

Uncertain Supply Chain Management

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The effect of integrated information technology on competitive advantage through supply chain integration and supply chain flexibility

Ruth Lovita Surodjo Putri^a, Zeplin Jiwa Husada Tarigan^{a*} and Hotlan Siagian^a

^a*School of Business and Management, Petra Christian University, Indonesia*

ABSTRACT

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Unlimited global competition for manufacturing companies means that companies must be efficient and effective, so implementing information technology is needed to produce fast and precise decisions. Manufacturing companies in East Java were obtained with a sample size of 89 companies as research respondents and processed using smart PLS. The research results show that the implementation of continuously adjusted information technology can provide improvements in supply chain integration, supply chain flexibility, and competitive advantage. Connections with external partners and transactions using information technology make it easier to coordinate internally and externally in decision making. Supply chain integration, which is described as collaborating with partners and involving them in decision making, can increase supply chain flexibility and competitive advantage. Manufacturing companies can increase flexibility in processes and develop new products, increasing market share and customer satisfaction compared to competitors. The company's supply chain flexibility can increase its competitive advantage. This research provides a practical contribution to company management in appropriately managing business strategy and in line with external changes. For operational practitioners, it includes enlightenment in maintaining the role and function of up-to-date information technology to make decision making easier. The theoretical contribution of the research is to enrich the theory's resources-based view on competitive advantage and operational system integration.

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1. Introduction

Information technology is developing rapidly so that distance is no longer an obstacle for businesses to play an active role in the global era (Siagian et al., 2021). Competition between businesses is becoming increasingly open, and companies can cooperate and collaborate so that a complex business environment can create opportunities to generate profits (Birasnav & Bienstock, 2019). This situation allows existing companies to partner with other companies to enter the global market and compete (Sahoo, 2021). The company's ability to build networks in various regions so that it is easy to reach markets quickly and is also able to get suppliers globally and international transportation (Li et al., 2022). This condition means that goods from each country can enter other countries rapidly. National borders can no longer hinder the mobility of capital and goods used for production. Producer activities are no longer limited to one country, so many producers have the same potential to enter the global market (Kwak et al., 2018).

A company's ability to maintain business continuity and increase competitiveness must be able to keep pace with global market competition (Siagian et al., 2022; Negi, 2021). The company's ability to play an active role in the global arena can impact the company in making improvements to be efficient and effective (Basana et al., 2024; Kalaitzi et al., 2019). The company always tries hard to become a strong competitor for other companies to face global market competition (Setiawan et al., 2023). A company can achieve this if all components increase productivity and performance (Dhaigude et al., 2021). Information technology is a significant need for companies when carrying out continuous innovation and improvement (Caniato & Größler, 2015; Lii & Kuo, 2016). Implementing information technology in companies requires substantial

* Corresponding author

E-mail address zeplin@petra.ac.id (Z.J.H. Tarigan)

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resources (Sundram et al., 2020). The resources in question are not limited to the company's financial resources and the time needed to prepare the company's infrastructure and workforce readiness (Fayezi et al., 2015).

The implementation of information technology was initially related technically but has now experienced a transition from being previously limited to becoming a problem in the management context. This condition is caused by companies having primary needs related to the increasing need for companies in technology and information to have quality information (Putra et al., 2020). Information technology in companies must be managed well to be helpful and provide resilience and excellence for the company (Ju et al., 2021). A company's success in managing technology and information depends significantly on the alignment between the goals of managing information technology and the company's goals. Information technology management in a company must ensure that technology and information can support company goals by using resources optimally (Vafaei-Zadeh et al., 2020).

The technology companies can provide fast and real-time data (Yuan et al., 2022). This condition can give management a quick overview of the company's conditions to make the right decisions. Adequate information technology can provide information related to the availability of raw materials in the warehouse, making it easier for the relevant departments to procure raw materials (Tarigan et al., 2021b). The purchasing department can build cooperation with suppliers regarding the company's material needs (Tarigan et al., 2020). Material procurement is carried out promptly and with good communication with suppliers (Tarigan, 2018). The company's integration of information technology with suppliers can increase the efficiency and quality of materials (Kalaitzi et al., 2019).

Information technology can provide data quickly on the finished product in the warehouse so that it can be informed to customers (Basana et al., 2024). Companies can directly share information regarding the position and quality of goods according to customer needs (Singh & Kumar, 2020). This condition can be implemented if both parties are well integrated (Siagian et al., 2023). Customers can monitor the latest conditions regarding the products they order. Companies and customers can share how to deal with problems they face and involve customers in maintaining product quality. Information technology that has been implemented can impact supply chain integration (Birasnav & Bienstock, 2019; Sundram et al., 2020). Information technology can impact fast coordination in a company's supply chain (Yuan et al., 2022). The company's ability to create internal systems quickly and precisely can provide good coordination along the supply chain flow (Riley et al., 2016). Information technology makes it easier for companies to communicate and collaborate with internal and external partners along the supply chain flow (Basana et al., 2022b; Tarigan et al., 2020). Information technology impacts supply chain processes that are more efficient and effective (Zadeh et al., 2020). The company's ability to maintain consistent information technology impacts providing quality data and information that can be shared with partners along the supply chain (Panahifar et al., 2018; Ganbold et al., 2020). The company's information technology can improve supply chain performance (Basana et al., 2022a).

The information technology owned by the company can provide appropriate information for the company's internal and external companies (Siagian et al., 2021). The company's ability to obtain information quickly to develop supply chain integration gives it high flexibility (Caniato & Größler, 2015; Jum'a & Bushnaq, 2023). Companies can inform customers about the process's continuity, improving communication (Ju et al., 2021). Both parties can directly communicate and coordinate well, increasing flexibility (Jum'a & Bushnaq, 2023). The company's ability to maintain high flexibility can make it easier to respond to customers (Putra et al., 2020). Companies can adapt to market changes to produce products with more variations or adapt to market trends as a form of coordination and responsiveness, which is also called supply chain flexibility (Singh & Kumar, 2020). Companies with flexible organizations can anticipate environmental changes and not disrupt the continuity of company processes (Doetzer & Pflaum, 2021). The disruption faced by a company can quickly return to normal when employees and other resources can be rapidly adjusted if the company's flexibility is high enough (Fayezi et al., 2015). A company's flexibility can increase with communication and coordination between the company and external partners (Siagian et al., 2021). The company can carry out the next stage by integrating internal and external partners, called supply chain integration (Tarigan et al., 2021b). Changes in product differentiation requested by customers will change the company's production planning, thereby changing the production process by shifting its use (Abeysekara et al., 2019). This change also impacts the availability of materials in the inventory section, thus determining changes in the raw material procurement schedule (Tarigan et al., 2021a). This condition results in the importance of supply chain flexibility for companies (Jum'a & Bushnaq, 2023).

The company's supply chain integration can have an impact on the company's organizational competitiveness (Subramanian & Gunasekaran, 2015). Sharing information between companies and external partners in solving problems faced together (Riley et al., 2016). Supply chain integration allows companies more flexibility in analyzing data quickly with partners to adjust joint strategies to increase the company's competitiveness (Munizu et al., 2024). Supply chain integration helps collaboration and coordination between companies (Wang et al., 2023) and partners to manage resources more flexibly and ultimately become efficient (Tarigan et al., 2020). Supply chain integration can make companies more flexible in sharing labor and equipment resources (Tiwari et al., 2015; Basana et al., 2024).

Supply chain integration formed in a company can impact the company's competitiveness by producing efficient processes and appropriate products according to customer needs (Basana et al., 2022b; Lii & Kuo, 2016). Supply chain integration allows companies with suppliers and customers to communicate to determine better planning to optimize inventory control (Vafaei-Zadeh et al., 2020; Tarigan & Siagian, 2021). This condition also impacts a more coordinated production process from procuring raw materials from suppliers to the delivery stage of finished products to company customers, resulting in increased operational efficiency (Rojo et al., 2018). The supply chain integration that is formed can provide quality raw materials according to predetermined criteria with on-time product delivery so that there is an increase in response to customer demand (Basana et al., 2022a). Accurate delivery to customers can increase customer satisfaction (Willis et al., 2016). Based on the explanation above, the importance of information technology that can be optimized so that there is strong supply chain integration with internal and external parties of the company can be determined. Implemented information technology and supply chain integration can provide an increase in company flexibility and ultimately have an impact on increasing competitiveness. Based on this explanation, the research objective is that implementing information technology influences supply chain integration, supply chain flexibility, and competitive advantage. Second, get the magnitude of the influence of supply chain integration on supply chain flexibility and competitive advantage. Third, get the magnitude of the impact of supply chain flexibility on competitive advantage.

2. Literature Review

2.1. Implementation of Information Technology

Implementation of information technology is the use of digital information technology in a company's business processes (Ju et al., 2021). Information technology allows companies to get information quickly in all areas to be easily presented and communicated between departments (Riley et al., 2016). Information that has been properly processed into quality information can be shared with external partners to communicate and coordinate (Siagian et al., 2021). Information technology that has been implemented can help top management make the right decisions (Pratono, 2022). A company's information technology can eliminate boundaries between functions to ensure the flow of information runs effectively (Sundram et al., 2020).

Implementing information technology is an application that can interconnect data functions in one or more tasks into information related to business interests (Riley et al., 2016). Implementing information technology that can run well is the responsibility of all employees in the organization (Subramanian & Gunasekaran, 2015). Implementing information technology is vital to support running a company's business processes and an effective supply chain (Putra et al., 2020; Basana et al., 2024). The implementation of information technology used by the company can retrieve data directly and can be stored in the company's database (Siagian et al., 2023). After data processing, the already owned data can be combined into reports required by the relevant departments. The reports obtained become the basis for direct users or top management in making decisions. Advances in information technology need to be adjusted according to developments in software and hardware. The implementation of information technology in the form of the Internet of Things (IoT) in companies can be used to collect information related to the stages of the raw material procurement process, production up to the stage of product delivery to customers (Tan & Sidhu, 2022).

An organization's ability to provide this data is beneficial in building partnerships and competitiveness (Vafaei-Zadeh et al., 2020; Wang, 2019). The company's information technology can deliver all departments access to data and information according to their needs. The availability of information systems can be used practically by external or internal company partners through the access rights granted. Information technology can be used to make plans and forecasts tailored to the company's needs so that all components in the supply chain can access them quickly (Setiawan et al., 2023). Information technology that many companies have implemented uses collaboration with partners to overcome uncertainty problems and optimize company achievements through goals and outcomes (Shukor et al., 2021). Sundram et al. (2020) stated that to measure information technology, companies use e-commerce websites for customers, customer relationship management (CRM) to analyze markets, company websites help integrate with external partners, and customers use websites to order goods and companies. Adopting online transactions to reduce operational costs. The indicators set for the implementation of information technology adopted in the research of Vafaei-Zadeh et al. (2020) are that company information technology is connected to company partners, coordination with partners can be done using electronic links, transactions used by companies are supported by information technology, companies can send messages to partners via electronic media, companies can purchase goods orders electronically, and companies use information technology in making deliveries.

2.2. Supply Chain Integration

Supply chain integration is the biggest challenge for companies in making activities or processes connected internally and externally to the company (Birasnav & Bienstock, 2019). Supply chain integration consists of two dimensions: implementing information technology and information sharing internally and externally with the company (Yuan et al., 2022). Internal integration in question is an integration that occurs between cross-functional companies (Ju et al., 2021). Internal integration is increased so that it is not only within the scope of one company but also between the company itself and companies upstream and downstream (Basana et al., 2022b). This integration does not involve specific ownership or domination but combines

company business processes and activities to support efficiency and effectiveness to increase competitiveness (Tarigan et al., 2021a). Supply chain integration implies process integration, which means close collaboration between buyers and suppliers (Dhaigude et al., 2021). Effective integration in a supply chain will be a crucial factor for a company to achieve the improvements needed to remain competitive (Dhaigude et al., 2021). The integration that is formed aims to create and coordinate supply chain processes uniquely, making it difficult for competitors to imitate (Lii & Kuo, 2016). The company's ability to manage activities or business processes in procuring raw materials with company suppliers is a form of integration of the supply chain (Tarigan et al., 2021b). Companies and suppliers can communicate and coordinate the amount of raw materials needed, plan for procuring raw materials for new products, and so on (Tan & Sidhu, 2022). The company's ability to coordinate with customers is related to the number of goods delivered, joint understanding of market trends, joint planning in the delivery and distribution of goods, and so on (Siagian et al., 2021). Integrating activities involving company customers is called customer integration (Shukor et al., 2021).

Developing cross-functional and cross-organizational teams is needed to align business processes that are managed jointly (Subramanian & Gunasekaran, 2015; Negi, 2021). The company focuses on the process orientation necessary to realize a smooth flow of resources in the supply chain (Sahoo, 2021). The company's ability to manage human resources within the organization is to adjust departmental boundaries according to business process functions to erase the boundaries between departments (Sundram et al., 2020). Companies can also involve human resources on the supplier and customer side to build functional or inter-company integration that is bigger than before by involving suppliers and customers (Siagian et al., 2022). Supply chain integration helps improve company performance, which can ultimately increase competitiveness with lower operational costs and increasing levels of effectiveness (Siagian et al., 2023; Munizu et al., 2024). Sundram et al. (2020) stated that to measure supply chain integration, it is determined that companies in the supply chain communicate actively, the company and partners can create compatible communication and information systems, the company builds a broader supply chain, and the company participates in marketing supply chain partners. Basana et al. (2022b) determine supply chain integration measurement items consisting of internal, upstream, and downstream integration. The indicators used to measure supply chain integration adopted by Tarigan et al. (2021a) are making decisions together, sharing forecasting with partners, collaborating with partners in determining strategies, and involving partners in solving the problems faced.

2.3. Supply chain flexibility

Companies strive to consistently manage the manufacturing process's continuity by involving the company's suppliers and customers (Tan & Sidhu, 2022). Changes that occur externally to the company can result in changes in the company's internal processes, so companies are required to be flexible (Siagian et al., 2021). The uncertainty of the external environment determines the company's internal conditions (Shukor et al., 2021). Disruptions in the procurement of raw materials in companies can affect the availability of raw materials, thus determining the stability of the company's production process and affecting operation capability (Tarigan et al., 2021a). The same thing, if determined by the customer, namely by making changes to the finished product delivery schedule, will disrupt the process of providing products and inventory. Changes in the number of products requested by customers also determine changes in production planning that occur within the company, thereby impacting the availability of raw materials and the availability of the company's work facilities (Caniato & Größler, 2015). Supply chain flexibility considers the ability to respond to change when forming strategic partners (Chunsheng et al., 2020; Tarigan & Siagian, 2021).

Companies must anticipate changes by building organizational flexibility (Shukor et al., 2021). Supply chain flexibility can be divided into three parts, namely supplier flexibility, production/services flexibility, and customer flexibility (Doetzer & Pflaum, 2021). Supplier flexibility is the company's ability to respond to and coordinate changes that occur (Singh & Kumar, 2020). The ability of a company's suppliers to supply the raw materials the company needs can determine changes that occur internally in the company, thereby disrupting product delivery on time (Rojo et al., 2018). Supply flexibility is the ability of suppliers to provide flexible raw materials when there is a sudden increase in demand for raw materials (Putra et al., 2020). Suppliers can anticipate a sudden increase in the volume of raw materials the company needs. Suppliers can send raw materials in specific quantities in a short time. Suppliers must be able to promptly send products with specific transportation and certain quantities with the required items according to company requests. Fulfilling sudden demand is difficult for company suppliers (Fayez et al., 2015). The flexibility that occurs in supply flexibility is the company's ability to adapt to changes caused by changes in customers and within the company (Jum'a & Bushnaq, 2023). Yuan et al. (2022) state that flexibility in small and middle enterprises (SMEs) is flexible loan volume, flexible loan terms, flexible number of employees, flexible duration of operations in the company, and the company's annual sales according to its capabilities.

The second flexibility that occurs in a company can be caused by customer flexibility, which impacts changes within the company (Tiwari et al., 2015). Flexibility with customers is generally related to changes in orders by changing requests for the number or volume of products and changes in product types (Willis et al., 2016). This change impacts the company's internal efforts to provide products or services according to demand (Li et al., 2022). These internal changes will affect the procurement of raw materials for customers. Besides that, there is flexibility with customers regarding the delivery of finished goods, which often changes (Chunsheng et al., 2020). Changes in product delivery can result in changes in transportation and ports, so companies also experience difficulties in fulfilling them.

The flexibility that occurs internally in the company is due to obstacles that occur at the manufacturing process stages in producing finished products (Wungkana et al., 2023). The availability of limited resources often causes flexibility in the manufacturing process (Kalaitzi et al., 2019). There are often problems in the production process, such as inadequate facilities due to irregular and unplanned machine maintenance systems, sudden power outages so that the production process runs smoothly, and shop floor flexibility (Tiwari et al., 2015). Caniato and Größler (2015) stated that flexibility in manufacturing companies is maintaining the goal of improving the company's operational performance through volume, mix, and delivery speed flexibility. The indicators used to measure supply chain flexibility, according to Doetzer & Pflaum (2021), are supplier flexibility (flexibility in the supplier network and flexibility in maintaining the stability of raw material procurement), manufacturing flexibility (flexibility in the use of technology in the production process and flexibility in maintaining the continuity of the production process) and distribution flexibility (flexibility in using technology in the distribution process and flexibility in maintaining accurate delivery as a form of distribution). The indicators used in the research adopted by Siagian et al. (2021) are flexibility in the production process, flexibility in developing new products, flexibility in procuring raw materials, and flexibility in distribution or delivery.

2.4. *Competitive Advantage*

Competitiveness is a company's advantage compared to products and services from competitors (Siagian et al., 2022). Competition in the business world is bound to happen because every business must have almost the same focus and, therefore, have competitors (Basana et al., 2024). One company produces almost the same product function as another, so it requires competition to get quality raw materials (Basana et al., 2022a). The company's ability to obtain suitable materials with adequate processes will produce quality products at affordable prices (Siagian et al., 2021). Companies offer products to the market with the same function so that users can compare the products. Users choose products that suit their needs and abilities in purchasing the product (Tarigan, 2018). This condition causes companies to have to produce products that have a competitive dimension. Competition in producing products is getting more robust, so many companies provide various types of products and even substitute products for the products offered by a company (Sahoo, 2021).

With more competitors in the same business field, the existing competition will undoubtedly become more challenging (Siagian et al., 2021). Companies always try to create high value in the products they produce to have a competitive advantage (Pratono, 2022). Companies always compete to produce products to be the first choice for users and with relatively low production prices but relatively good business value (Wang, 2019). The most crucial goal of a company operating in the business sector is to create a superior competitive advantage compared to other companies operating in the same industry (Negi, 2021). Companies should be able to create competitive business strategies compared to competitors to answer the challenges of increasing and varying market demand (Khanuja & Jain, 2022). The company's ability to manage its resources to produce products at lower costs compared to competitors will greatly interest users (Setiawan et al., 2023). Price competition is a competitive force formed by several companies to provide lower prices than their competitors (Munizu et al., 2024). Some companies build competitiveness by creating new products and markets to create customer preferences. Suppliers must support companies' products to build competitiveness in providing adequate raw materials and production processes (Wang et al., 2023). Competitive advantage is the relative advantage a business organization obtains over its competitors (Subramanian & Gunasekaran, 2015). The advantages it has allowed the company to continue to be observed continuously to gain benefits for the company in developing business operations and carrying out development.

A company's competitive advantage in carrying out activities or business activities is reflected in having lower operating costs compared to competitors (Siagian et al., 2022). Another advantage a company has is that it is more efficient, leading to higher profits than its competitors (Kalaitzi et al., 2019). The company always tries to consider the level of return required for the costs incurred. Companies with a more competitive advantage can provide lower prices and higher product production profits. Yuan et al. (2022) stated that the competitiveness of companies with supply chain responsiveness has items including first when compared with competitors, the company's response to customers is faster and more effective than competitors; introduction and marketing of new products faster than competitors; the company responds more quickly to market changes compared to competitors; and companies change competitive strategies more quickly compared to competitors (Abeysekara et al., 2019). Siagian et al. (2022) determined that indicators in measuring competitiveness are lower costs from customers, the company can create quality products above customer expectations, the company's ability to deliver products on time, innovation in new products on the market, the company's production of a new products faster than competitors. The advantages generated by the company are measured by adopting measurement items determined by Sundram et al. (2020): an increase in the company's market share above the competitor's average, the company's total costs are lower than the competitor's average, the company's ability to answer customer questions more quickly than competitors, and the company's satisfaction is better than that of customers.

2.5. *Relationship Between Concepts*

2.5.1. *The relationship between the concept of information technology implementation and supply chain integration*

The company's information technology is the basis of supply chain integration in providing fast information and assisting in making decisions to increase supply chain capability (Yuan et al., 2022). Information technology has great potential to

facilitate integration and coordination between supply chain partners through various information about demand forecasts and production schedules that explain activities in the supply chain (Kwak et al., 2018). The company's information technology has a positive impact on increasing supply chain integration (Sundram et al., 2020). Implementing information technology in companies is considered to have the power to provide timely, accurate, and reliable information (Yu et al., 2021). Information technology used in hotels impacts upstream and downstream integration, and this also happens to internal integration (Basana et al., 2022b). The information technology companies use in digital form can provide uniqueness for companies by carrying out supply chain integration (Ju et al., 2021). Information technology companies implementing the Internet of Things (IoT) can impact supply chain integration by providing transparent information (Tan & Sidhu, 2022). Implementing information technology in manufacturing companies impacts companies' ability to control supply chain integration and share quality information to facilitate decision-making (Tarigan et al., 2021a). Information technology companies that use electronic devices can improve supply chain integration by sharing information with external partners in an accurate, timely, and standardized way (Vafaei-Zadeh et al., 2020).

H₁: *Implementation of Information Technology has an influence on Supply Chain Integration.*

2.5.2. The relationship between the implementation of information technology and supply chain flexibility

The company's information technology impacts the company's ability to obtain data and process it into vital information to increase its flexibility and agility through internal empowerment and external communication (Yuan et al., 2022). The company's ability to implement websites as a form of information technology in purchasing raw materials and delivering finished products has increased the volume flexibility of manufacturing companies in Malaysia (Vafaei-Zadeh et al., 2020). Implementing ICT (Information, Communication, Technology) in companies can increase supply chain flexibility by increasing supplier, manufacturing, and distribution flexibility (Doetzer & Pflaum, 2021). Information technology that can produce good quality information can impact supply chain flexibility in retail companies (Putra et al., 2020).

H₂: *Implementation of information technology affects supply chain flexibility.*

2.5.3. The relationship between the implementation of information technology and competitive advantage

Information technology has a vital role in the survival of the company. Managers can use the information technology owned by the company to adopt recovery capabilities quickly, which impacts the company's competitiveness (Riley et al., 2016). The amount of information within the company can be utilized as knowledge that can be used as a separate resource for the company. The information technology owned by the company can impact the company's capability by increasing supply chain responsiveness (Yuan et al., 2022; Kwak et al., 2018). The company's ability to implement information technology by using e-commerce websites and quickly collecting market data and analyzing it has an impact on its competitiveness by establishing its ability to respond to customer complaints and questions quickly, thereby increasing customer loyalty (Sundram et al., 2020). Implementing information technology companies use through websites that can be well coordinated with partners can increase delivery speed and customer service levels (Vafaei-Zadeh et al., 2020).

H₃: *Implementation of information technology influences competitive advantage.*

2.5.4. The relationship supply chain integration with supply chain flexibility

Supply chain integration in companies consists of customer, supplier, and internal integration, which impacts organizational flexibility by expanding the company's distribution facility system (Shukor et al., 2021). Supply chain integration formed in companies with external partners accurately, in real-time, and with standards can impact increasing volume flexibility (Vafaei-Zadeh et al., 2020). Supply chain integration, which is determined by raw material procurement strategies, company supplier development, and the ability to coordinate with suppliers, can have an impact on increasing supply chain flexibility by producing flexible production volumes and mix flexibility in creating flexible delivery speeds (Caniato & Größler, 2015). The supply chain integration formed in the company can impact supply chain flexibility (Doetzer & Pflaum, 2021). Supply chain integration in manufacturing companies can impact increasing supply chain flexibility (Siagian et al., 2021; Khanuja & Jain, 2022). Supply chain integration consisting of internal and external integration can impact increasing flexibility in producing flexible product variations and product volumes (Willis et al., 2016).

H₄: *Supply chain integration influences supply chain flexibility.*

2.5.5. The relationship between the concept of supply chain integration and competitive advantage

Supply chain integration that is formed in a company that actively participates in marketing supply chain partner products is able to have an impact on the company's competitiveness by forming better customer loyalty compared to the company's competitors and the company's ability to answer customer questions more quickly (Sundram et al., 2020). Companies can adapt flexibly to supply chain integration (internal integration, upstream and downstream integration), which can impact hotel

performance and increase competitiveness (Basana et al., 2022b). The coordination and collaboration built by the company as a form of supply chain integration plays a role in producing increased business performance and prioritizing the company's position as a form of competitiveness (Siagian et al., 2021).

Supply chain integration in manufacturing companies in India has an impact on company performance so that it can increase competitiveness (Dhaigude et al., 2021; Wungkana et al., 2023; Kalaitzi et al., 2019). Supply chain integration, which consists of supplier integration, internal integration, and customer integration, can influence a company's competitiveness by developing new products (Shukor et al., 2021; Siagian et al., 2023). Supply chain integration, which is determined by the strategy of procuring raw materials, developing company suppliers, and the ability to coordinate with suppliers, can have an impact on increasing business competitiveness by creating innovative products and arriving at the right time on the market according to needs (Caniato & Größler, 2015; Lii & Kuo, 2016; Wang, 2019). Supplier and customer integration impact a company's competitiveness by producing new products faster than competitors (Siagian et al., 2022).

H₅: *Supply chain integration influences competitive advantage.*

2.5.6. *The Relationship between the concept of supply chain flexibility and competitive advantage*

Based on the results of expert interviews, supply chain flexibility implemented in German and Japanese companies was found to increase the companies' competitiveness (Doetzer & Pflaum, 2021). Supply chain flexibility in manufacturing companies (Sahoo, 2021), described by flexibility in production planning and flexibility in volume, impacts increasing customer satisfaction and high growth in product demand compared to competitors (Siagian et al., 2021). The flexibility between companies and inter-organizations can increase innovation in producing new products to increase competitiveness (Fayezi et al., 2015).

H₆: *Supply chain flexibility influences competitive advantage.*

2.5.7. *The relationship between the concept of information technology implementation and competitive advantage through supply chain integration and supply chain flexibility*

Information technology implementation enables a company to obtain and manage information well and quickly (Yuan et al., 2022). The information obtained by the company can be shared and sent to cross-functional external partner companies as a form of supply chain integration (Birasnav & Bienstock, 2019; Sundram et al., 2020). Information technology implemented by the company with a website to order raw materials and send products to customers can increase volume flexibility and competitiveness in the form of delivery speed and customer satisfaction (Vafaei-Zadeh et al., 2020). The company's information technology can use process automation and enable better communication between partners. Companies with suppliers and customers can communicate and operate by carrying out activities to achieve synergy (Chunsheng et al., 2020). The information technology owned by the company can enable the flow of information and coordination and collaboration between the company and external partners (Siagian et al., 2023). The information technology companies use can provide great opportunities to develop the company's overall business performance in generating competitiveness (Pratono, 2022; Wang, 2019). Companies can share long-term planning with suppliers and customers, so they can enter into contracts that increase the efficiency and effectiveness of company operations (Tarigan & Siagian, 2021). The company tries to be able to adapt the company's internal processes to changes that occur externally (Kalaitzi et al., 2019). The company's supply chain capability is a form of supply chain flexibility to adapt to changes in customer demand and determine the company's supply (Siagian et al., 2022). Information technology can help increase flexibility with supply chain integration, providing real-time visibility of appropriate data and information throughout the supply chain flow (Doetzer & Pflaum, 2021). This condition results in the company's planning and production processes being more flexible and responding well to market changes and changes in the availability of raw materials. The company's ability to use available information technology can increase supply chain integration and internal and external organizational flexibility (Sahoo, 2021). It will be superior to other companies as a form of competitiveness (Siagian et al., 2021). Combining company activities and business processes as a form of integration can increase company flexibility, ultimately increasing company competitiveness by allowing companies to respond more quickly and improve customer service (Khanuja & Jain, 2022; Setiawan et al., 2023). Based on this explanation, an indirect hypothesis can be established as follows:

H₇: *The implementation of information technology influences competitive advantage through supply chain integration.*

H₈: *Implementation of information technology influences competitive advantage through supply chain flexibility.*

H₉: *The implementation of information technology influences competitive advantage through supply chain integration and supply chain flexibility.*

Based on the explanation above, a research conceptual framework can be established, which is shown in Fig. 1.

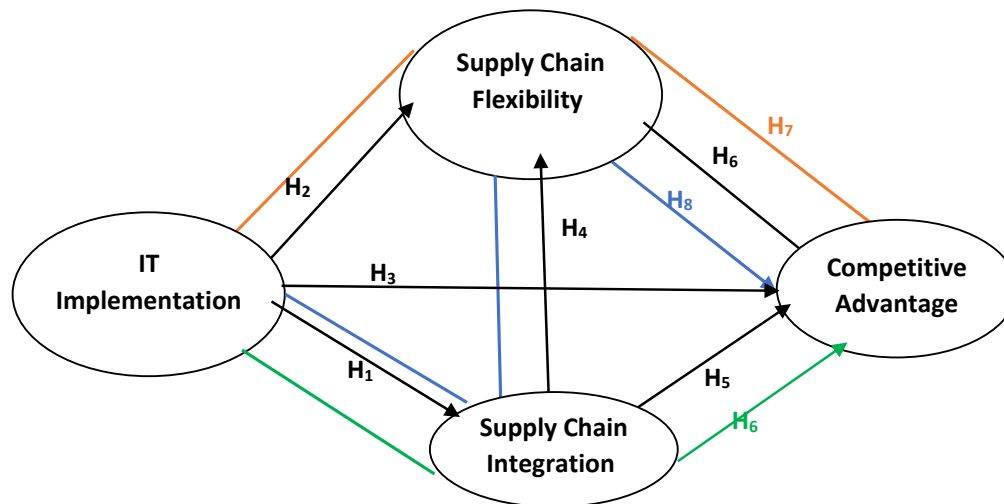


Fig. 1. Research conceptual framework

3. Research Methods

The type of research used in the research is causal quantitative. This research was conducted to test the influence between research variables. This research aims to examine the magnitude of the influence of information technology implementation on competitive advantage through supply chain integration and supply chain flexibility. Determining the population is a manufacturing company in East Java that has implemented information technology in enterprise resources planning, integrating the company's internal departments. The sample obtained was a sample of the population taken through sampling techniques. Samples will be taken using a non-probability sampling technique with a sampling method, namely purposive sampling. Purposive sampling is a sampling technique where the sample is explicitly selected according to the research objectives. The criteria set in this research are companies that have implemented information technology in East Java. The second criterion is that respondents have been designated as permanent employees with at least two years of work experience and, most recently, in a staff position at a manufacturing company. The amount of data collected was 89 respondents from a total of 100 questionnaires distributed. Determination of research items is determined by determining the operational definition of research. The information technology implementation variable is a form of information technology application that can interconnect data functions in one or more functions to become digital information in the company's business processes. The indicators set for the implementation of information technology adopted the research of Vafaei-Zadeh et al. (2020) is that company information technology is connected to company partners (ITI1), coordination with partners can be done using electronic links (ITI2), transactions used by companies are supported by information technology (ITI3), companies can send messages to partners via electronic media (ITI4), companies can purchase goods orders electronically (ITI5) and companies use information technology to make deliveries (ITI6).

Supply chain integration is a company activity that carries out activities or processes that are connected and integrated and occur cross-functionally and externally to the company. The indicators used to measure supply chain integration adopted by Tarigan et al. (2021a) are: making decisions together (SCI1), sharing forecasting with partners (SCI2), collaborating with partners in determining strategies (SCI3), and involving partners in solving problems faced (SCI4). Supply chain flexibility is the company's ability to be flexible in responding to and coordinating external changes that result in changes in the company's internal processes. The indicators used in this research to measure supply chain flexibility adopted by the research of Siagian et al. (2021) are flexibility in the production process (SCF1), flexibility in new product development (SCF2), flexibility in raw material procurement (SCF3), and flexibility in distribution or delivery (SCF4). The final variable, competitive advantage, is an advantage that a company has when compared to products and services from other competitors (Siagian et al., 2022). The advantages produced by the company are measured by adopting measurement items determined by Sundram et al. (2020): an increase in the company's market share above the competitor's average (CAD1), the company's total costs are lower than the competitor's average (Cad2), the company's ability to answer customer questions more quickly than competitors (Cad3), and better company satisfaction from customers (CAD4).

Primary data is collected directly from the source using a questionnaire given to respondents. Primary data in this research was obtained from the answers to a questionnaire distributed to respondents. The method used in this research is collecting data through a questionnaire created using Google Forms. The questionnaire is distributed online using a Google Forms link via social media such as Line, WhatsApp, and Instagram. Respondents only chose answers that matched the statements provided. The requirements for respondents who fill out the research questionnaire meet the sample requirements to be used. This research uses a Likert scale, which helps indicate the respondent's level of agreement or disagreement with each statement in the questionnaire from Strongly Disagree (STS = 1), Disagree (TS = 2), Neutral (N = 3), Agree (S = 4), and Strongly Agree

(SS). This research uses data analysis from data obtained from respondents and then processed using the Partial Least Square (PLS) method. PLS is a data analysis technique that can relate several independent variables to several dependent variables. PLS can be implemented as a path model, which handles causal paths connecting independent variables and paths connecting independent variables to dependent variables. Using the PLS approach, evaluating the model's suitability with latent variables is necessary by using outer and inner model assessment criteria (Shiau et al., 2019).

4. Data Analysis

The profile of respondents who filled out the questionnaire was found to be 61% male (54 respondents) and 39% (35 respondents) female. The respondent profile based on length of work was found to be between 2 and 3 years by 18% (16 respondents), three up to 5 years by 13% (12 respondents), between 5-7 years by 21% (19 respondents) and more than seven years by 47% (42 respondents). The respondent profile based on position in the company was found to be at the Owner level by six respondents (7%), Directors/General Managers 12% (11 respondents), Managers/Assistant Managers 20% (18 respondents), Supervisors 33% (29 respondents) and Junior/Senior staff 28% (25 respondents). Data processing used PLS with outer model assessment criteria as indicated by a validity test with an outer loading above 0.500 (Shiau et al., 2019). Testing the consistency of measurement used a reliability test as indicated by composite reliability, and Cronbach's Alpha values were more significant than 0.7, and AVE was above 0.50, as shown in Table 1.

Table 1

The results of the factor loadings

Item Measurement	Loading Factor	Composite Reliability	Cronbach Alpha	AVE
Implementation of information technology		0.877	0.866	0.607
Connect with corporate partners (IT11)	0.833			
Coordination with partners can be done via electronic link (IT12)	0.571			
Transactions supported by information technology (IT13)	0.835			
The company sends messages via electronic media (IT14)	0.844			
Purchase of goods is done electronically (IT15)	0.768			
Information technology can be used in delivery (IT16).	0.790			
Supply chain integration		0.789	0.744	0.577
Shared decision making (SCI1)	0.876			
Sharing forecasting with partners (SCI2)	0.725			
Collaborate with partners in setting strategy (SCI3)	0.859			
Involving partners to solve problems (SCI4).	0.528			
Supply chain flexibility		0.820	0.801	0.621
Flexibility in the production process (SCF1)	0.803			
Flexibility on new product development (SCF2)	0.804			
Flexibility in raw material procurement (SCF3)	0.816			
Flexibility on distribution or delivery (SCF4)	0.727			
Competitive advantage		0.849	0.848	0.687
Increase in market share above the average competitor (CA1)	0.823			
Lower costs compared to competitor average (CA2)	0.827			
Faster customer response capability than competitors (CA3)	0.834			
Company satisfaction is better than competitors (CA4)	0.832			

Table 1 shows that all research items met the validity test requirements, and the reliability test met the specified requirements. The Q square value as a form of inner model goodness of fit is obtained in Table 2.

Table 2

R-square value

Research variable	R Square	R-square adjusted
Supply Chain Integration	0.505	0.500
Supply Chain Flexibility	0.612	0.603
Competitive Advantage	0.751	0.743

Based on Table 2, it is found that the implementation of information technology can determine supply chain integration by 50%. Implementing information technology and supply chain integration can determine supply chain flexibility of 60.3%. Implementing information technology, supply chain integration, and flexibility together determines a competitive advantage of 74.3%. The Q square value determines the predictive value of the model are $Q^2 = 1 - [(1 - r_1^2) \times (1 - r_2^2) \times (1 - r_3^2)]$ is $Q^2 = 1 - [(1 - 0.505) \times (1 - 0.612) \times (1 - 0.751)] = 0.9522$. This shows that 95.22% of the changes provided by implementing information technology can provide changes to supply chain integration, supply chain flexibility, and competitive advantage.

5. Discussion

The test carried out in the next stage was a research model with partial least squares (PLS) obtained from the path coefficient or inner model values seen in Fig. 2 and Table 3.

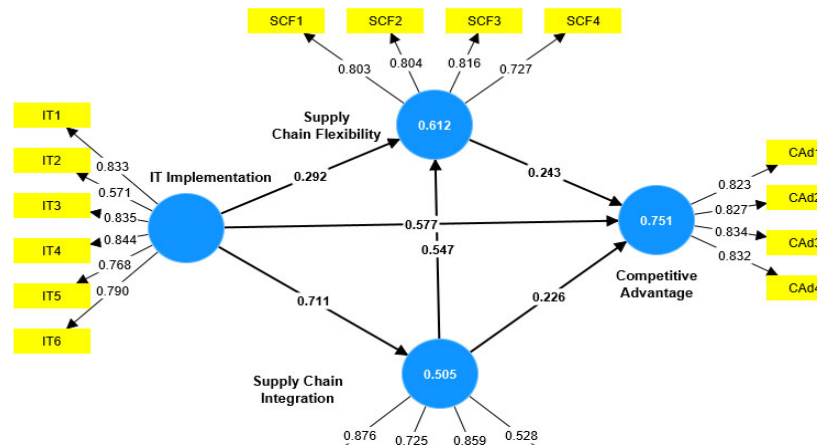


Fig. 2. Results of test path coefficient

Table 3
Hypothesis Test Results

Hypothesis testing	Original sample (O)	T statistics	P values
IT Implementation → Supply Chain Integration (H1)	0.711	15.469	0.000
IT Implementation → Supply Chain Flexibility (H2)	0.292	2.643	0.008
IT Implementation → Competitive Advantage (H3)	0.577	5.419	0.000
Supply Chain Integration → Supply Chain Flexibility (H4)	0.547	5.865	0.000
Supply Chain Integration → Competitive Advantage (H5)	0.226	1.967	0.047
Supply Chain Flexibility → Competitive Advantage (H6)	0.243	2.386	0.017
IT Implementation → Supply Chain Integration → Competitive Advantage (H7)	0.161	1.811	0.070
IT Implementation → Supply Chain Flexibility → Competitive Advantage (H8)	0.182	1.965	0.049
IT Implementation → Supply Chain Integration → Supply Chain Flexibility → Competitive Advantage (H9)	0.056	1.312	0.190

Testing the first hypothesis (H1), namely the implementation of information technology on supply chain integration, was obtained at 0.711, which had a t-statistic of 15.469, exceeding the t-statistic of 1.96, and p-values of 0.000 are below 0.050. It can be concluded that there is a significant influence between the implementation of information technology and the supply chain integration of manufacturing companies in East Java. The company's ability to carry out transactions is supported by information technology. The company's sending messages via electronic media can impact supply chain integration by increasing the ability to collaborate with partners in determining strategies. This research supports research results which state that the implementation of information technology influences increasing supply chain integration (Yuan et al., 2022; Sundram et al., 2020; Yu et al., 2021; Basana et al., 2022b; Ju et al., 2021; Tan & Sidhu, 2022; Tarigan et al., 2021a; Tarigan et al., 2020). The results of testing the second hypothesis, namely the implementation of information technology on supply chain flexibility, were obtained at 0.292, with a t-statistic of 2.643, exceeding the t-statistic of 1.96. This condition shows a significant influence between implementing information technology and supply chain flexibility in manufacturing companies in East Java. The company's ability to carry out transactions is supported by information technology, and the company's sending messages via electronic media can impact supply chain flexibility in the procurement of raw materials and flexible production processes. This research supports research results which state that the implementation of information technology influences increasing supply chain flexibility (Yuan et al., 2022; Vafaei-Zadeh et al., 2020; Doetzer & Pflaum, 2021; Putra et al., 2020). The third hypothesis (H3), which is determined by the implementation of information technology on competitive advantage, is 0.577, which has a t-statistic of 5.419, which exceeds the t-statistic of 1.96. Companies that relate to corporate partners and transactions supported by information technology as a form of information technology implementation have a positive and significant effect on competitive advantage. This research confirms research results stating that implementing information technology influences competitive advantage (Riley et al., 2016; Yuan et al., 2022; Sundram et al., 2020; Vafaei-Zadeh et al., 2020).

Testing the fourth hypothesis (H4), namely that supply chain integration influences supply chain flexibility of 0.547, which is indicated by a t-statistic value of 5.865 and exceeding the t-statistic of 1.96. This shows that the supply chain integration that is formed can make decisions together and share forecasting with partners, which impacts supply chain flexibility by increasing flexibility in new product development and flexibility in distribution or delivery. This research supports research results that state that supply chain integration influences supply chain flexibility in manufacturing companies (Shukor et al., 2021; Vafaei-Zadeh et al., 2020; Caniato & Größler, 2015; Doetzer & Pflaum, 2021; Siagian et al. al., 2021; Willis et al., 2016). The fifth hypothesis that supply chain integration influences competitive advantage can be accepted with a t-statistic

value of 1.967 and exceeds the t-statistic of 1.96. This condition shows that an increase in supply chain integration, which is described by the ability to collaborate with partners in determining strategies and involve partners in solving problems, has an impact on competitive advantage by creating lower costs compared to the average competitor and the ability to respond to customers faster than competitors. The research results confirm previous research which shows that supply chain integration influences competitive advantage (Sundram et al., 2020; Basana et al., 2022b; Siagian et al., 2021; Dhaigude et al., 2021; Shukor et al., 2021; Caniato & Größler, 2015; Siagian et al., 2022).

The sixth hypothesis (H6) states that supply chain flexibility influences competitive advantage and can be accepted with a t-statistic value of 2.386 and exceeds the t-statistic of 1.96. This shows that supply chain flexibility in new product development and flexibility in the production process influence competitive advantage. Manufacturing companies gain a competitive advantage by increasing customer response capabilities faster than competitors and better company satisfaction than competitors. The results confirm previous research stating that supply chain flexibility influences competitive advantage (Doetzer & Pflaum, 2021; Siagian et al., 2021; Fayezi et al., 2015; Wungkana et al., 2023). The seventh hypothesis (H7), namely that implementing information technology influences competitive advantage of 0.161 through supply chain integration, is obtained with a t-statistic value of 1.811, more excellent than 1.65 (significance value 10%), declared acceptable. This condition shows that the company's ability to connect with company partners can speed up joint decision-making, thereby having an impact on increasing market share above the average of competitors and lowering costs. This research supports previous research that implementing information technology influences competitive advantage through supply chain integration. Testing the eighth hypothesis (H8), namely that implementing information technology influences competitive advantage of 0.182 through supply chain flexibility, is obtained with a t-statistic value of 1.965, more significant than 1.95, considered acceptable. Implementing information technology owned by the company with flexibility in the production process and new product development can impact competitive advantage by increasing the company's ability to respond to customers more quickly and improving the company's satisfaction compared to competitors. This research supports research results that state that implementing information technology influences competitive advantage through supply chain flexibility.

The final hypothesis, namely the ninth hypothesis (H9), which states that information technology implementation influences competitive advantage through supply chain integration and supply chain flexibility, is 0.056 with a t-statistic value of 1.312, which is smaller than 1.65, so it is declared rejected. This research provides a practical contribution for company management to ensure that the implemented information technology runs well and can accommodate the company's operational needs so that it can be relied on to provide fast data. The capability of a reliable information technology system can help company leaders determine the right decisions to adjust to the competitive strategy set by the company (Khanuja & Jain, 2022). Company operational managers can utilize information technology to build adequate partnerships with suppliers and customers through supply chain integration. Contributions to the planning function can be to carry out flexible forecasting and schedules for the company's raw material needs and product delivery to customers. The theoretical contribution of the research is to enrich the resource-based view theory in increasing competitiveness with information technology in supply chain management.

6. Conclusion

Information technology is necessary for manufacturing companies to achieve efficiency and effectiveness during increasingly tight competition and short timeframes. The company's ability to maintain the integration of company systems so that they are agile and precise in making decisions to adapt to the company's external conditions. Based on the research results, several conclusions can be drawn, namely the implementation of information technology in manufacturing companies to improve supply chain integration. The company's ability to use information technology to communicate and transact quickly can improve joint decision-making. The implementation of information technology in manufacturing companies can increase supply chain flexibility. The information technology implemented by the company by connecting with partners can increase flexibility in the production process and new product development. Implementing information technology in manufacturing companies can increase competitive advantage by increasing the company's ability to respond to customers faster than competitors. Supply chain integration in manufacturing companies can increase supply chain flexibility and competitive advantage. Supply chain flexibility, with flexibility in developing new products and the production process, increases the ability to respond to customers faster. The company's customer satisfaction is better than competitors. Companies can increase their competitiveness by increasing supply chain performance achievements.

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