p-value of 0.000 ( $< 0.05$ ) acceptable. Information sharing was able to provide an increase in business performance (H8) of 0.187 with a t-statistics value of 2.503 ( $> 1.96$ ) and a p-value of 0.012 ( $< 0.05$ ) acceptable. Innovation systems do not significantly impact improving business performance (H9) because the p-value is more significant than 0.05. Finally, SC integration affects business performance (H10) at 0.552, with t-statistics values of 16.305 ( $> 1.96$ ) and p-values of 0.000 ( $< 0.05$ ). The results of testing the research hypothesis found that SC integration improved the company's business performance to increase competitiveness.

## 5.2. Discussion

The analysis found that supply chain (SC) integration affects information sharing. SC integration described in companies in sharing information demand with partners (SCMI4) and the ability to solve problems with partners (SCMI1) can increase information sharing in the company. This condition can be seen as information sharing, illustrated by companies and partners sharing information when there is change (IS1) and knowledge sharing (IS3). This research supports the results of research which state that the company's ability to manage SC integration has an impact on information sharing (Riley et al., 2016; Qiao & Zhao, 2023; Sundaram et al., 2020; Tarigan et al., 2021b). SC integration managed by the company can influence SC quality integration. SC integration set at the company can determine quality improvement by increasing process control under quality standards (Q.In3) and commitment to produce quality products (Q.In5). This study supports the results of research which state that SC integration influences SC quality integration (Machado et al., 2019; Zhong et al., 2016; Phan et al., 2016; Tarigan et al., 2021b; Zhao et al., 2021). SC integration influences the innovation system. These results show that SC integration in the company can consistently produce changes by adjusting the latest technology in the production process (Inn.Sy1) and the company's speed in producing new products (Inn.Sy4). The results of this study confirm the results of research which state that SC integration influences the innovation system (Afraz et al., 2021; Pratono, 2022; Agostini et al., 2020; Botha, 2019; Siagian et al., 2019; Wahyono & Hutahayan, 2021; Ayoub et al., 2017).

Besides, information sharing described by companies and partners sharing information when changes occur (IS1) and companies and partners sharing risk (IS5) influence SC quality integration by forming mutual assistance in solving quality problems (Q.In2). The results of this study confirm the results of the research, which states that information sharing affects SC quality integration (Feng et al., 2023; Liu et al., 2023; Sundaram et al., 2020; Tarigan et al., 2021b; Prajogo & Sohal, 2006). Information sharing influences innovation systems in shaping the creation of continuous process changes in supporting new products (Inn.Sy3) and using technology to produce new products (Inn.Sy5). The results of this study support the results of research which state that information sharing influences innovation systems (Zhang et al., 2023; Yu et al., 2021; Riley et al., 2016; Siagian et al., 2019; Li, 2021; Prajogo & Sohal, 2006). SC quality integration does not have a

significant impact on the innovation system. The disruption of COVID-19 severely impacted several manufacturing companies in East Java, resulting in not investing adequately in the latest technology to improve process and product innovation. The company still focuses on current condition processes and existing products to maintain existing performance. The company applies this to be able to survive and restore performance gradually. This research aligns with Tarigan et al.'s (2021b) research, which states that SC quality integration does not affect the innovation system. This research contradicts the results of research that states SC quality integration affects the innovation system (Machado et al., 2019; Wahyono & Hutahayan, 2021; Phan et al., 2016; Prajogo & Sohal, 2006; Tarigan, 2018; Li, 2021; Yuen & Thai, 2017).

Moreover, SC quality integration provides an impact on business performance. The company's ability to build SC quality is illustrated by the implementation of a continuous improvement quality system (Q.In1), process control following quality standards (Q.In3), and active involvement of external partners in maintaining quality (Q.In6) has an influence on business performance by increasing product quality, demand fulfillment, and customer satisfaction. This study supports the results of research which state that SC quality integration provides an influence on business performance (Machado et al., 2019; Phan et al., 2016; Tarigan, 2021b; Zhao et al., 2021; Zhang et al., 2019; Huo et al., 2019). The results of the processing obtained information sharing can provide an increase in business performance. Information sharing carried out by companies with internal and external partners described as companies and partners can share facilities (IS2), companies and partners share planning effectively (IS4), and companies and partners share risks (IS5) can influence improving business performance. This can be seen from the company's increasing performance with decreasing production costs (Bu.P1) and increasing delivery on time (Bu.P3). The results confirm the results of research which state that information sharing can provide improvements in business performance (Basana et al., 2022; Obonyo et al., 2023; Wang et al., 2023; Hong et al., 2023; Riley et al., 2016; Qiao & Zhao, 2023; Yu et al., 2021; Sundaram et al., 2020).

However, the company's innovation systems do not significantly impact improving business performance. This condition is due to the disruption of the pandemic that occurred and ended in 2020, which has not been able to provide companies with the ability to use processes with new technology facilities. The company still prioritizes current processes and products in maintaining the company's financing and operational income. This research supports contrary to the results of research which states that innovation systems have an impact on improving business performance (Tian et al., 2018; Novijanti et al., 2023; Caniato & Größler, 2015; Siagian et al., 2019; Li, 2021; Wahyono, & Hutahayan, 2021; Cho et al., 2022; Afraz et al., 2021; Falahat et al., 2020; Prajogo & Sohal, 2006; Chong et al., 2011; Tarigan, 2018). The processing results obtained a total influence of SC integration on business performance through information sharing and SC quality. The company's ability to manage internal and external integration as SC integration can improve the company's business performance to increase competitiveness.

These findings could provide new insight for middle-level management to build strong integration with internal partners as cross-functional teamwork maintains the production process's continuity by controlling the quality of processes and products together. Moreover, these results pave the way for top management to encourage external integration and invest in technology to accelerate new processes and product development. Finally, these findings enrich the current theory of resources-based view by increasing the competitiveness of companies through supply chain quality and integration.

## 1 Conclusion

This study examines the influence of supply chain integration on business performance through information sharing, supply chain quality, and innovation systems. The conclusion of the findings is summarized as follows. Supply chain integration positively affects information sharing, supply chain quality integration, and innovation systems. Moreover, supply chain integration, information sharing, and quality integration positively impact business performance. Similarly, information

sharing improves innovation systems. However, SC quality integration did not affect the innovation system. Besides, the innovation system did not affect business performance. The company's ability to build internal integration, supplier integration, and customer integration as a supply chain integration can influence SC quality integration. SC integration results in solving problems, creating new services and products, and improving the innovation system. SC integration also affects information sharing by maintaining information sharing when things change and companies and partners share knowledge. SC quality integration formed with partners who help each other solve quality problems and are jointly responsible for achieving product quality cannot influence the innovation system. SC quality integration is managed by the company with external by implementing a quality system, continuous improvement, and commitment to producing quality products to impact business performance. Information sharing described with companies and partners sharing risk, knowledge, facilities, and planning effectively can improve business performance. The competitiveness built by the company with increased business performance is shown by reducing production costs, improving product quality, ability to deliver on time, demand fulfillment, and customer satisfaction. The company's ability to manage SC integration can improve business performance through information sharing and SC quality integration. Manufacturing companies seek to involve external partners in building the company's competitiveness.

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# THE IMPACT OF SCM INTEGRATION ON BUSINESS PERFORMANCE THROUGH INFORMATION SHARING, QUALITY INTEGRATION AND INNOVATION SYSTEM

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