

The Influence of Information Technology Integration on Firm Performance through Supply Chain Quality and Supply Chain Resilience

by Sautma Ronni Basana

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The Influence of Information Technology Integration on Firm Performance through Supply Chain Quality and Supply Chain Resilience

¹Sautma Ronni Basana, ¹Mariana Ing Malelak, ¹Widjojo Suprpto, ¹Zeplin Jiwa Husada Tarigan,
²Zefanya Valentino Bastanta Tarigan, ³Roxanne O. Doron

²
¹School of Business and Management, Petra Christian University, Siwalankerto 121-131, Surabaya, East Java, Indonesia

² School of Business and Management, Bandung Institute of Technology, Ganesa 10, Bandung, West Java, Indonesia

³Department of Behavioral Science, University of the Philippines, Manila, Philippines

Abstract

Products produced by manufacturing companies are always required to meet the requirements set by customers. Manufacturing companies need to maintain product quality by involving internal company components and external partners by using integrated information technology to become supply chain quality integration. All components in the supply chain flow must be committed to maintaining product quality in their respective roles. The research aims to ensure that technology information integration can impact firm performance through supply chain quality integration and resilience. Data collection on manufacturing companies in Java using purposive sampling found 162 companies that had received ISO certification. Respondents were determined to be employees at the middle management level and had worked for a minimum of 3 years. Data processing used partial least squares version 4 to answer all research hypotheses. The data processing results showed that information technology integration influenced supply chain quality integration by 0.588 and supply chain resilience by 0.523 and had no significant effect on increasing firm performance. Supply chain quality integration influences supply chain resilience by 0.288 and increases firm performance by 0.496. Lastly, Supply chain resilience has a positive and significant effect on increasing firm performance by 0.169. The research results provide a practical contribution to the company's top management in maintaining the role and function of technology information integration and the ISO system in maintaining supply chain quality integration. Theoretical contribution to enrich the theory of total quality management and supply chain management.

Keywords: Technology information integration, supply chain quality integration, supply chain resilience, firm performance

1. Introduction

The globalization of the manufacturing industry is a phenomenon in which the production and distribution processes of manufactured products are spread over the country (Huo et al., 2019). With globalization, manufacturing companies can utilize various resources from various countries to increase efficiency and reduce costs (Anastasia et al., 2024; Tan et al., 2022). The main characteristic of manufacturing globalization is a global supply chain focusing on quality (Liu et al., 2023; Zhang et al., 2019; Machado et al., 2019). Product components are often produced in various countries and then assembled in one location, which may be different (Ju et al., 2021). The company controls the production results to maintain resilience for sustainability (Huang et al., 2023). Companies can use each country's comparative advantages, such as lower labor costs, more advanced technology, or better infrastructure (Christian et al., 2024).

The impact of globalization on the manufacturing industry has far-reaching impacts (Bag et al., 2023). Globalization allows companies to produce products by reducing production costs

(Ambekar et al., 2020). Globalization also benefits companies by increasing economies of scale in producing products as a form of global market (Yuan & Li, 2022). Globalization positively impacts companies because it can expand market share worldwide by increasing the number of customers (Liu et al., 2023). Dependence on global supply chains, which are vulnerable to disruptions, tends to be unstable if events with a global impact occur (Basana et al., 2023). The natural disaster that occurred with the global supply chain crisis during the COVID-19 pandemic is one of the disruptions in the region that can affect the entire global manufacturing system (Ali et al., 2023; Alvarenga et al., 2023; Bag et al., 2023; Frederico et al., 2021).

The globalization of the manufacturing industry is often considered a key driver of industrialization and economic growth (Lim et al., 2022). Many companies move production operations to countries with environmental regulations that can be met, making it easier for companies to operate as a form of resilience (Chowdhury & Quaddus, 2017). Globalization of the manufacturing industry can take advantage of cheap labor and have high productivity (Phan et al., 2021). Manufacturing companies always try to increase profits without eliminating responsibility for the environment (Christian et al., 2024). The globalization of the manufacturing industry is expected to grow and become an advantage for companies in producing products that suit market conditions (Tarigan et al., 2021; Tan et al., 2022). Advances in digital information technology can increase flexibility and responsiveness in facing global market changes (Bui et al., 2023; Sadha et al., 2024; Harianto et al., 2024).

Globalization and integrated information technology have a close relationship and mutually strengthen each other in many aspects of the industry (Alvarenga et al., 2023). Integrated technology in manufacturing companies can be the main driver in accelerating globalization to form supply chain integration (Christian et al., 2024; Putri et al., 2024; Yu et al., 2018). Internet technology, data management software, and computer hardware can integrate company systems (Zhao et al., 2023; Harianto et al., 2024). Data integration in companies allows companies to quickly interact with partners (Chaudhuri et al., 2018). Partners can use information technology in companies to conduct transactions and collaborate in real-time (Anastasia et al., 2024). Using integrated information technology allows companies to manage procurement spread across various countries efficiently and integrated quickly (Frederico et al., 2021).

Globalization allows companies to actively improve operational efficiency (Phan et al., 2021). Information technology allows companies to control all information in the company, making it easier to make the right decisions (Siagian & Tarigan, 2021). Companies can monitor business activities quickly and precisely (Tarigan et al., 2021). Companies utilizing information technology can monitor inventory and manage information correctly (Gu et al., 2021). The company can manage everything in response to external demand (Basana et al., 2023). Integrated information technology in companies has full visibility over supply chain flows so that companies can minimize risks (Azadegan et al., 2019). The company's information technology can organize and ensure timely product delivery (Tarigan & Siagian, 2021). Integrated technology also accelerates companies' ability to communicate and collaborate with external partners (Fayezi & Zomorodi, 2015). Today's small and medium companies can accurately participate in global competition using information technology (Harianto et al., 2024). Companies have widely used information technology applications to compete in international markets through digital systems without having a physical presence in each country (Feng et al., 2023; Sadha et al., 2024). Information technology that has been integrated can reach global consumers more flexibly (Gu et al., 2021). Integrated information technology can adjust services based on customer needs and preferences to create value and achieve satisfaction (Machado et al., 2019). Integrated technology

also enables the business transformation of manufacturing companies to be more adaptive (Bag et al., 2023; Setiawan et al., 2023; Siagian & Tarigan, 2021).

Manufacturing companies strive to give their companies a competitive advantage in producing products (Basana et al., 2022). Manufacturing companies always try to produce quality products according to customer needs (Huo et al., 2019). Quality integration in the supply chain begins with selecting and managing suppliers who can meet the specified requirements and meet the criteria by having high-quality standards (Zhang et al., 2019; Akhtar et al., 2024). Manufacturing companies can work closely with suppliers to ensure that the raw materials or components delivered by suppliers meet strict quality specifications (Yoon & Moon, 2019; Tarigan et al., 2020). The information technology owned by the company can be shared with suppliers so they can access information tailored to the company (Christian et al., 2024). Companies can implement an adequate supplier management system to assist in procuring quality raw materials (Soares et al., 2017; Basana et al., 2024). Companies can also use information technology related to information and product quality owned by suppliers (Ambekar et al., 2020). Information technology can monitor supplier quality performance in real time (Phan et al., 2021). The integration used with information technology in companies can ensure product quality meets the standards desired by customers (Machado et al., 2019).

Integrated information technology allows companies to be integrated with external parties in the supply chain flow, namely supply chain integration (Yu et al., 2018; Soesetyo et al., 2024; Tarigan et al., 2021; Putri et al., 2024). Information technology in companies can use historical and real-time data to identify supplier and customer resilience (Gu et al., 2021; Huo et al., 2024; Setiawan et al., 2023). Companies can quickly control the system for receiving raw material quality by using information technology (Frederico et al., 2021; Yoon & Moon, 2019). Companies can also control the quality of ongoing production processes in production areas by using information technology (Zhao et al., 2021). Companies can use integrated information technology to record production process trends to maintain quality products (Harianto et al., 2024). Companies can also quickly find the number of quality products stored in the warehouse using information technology (Pirmanta et al., 2022; Yuan & Li, 2022). Another condition is that companies can see many non-compliant products during the production process and raw materials that do not meet the criteria of suppliers (Yoon & Moon, 2019; Tarigan et al., 2020). The company's ability to obtain information regarding the incompatibility of raw materials and product results can be controlled quickly (Talib et al., 2011). The company's information technology system can support automatic quality control (Sarkar & Seo, 2021; Putri et al., 2024). Companies can check each stage of the process quickly so that it is easy to verify product criteria at each production stage in the supply chain (Chaudhuri et al., 2018). The company also has a good record of defects or deviations made at each process stage (Phan et al., 2021). This condition allows companies to provide early warnings to take corrective action before the problem becomes bigger as a form of preparedness for supply chain resilience (Li et al., 2017; Siagian et al., 2021). Quality control carried out by the company at each stage of the supply chain to ensure it produces products that meet customer requirements is said to be quality integration (Basana et al., 2024; Bastas & Liyanage, 2018).

Quality integration ensures the company can control the supply chain by meeting established standards (Bui et al., 2023). Companies establish standardization to help minimize variability in production processes in producing products to avoid nonconformities (Talib et al., 2011). Companies can identify early potential errors that could be a source of disruption in the supply chain to remain sustainable in supply chain quality (Bastas & Liyanage, 2018; Li et al., 2017). A standardized supply chain process in a company can prevent delays that can disrupt the

smooth running of the supply chain (Liu et al., 2023; Munir et al., 2022). A company's ability to maintain process continuity to be able to survive and recover from disruptions or unexpected changes is said to be supply chain resilience (Abeysekara et al., 2019; Cheng & Lu, 2017; Huo et al., 2024; Orlando et al., 2021). Quality monitoring and control are carried out continuously along the supply chain flow, called supply chain quality integration (Machado et al., 2019). Information technology allows companies to monitor product quality promptly (Chunsheng et al., 2020). Information technology allows companies to monitor the quality of production processes in real time to detect potential problems before they cause major disruptions that impact supply chain resilience (Alvarenga et al., 2023).

Information technology is integrated into companies by ensuring that product quality can be maintained adequately (Zhao et al., 2021). Quality integration using information technology can provide more accurate and relevant data (Pirmanta et al., 2022). The company's integrated quality management system makes it easy for management to access real-time information regarding product quality (Huo et al., 2019). Management can also trace the products produced by paying more detailed attention to the product manufacturing process from the initial stage to the end of the product (Tarigan et al., 2021). Management can also monitor the use of quality raw materials by using information technology available in the company (Fayezi & Zomorodi, 2015; Soares et al., 2017). The company's existing data provides adequate information for management to make the right decisions (Huang et al., 2023). Company management can allocate adequate resources to maintain product quality (Phan et al., 2021). Company management can also plan the need for quality raw materials (Frederico et al., 2021; Yoon & Moon, 2019) and quality processes in developing new products to meet market needs or direct customer requests (Li, 2021). Management's ability to use information technology strengthens quality supply chain integration (Chaudhuri et al., 2018). Decisions made by the company using data optimally can provide accuracy in determining decisions based on the company's external conditions to build resilience (Cheng & Lu, 2017). The results of the decisions can reduce uncertainty for the company and increase strong competitiveness for achieving the business strategy that has been determined (Huo et al., 2024).

The company's supply chain quality integration impacts the company's performance in producing quality products (Bastas & Liyanage, 2018). The quality integration that a company has can impact process efficiency to increase the company's overall efficiency (Zhong et al., 2016; Akhtar et al., 2024). Supply chain integration involving company suppliers can increase product innovation performance produced by customer expectations (Lim et al., 2022). Companies can also provide satisfaction to customers by increasing the quality of the products produced to increase competitiveness (Zhao et al., 2021). Supply chain quality integration encourages companies to achieve better operational results with certain values and involves all departments to control quality (Machado et al., 2019). The increasingly competitive business competition allows companies to integrate quality into every process to survive in making changes with high performance (Li, 2021).

Supply chain resilience determines company performance in an era of globalization and increasing uncertainty (Adobor & McMullen, 2018; Shukor et al., 2021). A resilient supply chain can face various disruptions to recover quickly (Ali et al., 2023; Frederico et al., 2021). Companies always try to adapt to changes that occur externally, so speed and accuracy are needed to respond to these changes by making rapid adaptations to the company by increasing supply chain resilience (Carissimi et al., 2023; Huang et al., 2023; Orlando et al., 2021). The company tries to maintain stability from disturbances that occur by maintaining the availability of raw materials (Harianto et

al., 2024). Companies can also manage product distribution continuously to meet customer needs (Machado et al., 2019). Companies with resilient supply chains can quickly adapt (Chowdhury & Quaddus, 2017). In order to maintain supply chain resilience, companies must try to find alternative suppliers (Cheng & Lu, 2017). When a company experiences production continuity problems, it must anticipate shifting production to facilities unaffected as a supply chain resilience alert (Li et al., 2017). Company flexibility with supply chain resilience supported by resource allocation and organizational culture allows companies to maintain production continuity (Siagian et al., 2021; Tan et al., 2022) and meet customer demand, which ultimately has a positive impact on company performance (Chunsheng et al. al., 2020; Huo et al., 2024; Munir et al., 2022)

Based on the explanation above, four general research questions can be determined. First, determine the influence of Information Integration technology on supply chain quality, supply chain resilience, and firm performance. Second, get the determined effect of the influence of supply chain quality on supply chain resilience and firm performance. Third, get the determined effect of the influence of supply chain resilience on firm performance.

2. Literature Review

2.1. Information Technology Integration

Information technology integration in companies improves company performance (Anastasia et al., 2024). A company's ability to combine information from various functions within and externally can increase operational efficiency (Feng et al., 2023). Integrated information technology can help companies make quick and appropriate decisions to suit organizational needs (Ambekar et al., 2020; Siagian & Tarigan, 2021). Information technology used in companies daily can help all components to innovate for the company (Soesetyo et al., 2024). Information technology enables companies to comply with applicable regulations to support increased performance (Sadha et al., 2024). Increasing company competitiveness and achieving overall business goals will be more effective in utilizing information technology adequately (Harianto et al., 2024). One of the main aspects of implementing integrated information technology is that it can increase data visibility across all department functions (Basana et al., 2023). In companies, many different functions provide different data according to their roles, so they are spread across various systems, making it difficult to get an overall picture of company performance without using information technology (Huang et al., 2023). The company's ability to integrate information in every part of the company so that system automation occurs so that it has access to relevant and up-to-date data (Sarkar & Seo, 2021), thus enabling faster and more precise analysis and decision-making in the supply chain (Christian e al., 2024).

Technology information integration in companies can provide data in real-time, especially inventory data contained in the warehouse, which can be accessed by all related departments (Pirmanta et al., 2022; Sadha et al., 2024). Data contained in other departments can be accessed to support analytical needs for companies to adapt quickly (Ju et al., 2021; Zhao et al., 2023). The company's ability to provide large data allows companies to adopt technology to provide independent analysis to help determine decisions (Yu et al., 2018); Setiawan et al., 2023). Companies can provide data in managing information to remain relevant and highly competitive (Chaudhuri et al., 2018). Integrated information technology in companies can provide intensive coordination between all supply chain components to overcome problems (Alvarenga et al., 2023; Siagian et al., 2022). Information technology in companies can provide strategic decision-making because they have comprehensive data (Ju et al., 2021).

2.2. Supply chain quality integration

The company has involved suppliers in maintaining the quality of raw materials according to criteria set as standards (Talib et al., 2011; Zhong et al., 2016; Yoon & Moon, 2019). The company has built partnerships with suppliers to play an active role in maintaining product quality (Machado et al., 2019). The company has also built good relationships with customer partners so that they can provide the required product requirements in a clear and detailed manner so that the company can easily understand them (Zhang et al., 2019). The company can involve external partners to maintain quality continuously and remain sustainable (Bastas & Liyanage, 2018). The participation of suppliers in maintaining quality in the company and the activeness of customers in determining the quality required in an integrated manner with the company is said to be supply chain quality integration (Basana et al., 2024). Companies are trying to build increased competitiveness by involving all components in the supply chain to maintain quality and produce efficient and effective internal processes (Huo et al., 2019). The company tries to encourage a competitive level for all members in the supply chain flow to control quality at all stages of the process to produce products that have an excellent quality business strategy (Zhao et al., 2021).

Companies can involve internal functional roles by involving all departments to maintain the quality of processes and products to meet customer quality requirements (Tarigan et al., 2021; Phan et al., 2021). High operational performance can produce a quality product or service to increase productivity and customer satisfaction (Li, 2021). Quality integration in the supply chain ensures that every organizational element contributes to achieving consistent and high-quality standards (Liu et al., 2023). Implementing quality integration requires cross-functional collaboration within the company to control quality in each business process (Lim et al., 2022; Akhtar et al., 2024). The use of information technology in companies integrates all departments to access data from other departments to maintain product quality on an ongoing basis (Huang et al., 2023). All company resource components are committed to continuous improvements to ensure long-term success (Basana et al., 2022).

Cross-functional collaboration in the company is an important component in quality integration to produce value and final customer satisfaction in this marketplace (Machado et al., 2019). All functions in the company need to work together to ensure that all aspects of quality are met to meet customer requirements (Talib et al., 2011). Functions in the company clearly understand their responsibilities in achieving the same product quality goals to produce consistency and high performance (Phan et al., 2021). Quality integration is defined in manufacturing companies as an activity that involves internal functions and external partners in producing quality products or services (Zhang et al., 2019).

2.3. Supply chain resilience

Supply chain resilience in the manufacturing sector is a supply chain system's ability to respond and adapt to disruptions or changes that occur (Adobor & McMullen, 2018; Siagian et al., 2021). Companies must create good designs to build adequate collaboration with suppliers and customers (Abeysekara et al., 2019; Frederico et al., 2021). Companies can build systems that can respond quickly to disruptions along the supply chain flow by providing sufficient flexibility to adapt quickly in real time (Alvarenga et al., 2023; Munir et al., 2022; Wills et al., 2016). Companies can build strong relationships with supplier partners and customers (Ali et al., 2023; Yuan & Li, 2022). Manufacturing companies can face external disruptions in the form of political instability and economic fluctuations so that they continue to operate well in producing products (Carissimi et al., 2023). Partnerships built by manufacturing companies with suppliers can provide

responsibility in providing diversified raw materials as supplier resilience and accurate delivery as customer resilience (Yoon & Moon, 2019; Gu et al., 2021). Companies can build good partnerships with many suppliers to overcome the problem of raw material availability (Bag et al., 2023; Soares et al., 2017). Good and established relationships with suppliers enable manufacturing companies to have resilience and resilience in facing problems because they have reliable suppliers (Chunsheng et al., 2020). This condition impacts manufacturing companies' ability to have high flexibility in operations (Azadegan et al., 2019; Shukor et al., 2021). Companies have systems that can tolerate sudden disruptions (Munir et al., 2022). Companies will act intensively when disruptions in the supply chain flow exceed predetermined standard values (Huo et al., 2024). This condition makes companies respond quickly to changes by maintaining stability with the right sourcing strategy (Frederico et al., 2021). The company has an adequate system to determine appropriate and fast responsiveness in overcoming vulnerabilities (Munir et al., 2022; Zhao et al., 2023). Supply chain resilience consists of the company's ability to form absorptive, response, and recovery capabilities to improve supply chain performance (Zhao et al., 2023).

Supply chain resilience is not only about preventing disruptions but also about the ability to recover quickly from sudden events to return to normal operations with levels of preparedness, alertness, and agility in supply chain resilience (Li et al., 2017). Manufacturing companies with a strong recovery plan can increase rapid response to overcome disruptions to produce high performance (Sadha et al., 2024). Manufacturing companies can create operational strategies and procedures to overcome emergency conditions and be able to collaborate with partners (Ju et al., 2021). The ability of manufacturing companies to build emergency systems will help them be better prepared to face unexpected events (Huo et al., 2024; Setiawan et al., 2023). Rapid recovery ensures that negative impacts on production and customers can be minimized so that operations return to normal quickly (Huang et al., 2023). Manufacturing companies continuously build resilient supply chains to win the competition (Orlando et al., 2021; Siagian et al., 2022). Manufacturing companies that pay attention to sustainable practices using environmentally friendly raw materials can increase supply chain resilience (Chunsheng et al., 2020; Tan et al., 2022).

2.4. Firm performance

Company performance is an achievement made by a company related to maintaining product or service quality that meets customer expectations (Anastasia et al., 2024). Company performance can impact increasing competitiveness (Christian et al., 2024). Manufacturing company performance achievements result from various interrelated factors to increase competitiveness: cost, quality, and delivery (Nenavani & Jain, 2022). Company performance can be demonstrated by efficiently using raw materials that meet supplier standards (Yoon & Moon, 2019; Soares et al., 2017). Companies try to increase productivity by producing product volumes using smaller resources to benefit the company (Gu et al., 2021). Product quality is one of the factors for companies to produce suitable products according to customer requests by meeting predetermined standards (Basana et al., 2024). Companies can ask for input from customers regarding the resulting quality standards so that continuous improvements can be made (Huo et al., 2019; Yu et al., 2018). Basana et al. (2022) state that operational business performance is quality products according to customer orders, reduced lead time, competitive position in the market, increasing product development volume, and increasing product exports. The product quality performance produced by the company is to be closer to customers so that they can involve customers in the company's processes so that company resources can be used efficiently and

effectively (Zhong et al., 2016). Company performance provides a clear direction for all components to reduce waste and increase profits (Tarigan et al., 2021). Companies can use existing data to assess performance achievements for each period (Harianto et al., 2024). Performance achievement should align with the company's goals to produce a competitive advantage (Sadha et al., 2024; Setiawan et al., 2023).

2.5. Relationships Between Research Concepts.

2.5.1. Information technology integration towards supply chain quality integration.

Integration information technology is important for companies to be able to synchronize data and information contained in various functions in the company (Yu et al., 2018) so that it can be combined to be able to create meaningful information to determine the right decisions (Feng et al., 2023; Harianto et al., 2024). Integrated information technology can reduce asymmetry between supply chain members and increase supply chain quality integration (Machado et al., 2019). Integrated information technology in companies can create cross-functional integration, including departments responsible for quality control (Basana et al., 2023). Digitally connected integration information technology plays an important role in improving the quality of information from the initial process of procuring raw materials to the final process of producing quality products in supply chain integration (Chaudhuri et al., 2018; Soesetyo et al., 2024). Information integration in companies produces compatible data to take the right steps in maintaining product or service quality in the supply chain flow (Phan et al., 2021). Technology information integration of physical example actuators, sensors, and system applications for programming enterprise resources planning to provide the quality module to monitor the quality and reliability of the product (Bui et al., 2023). Integrated information technology can improve supply chain quality integration (Machado et al., 2019; Setiawan et al., 2023). Management can maintain the role of all functions by focusing on quality to meet the requirements set by customers (Huo et al., 2019). Based on the explanation, the following hypothesis can be established:

H1: Information technology integration influences increasing supply chain quality integration

2.5.2. Information technology integration towards supply chain resilience.

Information technology integration in manufacturing companies has made cross-functional data adequate to provide practical conditions for the company's internal response strategy (Azadegan et al., 2019). Technology information integration, along with information technology for exploitation, exploration, and speed, impacts supplier and customer resilience (Gu et al., 2021). Various departments can find out the real condition of the company according to the access rights granted (Siagian et al., 2022). Management obtains complete and accurate information from various functions spread across the company to make decisions in overcoming disruptions to the company, thereby increasing supply chain resilience (Alvarenga et al., 2023). Digital technology used in companies using technology in data entry and integration has a significant impact on supply chain resilience (Sadha et al., 2024). The company's technology can combine valid information based on integrated and reliable data to overcome potential problems and maintain a strong supply chain resilience process (Chunsheng et al., 2020; Siagian et al., 2021). Information technology is a process of reengineering resilience to increase efficiency (Adobor & McMullen, 2018; Yuan & Li, 2022). Information quality integration technology at 322 logistics companies in China has impacted logistics services on supply chain resilience (Ju et al., 2021). Advanced information technology allows management to take appropriate steps to overcome disruptions by building collaboration and visibility to increase supply chain resilience (Huang et al., 2023). Supply chain

risk information sharing and analysis impact supply chain resilience in 216 supply chain finance companies (Yuan & Li, 2022). Supply chain digitalization with electronic applications for coordinating internal and external processes and processing administration in real time and accurately impacts supply chain resilience (Setiawan et al., 2023). Based on the explanation, the following hypothesis can be established:

H2: Information technology integration influences increasing supply chain resilience.

2.5.3. Information technology integration on firm performance.

Integrated information technology allows organizations to get a complete and accurate picture of performance achievements in a certain period (Christian et al., 2024). Companies can also determine periodic growth or decline in performance. Companies can identify opportunities for improvement in all company functions to generate operational efficiency. Information and communication technology impacts firm performance through purchasing strategies at 138 Center for Monitoring Indian Economy companies (Ambekar et al., 2020). The infrastructure technology used by companies to collect data and share information with external partners can impact operational performance (Anastasia et al., 2024). Supply chain integration in companies by implementing information integration technology impacts firm performance through lean manufacturing, green supply chain management, and risk management (Christian et al., 2024). Manufacturing companies can use integrated information to identify discrepancies in internal functions so that the collaboration process becomes easier and more efficient (Siagian et al., 2022). When internal data has been integrated comprehensively based on information technology, company management can make quick and appropriate decisions to improve company performance (Setiawan et al., 2023). Management can use integrated information technology as a reference for responding to market changes and increasing dynamic flexibility to provide customer satisfaction (Shukor et al., 2021; Putri et al., 2024; Wills et al., 2016). Based on the explanation, the following hypothesis can be established:

H3: Information technology integration influences increasing firm performance.

2.5.4. Supply chain quality integration on supply chain resilience and firm performance.

Quality integration in manufacturing companies refers to the application of quality principles and practices throughout the supply chain, starting from suppliers with procurement of raw materials, quality production processes, and up to customers by receiving appropriate and timely products (Yoon & Moon, 2019; Huo et al., 2019). Supply chain quality integration ensures that companies can face disruptions and continue to function effectively in maintaining sustainability, thus impacting supply chain resilience (Bag et al., 2023). Supply chain quality integration manufacturing companies apply high-quality standards according to customer criteria by maintaining consistency at every stage of procurement, production, and distribution (Zhao et al., 2021). All components in the company can control quality, which is an important process to ensure products meet quality standards and minimize defective products, supporting supply chain resilience (Bastas & Liyanage, 2018). Supply chain risk management culture can provide a good quality integration process (Abeysekara et al., 2019). The supply chain resilience that is formed can be coordinated with supply chain members to reduce vulnerability to product defects (Ali et al., 2023). The company makes the products produced in product modularity to be able to maintain durability so that it is more flexible, it has an impact on supply chain quality integration so that it is easy to plan, schedule, and design (Tarigan & Siagian, 2021). Supply chain quality management can increase transparency by using integrated information technology to identify and respond to

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various changes and customer needs, thereby increasing responsiveness and flexibility in the form of supply chain resilience (Bui et al., 2023; Nenavani & Jain, 2022; Shukor et al., 2021).

Supply chain quality integration ensures that each stage of the production process complies with established quality standards (Akhtar et al., 2024). Product quality is integrated with the entire production process with the right production time without spending time on repairs and returns, resulting in high productivity (Li, 2021). Quality integration formed in the supply chain with consistent quality control contributes to company performance by reducing production costs (Basana et al., 2024). Supply chain quality integration in companies impacts company performance by increasing product quality, delivery, cost of quality, and flexibility in High-Performance Manufacturing (HPM) projects from 10 countries (Huo et al., 2019). Companies can reduce the use of raw materials because they have products according to customer orders, resulting in increased company performance (Zhao et al., 2021; Siagian et al., 2022). Companies can produce high product quality through supply chain quality integration by meeting customer expectations and having an impact on customer loyalty (Machado et al., 2019). Companies can build collaboration with external partners to generate profits in a competitive market (Tarigan et al., 2021). Companies can increase production flexibility as one of the company's performances with supply chain quality integration when they can respond quickly to changes in market demand to build supply chain resilience (Adobor & McMullen, 2018; Siagian et al., 2021). Supply chain quality integration can improve firm performance in product and service quality and customer satisfaction (Bui et al., 2023). Supply chain quality integration by improving product quality can improve company performance by increasing market stock (Liu et al., 2023). A company's ability to maintain production sustainability without sacrificing quality can improve company performance (Lim et al., 2022; Zhong et al., 2016). Supply chain integration in manufacturing companies can improve firm performance by adopting green supply management using environmentally friendly raw materials (Christian et al., 2024). Based on the explanation, the following hypothesis can be established:

H4: Supply chain quality integration influences increasing supply chain resilience.

H5: Supply chain quality integration influences increasing firm performance.

2.5.5. Supply chain resilience on Firm performance.

Supply chain resilience is important for companies as a form of the supply chain's ability to run normally when recovering from disruptions and maintain the company's long-established performance. (Gu et al., 2021; Siagian et al., 2021). When the supply chain can recover quickly from disruptions, the company can continue to operate normally without experiencing major disruptions in maintaining the production process's continuity to maintain company finances and improve company performance (Li et al., 2017). Companies can survive conditions of high uncertainty by making quick responses to increase high flexibility, which impacts company performance (Shukor et al., 2021; Munir et al., 2022; Setiawan et al., 2023). The flexibility allowed the company to increase new market opportunities, contributing to increased performance (Wills et al., 2016). Proactive risk management in the supply chain helps improve company performance by identifying and overcoming potential problems before they become major disruptions and impact customer satisfaction and financial performance (Huo et al., 2024). Implement an effective risk management system with knowledge preparedness to ensure the company is ready to face emergencies and maintain smooth operations, thereby improving company performance (Orlando et al., 2021). Supply chain resilience with agility in 89 Sri Lankan apparel manufacturers has an impact on firm performance and competitive advantage (Abeysekara et al., 2019). Supplier and

customer resilience impact supply chain performance by creating speed in fulfilling customer orders and company accuracy in delivering products on time (Gu et al., 2021). Supply chain resilience in companies, along with the company's ability to survive in emergency conditions and provide services in emergency conditions, influences supply chain performance (Sadha et al., 2024). Supply chain quality integration, which consists of internal quality integration and supplier quality integration, impacts the competitive performance of 317 manufacturing plants in ten countries (i.e. Austria, China, Finland, Germany, Italy, Japan, Spain, South Korea, Sweden, and USA) (Huo et al., 2019). In contrast, customer quality integration does not influence competitive performance.

The sixth hypothesis can determine this explanation:

H6: Supply chain resilience influences increasing firm performance.

1 Based on the explanation above, the following research model can be determined:

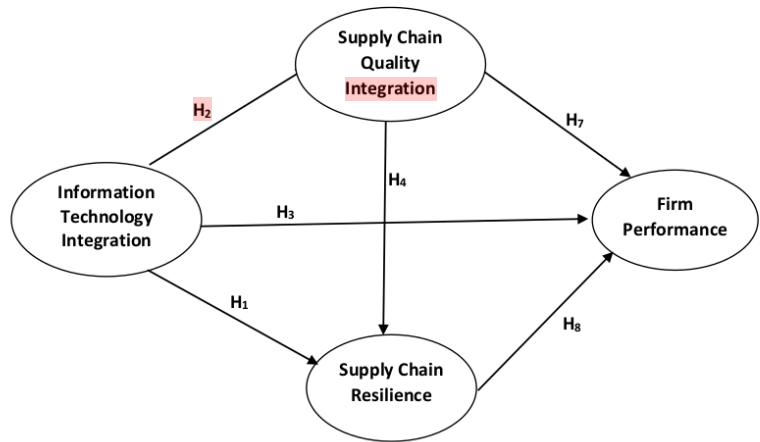


Figure 1. Research conceptual framework

3. Research Methods

The research method used is quantitative research, which tests the relationship between the independent variable and the dependent variable. This research examines the effect of information technology integration on firm performance through supply chain quality integration and supply chain resilience. Research determines operational variables to provide detailed understanding and precise measurements in research. The research determined that information technology integration is the technology companies use to integrate functions within the company in real time. The measurement items specified for information technology integration are: cross-functional

integration is going well (IT1) (Ambekar et al., 2020; Harianto et al., 2024; Putri et al., 2024; Setiawan et al., 2023), cross-functional can access data warehouse (IT2) (Harianto et al., 2024; Putri et al., 2024; Sadha et al., 2024; Shukor et al., 2021), share information in real time cross-functional (IT3) (Anastasia et al., 2024; Harianto et al., 2024; Sadha et al., 2024; Shukor et al., 2021), quality data reports can be monitored continuously (IT4) (Sadha et al., 2024; Setiawan et al., 2023) and cross-functional coordination related to quality is carried out every day (IT5) (Putri et al., 2024; Setiawan et al., 2023).

Supply chain quality integration is an integration of quality control by a company by involving external partners in producing products to meet customer expectations. The measurement item determined for supply chain quality integration is the achievement of quality analysis accessible to all departments (SCQ11) (Zhang et al., 2019; Huo et al., 2019), all departments are committed to maintaining quality (SCQ12) (Zhang et al., 2019; Huo et al., 2019; Phan et al., 2021; Tarigan et al., 2021), quality control is carried out all departments (SCQ13) (Huo et al., 2019; Phan et al., 2021; Tarigan et al., 2021), quality issues are coordinated by leadership periodically (SCQ14) (Zhang et al., 2019) and involve partners in maintaining company product quality (SCQ15) (Zhang et al., 2019; Huo et al., 2019; Tarigan et al., 2021; Yu et al., 2019). Supply chain resilience is the ability of a manufacturing company's supply chain system to adapt to disruptions or changes that occur to return to normal. The measurement items determined for supply chain resilience are being able to restore product quality if it is not suitable (SCR1) (Alvarenga et al., 2023; Munir et al., 2023; Li et al., 2017; Setiawan et al., 2023), quality production can recover quickly (SCR2) (Ali et al., 2023; Alvarenga et al., 2023; Sadha et al., 2024), companies can adapt quickly to the quality system (SCR3) (Ali et al., 2023; Alvarenga et al., 2023; Munir et al., 2022; Sadha et al., 2024) and companies can control high product quality (SCR4) (Munir et al., 2022; Setiawan et al., 2023).

Firm performance is an achievement made by a company that is related to maintaining product or service quality and matching customer expectations by involving all functions. The measurement item determined for firm performance is that the company produces product quality according to standards (FP1) (Ambekar et al., 2020; Basana et al., 2024; Zhang et al., 2019; Bui et al., 2023; Huo et al., 2019; Tarigan et al., 2021; Huo et al., 2024), companies can increase flexibility (FP2) (Zhang et al., 2019; Huo et al., 2019; Tarigan et al., 2021; Christian et al., 2024), companies can increase customer satisfaction (FP3) (Basana et al., 2024; Basana et al., 2022; Bui et al., 2023; Huo et al., 2019; Tarigan et al., 2021; Christian et al., 2024; Gu et al., 2021; Huo et al., 2024), companies can deliver products on time (FP4) (Basana et al., 2024; Basana et al., 2022; Zhang et al., 2019; Huo et al., 2019; Tarigan et al., 2021) and companies can meet customer demands (FP5) (Basana et al., 2024; Basana et al., 2022; Huo et al., 2019; Tarigan et al., 2021; Christian et al., 2024; Researchers used a questionnaire with a Likert scale to collect data on manufacturing companies in Java. The researcher determined the questionnaire items with a value of 1, which indicates strongly disagree, to a value of 5, which indicates strongly agree. The questionnaire was distributed to manufacturing practitioner respondents using a Google form whose link was sent to respondents who had worked for at least three years and had a role in maintaining the quality of the company's products or services. The second criterion is that manufacturing companies fall into the medium manufacturing category with more than 20 employees. The sampling technique used is purposive sampling based on predetermined criteria. The distribution was made to manufacturing companies as many 162 respondents over two years, funded by research grants from the Indonesian government. Researchers distributed links to practitioners assisted by ten enumerators who already had strong relationships with the

manufacturing industry. Data analysis used smartPLS version 4, which has been partially licensed for one year. Analysis can be used to obtain outer model and inner model tests.

The results of distributing questionnaires to manufacturing companies could be further processed by 162 respondents with different characteristic compositions. The distribution was 89 male (55%) and 73 female (45%). Profile of respondents based on working in departments related to quality responsibilities in marketing 24 people (15%), planning production totaling 28 people (17%), production process 32 people (20%), purchasing and procurement 45 people (28%) and warehouse as many as 33 people (20%). Respondent's positions in the company's organizational structure, it was found that there were 11 top management positions (director/general manager) (7%), 45 department managers (28%), 23 supervisors (14%), and 83 supervisors (51%). Work experience in the company with experience of 3 to < 5 years amounted to 29 people (18%), 5 to < 10 years amounted to 46 people (28%), and more than 10 years of experience amounted to 87 people (54%). The last level of education held by respondents was in two categories, namely undergraduate, totaling 140 people (86%), and postgraduate, totaling 22 people (14%). Characteristics of respondents with companies that have 20 to< 100 employees totaling 113 people (70%) and more than 100 employees are 49 people (30%). The outer model test is shown by the validity and reliability values in Table 1.

Table 1. The goodness of item measurement

Item Measurement	Mean	Loading Factor	Composite reliability	Cronbach alpha	R-Square
Information technology integration	4.420		0.891	0.845	0.000
Cross-functional integration is going well (IT1)	4.488	0.827			
Cross-functional can access data warehouse (IT2)	4.389	0.631			
Sharing information in real-time cross-functional (IT3)	4.444	0.858			
Quality data reports can be monitored continuously (IT4)	4.407	0.831			
Cross-functional coordination related to quality is carried out every day (IT5)	4.370	0.775			
Supply chain quality integration	4.111		0.845	0.774	0.459
Achievement of quality analysis can be accessed by all departments (SCQ11)	4.352	0.823			
All departments are committed to maintaining quality (SCQ12)	4.340	0.646			
Quality control is carried out by all departments (SCQ13)	4.204	0.780			
Quality issues are coordinated by leadership periodically (SCQ14)	3.784	0.588			
Involving partners in maintaining the quality of the company's products (SCQ15)	3.877	0.759			
Supply chain resilience	4.264		0.885	0.827	0.346
Can restore product quality if it is not suitable (SCR1)	4.228	0.786			
Production quality can be recovered quickly (SCR2)	4.229	0.801			
Companies can adapt quickly to the quality system (SCR3)	4.340	0.848			
The company can control high product	4.259	0.808			

quality (SCR4)					
Firm Performance	3.988		0.824	0.732	0.534
The company produces product quality according to standards (FP1)	4.130	0.581			
Companies can increase flexibility (FP2)	3.315	0.624			
Companies can increase customer satisfaction (FP3)	4.346	0.755			
The company can deliver products on time (FP4)	4.049	0.759			
The company can fulfill customer requests (FP5)	4.099	0.749			

Table 1 shows that the mean value for information technology integration is 4.420, which shows that the company already has an adequate and real time data integration system that all departments can access to help determine decisions. The company's ability to manage quality, as shown in the supply chain quality integration variable, obtained a mean value of 4.111. Quality integration is shown in Table 1, where the company has implemented a quality system starting from the process at supplier partners, the production process involving all departments, and the delivery of finished products to customers. Supply chain resilience is formed in manufacturing companies with a mean value of 4.264, which shows that the resilience formed in the company is adequate. The company can easily adapt to customer requests according to criteria with high flexibility, making it easy to maintain quality in normal conditions. Firm performance formed in companies with a mean of 3.988 in the good category. The company's performance achievements are good, but flexibility needs to be increased to meet changes in customer demand, especially in delivery schedules and volumes.

Testing the outer model shown in Table 1 with the loading factor value obtained for the information technology integration variable was at a value of 0.631-0.858, supply chain quality integration with a loading factor at a value of 0.588-0.823, for supply chain resilience it was between 0.786-0.848 and finally at firm performance with a loading factor between 0.581-0.759. The outer model examiner declared the validity test valid because all measurement items had a loading factor greater than 0.500. The outer model test for reliability shown in composite reliability and Cronbach alpha is greater than 0.700. Table 1 shows that all variables have met the reliability value. Where the smallest composite reliability value is found in the firm performance variable 0.824 and Cronbach alpha 0.732. The R-square value is obtained at supply chain quality integration 0.459, supply chain resilience 0.346, and firm performance 0.534. The results of the R-square value show a Q-square value of $Q^2 = 1 - [(1 - 0.459)(1 - 0.346)(1 - 0.534)] = 1 - 0.165 = 0.835$. Firm performance formed in a company is determined by information technology integration, supply chain quality integration, and supply chain resilience of 83.52%, so it can be said that the model has a high predictive relevance value.

4. Research Inferential Analysis

The results of distributing questionnaires to answer the research hypothesis are shown in Table 2 of the research hypothesis test, and the results of the research model structure in Figure 2. The research hypothesis is accepted if the p-value is below 0.05 or the -statistic exceeds 1.96.

Table 2. Results hypothesis testing of research

Hypothesis testing of research	Original sample	T-statistics	P-values
Information Technology Integration -> Supply Chain Quality Integration	0.588	13.061	0.000
Information Technology Integration -> Supply Chain Resilience	0.523	6.716	0.000
Information Technology Integration -> Firm Performance	0.093	0.959	0.338
Supply Chain Quality Integration -> Supply Chain Resilience	0.288	3.658	0.000
Supply Chain Quality Integration -> Firm Performance	0.496	6.016	0.000
Supply Chain Resilience -> Firm Performance	0.169	1.969	0.042

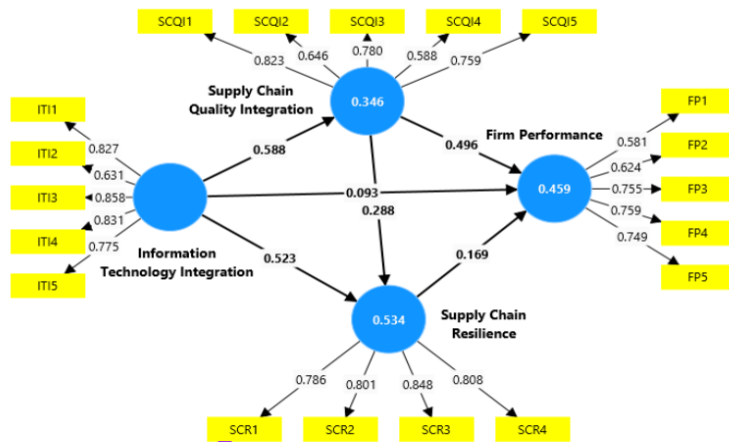


Figure 2. Results of the research model structure

The data processing results are obtained using partial least square version 4 to determine the correlation between the six hypotheses in Table 2 and Figure 2. The first hypothesis (H1) with information technology integration influences increasing supply chain quality integration with a t-statistic of 13.061 and p-value 0.000, so the first hypothesis is accepted. Information technology integration in companies has a positive and significant effect of 0.588 on increasing supply chain quality integration. Second, information technology integration influences increasing supply chain resilience with a t-statistic of 6.716 and a p-value of 0.000, so the hypothesis is accepted. It can be stated that information technology integration has a positive and significant effect on increasing supply chain resilience by 0.523. The third hypothesis formulated with information technology

integration influences increasing firm performance with a t-statistic of 0.959 and a p-value of 0.338, so the hypothesis is rejected. Information technology integration in companies does not have a significant effect on increasing firm performance. Supply chain quality integration influences increasing supply chain resilience as the fourth hypothesis with a t-statistic of 3.658 and a p-value of 0.000, so the hypothesis is accepted. It can be stated that supply chain quality integration has a positive and significant effect on increasing supply chain resilience by 0.288. The fifth hypothesis, supply chain quality integration influences increasing firm performance with a t-statistic of 6.016 and a p-value of 0.000, so the hypothesis is accepted. These results indicate that supply chain quality integration positively and significantly increases firm performance by 0.496. The sixth final hypothesis, supply chain resilience, influences increasing firm performance with a t-statistic of 1.969 and p-value of 0.042, so the hypothesis is accepted. These results indicate that supply chain resilience positively and significantly increases firm performance by 0.169. The overall results of the hypothesis show that information technology integration, supply chain quality integration, and supply chain resilience can improve firm performance.

5. Discussion

The results of analytical data processing show that information technology integration has a positive and significant effect on increasing supply chain quality integration by 0.588. Integration information technology in the company makes cross-functional integration work well so that quality data reports can be monitored continuously and in real-time, which has an impact on supply chain quality integration by creating quality analysis that all departments and quality issues can access can be coordinated by leadership periodically. Integration information technology is a tool for leaders in quality control. The research results support the research results which state that information technology integration influences increasing supply chain quality integration (Machado et al., 2019; Basana et al., 2023; Chaudhuri et al., 2018; Soesetyo et al., 2024; Setiawan et al., 2023).

Information technology integration has a positive and significant effect on increasing supply chain resilience by 0.523. Integration information technology can share information in real-time, cross-functionally, and with quality-related coordination carried out every day, impacting supply chain resilience. The company's ability to create a coordination program means that product quality restoration can be done quickly if it is unsuitable, and the company can adapt quickly to the quality system. The research results support the research results which state that information technology integration influences increasing supply chain resilience (Gu et al., 2021; Alvarenga et al., 2023; Sadha et al., 2024; Chunsheng et al., 2020; Siagian et al., 2021; Adobor & McMullen, 2018; Yuan & Li, 2022; Ju et al., 2021; Huang et al., 2023; Yuan & Li, 2022; Setiawan et al., 2023). Information technology integration in companies does not have a significant effect on increasing firm performance. Information technology, described as cross-functional integration, is running well; sharing real-time cross-functional information and reporting quality data can be monitored continuously and cannot directly affect firm performance. The research results are different from research which states that information technology integration in companies has a direct effect on increasing firm performance (Christian et al., 2024; Anastasia et al., 2024; Siagian et al., 2022; Setiawan et al., 2023; Shukor et al., 2021; Putri et al., 2024; Wills et al., 2016) but is in line with the research results (Ambekar et al., 2020; Christian et al., 2024).

Supply chain quality integration has a positive and significant effect on increasing supply chain resilience by 0.288. Supply chain quality integration, which is described as achieving quality analysis that can be accessed by all departments and can involve partners in maintaining the quality

of the company's products, has an impact on supply chain resilience. The company can restore product quality if unsuitable and adapt quickly to the quality system. Manufacturing companies must obtain ISO (International Organization for Standardization) certification to produce products as a requirement for product exports. The research results support previous research, which states that supply chain quality integration influences increasing supply chain resilience (Bag et al., 2023; Abeysekara et al., 2019; Bui et al., 2023; Nenavani & Jain, 2022; Shukor et al., 2021; Abeysekara et al., 2019; Adobor & McMullen, 2018; Siagian et al., 2021). Supply chain quality integration has a positive and significant effect on increasing firm performance by 0.496. Supply chain quality integration is formed in a company with all departments committed to maintaining quality, quality analysis can be accessed by all departments, and quality control is carried out by all departments can improve firm performance. Supply chain quality integration as a company commitment by involving external partners in producing quality products can impact improving product quality according to standards, meeting customer demands, and customer satisfaction. The research results confirm the results of previous research, which stated that supply chain quality integration influences increasing firm performance (Yoon & Moon, 2019; Huo et al., 2019; Bastas & Liyanage, 2018; Ali et al., 2023; Bui et al., 2023; Nenavani & Jain, 2022; Shukor et al., 2021; Li, 2021; Basana et al., 2024; Zhao et al., 2021; Siagian et al., 2022).

Supply chain resilience has a positive and significant effect on increasing firm performance by 0.169. The company's ability to face sudden changes or disruptions to return to normal is a form of company resilience. The supply chain resilience formed in the company is related to the quality of restoring product quality if it is not suitable, production quality can recover quickly, and the company can adapt quickly to the quality system, which influences increasing firm performance. The company can increase its competitiveness by establishing firm performance, which is illustrated by increasing product quality according to standards, increasing flexibility, increasing customer satisfaction, and delivering products on time. The research results support previous research, which states that supply chain resilience influences increasing firm performance (Gu et al., 2021; Siagian et al., 2021; Li et al., 2017; Shukor et al., 2021; Munir et al., 2022; Setiawan et al., 2023; Wills et al., 2016; Huo et al., 2024; Orlando et al., 2021; Sadha et al., 2024).

The company's ability to utilize information technology integration adequately can involve all cross-functional work with synergy and involvement of external partners. Companies can maintain product quality by providing quality control throughout, starting from raw material procurement, production processes, and product delivery until customers well receive them. The company has involved all components in the supply chain flow to maintain quality. The company always tries to be able to quickly restore conditions that disrupt quality so that it returns to normal quickly as a form of supply chain resilience. The ability of manufacturing companies to use integrated information technology and involve all components in the supply chain flow to maintain quality so that it can be sustainable and run normally quickly can produce firm performance. Manufacturing companies always improve their competitiveness and firm performance by increasing customer satisfaction, delivery accuracy, standard quality, and high flexibility. The practical contribution of research provides insight for top management to continue to perfect technology information integration and maintain ISO certification so that improvements can be made. Top management needs to coordinate intensively with managers in the company to collaborate and coordinate regularly to achieve quality and meet customer requirements. Theoretical contributions to research can enrich the total quality management theory related to system integration and quality supply chain management.

6. Conclusion

Product quality is important for companies in providing customer satisfaction. The company tries to involve all different functional departments and involves external partners to commit to producing standard products according to customer needs. The research results show that manufacturing companies have implemented information technology integration to use all functions in real-time. Information technology integration can be used to control quality, starting from procuring raw materials from suppliers and continuing until products are sent to customers. Information technology influences the increase in supply chain quality integration. Integrated information technology in companies can provide fast information so that information is quickly shared in real-time and can impact supply chain resilience. Information technology cannot directly impact firm performance, so it needs to involve intervening variables. Supply chain quality integration to maintain the quality of the company's products and make them accessible to all functions impacts supply chain resilience. Supply chain quality integration as a company commitment by involving external partners impacts improving product quality according to standards and meeting customer demands. Supply chain resilience in companies is described by the speed at which product quality is restored if it is not suitable and quickly, as well as the company's ability to adapt quickly to the quality system to increase firm performance. The company's ability to use integrated information technology means the company can coordinate quickly in all departmental functions and coordinate intensively with external partners to produce total quality for all activities in the company. The products produced always meet standards, so information integration technology and supply chain resilience are needed to improve firm performance.

7. References

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