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Research article

The Effect of Information Technology Implementation on Supply Chain Performance through Information Sharing and Supply Chain Collaboration

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Abstract

The Covid-19 pandemic has resulted in a slowdown in the global economy, and the Indonesian economy has also been affected. The implementation of industry 4.0 is considered the right strategy to revitalize the manufacturing sector. This study aims to determine and understand the effect of information technology implementation on supply chain performance through information sharing and supply chain collaboration. This study uses a quantitative approach to measure an independent variable effect on mediation and dependent variables to test the predetermined hypotheses. The data was collected using a non-probability sampling technique with a purposive sampling method through a questionnaire instrument with the total number of respondents of 70 manufacturers in Surabaya. Then, the data were analyzed using Partial Least Square software and Structural Equation Modeling based on components or variants. The results indicate that the relationship between supply chain collaboration and information sharing creates competitive advantages. Consequently, the existence of precise, accurate, and qualified information can facilitate joint decision-making. Furthermore, the increasing adoption of supply chain collaboration with information technology can improve company performance. In conclusion, a manufacturing company can maintain its supply chain performance during the Covid-19 pandemic by implementing information technology, information sharing and collaboration with partners in a supply chain. This study provides insight and guidance for managers on ways to improve supply chain performance. This study can also contribute to current research in supply chain management theory.

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1. Introduction

The competitiveness of the business world requires companies and organizations to optimize their supply chains. A company's supply chain must be optimized in order to operate efficiently and thus reduce costs and increase customer satisfaction. An adequate supply chain strategy must be implemented by taking into account the interactions at various supply chain stages to reduce costs and increase service performance. Therefore, Supply Chain Management (SCM) involves decisions that must be made at various levels, such as the strategic, tactical, and operational [1].

Nowadays, it is challenging for businesses to develop independently due to the effects of the Covid-19 pandemic [2]. In general, the Covid-19 pandemic has affected global industrial processing, and especially in Indonesia. The pandemic also causes SCM problems where companies have had difficulty monitoring demand and inventory for both long and short term due to the limited number of workers allowed in factories and the economic slowdown. On the other hand, retailers have experienced a shortage of inventory as customers tend to buy in large quantities to minimize contact in open spaces. Based on the Prompt Manufacturing Index data issued by Bank Indonesia (BI), the industrial sector performance index decreased from 51.5% in the fourth quarter of 2019 to 45.64% in the first quarter of 2020 [3]. BI also predicted that the index would increase again in the second quarter of 2020. This claim was supported by the upsurge in the volume of goods ordered and inventories. However, the Indonesian Minister of Industry admits that the current downturn in Indonesia's manufacturing purchasing index is influenced by the large number of areas affected by Covid-19. In line with this, the Minister came up with a solution to simplify the flow of raw materials and increase competitiveness through the 4.0 industrial revolution, which was believed to improve the digital-based economy.

Industrial Revolution 4.0 is a phenomenon that maximizes the collaboration of automation carried out by technology with cyber systems, and is focused on minimizing human labor. The significant development of information technology presents information quickly and easily. Information technology implementation (IT) contributes to noteworthy increase in SCM activities, giving effective results in managing raw materials. A company's supply chain management is essential because it directly affects the finance and the achievement of the company. It is also important to note that a company's supply chain management is gradually changing regardless of its current management system. Moreover, there are still significant delays in strategies on how to coordinate logistics and manage resources in the supply chain. For this problem, IT can develop better business performance, playing a role as a supply function [4]. There were significant findings in regard to information sharing (IS) and information quality, resulting in a mediating effect on IT and supply chain performance (SCP) relationships [5]. Therefore, by implementing IT in business, companies get to quickly and promptly share qualified information, which can improve SCP.

Additionally, SCP plays a considerable role in information technology [6]. It is not only aimed at understanding the impact of IS and collaboration on SCM, but also provides more insight into SCM implementation in industries. Information-sharing is considered as a vital component in managing supply chain relationships and influencing SCP [7]. In order to establish a good IS, companies invest in technological innovations that develop effective communication and collaboration channels to improve SCP. A relationship between trust, technology, collaboration, and company operational performance in Thailand's supply chain was founded by Salam [8]. The analysis showed that trust and technology capabilities systematically lead to increased collaboration, meaning that better collaboration among supply chain partners contributes to superior operational performance. Supply chain collaboration (SCC) is a viable strategy that highlights commitment to maintain an ongoing partnership [6]. Certainly, any future collaborative relationship between supply chain partners requires both parties' commitment to achieve their goals.

Although previous researchers have examined the effect of several variables used in this study, no research has explored their effects in a single research model. Therefore, this study presented SCC and IS as mediations in a relationship between IT and SCP with the objectives to determine and understand the effect of IT on SCP. The research questions were: 1) Does SCC mediate the effect of IT on SCP? 2) Does IS mediate the effect of the IT on SCP? and 3) Do IS and SCC mediate the effect of IT on SCP? This study indicated that the relationship between IS and SCC created a competitive advantage, where precise, accurate, and quality information could facilitate joint decision-making. Meanwhile, the increasing implementation of SCC combined with information technology implementation could improve company performance.

2. Materials and Methods

2.1 Materials

2.1.1 Information technology implementation (IT)

IT concerns with information systems and technology regarding information sharing, coordination, collaboration, and communication, features that connect companies with their supply chain partners [9]. These features allow a company to gain benefits such as operational cost reduction, customer service improvement, and a sustainable competitive advantage. IT is deemed crucial as a significant and specific investment in supply chain relationships [10]. Information technology can reduce coordination costs and lower transaction risk. It can also create a low-risk relationship between parties, either by exchanging information or investing. It is an integrated part of business operations [11] that has an impact on productivity, innovation, customer satisfaction, and control management. Admittedly, information technology is a crucial infrastructure that enables businesses to share information within their supply chain partners easily. The growth of information technology with communication technology in SCM plays an essential role in optimizing the supply chain network's decisions to achieve more substantial organizational competitiveness, higher service levels, lower inventory, lower supply chain costs, and lower electronic risk. In the SCM field, IT is also required to achieve effective integration and IS across and outside the organization. Furthermore, organizations are moving towards virtual supply chains with vast changes in information technology. Increasingly adopting applications such as EDI, RFID, bar-coding, e-commerce, decision support systems, ERP packages, are applied to limit electronic risk [12].

2.1.2 Information sharing (IS)

IS consists of all forms of data exchange between individuals within a department, between departments within a company, or between companies in a supply chain network. It helps companies avoid redundancies, reduce costs, and even improve the speed and quality of responses. Information technology advancement plays an essential role in facilitating IS between two parties to coordinate in a supply chain [5], referring to the flow of efficiency and effectiveness of information between a company and its partners in the supply chain. This information includes predictions and production schedules, as reflected in the inventory draw rates [13]. The finding of this research suggested that customers and suppliers frequently exchanged information through EDI in improving company performance.

IS fits the standard of the timeliness and continuous replenishment of supplies, making it the perfect basis of SCM [14]. It plays a vital role in SCC [11] by allowing companies to collect, analyze and distribute data among chain members to improve their decision making. Its system

requires real-time, relevant, and accurate information to maximize its performance, which also connects managers throughout functional and organizational boundaries to provide appropriate, accurate, and timely information that enables them to create better, more collaborative decisions. Moreover, IS refers to the company's ability to share knowledge among the supply chain partners effectively and efficiently as effective information sharing is considered to be one of the most crucial supply chain capabilities.

2.1.3 Supply chain collaboration (SCC)

SCC is a strategic response to supply chain problems [15] that includes information sharing, resource sharing, and coordination among all supply chain partners. Several studies have identified cost reduction, profit, forecast accuracy, and inventory control as benefits. In line with the effects of globalization and information technology, the adoption of SCC has increased [8]. The benefits of collaboration are to implement critical dimensions into collaborative relationships, including sharing information and resources, synchronizing decisions, and communication [16]. Therefore, it is necessary for companies to set appropriate collaboration standards. Once a chain of collaboration is formed, trust and commitment play a significant role in developing the relationship. In addition, several companies have built collaborations with other supply chain partner organizations [17]. For instance, after hearing the fruitful collaboration of Wal-Mart with their suppliers, SCC has become one of the expected norms for many companies worldwide. This chain of collaboration encourages all supply chain parties to be involved in planning, sharing information and resources. On the other hand, a lack of collaboration in the supply chain results in inefficient production, excessive inventory stock, and increased costs. With that being said, it is safe to assume that SCC is a core competency in the global market.

2.1.4 Supply chain performance (SCP)

Various SCP measurements are based on SCM evaluation [13]. SCP can be measured through inventory investment, efficiency of the delivery level, service, supplier performance, and costs. In this study, SCP is described as an evaluation of SCM, focusing on the effects of IS and business systems in the supply chain. SCP talks about the ability of a supply chain to effectively carry out its activities while minimizing costs for the primary purpose of meeting the critical needs of customers [16]. An organization's achievement is also dependent on the success of the supply chain in which the organization participates as a partner.

Success in the supply chain is mostly determined by customer satisfaction. The higher the customer satisfaction, the more efficient and effective the management at the organizational level are. Effective SCM influences the end customers' satisfaction and offers a relatively low total cost of the product or service [8]. A major challenge in supply chain operations and management is to provide products or services that increase revenue and achieve a high level of customer satisfaction. To overcome this challenge, every participant in the supply chain, including distributors, retailers, manufacturers, and suppliers is required to offer a competent supply chain [18].

2.1.5 Relationship between two concepts

To begin with, information technology provides information and collaborative communication infrastructure within SCC practice that leads to improving individual performance; hence, it is widely recognized as a critical factor. Therefore, two-way communication among supply chain members is the main characteristic of SCC relationships, which enables partners to build trust, commitment, a shared vision, and thus forms the root of information exchange to benefit the supply

chain [19]. Eventually, supply chain relationships achieve collaboration, where electronic mechanisms take place to be distributed among partners quickly.

H1a: IT affects the SCC

SCC is essential for many companies worldwide. The benefits of SCC, such as cost calculation, profit, demand forecast, and inventory control play an important role in SCP [16]. SCM requires a well-connected inter-organizational relationship between partners to perform better to achieve customer satisfaction, and ultimately, gain a competitive advantage [7].

H1b: SCC affects the SCP

The presence of IT in business operations enables companies to share information in real-time. IT also allows companies to provide qualified information, eventually improving SCP [20]. The development of supply chain information technology, in general, is affected by the global environment that demands quick response services to win the competition. As a result, there is an emerging development of specific information network patterns with advances in IT and communication that makes IS possible [21].

H2a: IT affects the IS

IS, joint decision-making, and EDI are essential factors for operational performance [22]. IS serves as a fundamental approach for corporate endurance and empowerment of supply chain integration. Also, IS becomes more efficient with cooperation and coordination between supply chains, leading to an increase in competitive advantage [11, 19].

H2b: IS affects the SCP

Concerning the implementation of operational, technical, and strategic activities with partners, companies with a commitment to partnerships are more likely to perform IS with their members [6]. SCC provides relevant, accurate, and timely information, which encourages better, more collaborative decision making. Technological advances facilitate the dramatic increase of company ability to connect and perform IS [22].

H3a: IS affects the SCC

The existence of information technology assists companies to communicate, to perform IS with supply chain partners, to make electronic transactions and decisions, leading to increased efficiency, effectiveness, competitiveness, and profitability to improve SCP [23]. IT can increase SCP in a direct way [8, 10] by positively influencing information exchange and information quality. It can be said that IS and information quality contribute to mediating effects in IT and SCP relationships.

H3b: IT affects the SCP

Based on the above hypotheses, the following main hypotheses will be evaluated. The research framework can be seen in Figure 1.

H1: SCC mediates the effect of IT on SCP
H2: IS mediates the effect of IT on SCP, and
H3: IS and SCC mediate the effect of IT on SCP

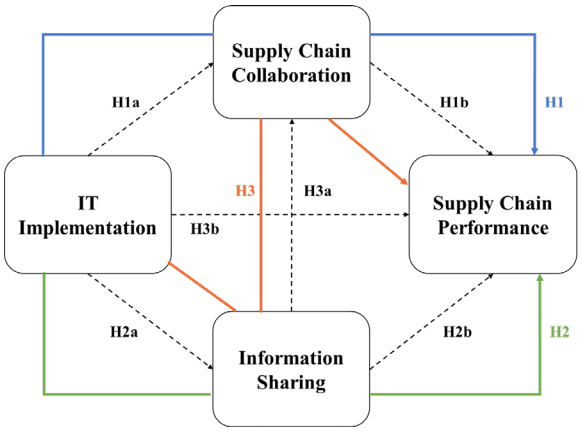

Figure 1. Research framework

2.2 Methods

This study was conducted through a quantitative approach to measure the effect between an independent variable (IT), mediating variables (IS, SCC), and a dependent variable (SCP), all of which have been defined in the hypotheses in the previous section. The indicators for each variable were be described as follows.

Information technology is a required infrastructure to facilitate IS in business and supply chain partners. The indicators used in the IT variable [11] were the following: Electronic systems (internet) (IT1), electronic payment systems (IT2), websites for product introduction (IT3), ERP/SCM software systems (IT4), RFID technologies (IT5), e-commerce (IT6), and information technology to manage supply chain systems (IT7). Another variable, information sharing, is a sharing system of operational, marketing, and logistics information in a supply chain network. The indicators used for the IS variable [24] were based on the following: IS with customers (IS1), IS with suppliers (IS2), inter-functional IS (IS3), and intra-organizational IS (IS4). The next variable, supply chain collaboration, is defined as two or more supply chain members who work together to create a competitive advantage. The indicators used for the SCC variable [8] were as follows: joint decision making (SCC1), demand forecasting (SCC2), and inventory replenishment (SCC3). The last variable was SCP; whether or not a supply chain succeeds is determined through the customer satisfaction. A successful supply chain is the one that achieves the highest customer satisfaction and manages the companies efficiently and effectively [25]. The indicators used for the SCP variable [22] were: performance of final products (SCP1), speed of deliveries (SCP2), volume or capacity flexibility (SCP3), and production costs (SCP4). In summary, questions in the questionnaire related to the indicators of the variables used in the research, i.e. IT, IS, SCC, and SCP, and they can be seen in Table 1.

The population of this study was 206 manufacturing companies that had implemented IT in their business process, and the number of employees was more than 100 people in the city of Surabaya, Indonesia [26]. The sampling size of 70 respondents was calculated using Slovin [27]. This study used a non-probability technique with a purposive sampling method. The researchers collected data by selecting respondents who met the criteria. Thus, the samples were suitable for the research objectives and provided representative research results. The researchers used five-points Likert scale questionnaire as the instrument to collect data, namely 1) Strongly Disagree, 2) Disagree, 3) Neutral, 4) Agree, and 5) Strongly Agree.

In this study, the collected data were analyzed using an analytical tool called Partial Least Square software (PLS). PLS is a structural equation modeling technique based on components or variants to evaluate the outer and inner models. Next, the evaluation of the outer model was categorized into validity and reliability tests. Then, the validity was asserted into convergent validity and discriminant validity tests, whereas the inner model evaluation was evaluated by R-Square and Q-Square.

3. Results and Discussion

3.1 Results

3.1.1 Respondent profile and descriptive analysis variable

The research respondents were employees from large manufacturing companies implementing IT in their business processes in Surabaya, Indonesia. In addition, respondents had worked for more than two years with the minimum requirement of being a staff member who understood the use of IT in the company. From 98 questionnaires, 28 questionnaires did not meet the research profile. Therefore, this study used 70 respondents who met the profile who had the following positions: manager (40.0%), staff (31.4%), supervisor (18.6%), and director/CEO (10.0%). The majority of respondents came from divisions as follows: purchasing (58.6%), followed by distribution (17.1%), warehousing (11.4%), and others (12.9%). The last categories of the manufacturing industry were based on the type of product. Most of them were electrical/technical equipment industry (15.71%), followed by the paint and printing ink industry (14.29%), metal goods industry (10.00%), pharmaceutical industry, chemical medicine and traditional medicine (8.57%), agriculture, fishery and livestock industry (8.57%), and other industries (42.86%). Thus, there was no dominant respondent in the category.

The average result of the IT indicators was 4.13, which meant that the respondents had implemented a satisfactory information technology system in their business operations. The average Bottom Two Box (BTB) and Top Two Box (TTB) values were 4.9% and 76.3%, meaning that there were 70 respondents who had developed IT in their business. Meanwhile, the standard deviation IT indicators were relatively high, ranging from 0.775 to 1.068, indicating that there was still a gap in IT between the companies.

The IS indicator average was 3.73, which meant the respondents had shared information about their business. Respectively, the BTB and TTB average values were 8.2% and 65%, which indicated that 70 respondents had shared information in their business operations. Meanwhile, the standard deviation values of the IS indicators were relatively high, ranging from 0.713 to 0.881, from which it could be claimed that there was still a gap in the implementation of IS between companies.

The SCC indicators average was 4.36, which meant the respondents had collaborated on supply chains in their business processes. The average values of BTB and TTB were 11.5% and 89.97%, respectively, demonstrating that all 70 respondents had practiced SCC in their business. Additionally, the standard deviation SCC indicators were reasonably high, ranging from 0.623 to 1.044, showing that there was still a gap in SCC among companies.

The SCP indicators average was 4.18, which meant that the respondents had generally seen a good supply chain performance in their business operations. The average values of BTB and TTB were 13.6% and 87.5%, respectively, confirming that 70 respondents had practiced SCP in their business. Considering the standard deviation values, the SCP indicators were somewhat high, ranging from 0.604 to 0.925, which showed that there was still a gap in the SCP between companies.

3.1.2 Outer model evaluation

The evaluation of the outer model involved testing for both convergent and discriminant validity. All indicators passed the convergent validity test if they had outer-loading values greater than 0.7 [28]. As shown in Figure 2, the outer-loading values (numbers on arrows leading to yellow rectangles) for each indicator were more than 0.7. Therefore, the predetermined variables were valid. Likewise, the Average Variance Extracted (AVE) values of IT, IS, SCC, and SCP were 0.604, 0.604, 0.661, and 0.637, respectively. All AVE values were greater than 0.5 [28], which meant that all variables were valid. Accordingly, all variables meet the convergent validity requirements and were able to be used for the subsequent analysis.

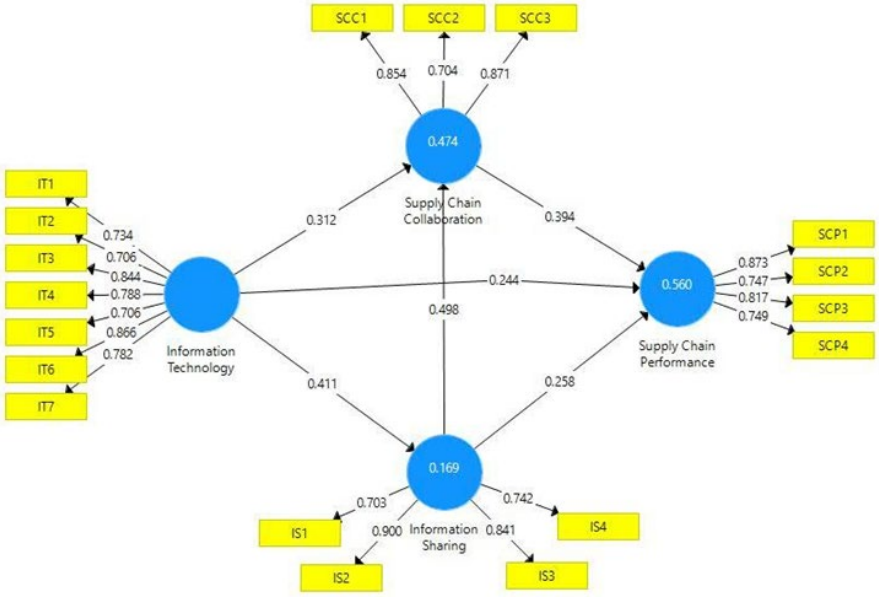

Figure 2. Outer and inner model evaluation

The indicators of the instruments proved to have adequate discriminant validity if the variable's cross-loading value of the indicator was greater than other variables' cross-loading values of other indicators. As shown in Table 1, the cross-loading values for IT indicators (**0.706~0.866**) were greater than non-IT (0.149~0.598), and the SCC cross-loading values (**0.704~0.871**) were higher than the non-SCC (0.211~0.608). Furthermore, the IS cross-loading values (**0.703~0.9**) were higher than the non-IS values (0.149~0.671), and the SCP cross-loading values (**0.747~0.873**) were greater than the non-SCP (0.284~0.613). In summary, all the cross-loading values of IT, SCC, IS, and SCP indicators were above 0.7 [28]. This meant that all indicators in this study met the requirements of discriminant validity. Therefore, we selected all the indicators.

Another method to measure the discriminant validity of a research instrument is through the Fornell Larcker criterion, which compares the AVE root value of a variable with its correlation values with other variables. So, if the root AVE value of a variable is greater than the correlation value with other variables, the variable qualifies for discriminant validity. The root AVE value of each variable in Table 2 is greater than the correlation value with other variables, which means the variables of this study adequate the discriminant validity requirements.

Table 1. Cross loading

Indicator	IT	SCC	IS	SCP
Our company exchanges business information optimally using electronic systems (internet) (IT1)	**0,734**	0,430	0,287	0,284
Our company uses an electronic payment system to optimize transactions (IT2)	**0,706**	0,376	0,254	0,360
Our company uses websites to introduce products optimally (IT3)	**0,844**	0,574	0,323	0,453
Our company uses information technology to integrate various business activities optimally (IT4)	**0,788**	0,395	0,500	0,538
Our company uses a barcode technology system for optimal data identification (IT5)	**0,706**	0,211	0,149	0,310
Our company uses an electronic system (internet) for optimal data dissemination (IT6)	**0,866**	0,442	0,227	0,488
Our company uses information technology systems to manage supply chain systems optimally (IT7)	**0,782**	0,303	0,391	0,496
Our company collaborates with suppliers for joint decision making (SCC1)	0,430	**0,854**	0,671	0,582
Our company collaborates with suppliers to determine the company's raw material inventory level (SCC2)	0,149	**0,704**	0,350	0,451
Our company collaborates with customers to estimate product demand (SCC3)	0,598	**0,871**	0,463	0,613
Our company shares information with customers (IS1)	0,265	0,488	**0,703**	0,327
Our company shares information with suppliers (IS2)	0,272	0,547	**0,900**	0,538
Our company shares information with organization partners (other than suppliers or customers) (IS3)	0,315	0,545	**0,841**	0,511
Our company shares information among business functions within the company (IS4)	0,453	0,427	**0,742**	0,532
Our company achieves production performance according to the planned target (SCP1)	0,545	0,608	0,483	**0,873**
Our company delivers goods according to customer orders (SCP2)	0,401	0,554	0,594	**0,747**
Our company has set a production capacity plan for each type of product according to market demand (SCP3)	0,393	0,592	0,483	**0,817**
Our company can achieve production costs within the planned budget (SCP4)	0,422	0,386	0,341	**0,749**

Table 2. Fornell-Larcker criteria

Variable	IS	IT	SCC	SCP
IS	**0.800**			
IT	0.411	**0.777**		
SCC	0.627	0.517	**0.813**	
SCP	0.605	0.554	0.682	**0.798**

The purpose of a reliability test is to discover whether the measuring instrument used in the study is appropriate and reliable. A variable is reliable if its Cronbach's Alpha value is greater than 0.7. As seen in Table 3, each variable has Cronbach's Alpha value that is greater than 0.7. Thus, the data collected in this study fulfills the reliability requirements and can be processed further.

Similarly, the composite's reliability requires a variable's value to be greater than 0.7. If less than 0.7, the variable is not reliable. Table 3 also shows that each variable had a composite reliability value above 0.7. Therefore, the variables were proven to be reliable and passed the standard for composite reliability.

Table 3. Cronbach's Alpha dan Composite Reliability

Variable	Cronbach's Alpha	Composite Reliability
IT	0.891	0.914
IS	0.809	0.876
SCC	0.809	0.875
SCP	0.746	0.853

3.1.3 Inner model evaluation

The evaluation of the inner model is dependent on the percentage of the selected variants, namely R-Square and Q-Square. A Q-Square value greater than zero indicates that a structural model has more predictive relevance, whereas a Q-Square value smaller than zero implies that the model has less predictive relevance. In this context, Figure 2 reports that the output values of the dependent variables from PLS with R-Square (numbers inside the blue circles) are all not less than zero. The dependent variable IS, SCC, and SCP are scored 0.169 (R_1^2), 0.474 (R_2^2), 0.560 (R_3^2), respectively. The scores mean that: the IT variable influences the IS variable by the percentage of 16.9%, both IT and IS variables have the influence of 47.4% on the SCC variable, all IT, IS, and SCC variables affect more than half of the SCP variable by 56.0%, while the influence of other factors outside of this study remains 43.1%.

Next, the predictive relevance test was done by evaluating the Q-Square values using (1) based on each R-Square value. In order to answer the research hypothesis, the result of Q-Square value must be greater than 0 (zero). The obtained Q-Square value was 0.482, which meant that this research met the predictive relevance requirements and was appropriate to answer the research hypothesis.

$$Q\text{-}Square = 1 - ((1-R_1^2) \times (1-R_2^2) \times \ldots \times (1-R_p^2)) \quad (1)$$

3.1.4 Hypothesis testing

Based on the research questions and framework, the researchers wanted to know whether IT affected SCP, which was mediated by SCC (H1), IS (H2), and IS and SCC (H3). The hypothesis of the direct relationship between the two variables must be evaluated firsthand, namely H1a, H1b, H2a, H2b, H3a, and H3b. Only if the hypotheses of the direct relationship between two variables associated with mediation are proven to be significantly positive can the mediated hypotheses be constructed, i.e. H1, H2, and H3.

Hypothesis testing was conducted with a certainty level of 95% and an error rate (p-value) of 5%, meaning that the t-table was 1.96. The research hypothesis is accepted if the critical structural ratio (t-statistic) is greater than or equal to the t-table. Table 4 shows the results of the research of direct hypotheses testing using the bootstrap procedure. The Table indicates that all t-statistics were greater than 1.96, all p-values were less than 0.05, and all of the Original Sample Estimates were greater than 0 (zero), which meant that all hypotheses of the direct relationship between two variables were proven to be significantly positive, particularly the hypotheses of the mediation relationship between IT and SCP through IS and SCC.

The last three lines in Table 4 present mediated hypotheses with all t-statistics greater than 1.96, p-values less than 0.05, and original sample estimated values greater than 0. It means that all

mediated relationships of IT to SCP are positive. Likewise, IT affects SCP, which is mediated by IS and SCC, with the same t-statistics and *p*-values, indicating that the two mediations share the same roles. However, by combining the mediated IS and SCC, the t-statistics increases from 2.092 to 2.665 whereas *p*-values decrease from 0.037 to 0.008. The finding suggests that IT effect on SCP that is mediated by IS and SCC is higher (*t*-statistics = 2.665) than the direct effect of IT on SCP (*t*-statistics = 2.145). The mediation on the IS and SCC variables, which generate a high effect (*t*-statistics = 5.510), confirms that the mediation is effective.

Table 4. Hypotheses test results

Hypothesis	Original Sample Estimate	t-statistics	p-values
H1a: IT→SCC	0.312	3.229	0.001
H1b: SCC→SCP	0.394	3.938	0.000
H2a: IT→IS	0.411	3.736	0.000
H2b: IS→SCP	0.258	2.964	0.003
H3a: IS→SCC	0.498	5.510	0.000
H3b: IT→SCP	0.244	2.145	0.032
H1: IT→SCC→SCP	0.123	2.092	0.037
H2: IT→IS→SCP	0.106	2.092	0.037
H3: IT→IS→SCC→SCP	0.081	2.665	0.008

3.2 Discussion

First, based on the hypothesis testing above, IT had a significant positive effect on SCC (H1a). IT is an essential variable in SCC because IT provides information and collaboration communication infrastructure that allows SCC practices. Regularly upgraded technological infrastructure promotes stable development and closer affiliation between partners. For supply chain partners to achieve collaboration, electronic instruments (i.e. technology) must be able to assess partners' needs to perform real-time information exchange. This finding supports the previous research [9, 17] that reported that IT in companies could improve SCC.

Second, SCC had a positive effect on SCP (H1b). SCC has become one of the essential things in many companies globally. SCC between partners is central for the relationship between organizations nowadays. A trust-based and long-term relationship with suppliers encourages many benefits for the company. The goal is to offer a better SCP on the customer side. This result agrees with the previous research [14, 25], which concluded that SCC in companies could improve SCP.

Third, IT had a significant effect on IS (H2a). The presence of IT in business enables companies to share information in real-time. IT makes it possible to access information from and to other organizations, which expands and updates organizational boundaries until the company's value needs to be reformed. Information technology helps companies sharing their data, information, and business applications with their business partners and provide electronic transaction capabilities. This study supports the previous research [20], which also showed that IT in companies could increase IS.

Fourth, IS had a notable effect on SCP (H2b). The TTB of IS4 is the highest (80%), and the third-highest of outer loadings (0.742) on the IS variable. It means that IS serves as a fundamental approach to corporate survival and empowerment of supply chain integration among business functions within the company. Nowadays, with the advancement of information technology and communication, information sharing has become possible. Also, information sharing in the supply chain becomes more efficient by introducing global long-term cooperation and coordination,

leading to an increase in its competitive advantage. The result of this study supports previous studies [13, 16], which also showed that IS in a company could improve SCP.

Fifth, IS had an important effect on SCC (H3a). The two highest IS outer loading indicators were IS2 (0.9) and IS3 (0.841). This means that IS leans its presence towards implementing operational, technical, and strategic activities with partners. Companies with a commitment to partnerships are more likely to be willing to share information with their suppliers (IS2) and organization partners (IS3). It makes sense because most of the respondents in this study are from purchasing departments (58.6%) who have more contact and share information with suppliers. IS and joint decisions play a significant direct role in the performance of supply chain members. This statement is in line with the previous research [12, 27], which also showed IS within a company could improve SCC.

Sixth, IT had a significant positive effect on SCP (H3b). The presence of information technology in business processes enables companies to share information quickly and on time. IT also enables companies to provide quality information that will eventually improve SCP. This finding provides insight into the importance of IT, information sharing, and information quality in the pursuit of excellence in SCP. With the advent of internet technology, the world wide web, and e-commerce in a specific design, it will change the way companies do business by observing past performance and historical trends in order to determine the best cost and product quantity. This statement acknowledges the previous research [8, 17, 18], which also showed that IT in companies could improve SCP.

Seventh, IT affected the SCP, which is mediated by IS. SCP will increase if it provides better IT to strengthen IS. Information technology can help companies to share data, information, and business applications with their business partners and provide electronic transaction capabilities, including buying and selling goods, services, facilitating communication and decision making to increase efficiency, effectiveness, competitiveness, and profitability to improve organizational performance.

Eighth, IT had an effect on SCP mediated by SCC. SCP will increase by providing better IT and then, strengthens SCC. The influence of globalization and information technology affects the increasing supply chain collaboration. Two or more chain members work together to create competitive advantage, make joint decisions, and share benefits results in a greater profitability obtained by meeting the end customer's needs rather than acting alone to achieve increased company performance.

Lastly, IT had an influence on SCP as mediated by IS and SCC. Through the mediations of IS and SCC, IT effects on SCP become higher than the direct effect of IT on SCP (i.e. 2.665 vs. 2.145). It is due to the mediation of the IS and SCC variables, which reports a more significant effect (5.510), so it can be said that mediation is influential. From these results, it can be concluded that the relationship between SCC and IS creates a competitive advantage, where precise, accurate, and quality information can facilitate joint decision making. Meanwhile, the increasing implementation of SCC with globalization and information technology can improve company performance. SCP will increase if it improves and IT improves and strengthens the IS and SCC. In short, based on the above results, it could be concluded that IT, IS, and SCC could well be able to improve SCP, especially in manufacturing companies in Surabaya.

4. Conclusions

This study investigated the effect of IT on SCP by mediating the roles of IS and SCC. The study proposed three main hypotheses and six direct relationship hypotheses based on the research model. The results showed that the study accepted all nine hypotheses. IT had a significant effect on SCP

directly in a positive manner. IT also had a meaningfully positive influence on IS and SCC. IS and SCC affected SCP directly, and they also mediate the relationship between IT and SCP.

One of the essential findings of this study was that IS and SCC positively mediated the effect of IT on SCP significantly. Based on these findings, the research gap among unifying IT, SCC, IS, and SCP in a single research model is answered. The presence of information technology in business enables companies to share information quickly and in real-time. IT also encourages companies to collaborate between supply chain partners, which eventually increases SCP. These findings provide practitioners with insight into the importance of IT, IS, and SCC in the pursuit of superior SCP. Also, manufacturing companies that want to improve their supply chain performance can adopt the results of this study. In addition, this study can also contribute to the current research in supply chain management.

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