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The Effect of Information Management Capability, Collaboration, and Supply Chain Resilience on Company Performance

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Abstract

A covid-19 pandemic is a significant event that causes supply chain disruption in Indonesia. As a result, the manufacturing sector experienced a significant decline which is indicated by the greatly decreasing Purchasing Manager Index (PMI) in April and May 2020. Therefore, supply chain resilience (SCR) becomes essential for a company to minimize risk, reduce negative impact, and quickly adapt to the business condition. This research aims to analyse the relationship between variables that can increase SCR, namely information management capability (IMC) and collaboration, and the relationship between SCR and company performance. This research was conducted by collecting primary data using questionnaires and analysing the relationship among variables using the PLS-SEM method. This research indicates that IMC and collaboration significantly affect SCR. SCR also has a significant effect on company performance. However, IMC does not significantly impact company performance, while collaboration significantly affects company performance. This research also indicates that collaboration mediates the relationship between IMC toward company performance.

Keywords: Information management capability; Collaboration; supply chain resilience; company performance.

1. Introduction

In today's business environment, increased volatility has become a new norm that exposes companies to supply chain risk. For example, the recent Covid-19 pandemic in Indonesia caused considerable supply chain disruption due to panic buying, interruption of product flow due to restrictions on import and local movement between regions, cessation of factory operations, limited raw materials, etc. (Fadiyah, 2020). The decreasing PMI indicates it in Indonesia, an indicator of the direction of economic trends and the manager's confidence in a particular sector, which is measured by the number of new orders, factory output, employment, supplier's lead time, and stocks of purchases (Singgih, 2014). Manufacturing PMI in Indonesia decreased from 45.3 in March 2020 to 27.5 in April 2020 (Nurdiana, 2020) and 28.6 in May 2020 (Timorria, 2020), where a value below 50 indicated a contraction in the manufacturing sector. The decreasing PMI showed the overall manufacturing sector in Indonesia did not have a supply chain network that was resilient to disruption. To minimize and manage the risks and impacts caused by the Covid-19 disruption, companies that rely on supply in their operations need a supply chain system that is tougher than before and increases adaptability (Aryanto, 2020). The supply chain risk and uncertainty due to volatility in the business environment make SCR an essential aspect of supply chain management. SCR is the company's ability to adapt and recover immediately after experiencing a disruption that harms the company (Pereira et al., 2014). SCR is considered a tool to minimize risk and supply chain disruption (Adobor & McMullen, 2018; Pettit et al., 2010) and represents a critical and strategic capability to reduce the impact of disruption on the company's operation and supply chain. To have SCR management practices, companies need to invest in practices that can increase risk awareness to manage risk better and prevent supply chain disruption (Li et al., 2017).

Investing in an SCR practice requires a large amount of money. Therefore, companies must evaluate whether an SCR brings advantages. Li et al. (2017) also suggest companies need to justify whether the investment proved beneficial for the company compared to the cost and effort spent. This research aims to answer this concern, to empirically test whether SCR brings a significant impact on company performance in Indonesia during the Covid-19 pandemic, as previous studies indicated that SCR has a significant impact on company performance in different countries and time (Asamoah et al., 2020; Birkie & Trucco, 2020; Gu & Huo, 2017; Li et al., 2017). Previous research also suggests other variables that are relevant to the research. IMC (Gu et al., 2021; Ponomarov, 2012; Ponomarov & Holcomb, 2009) and collaboration (Botes et al., 2017; Scholten & Schilder, 2015; Singh et al., 2019; Zineb et al., 2017) are indicated as essential factors in building an SCR. IMC is essential for better information sharing and an integrated supply chain (Yu et al., 2021). It enables the joint supply chain

activities to achieve collective supply chain objectives and bring benefit to all parties involved in the supply chain (Cao et al., 2010) and enhance collaboration (Cui et al., 2022; Fawcett et al., 2011; Jimenez-Jimenez et al., 2019; Xu et al., 2014). As a result, companies will be able to manage supply chain risk better and become more adaptable to disruptions, which results in a more SCR (Gu et al., 2021; Qian et al., 2018). Previous research also suggests that IMC (Azam, 2015; Chen & Tsou, 2012; Fawcett et al., 2011; Siagian & Tarigan, 2021) and collaboration (Asamoah et al., 2020; Fawcett et al., 2011; Jin et al., 2019; Liu et al., 2020; Ramanathan & Gunasekaran, 2014) influence company performance directly (Setiawan et al., 2022)

In the SCR literature, there are significant variations in the conceptualization of SCR. Many researchers are still defining the dimensions or indicators of SCR (Li et al., 2017; Siagian et al., 2021). Scholten & Schilder (2015), Cheng & Lu (2017), and Adobor & McMullen (2018) argued that SCR is a multidimensional concept. However, Asamoah et al. (2020), Birkie & Trucco (2020), Ponomarov (2012), and Zineb et al. (2017) argued that SCR is a unidimensional concept. They provided empirical evidence to prove the relationship among variables related to SCR, namely IMC, collaboration, and company performance. In addition to the conceptualization and dimensions of SCR, previous research has a different model and only includes partial relationships from this study. Each research model has yet to prove the relationship among four variables: IMC, collaboration, SCR, and company performance. Moreover, most research before the Covid-19 pandemic indicates different types of disruptions were happening during the study, and the research location was from countries other than Indonesia.

This study aims to answer the phenomenon that is currently happening and to solve the research gap from the previous research. The object of this research is companies in Indonesia during the Covid-19 pandemic. This research will answer six research questions regarding the relationship among variables. They are the relationship of IMC toward collaboration, the relationship of IMC toward SCR, the relationship of SCR, the relationship of SCR toward company performance, the relationship of IMC toward company performance, and the relationship of collaboration toward company performance.

2. Literature Review

2.1. Information Management Capability (IMC)

IMC is defined as the ability to use the right Information Technology (IT) infrastructure and utilize IT to integrate systems and processes to build an effective collaborative network and information sharing (Ponomarov, 2012; Yu et al., 2021; Setiawan et al., 2022; Siagian & Tarigan, 2021). IMC covers several aspects of IT as a resource, IT capability, and integration (Ponomarov, 2012; Jiputra et al., 2020). For example, within information management activity, the company needs an IT infrastructure to support the supply chain activity, use IT to perform practical information sharing, and integrate supply chain activity with supply chain partners (Tarigan et al., 2021). Indicators of IMC are described in the following (Ponomarov, 2012): 1) Have an IT system that can facilitate information sharing (IMC1), 2) Able to share information effectively internally (IMC2), 3) Able to share information effectively with supply chain partners (IMC3), 4) Have an integrated database (IMC4), 5) Have an accurate database (IMC5), 6) Have a real-time database (IMC6).

2.2. Collaboration

Collaboration in the supply chain is the ability to cooperate effectively and create synergy with business partners in planning and implementing supply chain activities to achieve common goals (Cao et al., 2010; Scholten & Schilder, 2015; Riofiandi & Tarigan, 2022). Companies exchange relevant information, share risk and benefit, create joint strategic plans, and synchronize operations so that all parties involved will have mutual benefit and minimize risk and loss (Scholten & Schilder, 2015; Setiawan et al., 2022). Collaboration benefits the companies and supply chain partners (Jiputra et al., 2020). With strategic collaboration, companies and supply chain partners bear the risk. Instead, the risk is shared with the consideration of mutual benefit. As a result, companies can have better supply chain visibility and flexibility, more effective and efficient operation, reduced waste and redundant processes, and increased awareness of supply chain partners' capability (Randall, 2013; Scholten & Schilder, 2015). In turn, companies enable to respond to consumer demand better. Indicators of collaboration are described in the following points (Jin et al., 2019): 1) Have a great relationship with supply chain partners (COL1), 2) Have mutual trust with supply chain partners (COL2), 3) Have a collaborative operation with supply chain partners (COL3), 4) Have a mutual goal with supply chain partners (COL4).

2.3. Supply Chain Resilience (SCR)

SCR is defined as the supply chain's ability to cope with changes, which is formed through readiness, alertness, and agility in responding to changes in the business environment, as well as the ability to recover from disruption, adapt to the new condition and ensure

operational sustainability (Asamoah et al., 2020; Li et al., 2017; Siagian et al., 2021). Previous researchers had different opinions regarding the conceptualization and dimensionality of SCR. Scholten & Schilder (2015) uses flexibility, velocity, and visibility as the dimension of SCR. Cheng & Lu (2017) measures SCR from the proactive and reactive dimension. Adobe & McMullen (2018) describe three types of SCR, namely engineering resilience (efficiency), ecological resilience (adaptation), and evolutionary resilience (growth and renewal), and there are four phases of SCR, namely readiness, response, recovery, development, and regeneration. Other researchers, Asamoah et al. (2020), Birkie & Trucco (2020), Ponomarov (2012), and Zineb et al. (2017), argued SCR is a unidimensional concept. The unidimensional SCR covers two essential and complementary parts: the ability to resist and recover (Asamoah et al., 2020; Zineb et al., 2017). The unidimensional SCR is more suitable for measuring relationships among variables relevant to this research, as is proven in empirical research. Therefore, indicators of the unidimensional SCR are adopted Asamoah et al. (2020): 1) Able to quickly respond to changes (SCR1), 2) Able to recover from losses (SCR2), 3) Able to restore performance to the desired level (SCR3), 4) Able to realign/adapt operational process (SCR4), 5) Able to renew or transform operational process (SCR5).

2.4. Company Performance (CP)

CP is the measurement of how well companies can perform in a certain time, which may be measured from several perspectives, such as customer service, operational, financial, and workforce performance (Jin et al., 2019; Jiputra et al., 2020; Siagian & Tarigan, 2021). Operational performance is the most used perspective to measure performance in supply chain literature. It is also supported by previous research that the operational perspective of CP is more relevant in the supply chain context, and its empirical relation has been tested and proved to be significant compared to other perspectives of performance (Asamoah et al., 2020; Yu et al., 2021; Riofiandi & Tarigan, 2022). Indicators of IMC are described in the following points (Asamoah et al., 2020; Yu et al., 2021): 1) Delivery lead time (CP1), 2) Flexibility in product delivery (CP2), 3) Overall product quality (CP3), 4) Product availability (CP4).

2.5. The Relationship Between Concepts

The importance of IMC can be seen in the supply chain collaboration activity with supply chain partners (Siagian & Tarigan, 2021). IMC is the infrastructure enabling collaboration (Tarigan et al., 2021). Jimenez-Jimenez et al. (2019) supported that manufacturing companies in Spain can boost collaboration with good IMC. Cui et al. (2022), in their research using the Internet of Things (IoT) perspective in companies in Shandong, China, proves that IT capability and integration of information management systems enhance collaboration with the supply chain partners. Xu et al. (2014) performed research in China, suggesting that IT is essential in improving collaboration with customers and suppliers from the senior management perspective. Utilizing IT is considered an enabler in improving the company's supply chain collaboration (Fawcett et al., 2011) in their research on senior managers' supply chain associations in the United States.

H_1: IMC has a significant influence on collaboration.

IMC is crucial in facing disruption and is considered a part of risk management (Tarigan et al., 2021). Reliable information is helpful for the decision-making process, especially when responding to disruption. Gu et al. (2021), in their research during the Covid-19 pandemic on manufacturing firms in China, found that the company's ability to utilize IT would enhance the supply chain activity to become more challenging and resilient. Ponomarov (2012) proved that IMC is statistically significant in influencing SCR. Ponomarov & Holcomb (2009) also suggested that IMC is one of the essential factors in building SCR.

H_2: IMC has a significant influence on SCR.

Collaboration is crucial in uniting supply chain partners to overcome disruption and crisis. A study on North Moroccan manufacturing firms by Zineb et al. (2017) suggested that collaboration plays a significant role for companies and their supply chain partners in facing disruption and building a SCR. Botes et al. (2017) studied SCR in petrochemical firms in South Africa and suggested that collaboration with supply chain partners would increase visibility, velocity, and flexibility. In turn, it makes the supply chain network resilient. Scholten & Schilder (2015) found that collaboration is an antecedent of SCR construct.

H_3: Collaboration has a significant influence on SCR.

SCR is meant for companies to overcome disruption while maintaining operational activity. SCR would help companies to achieve better operational performance in the event of a disturbance. Asamoah et al. (2020), in their study on companies in Ghana, proved that SCR positively and significantly impacts CP. A survey of companies that experience disruption

by Birkie & Trucco (2020) suggests that SCR is an influencing factor in CP in the event of a disturbance. Li et al. (2017) studied SCR in American firms and found that SCR contributes to increased CP. Companies with more SCR tend to have better operational and financial performance, as Gu & Huo (2017) did on Chinese firms.

H_4: SCR has a significant influence on CP.

IMC is also indicated to influence CP directly (Jiputra et al., 2020; Siagian et al., 2021). It serves as the foundation of the operational activity, which will, in turn, boost the company's performance. A study on SMEs in Bangladesh by Azam (2015) suggested that IMC is considered one of the essential factors in boosting CP. Chen & Tsou (2012) studied IT in technology firms in Taiwan and proved that companies with better IMC could increase their performance. Fawcett et al. (2011), in their research on senior managers in professional supply chain associations in the United States, found the ability to manage information effectively increases CP.

H_5: IMC has a significant influence on CP.

Collaboration also directly influences CP (Riofiandi & Tarigan, 2022; Setiawan et al., 2022). It is considered an essential skill for the company and supply chain partners to bring better value to the consumer. A study on Ghanaian firms by Asamoah et al. (2020) suggested that good collaboration is essential in increasing CP. Collaboration is proven to significantly impact CP (Liu et al., 2020) in their study on Chinese public companies and Jin et al. (2019) in their research on European supply chain managers. Fawcett et al. (2011) also found that supply chain collaboration is one of the most critical factors in increasing CP.

H_6: Collaboration has a significant influence on CP.

Based on the literature review and the relationship between concepts, the research model is determined in Figure 1.

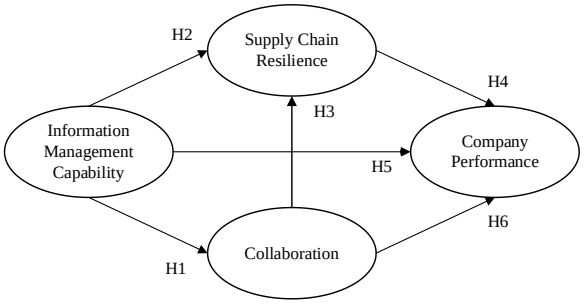

Figure 1. Research Framework

3. Research Methods

The research model is determined based on the literature review and the relationship between concepts. The method used in this research is the quantitative method, considered explanatory research, as the purpose of this study is to test the relationship among variables (Saunders et al., 2016). The population in this research is manufacturing firms in Indonesia, with a total amount of 33,923 firms (Statistics Indonesia, 2019). This amount consists of medium-sized companies with 20-99 employees and large-sized companies with 100 or more employees. The respondents are representative employees from each manufacturing firm who understand the company's supply chain process. Therefore, respondents must be from companies with 20 or more employees and departments related to supply chain activities. The sampling technique used in this research is non-probability sampling with mixed methods. The first method is purposive sampling, where the research area is purposely chosen. Due to the researcher's limitation, the sample is gathered from East Java, a significant and representative manufacturing region in Indonesia with ten industrial complexes and a total area of around 6,255 hectares (Ministry of Industry, 2022). The second method used is the self-selection sampling method, where the researcher announced the need for research on social media and sent invitations to probable respondents to participate in this research. Responses from respondents not from the proper criteria are removed. 'The minimum sample is 68 samples representing the population Figure 1 (Cochran, 1963).

The data analysis method used in this research is Structural Equation Modelling (SEM) using Partial Least Square (PLS) program, and the software name is SmartPLS. There are two stages of analysis, namely, the goodness of fit evaluation on the outer and inner models. In the outer model, the validity and reliability test are used to evaluate the accuracy and consistency of the indicators in measuring the variable (Hair et al., 2017). In the inner model, the relationships among latent variables are tested to answer the hypotheses of this research.

4. Results

The research is conducted by sending invitations to fill in an online questionnaire through social media, such as Instagram, WhatsApp, Line, and Facebook, to probable respondents. Data collection was done from April 2022 to June 2022. Respondents not according to the criteria were removed, resulting in 80 usable responses for the PLS-SEM analysis. The minimum sample amount was calculated using the formula from Cochran (1963).

4.1. Research Characteristics

The characteristics of respondents in this research are classified based on the job position, length of employment, department number of employees, and industry type.

Table 1. Characteristics of Respondents Based on Job Position

Position	Frequency	Percentages
Analyst/Staff	9	11.25%
Coordinator	1	1.25%
Supervisor	46	57.50%
Project Leader	1	1.25%
Manager	23	28.75%
Total	**80**	**100.00%**

Table 1 indicates the characteristics of respondents based on the job position. As seen in the table, 89% of the respondents are higher than the analyst/ staff. It means most respondents have a great responsibility in the operational activity and have higher knowledge about the company's condition to represent the company in filling out the questionnaire.

Table 2. Characteristics of Respondents Based on Length of Employment

Length of Employment	Frequency	Percentages
< 1 year	3	3.75%
1-3 years	5	6.25%
4-6 years	16	20.00%
> 6 years	56	70.00%
Total	**80**	**100%**

Table 2 indicates the characteristics of respondents based on their length of employment. As seen in the table, 90% of the respondents have worked in the company for over three years. It means most respondents have adequate work experience to understand the company's condition so they can represent the company to fill out the questionnaire.

Table 3. Characteristics of Respondents Based on Department

Department	Frequency	Percentages
Warehouse	12	15.00%
Logistic/Distribution	5	6.25%
Marketing	2	2.50%
New Product Development	1	1.25%
Operation	24	30.00%
PPIC	7	8.75%
Procurement	8	10.00%
Production	13	16.25%
Project	1	1.25%
Purchasing	3	3.75%
Quality Assurance	1	1.25%
Quality Control	2	2.50%
Supply Chain	1	1.25%
Total	**80**	**100%**

Table 3 indicates the characteristics of respondents based on department. All respondents are from a department related to the company's supply chain activities, and the non-related departments' respondents are removed. Therefore, the respondents have sufficient knowledge about the supply chain activity to measure in this research.

Table 4 indicates the characteristics of respondents based on the number of employees. Respondents are from medium and large-sized companies, as defined in section 3, meaning that the respondents are the correct sample from the population. The company size also indicates the usage of IT in the operational process. Medium and large-sized companies have implemented IT as operational activity, and communication of 20 or more people would not be possible to be done face to face. Therefore, the respondents are valid to fill in the questionnaire.

Table 4. Characteristics of Respondents Based on The Number of Employees

Length of Employment	Frequency	Percentages
20-99 persons	17	21.25%
≥ 100 persons	63	78.75%
Total	**80**	**100%**

Table 5 shows the characteristics of respondents based on industries. Again, respondents are from various sectors, which means the sample already represents the population of manufacturing firms in East Java.

4.2. Research Analysis

In evaluating the outer model, the validity and reliability of the model are tested. Two tests are performed to evaluate convergent validity and discriminant validity. In convergent validity, the model is acceptable if the indicators represent the construct. The criteria used are the outer loading of each indicator toward the construct, which must be above 0.5. In addition, each construct's average variance extracted (AVE) must be above 0.5 (Hair et al., 2019). Therefore, the outer loading of all indicators is acceptable. However, the AVE of the variable CP is unfulfilled the criteria. The AVE of variable CP is 0.448. Therefore, hair et al. (2019) recommended the lowest loading indicator, CP3, be removed from the model. After the model is retested, the outer loading of all indicators meets the requirements, as seen in Figure 2. The AVE value of CP is also improved from 0.448 to 0.536, as seen in Table 6. Therefore, all variables and indicators already satisfy the convergent validity requirement.

Table 5. Characteristics of Respondents Based on Industry

Industry	Frequency	Percentages	Industry	Frequency	Percentages
Household appliances	2	2.50%	Poultry feed	2	2.50%
Petrochemical	9	11.25%	Can production	1	1.25%
Flexible packaging film	1	1.25%	Argo-business	1	1.25%
Wood, leather, paper	17	21.25%	Plastic	3	3.75%
Ceramic	1	1.25%	Rigid packaging	1	1.25%
Machine	1	1.25%	Cigarette	2	2.50%
Food and beverages	21	26.25%	Cement	1	1.25%
Oil and gas	2	2.50%	Bicycle	2	2.50%
Pharmacy	1	1.25%	Steel	4	5.00%
Automotive	5	6.25%	Textile	2	2.50%
Packaging	1	1.25%			
			Total	**80**	**100%**

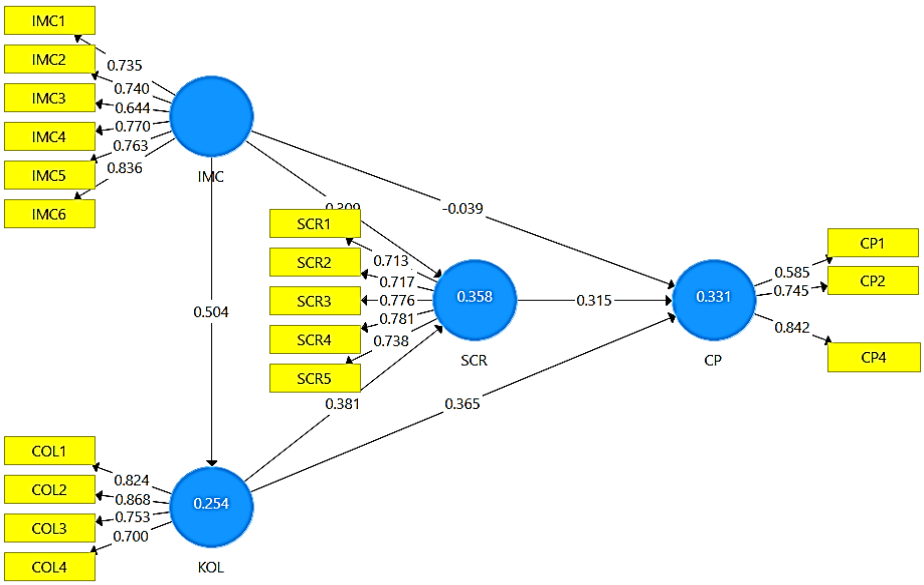

Figure 2. Convergent Validity: Outer Loading

Table 6. Convergent Validity: AVE

Variable	AVE
IMC	0.563
COL	0.623
SCR	0.556
CP	0.536

The discriminant validity is acceptable when the correlation with other variables is less than the square root of the AVE value (Hair et al., 2017). The square root of AVE for each construct in Table 7 is written in bold. Besides, the cross-loading test result in Table 8 also indicates the loading factor of each indicator is higher than loading with other constructs. Therefore, all variables and indicators already fulfil the discriminant validity test.

Table 7. Discriminant Validity: Fornell-larcker

Fornell-larcker	IMC	COL	SCR	CP
IMC	**0.750**			
COL	0.504	**0.789**		
SCR	0.500	0.536	**0.746**	
CP	0.302	0.514	0.491	**0.732**

Composite reliability was employed as a metric to assess the variables' dependability. The model is acceptable if the composite reliability value exceeds 0.7 (Hair et al., 2017). All variables in Table 9 fulfil the criteria and pass the composite reliability test.

The R-Square indicates the dependent variable's variability explained by the independent variables. For example, based on Table 10, IMC presents 25.4% variability in COL. IMC and COL explain 35.8% variability in SCR. IMC, COL, and SCR explain 33.1% variability in CP.

The R-Square is used to calculate Q-Square, which tests whether the research model has a predictive relevance. Q-Square above 0 indicates the model has a predictive relevance. Based on the formula of Q-Square, the value is calculated, and the result shows a Q-Square of 0.6796, which means the research model has a predictive relevance. Therefore, the model accurately predicts data not used in the model estimation (Hair et al., 2019).

Table 8. Discriminant Validity: Cross-Loading

Indicators	IMC	COL	SCR	CP
IMC1	**0.735**	0.324	0.362	0.228
IMC2	**0.740**	0.386	0.445	0.207
IMC3	**0.644**	0.338	0.306	0.279
IMC4	**0.770**	0.387	0.441	0.223
IMC5	**0.763**	0.399	0.257	0.178
IMC6	**0.836**	0.424	0.407	0.244
COL1	0.463	**0.824**	0.428	0.410
COL2	0.437	**0.868**	0.533	0.451
COL3	0.370	**0.753**	0.416	0.337
COL4	0.302	**0.700**	0.285	0.427
SCR1	0.401	0.398	**0.713**	0.379
SCR2	0.246	0.346	**0.717**	0.323
SCR3	0.339	0.431	**0.776**	0.355
SCR4	0.457	0.299	**0.781**	0.299
SCR5	0.400	0.487	**0.738**	0.444
CP1	0.271	0.276	0.252	**0.585**
CP2	0.224	0.379	0.367	**0.745**
CP4	0.201	0.451	0.434	**0.842**

Table 9. Composite Reliability

Variable	Composite Reliability
IMC	0.885
COL	0.868
SCR	0.862
CP	0.772

Table 10. R-Square

Variable	R-Square
COL	0.254
SCR	0.358
CP	0.331

After the model passes the validity and reliability test, the inner model is evaluated by using the bootstrapping method in SmartPLS. The path coefficient and t-value or p-value indicate the relationship between variables. In addition, the path coefficient indicates the direction of the relationship, which can be positive or negative. In contrast, the t-value ≥ 1.96 or p-value ≤ 0.05 indicates a significant relationship between variables on a 95% confidence level (Hair et al., 2017), and the research hypothesis is accepted.

Figure 3 shows the t-value of each relationship among variables, and Table 10 indicates the path coefficient, t-value, and p-value result. The H_1 has a path coefficient of 0.504, a t-value of 4.313, and a p-value of 0.000, meaning that IMC significantly and positively influences COL. The H_2 has a path coefficient of 0.309, a t-value of 2.679, and a p-value of 0.008. Mean IMC has a significant and positive influence on SCR. The H_3 has a path coefficient of 0.381, a t-value of 3.868, and a p-value of 0.000, which means

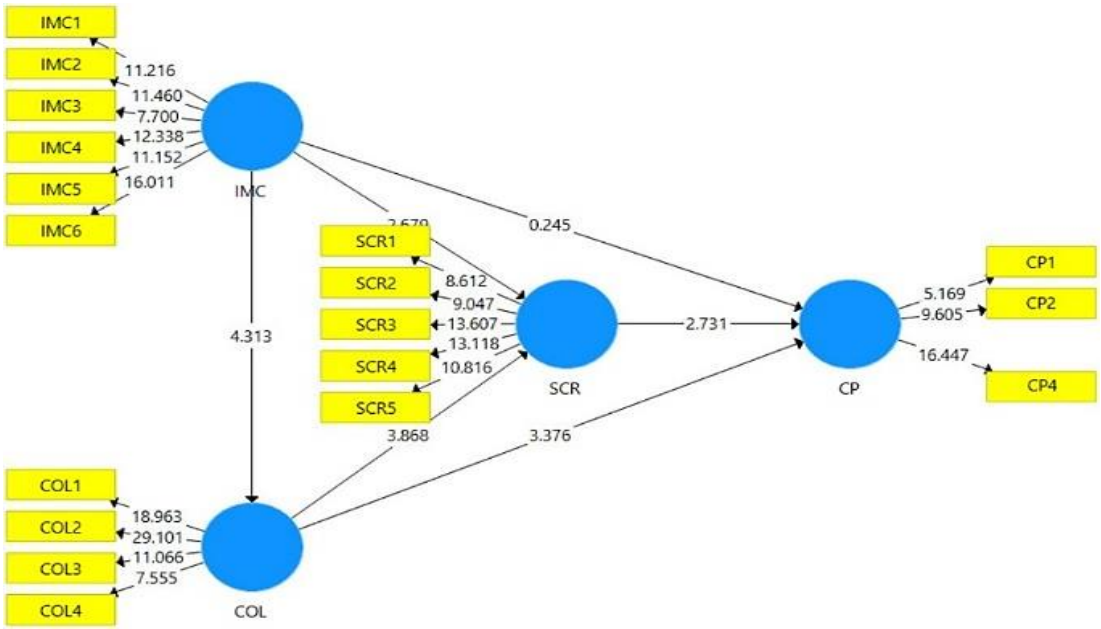

Figure 3. Path Coefficient Testing Results

Table 11. Path Coefficient Direct Effect Testing Results

Direct Effect	Path Coefficient	t-value	p-value	Explanation
H_1: IMC → COL	0.504	4.313	0.000	Accepted
H_2: IMC → SCR	0.309	2.679	0.008	Accepted
H_3: COL → SCR	0.381	3.868	0.000	Accepted
H_4: SCR → CP	0.315	2.731	0.007	Accepted
H_5: IMC → CP	-0.039	0.245	0.807	Rejected
H_6: COL → CP	0.365	3.376	0.001	Accepted

COL significantly and positively influences SCR. The H_4 has a path coefficient of 0.315, a t-value of 2.731, and a p-value of 0.007. SCR has a significant and positive influence on CP. The H_5 has a path coefficient of -0.039, a t-value of 0.245, and a p-value of 0.807, which means IMC has a non-significant and negative influence on CP. Finally, the H_6 has a path coefficient of 0.365, a t-value of 3.376, and a p-value of 0.001, meaning that COL significantly influences CP.

The indirect effect on the model is also tested despite not being hypothesized. Based on Table 11, the relationship of IMC toward SCR mediated by COL has a path coefficient of 0.192, a t-value of 2.684, and a p-value of 0.008, meaning that COL positively and significantly mediates the relationship of IMC toward SCR. The relationship of IMC toward CP mediated by COL has a path coefficient of 0.184, a t-value of 2.285, and a p-value of 0.023, meaning that COL positively and significantly mediates the relationship of IMC toward CP. The relationship of IMC toward CP mediated by SCR has a path coefficient of 0.097, a t-value of 1.929, and a p-value of 0.054, meaning that SCR does not mediate the relationship of IMC toward CP. The relationship of COL toward CP mediated by SCR has a path coefficient of 0.120, a t-value of 2.075, and a p-value of 0.039, meaning that SCR positively and significantly mediates the relationship of COL toward CP. The relationship of IMC toward CP mediated by COL and SCR has a path coefficient of 0.060, a t-value of 1.790, and a p-value of 0.074, meaning that COL and SCR together do not mediate the relationship of IMC toward CP.

5. Discussion

The H_1 tested the significant relationship of IMC toward CO. Therefore, H1 is accepted and aligned with Fawcett et al. (2011), Jimenez-Jimenez et al. (2019), and Xu et al. (2014). Good IMC facilitates information sharing with supply chain partners. Information management is the basis for sharing and communication during collaborative activities (Fawcett et al., 2011). A good IT system, effective information sharing, and a database that is accurate, integrated, and real-time serve as infrastructure in collaborative activities with supply chain partners. For example, information about the production plan, stock level, or sales data would be beneficial to estimate orders. Information about the supplier's lead time would be helpful for the customer to estimate the frequency, quantity, and timing of orders. This information is also beneficial for collaborative decision-making and promoting collaborative work.

The H_2 tested the significant IMC's relationship toward SCR. Therefore, the H_2 is accepted and aligned with Gu et al. (2021) and Ponomarov (2012). IMC has a substantial influence on SCR. Good IT systems and information sharing that is fast, accurate, integrated, and done effectively help companies respond to disruption. Information or data is essential in decision-making, especially when adapting the operational process to suit the business situation. Therefore, it will result in more SCR.

The H_3 tested the significant relationship of COL toward SCR. Therefore, the H_3 is accepted and aligned with Botes et al. (2017), Scholten & Schilder (2015), and Zineb et al. (2017). Companies with good relationships and trust with supply chain partners, do operations collaboratively, and have the same supply chain goals for mutual benefit are more likely to have CSR. In addition, collaboration helps companies to reduce uncertainty, increase transparency, and help supply chain partners manage risk and uncertainty, resulting in a better ability to resist, adapt, and recover from disruption (Zineb et al., 2017). With collaboration, shared information would help companies and their supply chain partners to find the best solution that brings mutual benefit and enhance the relationship and trust among supply chain partners.

The H_4 tested the significant relationship of SCR toward CP. Therefore, the H_4 is accepted and aligned with Asamoah et al. (2020), Birkie & Trucco (2020), Gu & Huo (2017), and Li et al. (2017). Companies that respond, adapt, recover, and transform to cope with disruption can perform significantly better. Companies with SCR can minimize the negative impact of disruption, recover faster, and maintain their operational performance, continuously offering added value to the consumers and providing the necessary products during disruption. SCR also helps companies maintain product quality, have more flexibility and timeliness in delivery and ensure product availability. It will help companies deliver reliable products and services in the event of a disruption, which is a competitive advantage compared to competitors (Asamoah et al., 2020).

The H_5 tested the insignificant relationship of IMC toward CP. Therefore, the H5 is rejected. This result differs from Azam (2015), Chen & Tsou (2012), and Fawcett et al. (2011). They have different sample characteristics, industry characteristics, company size, and the timing of data collection. Azam (2015) researched SMEs in Bangladesh, which has different intensity of IT usage compared to most large-sized companies in this research. Chen & Tsou (2012) studied technology firms in Taiwan, which are very technology-intensive and have different supply chains than manufacturing firms. Fawcett et al. (2011) collected data in 2001 and 2007, in which early 2000 was the beginning of the internet boom and massive IT investment, while the data collection in this research

was done in 2022, in which the barrier to entry to IT adaptation has decreased significantly, resulting a decreased relevance of IT (Chae et al., 2014). Another research by Chae et al. (2014) and Wang (2010) has different views compared to those three research and similar views to this research. Chae et al. (2014) and Wang (2010) found IMC was an insignificant influence on CP because IT was expensive and complex and had undergone considerable development. Standardized and homogenized IT makes IT cheaper and easy to implement, which makes IT utilization a standard and universal thing. The significantly decreased barrier to entry to IT implementation makes companies that previously were unable to implement IT now able to utilize IT. It makes the competitive advantage gained from IT no longer significant since the competitors also do the same thing (Masli et al., 2011; Wang, 2010). The non-significant result indicates that IMC alone cannot enhance CP significantly, but when mediated by collaboration, it can substantially enhance CP. It is consistent with Xu et al. (2014) that COL substantially mediates the relationship of IMC toward CP. This finding is also in line with Chae et al. (2014) and Wang (2010), which indicate another variable to support the effect of IMC on CP due to the relevance of IT. When a company has IMC as the infrastructure and performs excellent collaboration, it increases CP significantly.

The H_6 tested the significant relationship of COL toward CP. Therefore, the H_6 is accepted and aligned with Asamoah et al. (2020), Fawcett et al. (2011), Jin et al. (2019), and Liu et al. (2020). Companies with good relationships and trust with supply chain partners, work collaboratively, and have the same supply chain goals can perform better than companies that do not work collaboratively. The way to compete in a volatile business environment has changed from individualistic to collaborative (Asamoah et al., 2020). A collaborative effort and synergy between companies and their supply chain partners through information sharing, joint planning, and joint innovation enable them to produce better output. Increasing commitment and collaboration with supply chain partners would allow companies to create new ideas and initiatives collaboratively, resulting in a more effective and efficient operation. In short, companies can collaboratively provide more added value for the consumer.

6. Conclusion

Several conclusions can be drawn based on the research analysis and the discussion on the relationship between IMC, collaboration, SCR, and CP. First, IMC has a significant influence on collaboration. The second IMC is the basis of increasing SCR. Third, collaboration contributes to creating a SCR within the company. Fourth, SCR proves to have a significant impact on CP. Fifth, IMC cannot directly enhance CP, but when mediated or supported by a great collaboration, it can enhance CP significantly. Sixth, collaboration can significantly enhance the company's performance. This research also provides several recommendations for both managerial purposes. First, management should focus on enhancing IMC and, most importantly, having a real-time, integrated, and accurate database. Data is an essential factor in decision-making, especially when dealing with disruption. The theoretical contribution is to enrich the theory of SCR in improving CP by building external partnerships.

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