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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 major event that causes supply chain disruption in Indonesia. As a results, the manufacturing sector experienced a significant decline which is indicated by the greatly decreasing Purchasing Manager Index (PMI) in April and May 2020. Supply chain resilience becomes essential for a company to minimize risk, reduce negative impact, and quickly adapt to the business condition. This research aims to analyze the relationship between variables that can increase supply chain resilience, namely information management capability and collaboration, and the relationship between supply chain resilience and company performance. This research was conducted by collecting primary data using questionnaires and analyzing the relationship among variables using the PLS-SEM method. This research indicates that information management capability and collaboration significantly affect supply chain resilience. Supply chain resilience also has a significant effect on company performance. However, information management capability has no significant effect on company performance, while collaboration has a significantly effects on company performance. This research also indicates that collaboration mediates the relationship between information management capability 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). This is indicated by the decreasing Purchasing Manager (PMI) 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 indicates a contraction in the manufacturing sector. The decreasing PMI indicates that the overall manufacturing sector in Indonesia does not have a supply chain network that is resilient to disruption. In order 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 supply chain resilience (SCRES) an essential aspect of supply chain management. SCRES is the company's ability to adapt and recover at the right time after experiencing a disruption that has a negative impact on the company (Pereira et al., 2014). SCRES 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 minimize the impact of disruption on the company's operation and supply chain. To have resilient supply chain management practices, companies need to invest in practices that can increase risk awareness to manage risk better and prevent supply chain disruption better (Li et al., 2017).

Investing in a resilient supply chain practice requires a large amount of money, therefore companies must evaluate whether a resilient supply chain brings advantages. Li et al. (2017) also suggest that 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 SCRES brings a significant impact on company performance in Indonesia during the Covid-19 pandemic, as previous studies indicated that SCRES 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 this research. Information management capability (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 important factors in building a resilient supply chain. Information management capability is considered as an essential skill to have better information sharing and build an integrated supply chain (Yu et al., 2021), which enable the joint supply chain activities to achieve collective supply chain objective 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 resilient supply chain (Gu et al., 2021; Qian et al., 2018). Previous research also suggests that information management capability (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 supply chain resilience literature, there are large variations in the conceptualization of supply chain resilience. Many researchers are still defining the dimensions or indicators of supply chain resilience (Li et al., 2017; Siagian et al., 2021). Scholten & Schilder (2015), Cheng & Lu (2017), and Adobor & McMullen (2018) argued that supply chain resilience is a multidimensional concept. However, Asamoah et al. (2020), Birkie & Trucco (2020), Ponomarov (2012), and Zineb et al. (2017) argued that supply chain resilience is a unidimensional concept. They provided empirical evidence to prove the relationship among variables related to SCRES, namely information management capability, collaboration, and company performance. Aside from the conceptualization and dimensionality of SCRES, previous research has different models and only covers the partial relationship which is used in this research. There is no single research model has been able to prove the relationship among four variables, namely information management capability, collaboration, SCRES, and company performance. Moreover, most research was done before the Covid-19 pandemic, which indicates different types of disruptions were happening during the research, and the research location was from various 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. There are six research questions regarding the relationship among variables that will be answered in this research, which are the relationship of information management capability toward collaboration, the relationship of information management capability toward SCRES, the relationship of collaboration toward SCRES, the relationship of SCRES toward company performance, the relationship of information management capability toward company performance, and the relationship of collaboration toward company performance.

2. Literature Review

2.1. Information Management Capability

Information management capability 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). Information management capability covers several aspects of IT, which are IT as a resource, IT capability, and integration (Ponomarov, 2012; Jiputra et al., 2020). Within information management activity, the company needs to have an IT infrastructure that can support the supply chain activity and the ability to use IT to perform practical information sharing and integrate supply chain activity with supply chain partners (Tarigan et al., 2021). Indicators of information management capability are described in the following points (Ponomarov, 2012): 1) Have an IT system that is able to 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 defined as 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 minimized risk and loss (Scholten & Schilder, 2015; Setiawan et al., 2022). Collaboration benefits for the companies and supply chain partners (Jiputra et al., 2020). With strategic collaboration, companies and supply chain partners do not bear the risk alone, 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). This will in turn enable companies to respond to consumer demand better. Indicators of information management capability 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 (SCRES)

Supply chain resilience 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 have different opinions regarding the conceptualization and dimensionality of SCRES. Scholten & Schilder (2015) uses flexibility, velocity, and visibility as the dimension of SCRES. Cheng & Lu (2017) measures SCRES from the proactive and reactive dimension. Adobor & McMullen (2018) describe three types of SCRES, namely engineering resilience (efficiency), ecological resilience (adaptation), and evolutionary resilience (growth and renewal), and there are four phases of SCRES, namely readiness, response, recovery, and growth and renewal. Other researchers, namely Asamoah et al. (2020), Birkie & Trucco (2020), Ponomarov (2012), and Zineb et al. (2017) argue that SCRES is a unidimensional concept. The unidimensional SCRES covers two essential and complementary parts, namely the ability to resist, and the ability to recover (Asamoah et al., 2020; Zineb et al., 2017). Despite the difference in conceptualization and dimensionality, the unidimensional SCRES proves to be more suitable for in measuring relationships among variables that is relevant to this research, as is proven in empirical research. Therefore, the indicators of SCRES in this research are adopted from the unidimensional SCRES (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

Company performance 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). The most used perspective to measure performance in supply chain literature is operational performance. This is also supported by previous research that the operational perspective of company performance 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 information management capability 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 information management capability can be seen in the supply chain collaboration activity with supply chain partners (Siagian & Tarigan, 2021). Information management capability serves as the infrastructure which enables collaboration (Tarigan et al., 2021). This is supported by Jimenez-Jimenez et al. (2019) that manufacturing companies in Spain can boost collaboration with a good information management capability. 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 system can enhance the collaboration with the supply chain partners, enabling them to have better information sharing and collaborative activities. Xu et al. (2014) who performed research in China suggest that from the senior management perspective, the usage of IT is very important in improving the collaboration with customers and suppliers. The ability to utilize IT is considered an enabler in improving the company's supply chain collaboration, as Fawcett et al. (2011) in their research on senior managers within three professional supply chain association in the United States.

H1. Information management capability has a significant influence on collaboration

Information management capability 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 tough and resilient. Ponomarov (2012), in his study on manufacturing firms in the United States, proves that information management capability is statistically significant in influencing SCRES. This is also suggested by Ponomarov & Holcomb (2009) that information management capability is one of the most important factors in building a resilient supply chain.

H2. Information management capability has a significant influence on SCRES

Collaboration is also considered the key factor in uniting supply chain partners to overcome disruption and crisis. A study on North Moroccan manufacturing firms by Zineb et al. (2017) suggests that collaboration plays a significant role for companies and their supply chain partners in facing disruption and building a resilient supply chain. Botes et al. (2017) who studied about SCRES in petrochemical firms in South Africa suggest that collaboration with supply chain partners would increase visibility, velocity, and flexibility, which will in turn make the supply chain network resilient. Scholten & Schilder (2015) in their study on Fast Moving Consumer Goods (FMCG) industry in Netherland found that collaboration is an antecedent of SCRES construct.

H3. Collaboration has a significant influence on SCRES

A resilient supply chain is meant for companies to overcome disruption while maintaining their operational activity. A resilient supply chain would help companies to achieve better operational performance in the event of a disruption. Asamoah et al. (2020), in their study on companies in Ghana prove statistically that SCRES has a positive and significant impact on company performance. A study on companies that experience disruption by Birkie & Trucco (2020) suggests that SCRES is an influencing factor of company performance in the event of a disruption. Li et al. (2017), who studied SCRES in American firms, found that SCRES contributes to increased in company performance. Companies with a more resilient supply chain tend to have better operational and financial performance, as Gu & Huo (2017) in their study on Chinese firms.

H4. SCRES has a significant influence on company performance

Information management capability is also indicated to influence company performance 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 performance. A study on SMEs in Bangladesh by Azam (2015) suggests that information management capability is considered one of the most important factors in boosting company performance. Chen & Tsou (2012), who studied IT in technology firms in Taiwan, proves that companies with better information management capability can increase their performance. Fawcett et al. (2011) in their research on senior managers in professional supply chain associations in the United States found that the ability to manage information effective in increasing company performance.

H5. Information management capability has a significant influence on company performance

Collaboration is also said to direct influence on company performance (Riofiandi & Tarigan, 2022; Setiawan et al., 2022). It is considered an important 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) suggests that good collaboration plays important role in increasing company performance. Collaboration is proven to have a significant impact on company performance, as suggested by Liu et al. (2020) in their study on Chinese public companies and Jin et al. (2019) in their study on European supply chain managers. Fawcett et al. (2011), in their research on senior managers in professional supply chain associations in the United States also found that supply chain collaboration is one of the most critical factors in increasing company performance.

H6. Collaboration has a significant influence on company performance

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

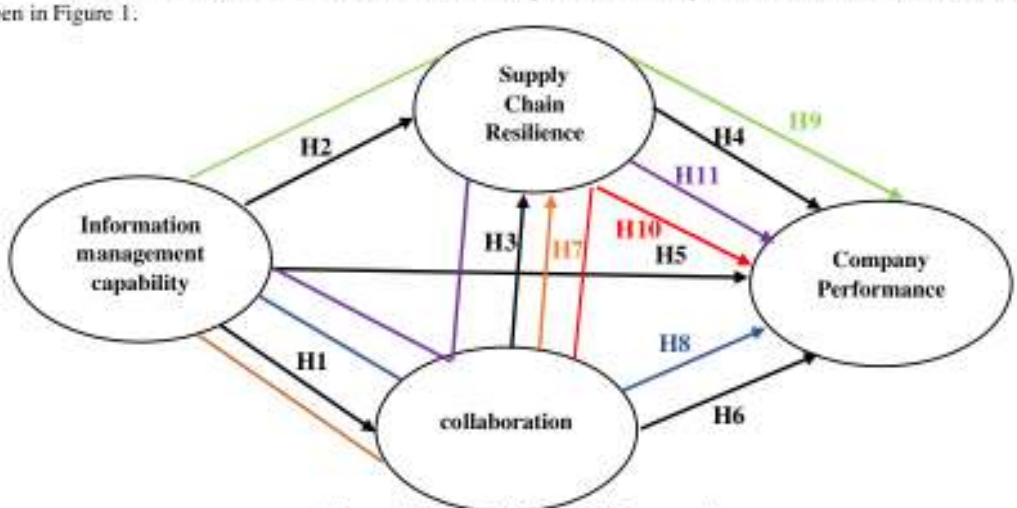

Figure 1. Research Concept Framework

Based on Figure 1, it can be determined that the research hypothesis indirectly as follows:

H7: Information management capability influences on SCRES through collaboration
H8: Information management capability has influence on company performance through collaboration
H9: Information management capability has influence on company performance through supply chain resilience
H10: Collaboration has influence on company performance through supply chain resilience
H11: Information management capability has influence on company performance through Collaboration and supply chain resilience

3. Research Methods

The method that is used in this research is the quantitative method, which is considered explanatory research, as the purpose of this study is to test the relationship among variables using quantitative data (Saunders et al., 2016). The population in this research is manufacturing firms located 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. To calculate the minimum required sample, a formula by Cochran (1963) was used. Based on this formula, the minimum sample amount is 68 samples representing the population.

The data analysis method that is 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 the analysis, namely the goodness of fit evaluation on the outer model and the goodness of fit evaluation on the inner model. 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 was conducted by announcing the need for research on social media, such as Instagram, and by sending invitations to fill in an online questionnaire through social media as well, such as Instagram, WhatsApp, Line, and Facebook to probable respondents. Data collection was done from April 2022 to June 2022. Respondents that are not according to the criteria were removed, resulting in a total of 80 usable responses for the PLS-SEM analysis. This already fulfils the minimum sample amount that was calculated using the formula from Cochran (1963).

4.1. Research Characteristics

The characteristics of respondents in this study 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, 88% of the respondents have a position higher than analyst/staff. This suggests that most of the respondents have a great responsibility in the operational activity and have higher knowledge about the company's condition so that they can represent the company in filling out this 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 3 years. This suggests that most of the respondents have adequate work experience to understand the company's condition so that they can represent the company in filling out this 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. As seen in the table, all respondents are from a department related to the company's supply chain activities, as the respondents from the non-related departments have been removed. This suggests that the respondents have sufficient knowledge about the supply chain activity of the company that is measured in this research.

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 4 indicates the characteristics of respondents based on the number of employees. As seen in the table, 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 are indicated to have implemented IT as operational activity, and communication of 20 or more people would not be possible to be done face to face. This suggests that the respondents are valid to fill in the questionnaire about information management capability.

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%	Agro-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%**

Table 5 indicates the characteristics of respondents based on industry. As seen in the table, respondents are from various industries, suggesting which suggests that the sample already represents the population of manufacturing firms in East Java.

4.2. Research Analysis

In evaluating of the outer model, the validity and reliability of the model are tested. Two tests are performed to evaluate the validity: convergent validity and discriminant validity. In convergent validity, the model is acceptable if the indicators represent the construct, and the criteria used are the outer loading of each indicator toward the construct, which must be above 0.5, and the average variance extracted (AVE) of each construct which must be above 0.5 (Hair et al., 2019). During the first test, the outer loading of all indicators is acceptable. However, the AVE of the variable, which represents the average square value of the outer loading within one variable, does not fulfil the criteria, as variable CP has an AVE of 0.448. Hair et al. (2019) recommended that the indicator with the lowest loading, CP3, is removed from the model until the AVE fulfils the criteria. After the model is re-tested, the outer loading of all indicators still fulfils the criteria, as seen in figure 1. The AVE of CP also improved from 0.448 to 0.536 as seen in table 6, which indicates that all variables fulfil the criteria. It can be concluded that all variables and indicators already fulfil the convergent validity test.

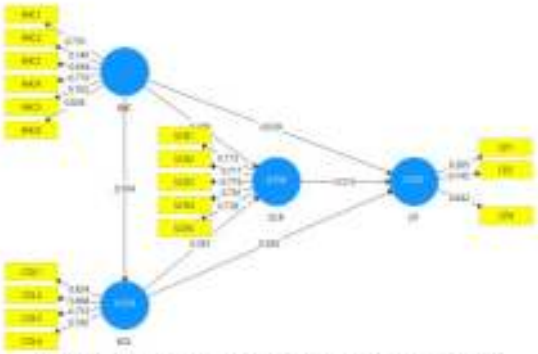

Figure 1. Convergent Validity: Outer Loading

Table 6. Convergent Validity: Average Variance Extracted (AVE)

Variable	AVE
Information Management Capability (IMC)	0.563
Collaboration (COL)	0.623
Supply Chain Resilience (SCR)	0.556
Company Performance (CP)	0.536

In discriminant validity, the model is acceptable if the indicators of a certain variable do not represent the other variable, which is reflected by the Fornell-larcker criterion of each construct that must be higher than its value on another construct, and the cross-loading value of each indicator toward the construct that must be higher than its value toward another construct (Hair et al., 2017). As seen in table 7, the Fornell-larcker of each variable toward itself is higher than the Fornell-larcker toward other variables. The cross-loading in table 8 also indicates that the loading of each indicator toward its construct is higher than the loading toward other constructs. It can be concluded that all variables and indicators already fulfill 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**

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**

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). As seen in table 9, all variables fulfil the criteria and pass the composite reliability test.

Table 9. Composite Reliability

Variable	Composite Reliability
Information Management Capability (IMC)	0.885
Collaboration (COL)	0.868
Supply Chain Resilience (SCR)	0.862
Company Performance (CP)	0.772

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

Table 10. R-Square

Variable	R-Square
Collaboration (COL)	0.254
Supply Chain Resilience (SCR)	0.358
Company Performance (CP)	0.331

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

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. The path coefficient indicates the direction of the relationship, which can be positive or negative, while the t-value ≥ 1.96 or p-value ≤ 0.05 indicates the significant relationship between variables on a 95% confidence level (Hair et al., 2017). The t-value or p-value, which is significant, also indicates that the hypothesis of the research is accepted.

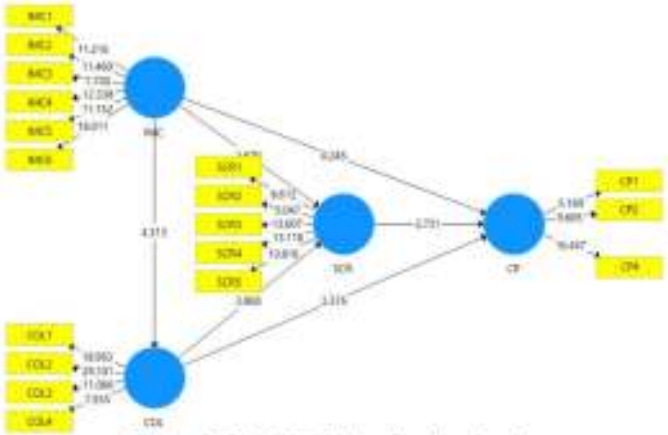

Figure 2. Path Coefficient Testing Results

Table 11. Path Coefficient Direct Effect Testing Results

Direct Effect	Path Coefficient	t-value	p-value	Explanation
H1: IMC → COL	0.504	4.313	0.000	Accepted
H2: IMC → SCR	0.309	2.679	0.008	Accepted
H3: COL → SCR	0.381	3.868	0.000	Accepted
H4: SCR → CP	0.315	2.731	0.007	Accepted
H5: IMC → CP	-0.039	0.245	0.807	Rejected
H6: COL → CP	0.365	3.376	0.001	Accepted

Figure 2 shows the t-value of each relationship among variables, and table 10 indicates the path coefficient, t-value, and p-value result. The first hypothesis (H1) has a path coefficient of 0.504, a t-value of 4.313, and a p-value of 0.000, meaning that IMC has a significant and positive influence on COL. The second hypothesis (H2) has a path coefficient of 0.309, a t-value of 2.679, and a p-value of 0.008, meaning that IMC has a significant and positive influence on SCR. The third hypothesis (H3) has a path coefficient of 0.381, a t-value of 3.868, and a p-value of 0.000, meaning that COL has a significant and positive influence on SCR. The fourth hypothesis (H4) has a path coefficient of 0.315, a t-value of 2.731, and a p-value of 0.007, meaning that SCR has a significant and positive influence on CP. The fifth hypothesis (H5) has a path coefficient of -0.039, a t-value of 0.245, and a p-value of 0.807, meaning that IMC has a non-significant and negative influence on CP. Finally, the sixth hypothesis (H6) 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.

Table 12. Path Coefficient Indirect Effect Testing Results

Indirect Effect	Path Coefficient	t-value	p-value	Explanation
IMC → COL → SCR	0.192	2.674	0.008	Significant
IMC → COL → CP	0.184	2.285	0.023	Significant
IMC → SCR → CP	0.097	1.929	0.054	Not significant
COL→ SCR → CP	0.120	2.075	0.039	Significant
IMC → COL → SCR → CP	0.060	1.790	0.074	Not significant

Aside from the direct effect, 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.

4.3. Discussion

The first hypothesis which, tests the relationship of IMC toward COL proves to be significant, therefore the hypothesis is accepted. This is aligned with the previous research (Fawcett et al., 2011; Jimenez-Jimenez et al., 2019; Xu et al., 2014) where information management capability significantly influences collaboration. Good information management capability 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/needs, stock level, or sales data would be beneficial for suppliers to estimate orders, and information about the supplier's lead time would be beneficial for the customer to estimate the frequency, quantity, and timing for orders. This information is also helpful for collaborative decision-making and promoting collaborative work, resulting in mutual benefit for all parties involved in the supply chain.

The second hypothesis, which tests the relationship of IMC toward SCR proves to be significant, therefore the hypothesis is accepted. This is aligned with the previous research (Gu et al., 2021; Ponomarov, 2012) where information management capability has a significant influence on supply chain resilience. Information management capability is the base of a resilient supply chain. Good IT systems and information sharing that is fast, accurate, integrated, and done effectively help companies respond to disruption, as information or data is an essential factor in decision-making, especially when adapting the operational process to suit the business situation. This will result in a more resilient supply chain. The previous researcher also supported that utilizing IT on an unstructured process is more effective in building supply chain resilience (Gu et al., 2021). This indicates that the importance of IT is even higher in the event of a disruption to support the adaptation and transformation of the operational process, resulting in a faster and better recovery from disruption.

The third hypothesis, which tests the relationship of COL toward SCR proves to be significant, therefore the hypothesis is accepted. This is aligned with the previous research (Botes et al., 2017; Scholten & Schilder, 2015; Zineb et al., 2017) where collaboration has a significant influence on supply chain resilience. 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 a resilient supply chain. 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). Insufficient, collaboration often results in a lack of necessary information or misunderstanding, which makes companies hard to find the root of the problem and synergy in decision-making and solutions. 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 fourth hypothesis, which tests the relationship of SCR toward CP proves to be significant, therefore the hypothesis is accepted. This is aligned with the previous research (Asamoah et al., 2020; Birkie & Trucco, 2020; Gu & Huo, 2017; Li et al., 2017), where supply chain resilience significantly influences company performance. Companies that can respond, adapt, recover, and transform to cope with disruption can perform significantly better. Companies with a resilient supply chain can minimize the negative impact of disruption, recover faster, and maintain their operational performance, continuously offering added value to the consumers and provide the necessary products during disruption. A resilient supply chain also helps companies maintain product quality, have more flexibility and timeliness in delivery and ensure product availability. This will help companies deliver reliable products and services in the event of a disruption, which is a competitive advantage compared to the competitors (Asamoah et al., 2020).

The fifth hypothesis which tests the relationship of IMC toward CP proves to be not significant, therefore the hypothesis is rejected. This result differs from previous research (Azam, 2015; Chen & Tsou, 2012; Fawcett et al., 2011), as they have different sample characteristics, industry characteristics, company size, and the timing of data collection. Azam (2015) researched Small Medium Enterprises (SMEs) in Bangladesh, which has different intensity of IT usage compared to the majority of large-sized companies in this research. Chen & Tsou (2012) researched technology firms in Taiwan, which are very technology-intensive and have different supply chains compared to manufacturing firms. Fawcett et al. (2011) did data collection 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. Both Chae et al. (2014) and Wang (2010) in their research on American firms, found that information management capability has no significant influence on company performance. This is because IT, which was expensive and complex, has undergone significant development. Standardized and homogenized IT makes IT cheaper and easy to implement, which makes IT utilization a common 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. This makes the competitive advantage gained from IT no longer significant since the competitors also do the same thing (Masli et al., 2011; Wang, 2010). In this research, the non-significant result indicates that IMC alone cannot enhance CP significantly, but when mediated by collaboration, it can significantly enhance CP. This is consistent with Xu et al. (2014) that COL significantly mediates the relationship of IMC toward CP. This finding is also in line with Chae et al. (2014) and Wang (2010) as they both indicate there should be another variable to support the effect of IMC on CP, due to the relevance of IT that decreased over time. When a company has information management capability as the infrastructure and performs excellent collaboration, it becomes their competitive advantage enabling them to increase company performance significantly.

The sixth hypothesis, which tests the relationship of COL toward CP proves to be significant, therefore the hypothesis is accepted. This is aligned with previous research (Asamoah et al., 2020; Fawcett et al., 2011; Jin et al., 2019; Liu et al., 2020), where collaboration significantly influences company performance. 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. As suggested by Asamoah et al. (2020), the way to compete in a volatile business environment has changed, from individualistic to collaborative. 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 enable the companies to collaboratively produce new ideas and initiatives, resulting in a more effective and efficient operation, and in the end, companies can collaboratively provide more added value for the consumer.

5. Conclusion

Several conclusions can be drawn based on the research analysis and the discussion on the relationship between information management capability, collaboration, supply chain resilience, and company performance. First, information management capability has significant an influence on collaboration. The second, information management capability proves as the basis of increasing supply chain resilience. Third, collaboration contributes to creating a resilient supply chain within the company. Fourth, supply chain resilience proves to have a significant impact on company performance. Fifth, information management capability cannot directly enhance company performance, but when mediated or supported by a great collaboration, it can enhance company performance 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 information management capability 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 supply chain resilience in improving company performance by building external partnerships.

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