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The Impact of Information Technology Implementation on Firm Performance: The Mediating Roles of Supply Chain Collaboration, Innovation Capability, and Supply Chain Resilience

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Abstract

Information technology is important for companies in producing supply chain collaboration, innovation capability, and supply chain resilience. The company's ability to maintain continuity in information technology implementation can enhance its performance in manufacturing companies in East Java. Data collection was carried out on manufacturing companies in East Java using a survey method, targeting medium- and large-category companies with purposive sampling that have implemented information technology for at least 2 years. Respondents were permanent employees with at least 2 years of experience. The analysis used is PLS-SEM, which met the goodness-of-fit requirements for the inner and outer models. The study found that implementing information technology positively affects supply chain collaboration, innovation capability, and supply chain resilience. Supply chain collaboration affects innovation capability and firm performance, but not directly supply chain resilience. The results of the study show that innovation capability positively affects supply chain resilience and company performance. The study's results also show that supply chain resilience improves company performance. Overall, the results of the study confirm that implementing integrated information technology strengthens collaboration in the supply chain, enhances innovation capabilities, and builds supply chain resilience, ultimately improving company performance. The results of the research contribute practically by providing insights for the management of companies seeking to sustainably develop information technology investments, strengthen collaboration with partners, and encourage organizational innovation to improve competitiveness and long-term performance.

Keywords: Information Technology Implementation, Supply Chain Collaboration, Innovation Capability, Supply Chain Resilience, Firm Performance.

INTRODUCTION

In an era of increasingly fierce global competition, companies must manage and leverage information technology and supply chain collaboration to maintain a competitive advantage and improve performance (Basana et al., 2025). The effective application of information technology can accelerate the flow of information throughout the company's supply chain. The use of information technology can increase operational efficiency by enabling processes to run more effectively. The use of information technology in a company's operations can impact innovation in managing complex and dynamic supply chains (Aziz et al., 2022). Information technology can be used to manage data within the company and produce reports that meet the department's needs (Al Tera et al., 2024). The reports generated can be used to build coordination between departments, so they run effectively. Companies can also leverage data outputs from information technology to build strong collaboration in the supply chain, thereby improving communication and coordination with

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external partners (Gunawan et al., 2025). Sharing information that companies use, both internally and with external partners, can help solve problems and increase knowledge together (Sundram et al., 2020). Information technology implemented within the company drives coordination and collaboration with external partners, improving the company's performance amid environmental uncertainty (Jimenez-Jimenez et al., 2019).

The use of information technology makes it easier for companies to foster collaboration in the supply chain (Zhao et al., 2023). The company can inform suppliers in real time about the latest conditions in the ongoing production process, so that suppliers can plan material deliveries. Information technology within the company can be shared with supplier partners, with limited access to understand the company's condition. A company's ability to share information with suppliers can improve collaboration in the supply chain (Panahifar et al., 2018). Companies can provide the same facilities to customer partners so they can understand the company's position and increase process flexibility. Customers can collaborate with the company to make changes to orders (Siagian et al., 2022). Customers' ability to understand the company can increase process capacity and planning alignment over the long term amid environmental uncertainty.

The implementation of information technology has become an important system for companies to access information quickly, making it easier to coordinate within the company, accelerate decision-making, and create new solutions. Companies can use information technology as a data-driven, fast-response platform to innovate in a structured manner (Sai et al., 2025). Companies that utilize information technology can automate work processes as a form of process innovation (Basana et al., 2025). The technology used makes it easier for companies to carry out internal integrations, reducing miscommunication and operational errors that affect the speed of service to external partners. Technology integrated with external partners makes it easier for companies to accurately understand external needs through data, so that they can be adapted to internal conditions and new products relevant to those needs (Siagian et al., 2023). The company's investment in information technology does not always lead to increased product or process innovation, because it depends on employees' competence in using it. The implementation of information technology increases supply chain resilience because companies can quickly obtain internal and external data to align operations. The company has utilized information technology to integrate processes to reduce administrative and operational errors, thereby increasing supply chain resilience (Pu et al., 2025).

Supply chain collaboration enables companies to accelerate product innovation in response to customer orders or market conditions. Supply chain collaboration makes the production process run smoothly. The involvement of external partners in the company's operational planning is evidence of supply chain collaboration. The company's ability to empower external partners to overcome operational problems can improve company performance through strong collaboration (Liu et al., 2018). The integration of information technology into supply chain systems can strengthen innovation capabilities in developing new products and increase operational flexibility (Lii & Kuo, 2016). A company's ability to innovate is an important factor in responding to changing market needs, with companies that can innovate faster tending to have a stronger market position.

Supply chain collaboration is important for companies in dealing with disruptions in material procurement and delays caused by material shortages stemming from shifts in global political stability. Companies cannot rely on internal coordination to drive efficiency; they must collaborate with external partners amid fluctuating demand and disasters to build operational resilience. Strong supply chain collaboration enables the rapid sharing of information, allowing alignment of planning with external partners and improving supply chain resilience (Liu & Lee, 2018). Companies that have formed supply chain collaborations can help each other quickly, so they tend to change quickly in the face of market uncertainty. Strong collaboration with external partners makes it easy for companies to detect risks arising from potential disruptions (Gunawan et al., 2025). Quick internal information about obstacles related to material inventory and the sustainability of the production process can enable quick decision-making to mitigate these issues. Collaborations formed with partners can increase flexibility as a component of supply chain resilience. Strong supply chain collaboration can enable rapid responsiveness, so that together we can overcome disruptions and increase supply chain resilience. Companies that can establish reliable communication with partners can resolve disruptions quickly. Companies can communicate material needs to suppliers at short notice, enabling them to make changes to material shipments more quickly and prioritize shipments to respond to changes in customer orders, building supply chain resilience.

Innovation capability refers to a company's capacity to develop and implement new products or processes that deliver greater value to customers (Rajapathirana & Hui, 2018). The speed and quality innovations

implemented by the company can impact firm performance by improving product quality and productivity (Wang et al., 2021). The innovation process within the company, and the speed at which it adapts to technological changes, can improve company performance by increasing productivity and employee satisfaction (Beltramino et al., 2022). System innovations developed within companies are a mainstay for producing product innovations that improve business performance (Basana et al., 2025).

Supply chain resilience also plays an important role in ensuring the continuity of company operations amid market disruptions (Gu et al., 2021). Good collaboration in supply chains, driven by IT, allows companies to increase resilience and respond to market challenges more efficiently (Jimenez-Jimenez et al., 2019).

This study aims to explore the impact of IT implementation on company performance by examining the role of collaboration mediation in the supply chain as well as the ability to innovate in these relationships. Based on previous research, it is expected that IT will impact company performance through better collaboration in supply chains and increased innovation capacity, which in turn will improve the overall performance of the company.

Literature Review

Information Technology Implementation

The application of Information Technology (IT) in modern organizations is increasingly important for improving operational efficiency and supporting competitive advantage (Al Tera et al., 2024). This technology enables companies to accelerate business processes and improve supply chain coordination (Aziz et al., 2022; Sundram et al., 2020). Research shows that IT facilitates faster information flow among companies and supply chain partners, thereby improving efficiency and reducing operational costs (Gu et al., 2021). Liu et al. (2018) also emphasized that IT can strengthen collaborative relationships between suppliers and customers and improve the risk management companies face amid market uncertainty.

In the context of supply chains, IT implementation supports better system integration between different parts within the company, from raw material procurement to product distribution (Fawcett et al., 2011). Jimenez-Jimenez et al. (2019) found that IT enables companies to collaborate more efficiently on designing and planning operations and to respond more quickly to changing market demands. However, the biggest challenge in IT deployment is the high implementation costs and difficulty of integrating new technologies with existing systems (Aziz et al., 2022). However, if managed well, IT implementation can provide great benefits in increasing operational flexibility and accelerating product and process innovation (Lii & Kuo, 2016).

Supply Chain Collaboration

Supply chain collaboration is a strategic relationship between a company and its supply chain partners aimed at improving overall operational efficiency and performance (Siagian et al., 2023). This collaboration includes various forms of interaction, such as information sharing, joint planning, and better operational coordination, which in turn improve decision-making and reduce costs (Cao & Zhang, 2011; Fawcett et al., 2011). Supply Chain Collaboration allows companies to respond to changes in market demand and external disruptions more quickly and effectively, thereby strengthening the resilience of their supply chains (Liu et al., 2018).

Research shows that Supply Chain Collaboration plays an important role in increasing product and process innovation (Gunawan et al., 2025). Jimenez-Jimenez et al. (2019) explain that effective collaboration in the supply chain enables companies to share new knowledge and technologies with their partners, thereby accelerating product development and enhancing competitiveness (Al-Omoush et al., 2022). In addition, Aziz et al. (2022) show that the application of information technology in supply chain collaboration can accelerate information flow among partners and improve coordination. Although the benefits of supply chain collaboration are enormous, challenges in its implementation remain, particularly regarding cultural differences and system mismatches between partners (Gu et al., 2021; Korompis et al., 2022). Therefore, companies need to invest in technology infrastructure and build trust to maximize the results of these collaborations (Fawcett et al., 2011; Panahifar et al., 2018).

Innovation Capability

Innovation capability refers to a company's capacity to develop and implement new products, processes, or services that deliver value and enhance its competitiveness (Lii & Kuo, 2016). This innovation capability is

strongly influenced by technological capabilities and an organizational culture that supports creativity and experimentation in new product development (Rajapathirana & Hui, 2018). Innovations carried out by companies require greater speed in developing new products and processes than competitors (Wang et al., 2021). Research shows that companies with strong innovation capabilities can adapt more quickly to external and internal changes, thereby remaining competitive in rapidly changing markets (Lii & Kuo, 2016; Rajapathirana & Hui, 2018).

The ability to innovate processes and products in small and medium enterprises in Cordoba, Argentina, plays an important role in improving company performance with increased profitability and customer satisfaction (Beltramino et al., 2022). Companies that can collaborate effectively with supply chain partners and leverage advanced technology are better able to create innovative solutions that meet market needs (Gu et al., 2021). Strong information technology competencies enable companies to introduce innovations more quickly, thereby improving performance and competitive advantage in the global market (Liu et al., 2018). Therefore, the ability to innovate is a key factor in achieving the company's long-term success (Liu et al., 2018; Rajapathirana & Hui, 2018). Innovation capabilities can make companies more efficient and effective by enabling them to adopt new methods or products to generate value from innovation (Sai et al., 2025). Innovations carried out in companies are categorized as process and product innovations that can produce sustainable business performance (Basana et al., 2025).

Supply Chain Resilience

Supply chain resilience refers to a company's ability to address supply chain disruptions and return to operations efficiently after such disruptions (Liu & Lee, 2018; Shin & Park, 2021). This supply chain resilience is important for mitigating the impact of external disruptions, such as natural disasters, economic crises, or other logistical issues (Gu et al., 2021; Korompis et al., 2022). Research shows that companies with high supply chain resilience can respond to disruptions more quickly and maintain operations even in uncertain market conditions (Liu et al., 2018; Zhao et al., 2023). Companies that increase visibility in their supply chains through better monitoring and effective use of data have greater resilience to disruptions (Gu et al., 2021). In addition, it shows that closer collaboration with supply chain partners strengthens a company's supply chain resilience, as partners can support one another in managing risks (Liu et al., 2018). Therefore, building supply chain resilience not only helps companies survive after disruptions but also strengthens their competitiveness in the long run (Gu et al., 2021; Pu et al., 2025).

Firm Performance

A company's performance is the extent to which it achieves its desired goals and produces appropriate results across both financial and operational dimensions (Lii & Kuo, 2016). Research shows that a company's performance is influenced by various internal factors, including innovation, managerial capabilities, and operational efficiency, resulting from the strategy implemented (Rajapathirana & Hui, 2018). A company's performance is measured not only by profitability or revenue but also by its ability to remain competitive and adapt to rapid market changes (Liu et al., 2018; Zhao et al., 2023). Improved company performance can be achieved through strong innovation capabilities and effective resource management (Lii & Kuo, 2016; Pu et al., 2025). In addition, companies that successfully integrate innovation into operational processes and strategies often show significant performance improvements (Rajapathirana & Hui, 2018). Companies that collaborate effectively in the supply chain and make optimal use of internal capabilities perform better than those that are unable to adapt to market changes (Gu et al., 2021). Therefore, a company's performance is influenced not only by external factors but also by its internal capabilities and its ability to innovate and adapt effectively to market changes (Liu et al., 2018; Sundram et al., 2020).

The Relationship Between Research Concepts

The Relationship between Information Technology Implementation and Supply Chain Collaboration

The implementation of information technology in companies plays an important role in improving collaboration along the supply chain. Research shows that the effective use of information technology accelerates information exchange among companies and their supply chain partners, thereby improving

coordination and operational performance (Cao & Zhang, 2011). By utilizing information technology, companies can manage information flows more transparently and in real time, thereby accelerating decision-making and improving responses to demand fluctuations and market disruptions (Fawcett et al., 2011). Well-established collaboration through information technology allows partners in the supply chain to share data more accurately and faster, thereby enhancing mutually beneficial business relationships (Liu et al., 2018). In addition, information technology also supports the development of innovations in supply chain collaboration. Information technology-driven SCCs enable companies to introduce new products faster and more efficiently and to improve existing processes to respond to market changes (Jimenez-Jimenez et al., 2019). With information technology, companies can collaborate more closely with suppliers and customers and manage more integrated business processes, thereby improving their operational performance and competitiveness (Gu et al., 2021).

H_1: Information Technology Implementation affects supply chain collaboration.

The Relationship between Information Technology Implementation and Innovation Capability

The implementation of information technology plays an important role in improving the company's innovation capabilities (Sai et al., 2025). Information technology facilitates faster, more accurate information sharing between companies and their partners, thereby improving the ability to innovate (Lii & Kuo, 2016). Research shows that information technology enables companies to accelerate the innovation cycle, both in developing new products and improving operational processes (Rajapathirana & Hui, 2018). With information technology, companies can access the necessary information faster and more efficiently, enabling them to develop more relevant and timely innovative ideas (Liu et al., 2018). The ability to innovate, driven by information technology, also enables companies to introduce new products or services that meet market needs (Basana et al., 2025). Aziz et al. (2022) explain that the application of information technology in the supply chain increases collaboration among companies and partners, thereby accelerating new product development and creating more innovative solutions. Gu et al. (2021) also emphasized that companies integrating information technology into their operations can accelerate the adoption of new technologies and adapt to market changes, thereby improving their innovation capabilities.

H_2: Information Technology Implementation Affects Innovation Capability.

The Relationship between Information Technology Implementation and Supply Chain Resilience

The implementation of information technology plays an important role in improving supply chain resilience by enhancing visibility, coordination, and response to disruptions (Al Tera et al., 2024). Information technology enables companies to monitor and manage information flows in real time, helping them address and mitigate risks arising from market disruptions or uncertainties (Gu et al., 2021). Research shows that the use of information technology in supply chains increases resilience by enabling faster, data-driven decision-making, thereby helping companies survive and recover faster after disruptions (Liu & Lee, 2018). With information technology, companies can obtain more accurate and transparent information regarding supply conditions, allowing them to identify potential disruptions earlier and adjust their strategies to mitigate their impact (Aziz et al., 2022). In addition, the implementation of information technology improves collaboration in the supply chain by enabling partners to share data more efficiently, thereby strengthening the supply chain's overall resilience (Fawcett et al., 2011).

H_3: Information technology implementation affects supply chain resilience.

The relationship between Supply Chain Collaboration and Innovation Capability

Supply chain collaboration plays an important role in improving the company's innovation capabilities. Close collaboration between companies and supply chain partners facilitates the exchange of new knowledge, technologies, and ideas, accelerating innovation in products and processes (Jimenez-Jimenez et al., 2019; Al-Omoush et al., 2022). Research shows that companies engaged in supply chain collaboration can access external knowledge that enhances creativity and supports the development of innovative, more efficient, and market-relevant solutions (Aziz et al., 2022). Supply chain collaboration enables companies to integrate their partners' capabilities, strengthen innovation, and accelerate the development of new products or services (Lii & Kuo, 2016). Supply chains that integrate with external partners can drive product innovation by providing

materials as needed and offering adequate flexibility (Basana et al., 2025). Liu et al. (2018) show that supply chain collaboration enhances innovation capabilities by providing access to new technologies and external resources, thereby accelerating new product development. Information technology-driven supply chain collaboration enables companies to accelerate information flow and shorten the time required for innovation by making the information needed for innovative decision-making available more quickly (Gu et al., 2021).
H_4: Supply chain collaboration affects innovation capability.

The Relationship between Supply Chain Collaboration and Supply Chain Resilience

Collaboration in the supply chain plays an important role in strengthening supply chain resilience. Supply Chain Collaboration allows companies and their partners to share information more efficiently and accelerate coordination in the face of disruptions or changes in market demand (Korompis et al., 2022). Research shows that close collaboration in supply chains increases supply chain resilience, as companies can adapt more quickly and effectively to disruptions (Liu et al., 2018). By sharing knowledge and technology among partners, companies can identify potential issues early, plan more effective responses, and mitigate the negative impacts of supply disruptions (Aziz et al., 2022). Supply chain collaboration driven by information technology strengthens supply chain resilience by increasing visibility and coordination between partners (Gu et al., 2021). SCC allows companies to have faster access to relevant information, thereby accelerating recovery from disruptions and increasing operational resilience (Jimenez-Jimenez et al., 2019). Therefore, effective supply chain collaboration provides a stronger foundation for supply chain resilience, enabling companies to survive and remain competitive despite major challenges (Liu et al., 2018).
H_5: Supply chain collaboration affects supply chain resilience.

The Relationship between Innovation Capability and Supply Chain Resilience

Innovation capabilities play an important role in strengthening supply chain resilience. Companies with high innovation capabilities tend to be more flexible in dealing with market disruptions or uncertainties because they can develop new solutions to address emerging problems (Rajapathirana & Hui, 2018). Research shows that innovation capabilities enable companies to adapt quickly to changes in the supply chain, including changes in demand, supply disruptions, and market shifts (Liu et al., 2018). Innovation in operational processes, products, and services often helps companies increase resilience by providing more efficient and flexible alternatives (Gu et al., 2021). Strong innovation capabilities enable companies to introduce new solutions that more effectively respond to supply chain disruptions or crises (Shin & Park, 2021). Companies that can innovate in the face of disruptions often recover operations faster and reduce the impact of such disruptions on operational performance (Liu et al., 2018). Research also shows that companies that focus on innovation in supply chain processes exhibit greater resilience, as they can adapt to change and introduce new products or solutions to address existing challenges (Aziz et al., 2022; Gu et al., 2021).
H_6: Innovation capability affects supply chain resilience.

The Relationship between Supply Chain Collaboration and Firm Performance

Supply chain collaboration plays a key role in improving company performance. Research shows that companies with strong supply chain collaboration can improve coordination, operational efficiency, and reduce costs, which directly contributes to improved company performance (Cao & Zhang, 2011). Supply Chain Collaboration allows companies to share information and resources more effectively, accelerate decision-making, and respond to market demands more efficiently (Gu et al., 2021). With effective supply chain collaboration, companies can also increase their flexibility in the face of emerging market disruptions or uncertainties, thereby contributing to better company performance in the long run (Liu et al., 2018). In addition, SCC contributes to the company's performance by supporting innovation and the development of new products that are more relevant to market needs (Siagian et al., 2022). Effective collaboration in the supply chain enables companies to access their partners' knowledge and technology, accelerating innovation and helping them stay competitive (Jimenez-Jimenez et al., 2019). Information technology-driven collaboration enables companies to increase productivity and maximize operational performance, ultimately improving overall company performance (Aziz et al., 2022).
H_7: Supply chain collaboration on firm performance.

The Relationship between Innovation Capability and Firm Performance

The ability to innovate plays an important role in improving company performance in generating productivity and customer satisfaction (Wang et al., 2021). Companies with high innovation capabilities can introduce new products, improve operational processes, and adapt their strategies to remain competitive in a dynamic market (Rajapathirana & Hui, 2018). Research shows that innovation capabilities not only support the development of new products but also improve operational efficiency and help companies respond to market changes more quickly (Lii & Kuo, 2016). Innovation-focused companies can improve performance by developing solutions that are more efficient and better aligned with customer needs (Liu et al., 2018). Strong innovation capabilities enable companies to achieve excellence and improve performance (Beltramino et al., 2022). Companies with strong innovation capabilities can better adapt to existing market disruptions and uncertainties and introduce more efficient and effective solutions to meet customer needs (Gu et al., 2021). Innovation competencies support companies in improving production and distribution processes, which ultimately drives improved company performance (Liu et al., 2018).
H_8: Innovation capability affects firm performance.

The Relationship between Supply Chain Resilience and Firm Performance (H9)

Supply chain resilience plays a very important role in improving company performance. Research shows that companies with strong supply chain resilience are better able to handle market disruptions and uncertainties that affect their operations. Supply chain resilience helps companies recover operations faster after disruptions and ensure continuity of material supply and timely product delivery, which directly impacts company performance (Chowdhury & Quaddus, 2017; Fiksel et al., 2015). Thus, supply chain resilience ensures that companies can continue to operate despite disruptions, thereby improving overall performance (Singh, 2020). In addition, supply chain resilience also contributes to the company's performance by maintaining stable relationships between suppliers, companies, and customers. Companies with strong supply chain resilience can maintain long-term relationships with their customers and partners, thereby strengthening loyalty and increasing customer satisfaction (Chowdhury & Quaddus, 2017). High supply chain resilience allows companies to reduce the negative impact of disruptions, maintain product quality, and better meet customer needs (Fiksel et al., 2015).
H_9: Supply chain resilience to firm performance.

Based on the explanation of the background and the relationship between the concepts, the framework of the research concept can be determined as follows:

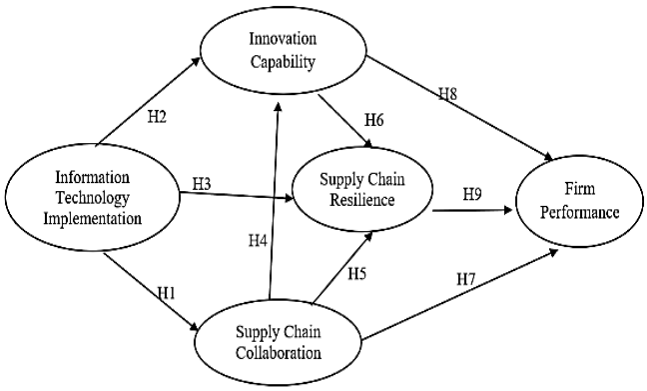

Figure 1. Research Model

METHODS

The research is causal, examining the relationship between the concepts under study. The research determines the characteristics of the research object, namely manufacturing companies in East Java. The researcher determined that the sample comprises companies in the medium and large categories, namely those with a minimum of 20 employees. Data collection is carried out by distributing questionnaires directly to

companies that already have information technology as an operational and administrative system. The research questionnaire distributed was closed-ended, with respondents answering questions from a set of predetermined answer options provided by the researcher. The answer choice was made using a Likert scale, with respondents selecting strongly disagree = 1 and strongly agree = 5. In the study, the definition of research and measurement items for each research concept is determined.

Information technology implementation is the application of information technology within an integrated company system to carry out business activities. The measurement items used for information technology implementation are the information technology application system as a day to day system (ITI1), the information technology application system integrated well between departments (ITI2), data can be accessed by all departments in real time as needed (ITI3), the application system can provide accurate data (ITI4), and the application system can provide complete data (ITI5). Supply chain collaboration is a strategic relationship between a company and supply chain partners that aims to improve operational efficiency and performance. The measurement items used for supply chain collaboration are the company sharing information with external partners (SCC1), the company involving partners in determining planning (SCC2), the company coordinating orders with external partners (SCC3), the company working with external partners in problem solving (SCC4), and the company synchronizing data periodically with external partners (SCC5).

Innovation capability: The ability of a company to continuously increase capacity by transforming ideas into better products, services, or work processes. The measurement items used for innovation capability are the company actively implementing new programs continuously (IC1), employees in the company sharing knowledge in carrying out work activities (IC2), the company collaborating on innovation between departments (IC3), the company quickly adapting to product innovations according to market changes (IC4), and the company innovating processes in customer needs (IC5). Supply chain resilience is a company's ability to withstand and recover from supply chain disruptions and return to normal operations. The measurement items used for supply chain resilience are that the company routinely identifies the disruption that occurs (SCR1), the company provides a safe inventory in addressing the disruption (SCR2), the company increases flexibility (SCR3), the company can adjust to external changes (SCR4), and the company has a recovery procedure that involves cross-functional teams (SCR5).

Firm performance is the company's ability to achieve its goals and produce the expected output. The measurement items used to assess firm performance are product quality according to customer standards (FP1), company responsiveness to needs (FP2), on-time product delivery (FP3), increased company flexibility (FP4), and decreased company operating costs (FP5). The researcher determined that manufacturing companies that have implemented information technology systems and have been running them for at least 2 years are considered to have stable use. The data collection approach was purposive sampling, with the criteria that respondents be permanent employees and have at least 2 years of work experience. Employees designated as respondents are developers, end users, and key users involved in implementing information technology. Data analysis was conducted to test the research hypotheses using PLS-SEM. Testing is carried out with an outer model to test research instruments and an inner model to test all research hypotheses.

RESULT

The distribution of questionnaires was conducted among manufacturing companies in East Java that have implemented integrated information technology across departments, called enterprise resource planning. The results of the dissemination of data with respondent characteristics were obtained from 109 manufacturing companies in East Java. The characteristics of respondents with male gender, 74 people (68%), and female, 35 people (32%), based on respondent education, were obtained: Senior high school or equivalent, 13 people (12%), undergraduate, 87 people (80%), and postgraduate, 9 people (8%). The work experience of respondents in companies with a working period of 1-4 years was 19 people (17%), 5-10 years, as many as 23 people (21%), 10-15 years, as many as 37 people (34%), and more than 15 years, as many as 30 people (28%). The characteristics of the respondents were based on the number of employees: 20-100 employees (47 companies, 43%) and more than 100 employees (62 companies, 57%). Finally, the current employee positions are divided into two categories: middle/top management (Directors, General Managers, and Managers), totaling 29 people (27%), and lower management (supervisors and staff officers), totaling 80 people (73%).

The next stage of data processing was descriptive mean analysis and outer model test analysis, shown in Table 1.

Table 1. Outer model test and descriptive analysis

Item Measurement	Red	Loading Factor	AVE	Cronbach Alpha	Composite Reliability
Information technology	4.1817		0.587	0.824	0.876
implementation	4.2110	0.837			
ITI1	4.2844	0.791			
ITI2	4.1376	0.633			
ITI3	4.1009	0.792			
SMALL4	4.1743	0.763			
ITI5					
Supply Chain Collaboration	4.1028		0.628	0.850	0.892
SCC1	4.0642	0.823			
SCC2	3.7006	0.558			
SCC3	4.3578	0.814			
SCC4	4.2477	0.883			
SCC5	4.0734	0.842			
Innovation capability	3.9651		0.563	0.803	0.865
IC1	3.7890	0.704			
IC2	4.1101	0.760			
IC3	4.0642	0.864			
IC4	3.9633	0.730			
IC5	3.8991	0.678			
Supply chain resilience	4.0073		0.570	0.822	0.868
SCR1	3.8349	0.674			
SCR2	4.1009	0.761			
SCR3	3.9541	0.744			
SCR4	4.0000	0.843			
SCR5	4.1468	0.745			
Firm performance	4.0514		0.600	0.828	0.881
FP.1	3.5138	0.592			
FP.2	4.2752	0.836			
FP.3	4.1009	0.853			
FP.4	4.0826	0.782			
FP.5	4.2844	0.781			

The next step is to test the outer model using the Fornell-Larcker test as discriminant validity for the outer model, as shown in Table 2.

Table 2. Discriminant validity results with Fornell-Larcker

	FP	IC	ITI	SCC	SCR
FP	0.774				
IC	0.716	0.750			
ITI	0.656	0.613	0.766		
SCC	0.708	0.744	0.506	0.793	
SCR	0.567	0.590	0.621	0.437	0.755

Discriminant validity was assessed using the Fornell-Larcker criterion. The square root of the AVE for each construct was compared with the correlations among the latent constructs. The results indicate that the square root of the AVE for each construct is higher than its correlations with other constructs. Therefore, the measurement model meets the requirement for discriminant validity, indicating that each construct is empirically distinct from the other constructs in the model.

The next stage is to conduct an inner model test by calculating Q2 = 1-(1-R^{2SCC})(1-R2IC)(1-R2SCR)(1-R2FP), which is obtained by calculating = 1-(1-0.256)(1-0.629)(1-0.457)(1-0.614) = 1-0.0579 = 0.9421 = 94.21%. The results of the study show that 94.21% of firm performance is determined by information technology implementation, supply chain collaboration, innovation capability, and supply chain resilience. At the same time, the remaining 5.79% is determined by other variables that have not been included in the research variable. The results of the study show that Q2 > 0, indicating high predictive relevance. The research hypothesis, as an inner test of the second model, is shown in Table 3 and Figure 2.

Table 3. Results of the research hypothesis test

Research Hypothesis	Original Sample	T Statistics	P Values
(H1) ITI -> SCC	0.506	7.264	0.000
(H2) ITI -> IC	0.317	2.939	0.003
(H3) ITI -> SCR	0.420	4.074	0.000
(H4) SCC -> IC	0.583	4.540	0.000
(H5) SCC -> SCR	-0.052	0.410	0.682
(H6) IC -> SCR	0.371	3.079	0.002
(H7) SCC -> FP	0.394	3.981	0.000
(H8) IC -> FP	0.292	3.059	0.002
(H9) SCR -> FP	0.223	3.077	0.002

DISCUSSION

The results of data processing using the SEM-PLS method show that the first hypothesis of information technology implementation has an effect on supply chain collaboration of 0.506 with a t-statistical value of 7.264 (>1.96) and a p-value of 0.000 (<0.05), so that it is declared accepted. These results show that the application of integrated information technology in manufacturing companies can increase supply chain collaboration. The integrated implementation of information technology across departments enables companies to share information in real time, improve coordination with external partners, and speed up decision-making. This condition affects the formation of more effective supply chain collaboration among companies, suppliers, and customers. With an integrated information system, the company can improve communication and synchronize activities across the supply chain, enabling more efficient operations. The second hypothesis shows that information technology implementation affects innovation capability by 0.317, with a t-statistic of 2.939 (>1.96) and a p-value of 0.003 (<0.05), so it is declared accepted. These results show that the effective application of information technology within the company can increase its innovation capability. The implementation of information technology enables companies to manage data more quickly and accurately, thereby supporting the development of new ideas, improving work process efficiency, and developing more innovative products. An integrated information system also makes it easier for employees to share knowledge and coordinate across departments, creating an organizational environment that supports sustainable innovation. Thus, companies that optimize the use of information technology will have stronger innovation capabilities in responding to market changes.

The third hypothesis shows that information technology implementation has an effect on supply chain resilience of 0.420, with a t-statistic of 4.074 (>1.96) and a p-value of 0.000 (<0.05), so it is declared accepted. These results show that the effective use of information technology can improve the company's ability to handle supply chain disruptions. An integrated information technology system enables companies to monitor supply chain activities more accurately and quickly, allowing potential disruptions to be identified early. In addition, the availability of real-time information makes it easier for companies to adjust to changes in external conditions, such as shifts in customer demand or distribution disruptions. Thus, the implementation of information technology plays an important role in increasing companies' flexibility and ability to maintain operational continuity during supply chain disruptions. The fourth hypothesis shows that supply chain collaboration affects innovation capability by 0.583, with a t-statistic of 4.540 (>1.96) and a p-value of 0.000 (<0.05), so it is declared accepted. These results show that effective collaboration between companies and supply chain partners can improve companies' innovation capabilities. Collaboration with suppliers and customers enables companies to gather information on market needs, technological developments, and new product development opportunities. The exchange of information encourages the generation of innovative ideas that can improve product quality and the company's operational processes. Therefore, strong collaboration in the supply chain not only improves operational efficiency but also plays an important role in strengthening the company's innovation capabilities.

The fifth hypothesis states that supply chain collaboration has no significant effect on supply chain resilience. The coefficient is -0.052, the t-statistic is 0.410 (<1.96), and the p-value is 0.682 (>0.05), so the hypothesis is rejected. These results show that supply chain collaboration within companies has not directly improved their ability to deal with supply chain disruptions. This condition may result from the company's collaboration focusing more on day-to-day operational coordination than on supply chain risk management strategies. Therefore, even though the company has established cooperative relationships with external partners, the ability to handle disruptions still requires support from other factors, such as risk management

systems, operational flexibility, and the readiness of the company's internal resources. The sixth hypothesis shows that innovation capability has an effect on supply chain resilience of 0.371, with a t-statistic of 3.079 (>1.96) and a p-value of 0.002 (<0.05), so it is declared accepted. These results show that companies with high innovation capabilities tend to be better able to handle supply chain disruptions. Innovation capabilities enable companies to develop new solutions, improve operational processes, and increase flexibility in response to changing business environments. With innovations in production processes and operational management, the company can respond to disruptions more quickly, ensuring its operations continue to run effectively. Therefore, innovation capability is an important factor in increasing a company's supply chain resilience.

The seventh hypothesis shows that supply chain collaboration has an effect on firm performance of 0.394, with a t-statistic of 3.981 (>1.96) and a p-value of 0.000 (<0.05), so it is declared accepted. These results show that effective collaboration between companies and supply chain partners can improve company performance. The collaboration allows the company to improve coordination in production planning, inventory management, and product distribution to customers. With good cooperation with external partners, companies can reduce operational costs, improve production process efficiency, and meet customer needs. This condition directly contributes to improved firm performance. The eighth hypothesis shows that innovation capability affects firm performance by 0.292, with a t-statistic of 3.059 (>1.96) and a p-value of 0.002 (<0.05), so it is declared accepted. These results show that the company's innovation capabilities improve its overall performance. Companies that can develop new products, improve product quality, and streamline operations will be more competitive in the market. Continuous innovation enables the company to respond to customer needs more quickly and increase the value generated by its operational processes. Thus, innovation capability is an important factor in improving firm performance.

The ninth hypothesis shows that supply chain resilience affects firm performance by 0.223, with a t-statistic of 3.077 (>1.96) and a p-value of 0.002 (<0.05), so it is declared accepted. These results show that the company's ability to manage and overcome supply chain disruptions positively impacts its performance. Companies with strong supply chain resilience can maintain operational continuity despite disruptions in distribution or raw material supply. This capability allows the company to continue to meet customer demands promptly and maintain the stability of the production process. Thus, supply chain resilience is an important factor in supporting the continuous improvement of firm performance. However, this rejected direct effect should not be interpreted as evidence that supply chain collaboration is irrelevant to supply chain resilience. The model also shows that supply chain collaboration has a significant effect on innovation capability (H4, beta = 0.583, $p < 0.001$), while innovation capability has a significant effect on supply chain resilience (H6, beta = 0.371, $p < 0.01$). This pattern suggests that supply chain collaboration may strengthen supply chain resilience indirectly through innovation capability, with an approximate indirect effect of 0.216 (0.583 x 0.371). In this sense, collaboration contributes to resilience when shared information, joint problem solving, and partner involvement are transformed into new processes, adaptive solutions, and operational innovations. Innovation capability, therefore, serves as a mechanism that converts collaborative activities into stronger resilience outcomes. This interpretation enriches the rejection of H5 by showing that collaboration may not be sufficient on its own, but it can support resilience by improving the company's capacity to innovate in response to disruption.

The results of the study provide practitioners with insight into implementing information technology sustainably by updating software and hardware to suit their needs. The investment companies make in information technology, depending on how it is used, can increase supply chain resilience to sudden changes. Managers' ability to build supply chain collaboration can increase innovation capabilities, which in turn impacts company resilience. Contributions to theory can enrich the theory of supply chain sustainability and capacity in producing company performance and competitiveness.

CONCLUSION

Information technology implementation affects firm performance through supply chain collaboration, innovation capability, and supply chain resilience. The use of effective information technology enables companies to improve coordination and information exchange with supply chain partners, thereby encouraging more effective collaboration. In addition, information technology implementation can increase the company's innovation capability by using information systems to support the development of more efficient ideas and work processes. Research shows that supply chain collaboration affects innovation capability and firm performance, but not supply chain resilience. Innovation capability has been proven to affect supply chain

resilience and firm performance. Furthermore, supply chain resilience also affects firm performance. This condition indicates that improving company performance can be achieved by strengthening supply chain collaboration, increasing the company's innovation capabilities, and building its capacity to enhance supply chain resilience in response to changes in the business environment.

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