Vilnius University Press

Contents lists available at Vilnius University Press

Organizations and Markets in Emerging Economies
2022, vol. 13, no. 1(25), pp. 71–95

ISSN 2029-4581 eISSN 2345-0037
DOI: https://doi.org/10.15388/omee.2022.13.71

The Influence of IT Capability on Operational Performance Through Internal and External Integration: Evidence from Indonesia

Steven Hadikusuma

Petra Christian University, Indonesia
stevh1107@gmail.com

Hotlan Siagian (corresponding author)

Petra Christian University, Indonesia
https://orcid.org/0000-0002-1105-2717
hotlan.siagian@petra.ac.id

Abstract. *During the Pandemic of COVID-19, many manufacturing companies around the world, such as Indonesia, experienced supply and demand disruption. The PMI index reflecting the operational performance declined to 27.5 in April 2020 from 45 in January 2020. This study investigates the influence of IT capability on operational performance through internal and external integration. The sample consists of 111 manufacturing companies, and data analysis adopts the Partial Least Square (PLS) approach with SmartPLS. The results revealed that nine hypotheses proposed were supported. First, IT capability directly affects internal, external integration, and operational performance. Second, internal and external integration affects operational performance. Third, IT capability indirectly affects operational performance through internal and external integration. This research paves a way on how to recover the operational performance during the pandemic. These findings also contribute to enriching and extending the acceptance of previous research in the manufacturing industry context.*

Keywords: *information technology capability, internal integration, external integration, operational performance*

1. Introduction

In recent years, there have been new threats to the global supply chains network. Numerous companies in many countries, including Indonesia, have experienced supply

Received: 12/10/2021. **Accepted:** 31/3/2022

and demand disruption, particularly the supply from the suppliers during the outbreak (Sherman, 2020). However, several companies have experienced a sudden increase in demand for pharmaceutical products required for Covid-19 treatment, such as sanitizers, masks, and medicines, while the demand for other goods such as sporting goods, automotive has decreased drastically. Overall, manufacturing companies in Indonesia experienced a decline in performance during this pandemic. The decrease in the performance of manufacturing companies in Indonesia can be seen from the image Purchasing Manufacturing Index (PMI). PMI is one of the overall indicators of the manufacturing industry sector's performance. PMI is calculated based on a percentage of five influencing factors: cost, new product, time to market, flexibility, delivery (Jabbour et al., 2013). PMI also reflects the extent of the achievements of the manufacturing sector performance, such as manufacturing operational performance. A statistical report shows a significant decrease in Indonesia's PMI in April 2020 from 45.3 points to 27.5 points, the worst record since 2011. According to the Industrial Ministry, manufacturing industry performance declined up to 50 percent, caused by the Covid-19 pandemic (Ginting, 2020). Therefore, the manufacturing companies need to take immediate initiatives to balance the economic growth while avoiding the spread of Covid-19. Fortunately, from June 2020 until the end of 2020, Indonesia's PMI improved, but it is unclear what initiatives the companies had taken. What is well understood is that the manufacturing companies have been trying to keep operating and doing business while sticking to the health protocol set up by the government policy. The essential question that arises is what strategy the companies should adopt or have adopted to keep in operation while dealing with the Covid-19 pandemic. This paper's motivation is to find how the company could survive while obeying the government policy to eliminate the spread of the Covid-19 pandemic.

The principal response is that the company should keep doing business while obeying the pandemic health protocol and cope with any uncertainty in supply and demand. One solution that could solve the problem of obeying the health protocol is the usage of information technology. Besides, every company needs to adopt a strategy that can respond flexibly to the uncertain supply and demand patterns. Manufacturing companies need to carry out a production system that can quickly adjust to demand. It is also mandatory to strengthen internal integration (cross-functional) and collaborate more intensely with external partners such as suppliers and distributors. Besides adopting capable information technology, a company must reconfigure its internal function and external partnership in the supply chain in a more responsive manner to follow the fluctuated supply and demand, and cope with highly uncertain risk. It appears that the use of information technology becomes the first choice of strategy enabling people to work from home. Information technology (IT) capabilities such as cloud computing and the internet of things connecting information and communicating allow people to work from home while maintaining the operation. The company also needs to consider other alternative suppliers to avoid any disruption in raw materials supply. Collabora-

tion with supply chains is an essential key to the success of companies to improve the performance of their companies. Besides, communication between departments on the internal and external sides of the company needs to be improved and overhauled to support the company's operational activities during this pandemic, where everyone needs to comply with health protocols utilizing social distancing.

Previous studies have shown several concepts on how to improve firm performance effectively during uncertain demand. Liu et al.(2015) proposed that IT development by the firm enhances firm performance during a fluctuated market. Information technology (IT) capability is essential for information exchange between an organization and its external partners to enhance their operational performance. IT is one option in today's situation. IT helps the organization deal with communication, integration, and coordination between partners in the supply chain network. Therefore, IT capability plays a vital role in enhancing firm performance. Excellent information technology could strengthen the business process. An organization with adequate information technology could enhance its business processes, such as improving delivery speed, lowering costs, and increasing responsiveness (Omar et al., 2010). IT capability integrates the supply network with its operational achievement. IT allows enhanced information exchange between partners even though the activities are severely restricted. Hence, IT capability needs to be improved in terms of both software and hardware. It was noticed that IT capability constitutes a key factor for the success of supply chains practices (Flynn et al., 2010; Wong et al., 2011; Yu, 2015). The companies and partners need reliable IT capabilities for optimum collaboration. IT capabilities enable the firm to integrate, organize, and use resources for business needs. Therefore, large companies such as Cisco, General Electric, and Dell have developed efficient strategies that leverage their information technology for supply chain integration to achieve superior enterprise operational performance.

Besides, other research also indicated that the company's operational performance is also affected by the integration of the supply chain. Wong et al.(2011) research conducted in automotive companies in Thailand found that supply chain integration, which is divided into internal and external integration, can also improve its operational performance. Internal integration means eliminating cross-functional barriers through synchronized real-time information sharing, collaboration, and coordination to achieve superior performance. By carrying out internal integration, different functions can work with the same goal and reduce redundancy and waste of resources, positively impacting organizational performance. Internal integration is highly essential to enhancing operational performance.

Moreover, other researchers also suggested that external integration is as vital as internal integration in improving the company's operational performance. External integration involves integration with suppliers, distributors, and retailers. Supplier integration and customer integration refer to sharing information, joint planning, and cooperation between organizations, upstream suppliers, and downstream customers

in managing processes (Flynn et al., 2010). External integration is implemented using an information technology system to connect companies with customers, distributors, and suppliers (Gunasekaran et al., 2001; Reaidy et al., 2015). According to Demeter et al. (2016), external integration can be measured by the level of information exchange, collaborative approaches, and joint decision-making with supply chain partners.

This paper's primary objective is to seek a way to enhance the operational performance of manufacturing companies during the Covid-19 pandemic in the context of supply chain management. For this purpose, the study involves four constructs: IT capability, internal integration, external integration, and operational performance, which are considered highly related in response to the Covid-19 pandemic situation. As discussed above, it appears that operational performance can be improved by enhancing IT capability, implementing a comprehensive internal integration, and external integration with partners. However, the studies concern only the direct relationship of the constructs, and the studies were conducted in the normal situation. Furthermore, this study designs a model that examines the IT capability effect on operational performance through the mediating role of integration and external integration. To the best of the authors' knowledge, there has been no research using a similar model of this study. The novelty of this study is the proposed new model involving four constructs simultaneously to be examined during the Covid-19 era. The second novelty is the mediating role of internal and external integration on the relationship between IT capability and operational performance, which has not existed before. In addition, this work also examines the extended acceptance of previous studies, particularly in the Covid-19 era.

Therefore, four research questions are raised to be examined: 1) Does IT capability directly affect internal integration, external integration, and operational performance? 2) Do internal and external integration directly impact operational performance? 3) Does IT capability indirectly impact operational performance through internal and external integration? 4) Does internal integration influence external integration? It is expected that the result might help manufacturing companies sustain and enhance their operational performance during the Covid-19 era. This study could also enrich the supply chain management research from an academic standpoint.

The paper is laid out as follows. The literature review and hypothesis section look at prior studies to support and develop the study hypotheses. The methods utilized to gather and analyze the data acquired from respondents are then described in the research method section. In addition, the results part covers data analysis and hypotheses testing outcomes. The analyses outcome and its link to past research and interpretation are discussed in the discussion section. Finally, in the conclusion section, the main findings relevant to the study topics are summarized.

2. Literature Review

2.1 Supply Chain Management

A supply chain is a network between interdependent organizations that works together to control, manage, and improve the flow of material, information, and the fund from suppliers to end-users and vice versa (Chopra & Meindl, 2012). A supply chain consists of a group of entities collaborating with their partners upstream and downstream. The supply chain makes sure that the customer received their order correctly and the fund from the customer is received by the firm. Christopher (2011) suggested that supply chain management manages the interaction between upstream and downstream, involving consumers and suppliers to provide customer value at lower costs throughout the network. An integrated supply chain necessitates a commitment from its members.

2.2 IT Capability

IT includes not only software but also network, hardware, and people. IT capability is required to support companies in gaining a competitive advantage. In addition, IT supports information sharing and building relationships between partners (Zhang et al., 2016). According to Prajogo et al. (2018), companies using modern IT can access huge amounts of data from internal and external sources. They can then share it with internal and external partners. Therefore, IT capability should become a key competence to stay in business, not just a supporting system. According to Kala Kamdjoug et al. (2018), IT capability consists of IT management, system, and personnel. IT capability reflects the ability to provide dependable, consistent, advanced IT to support current activities (Liu et al., 2015). This research measures the IT capability adopted from Liu et al. (2015). Namely, information capability supports the business processes (IC1), information systems are integrated to enable rapid change (IC2), information systems are compatible with company requirements (IC3), and information system is highly reliable (IC4).

2.3 Supply Chain Integration

Supply chain integration is the cooperation between companies with their partners and relationship management between organizations (Flynn et al., 2010). Supply chain integration is compulsory for any company willing to sustain itself in business. The intense competition in the global market has forced all companies to actively build mutual collaborations with their partners to pursue a competitive advantage. In several studies, supply chain integration is considered essential for improving company operational performance (Flynn et al., 2010; Yu, 2015; Yu et al., 2021). Three dimensions of supply chain integration are supplier, customer, and internal integration, which can be defined as external integration and internal integration (Alfalla-Luque et al., 2015; Flynn et al., 2010).

2.4 External Integration

External integration refers to the collaboration with suppliers, distributors, retailers, and end customers. The objective is to integrate the activities of each member in the same direction. This objective could be achieved through joint planning, information sharing, and other cooperation. Integration involves managing cooperation and synchronizing processes to meet upstream suppliers and downstream customers (Flynn et al., 2010). External integration is close interactive relationships by reacting, developing, selecting, and implementing strategies to improve performance (Han et al., 2013). Research on 202 manufacturing companies in China found that companies need to exploit their internal resources and pay attention to external resources through an appropriate integration with suppliers and customers to pursue a competitive strategy (Xu et al., 2014). Demeter et al. (2016) defined that the external integration is implemented through information exchange with the primary customer (EI1), collaboration with the key customer (EI2), joint decision making with major customers (EI3), exchange information with the principal supplier (EI4), cooperation with the principal supplier (EI5), joint decision making with the major supplier (EI6). Our study adopted this measurement to assess external integration implementation.

2.5 Internal Integration

Internal integration reflects the extent to which a company compiles its functional practices, procedures, and behavior into integrated and synchronized processes to meet consumers' needs accordingly (Tarigan et al., 2021; Zhang et al., 2018). Internal integration enables real-time data and knowledge exchange, strategic cross-functional cooperation, and logistics activity alignment in all functional areas, including marketing, manufacturing, purchasing, warehousing, financial, R&D, and information technology. Integrating these business functions enables the company to gain a competitive advantage and superior performance (Ganbold et al., 2020). According to Han et al. (2013), internal integration makes each department and various functional areas aware that they must work within an integrated process to deliver customer orders. Internal integration allows all related internal business functions to be connected through information sharing, such as inventory systems, inventory availability, logistic information, and information sharing among all functions. Flynn et al. (2010) suggested four measurement indicators of internal integration, which are also adopted in this study, namely, the level of internally integrated inventory system (II1), real-time inventory availability information (II2), real-time logistic information availability (II3), the real-time information sharing and connection among all internal functions (II4).

2.6 Operational Performance

Operational performance can be defined as the ability of a company to satisfy its customers through quick delivery, high product quality at low costs, and flexibility in op-

erational activities (Flynn et al., 2010). Operational performance is also defined as the extent to which a company achieves an efficient flow of material, products, and information in delivering goods and services to customers (Christopher, 2011). Another study measured operational performance based on four factors: fulfillment of customer orders, quality of product, customization of the product, and total cost reduction (Tarigan & Siagian, 2021). Operational performance measurement is principally based on the capability to fulfill the customers' needs (Kebede Adem & Virdi, 2020). Kebede Adem and Virdi (2020) used eight indicators, which are also adopted in our study, to measure operational performance. The eight indicators are: quick response to market change (OP1), reliable delivery services to customers (OP2), reduced production cost (OP3), maintaining the unit cost at a minimum level (OP4), achieving productivity target (OP5), maintaining productive working hour as planned (OP6), achieving product quality as targetted (OP7), and achieving defective product rate as low as possible (OP8). Other studies indicated different indicators affecting operational performance. Flynn et al. (2010) used four main indicators, i.e., quick delivery, high quality, low cost, and flexibility. Meanwhile, Christopher (2011) measured the operational performance against an efficient material, product, and information flow. Moreover, Tarigan and Siagian (2021) proposed the measurement of order fulfillment, quality, and total cost. To measure operational performance, we adopted the scale developed by Kebede Adem and Virdi (2020). Their study proposed a broader coverage (8 items) and included almost all indicators used by other studies.

3. Hypotheses Development

3.1 IT Capability and Operational Performance

IT capability can help companies survive in the face of competition and make it easier to cope with external changes. Research conducted by Apulu et al. (2011) found that IT capabilities in companies are used to increase customer satisfaction, save time and costs on company operations. Any IT system problem experienced by the company will undoubtedly disrupt its activities, resulting in a decline in its performance. Companies' management needs to pay attention to and upgrade their information technology capabilities following the advanced technology development. A study by Tarigan et al. (2020) surveyed 61 manufacturing companies in East Java, Indonesia. The result indicated that information technology adoption in enterprise resource planning (ERP) technology improved the manufacturing company's operational performance. Besides, research conducted by Liu et al. (2015) indicates that companies with high IT capabilities tend to outperform their competitors, especially in operational performance. Prajogo and Olhager (2012) and Tarigan et al. (2020) suggest that information technology within a company can provide the real-time information needed by the company, such as the amount of inventory, delivery schedules, and other data related to company op-

erations. Moreover, Yu et al. (2021) surveyed 296 manufacturing companies in China and found that IT capability can improve quality, delivery, flexibility, and reduce costs to improve operational performance. Another study by Joshi et al. (2022) has surveyed 881 global companies to examine the impact of IT governance processes on business performance. The study found that the capability of IT governance processes positively affects business performance. Therefore, the first hypothesis is proposed as follows:

H1: *IT capability influences operational performance.*

3.2 IT Capability and External Integration

IT capability in the enterprise can involve suppliers and customers exchanging information, such as sales, promotion, procurement, customer service, and delivery schedules without space and time constraints (Liu et al., 2015). Research conducted by Liu et al. (2015) on 261 manufacturing companies in China found that external integration supported by IT capabilities can help companies access more information, increase flexibility in market changes, reduce costs, and reduce product life cycles. These factors are essential in company operational performance. Furthermore, excellent integration with suppliers and consumers can be achieved using reliable IT capability because of the fast exchange of information. Besides, IT can provide facilities in forecasting and scheduling to improve integration with customers. Previous research has found that IT capability positively affects external integration (de Vass et al., 2018; Liu et al., 2015; Yu, 2015). A survey of 108 large manufacturing firms listed in the Tokyo Stock Exchange investigated the relationship between information technology capability on supply chain integration and firm performance. The supply chain integration consists of internal and external integration. The result indicated that information technology affects internal integration, external integration, and firm performance (Ganbold et al., 2020).

This argument proposes the second hypothesis below.

H2: *IT capability affects external integration.*

3.3 IT Capability and Internal Integration

Internal integration entails sharing knowledge between internal functions and coordinating through strategic functions, allowing departments with different roles with suppliers, such as R&D, buying, marketing, and manufacturing, to collaborate on design and development (Yu, 2015). Previous research indicated the importance of IT in increasing internal integration, and this integration will not run if no information technology supports it (de Vass et al., 2018; Prajogo et al., 2018). Therefore, the IT capability of a company is vital, primarily to support the company's internal integration. Furthermore, information technology capabilities are arguably essential for business survival and create smooth integration in the supply chain. They help companies transmit

and process information required for fast decision-making on the internal side (Kala Kamdjoug et al., 2018). The previous studies, as presented above, also support that information technology affects internal integration. Therefore, adapting information technology capability enables an organization to reinforce cross-functional integration (Ganbold et al., 2020).

The above discussion formulates the third hypothesis:

H3: *IT capability influences internal integration.*

3.4 External Integration and Operational Performance

The proper external integration with suppliers and customers can significantly improve the company's operational performance. First, external integration with suppliers involves communication, coordination, exchange of information, and participation by suppliers and customers in the production process and planning. Second, the delivery of goods can also be shortened by careful planning with external parties to reduce costs, increasing company performance (Yu et al., 2021). Third, external integration can enable companies to create collaborative relationships with their partners, increasing their competence and reducing transaction costs (Flynn et al., 2010). Fourth, previous research showed that by having good integration with customers, a company's supply chain can be more adaptive, reactive, and responsive to uncertainties in today's market (Reaidy et al., 2015). Finally, customers can check their orders at any time so that companies can collect feedback on time to minimize errors and increase efficiency (Yu et al., 2021). In addition, a survey on the "Big Three" car companies (OEMs) in North America of 150 first-tier suppliers has found that integration practices, in terms of internal and external integration, positively enhance the firm performance (Droge et al., 2004). A study on a total of 415 third-party logistics (3PLs) providers based in Shanghai, Guangdong, and Fujian examined the impact of external integration capabilities on their financial performance. The result proved that external integration directly and positively improves financial performance (Liu & Lai, 2016). Therefore, the fourth hypothesis is formulated as follows:

H4: *External integration influences operational performance.*

3.5. Internal Integration and Operational Performance

The importance of cross-functional integration in improving company performance has been broadly researched. Internal integration reflects several activities such as real-time information in finding suppliers, information about requests, and several activities from several functional departments (Yen & Wu, 2016). Lack of internal integration within the company can cause internal objectives to be the opposite, causing a waste of resources negatively impacting operational performance (Wong et al., 2011). Practical cooperation in internal functions can meet the ever-changing needs of customers. It can

facilitate the company's operating performance, including delivery, cost, quality, and flexibility, to meet customer demands. Internal integration can break down hierarchical spatial barriers and improve relationships with various functions in an organization (de Vass et al., 2018). Several other studies found that internal integration positively influences company operational performance (Flynn et al., 2010; Yu, 2015). As indicated previously, a study by Droge et al. (2004) on the "Big Three" car companies (OEMs) in North America of 150 first-tier suppliers found that internal integration positively affects the firm performance.

The previous argument postulates the fifth research hypothesis:

H5: *Internal integration influences operational performance.*

3.6 Internal Integration and External Integration

Previous research revealed that the supply chain integration process must develop from an internal logistic process to an external integration, namely suppliers and customers (Ganbold et al., 2020). On the contrary, a study on 82 purchasers examining the relationship between internal and external integration in global sourcing found that internal integration did not directly affect external integration. Instead, it indirectly affects external integration by mediating the role of social capital within the relationship (Horn et al., 2014). Exchanging information with suppliers can increase understanding of forecasting joint planning in partnerships. Exchange of information with customers can help organizations understand customer needs and collaborate to make demand planning and customer service better (de Vass et al., 2018). Research conducted by Zhao et al. (2011) in 617 companies in China found that companies with good communication skills and internal coordination skills will be better able to achieve good external integration. The premise that internal integration affects external integration can be explained by three main perspectives: information exchange, strategic cooperation or alliances, and working together (Flynn et al., 2010). Flynn explained that companies could not exchange information with their external partners if their internal systems were not well integrated. Also, exchanging information with supply chain partners can be inaccurate and take a long time if there is no internal integration. Moreover, another study indicated that internal integration enables the organization to build an external integration in terms of supplier integration and customer integration (Zhao et al., 2011). This discussion determines the sixth research hypothesis.

H6: *Internal integration influences external integration.*

3.7 IT Capability and Operational Performance through Internal Integration

The previous discussion concerns the direct relationship of IT capability to internal integration (H3) and the direct effect on operational performance (H5). These direct relationships support the indirect association of IT capability and operational perfor-

mance. If these two direct effects exist, it can be postulated that IT capability also indirectly affects operational performance through internal integration. Previous studies found that IT capability has a direct effect on internal integration (de Vass et al., 2018; Liu et al., 2015; Prajogo & Olhager, 2012; Yu, 2015). Then, internal integration directly affects operational performance (de Vass et al., 2018; Flynn et al., 2010; Ganbold et al., 2020; Liu et al., 2015; Yu, 2015; Yu et al., 2021). Based on the two arguments above, the seventh hypothesis can be formulated as follows:

H7: *IT capability indirectly affects operational performance through internal integration.*

3.8 IT Capability and Operational Performance through External Integration

Similarly, in the previous discussion, it was found that IT capability has a direct effect on external integration (de Vass et al., 2018; Prajogo & Olhager, 2012; Yu, 2015). Then, external integration directly affects operational performance (de Vass et al., 2018; Flynn et al., 2010; Liu et al., 2015; Yu et al., 2021). This rationale indicated an indirect influence of IT capability on operational performance through the mediating role of external integration. Based on the two arguments above, the eighth hypothesis can be formulated as follows:

H8: *IT capability influences operational performance through external integration.*

3.9 IT Capability and Operational Performance through Internal Integration and External Integration

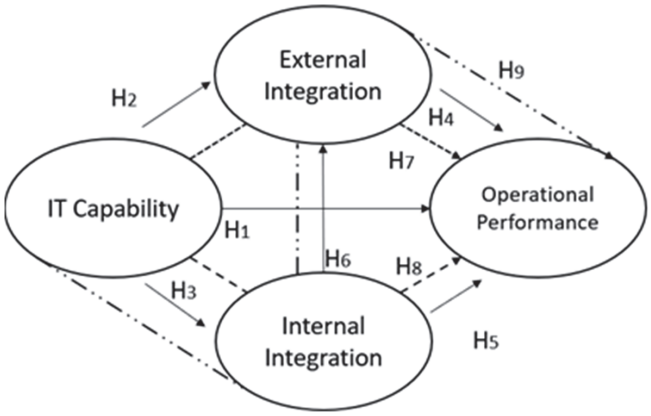
This relationship is built based on three direct relationships. Firstly, with regard to the relationship between IT capability and internal integration, researchers indicated the importance of IT in increasing internal integration, and this integration will not run if no information technology supports it (de Vass et al., 2018; Prajogo et al., 2018). Information technology capabilities are arguably essential for business survival, they create smooth integration in the supply chain, and it helps companies transmit and process information required for fast decision-making on the internal side (Kala Kamdjoug et al., 2018). Information technology capability enables an organization to reinforce cross-functional or internal integration (Ganbold et al., 2020). The second relationship is between internal integration and external integration. Supply chain integration process must develop from an internal logistic process to an external integration, namely suppliers and customers (Ganbold et al., 2020). Companies with good communication skills and internal coordination skills will be better able to achieve good external integration (Zhao et al., 2011). Information exchange with their external partners is not possible if their internal systems were not well integrated (Flynn et al., 2010). Internal integration enables the organization to build an external integration in terms of supplier integration and customer integration (Zhao et al., 2011). The third relationship is between external integration and operational performance. External integration with

suppliers involves communication, coordination, exchange of information, and participation by suppliers and customers in the production process, and company planning, and delivery of goods can also be shortened by careful planning with external parties to reduce costs, increasing company performance (Yu et al., 2021). External integration can enable companies to create collaborative relationships with their partners, increasing their competence and reducing transaction costs (Flynn et al., 2010). Having good integration with customers, a company's supply chain can be more adaptive, reactive, and responsive to uncertainties in today's market (Reaidy et al., 2015). In addition, a survey on automotive industry in North America has found external integration to positively enhance the firm performance (Droge et al., 2004). The result showed that external integration directly and positively improves financial performance (Liu & Lai, 2016). Based on these three direct relationships, the ninth hypothesis is postulated as follows:

H9: *IT capability affects operational performance through internal integration and external integration.*

The research model with all the proposed hypotheses is depicted in Figure1.

Figure 1
The Research Model



Note. Solid lines indicate direct hypotheses, and dotted lines indicate indirect hypotheses.

4. Methodology

This study surveyed manufacturing companies in East Java with 20 up to 99 employees (medium size) and more than 100 employees (large size). The primary reason for selecting the region of East Java is its status as the second most populated region that has become a center of the manufacturing industry in Indonesia. Based on the Statistics Bureau of East Java Province 2020, there are 5024 manufacturing companies domiciled in

East Java, Indonesia, including medium and large-sized companies (https://jatim.bps.go.id/). The data also covers all organizations involved in supply chains, such as suppliers, manufacturers, distributors, and retailers. However, this study focuses only on the companies engaged in the manufacturing industry. These companies are engaged in various sectors: food and beverage, chemical, textile, and automotive. Therefore, we estimate that from the data obtained, there are around 578 medium and large-size manufacturers to be surveyed in this study. Based on this population, the requirement of the minimum samples is calculated using the Slovin formula with a margin of error of 10%, and the result is 84 samples. As noted, the more samples, the more accurate is the result. Therefore, this study tried to obtain as many samples as possible. For this purpose, this study distributed 200 questionnaires representing 200 manufacturers.

Data was collected using a questionnaire based on a five-point Likert scale from (1) Strongly disagree to (5) Strongly agree. The questionnaire was created using Google Form, and the links were distributed to the respondents through WhatsApp, Line, and Facebook social media. Besides, the authors also made a telephone call to the companies to request their willingness to fill in the questionnaire. The respondents are from the management level (supervisor and higher level), in charge of various organizational functions. They are considered eligible as respondents since they understand their organization's strategic decisions and activities. A total of 200 companies were contacted, and 132 respondents filled in the questionnaire. After the data selection process, 111 of 132 respondents were considered valid for further analysis. The study samples represented seven (7) industry regions in East Java, Indonesia. They included 33 samples from Sidoarjo region, 25 samples from Gresik region, 23 samples from Surabaya region, 21 samples from Mojokerto region, three samples from Lamongan region, three samples from Bojonegoro, and three samples from Pasuruan region. The composition of the study samples indicated that the samples well represented the region of East Java as the area of study.

4.1 Respondent Profile

Table 1 indicates the respondent profile by the manufacturing sector. The respondents represented the majority of industries existing in the manufacturing industry. Hence, the respondents reflected the manufacturing industry in East Java, Indonesia.

Moreover, Table 1 demonstrates the composition of the respondents based on the department they are in charge of. All respondents work in the department related to logistics, operation, production control, and purchasing. This composition indicates that respondents are related and knowledgeable on the constructs of this study. This finding shows that respondents are in charge of most of the company operational activities at the management level. Therefore, they are considered knowledgeable in the daily manufacturing operation activities. In addition, respondent profile by position repre-

sents the level of management such as supervisor, manager, and owner of the company. This finding shows that the respondents recognize the company strategy and activities, which means that the responses given are considered precise and relevant.

Table 1

Respondents by Sector, Function and Position

Manufacturing Sector		
	Freq.	(%)
Textile	20	18.0
Chemical	44	39.6
Food & Beverage	21	18.9
Automotive	13	11.7
Other	13	11.7
Total	111	100
Department		
Production	38	34.2
PPIC	34	30.6
Logistic and Storage	19	17.1
Purchasing	12	10.8
IT	8	7.2
Total	111	100.0
Position		
Supervisor	71	64.00
Manager	34	30.60
Owner	6	5.40
Total	111	100

5. Results

5.1 Measurement Model Assessment

The research model may need a more complex model in applied social and behavioral science, and collected data frequently do not adhere to a multivariate normal distribution. In addition, the research model may not be sufficiently supported by theories and data availability. In this situation, covariance-based structural equation modeling is not recommended, but variance-based or partial least square (PLS) is recommended (Hair et al., 2012). The partial least square (PLS) is a robust method and is increasingly widely used in management research. The advantage of PLS is its suitability with a limited number of samples and supporting theories. The main reason for using PLS

in this study is the limited number of samples, namely 111 samples. The step-by-step procedure in PLS could be defined as follows. There are two major steps in PLS: measurement model assessment and inner model assessment to examine the direct and indirect causal relationship between two constructs. First, measurement model assessment examines the validity and reliability of construct indicators. The indicator validity consists of convergent validity and discriminant validity. At the same time, reliability assessment examines the consistency of indicators in measuring the construct. The second analysis examines the inner model, namely, the relationship of constructs and the model's goodness of fit against the collected data. For this purpose, R^2, Q^2, and GoF are evaluated. Then the significant level of path coefficient is evaluated to assess whether the hypothesis is supported or not. The hypothesis is supported for the t-value greater than 1.96 or p-value less than 0.05. The indicator for each variable is considered valid if the value of outer loading has a value greater than 0.5 (Hair et al., 2019) and greater than the value of cross-loadings.

Table 2
Outer Loading, Cross Loading, and the Mean

Item	Statement	Mean	IC	II	EI	OP
IC1	Information systems support the business processes	3.93	**0.854**	0.415	0.467	0.465
IC2	Information systems are integrated for rapid change	4.09	**0.799**	0.352	0.461	0.425
IC3	Information systems compatible with requirement	3.95	**0.818**	0.422	0.412	0.501
IC4	Information system is highly reliable	3.83	**0.775**	0.270	0.374	0.493
II1	Internally integrated inventory system	4.04	0.416	**0.849**	0.418	0.620
II2	Real-time inventory availability information	3.62	0.363	**0.793**	0.411	0.579
II3	Real-time logistic information availability	4.07	0.397	**0.861**	0.417	0.607
II4	Real-time information sharing all internal functions	4.12	0.350	**0.870**	0.415	0.573
EI1	Information exchange with the main customer	3.95	0.361	0.453	**0.821**	0.590
EI2	Collaboration with the key customer	3.77	0.460	0.357	**0.753**	0.491
EI3	Joint decision making with major customers	3.55	0.372	0.352	**0.764**	0.473

Item	Statement	Mean	IC	II	EI	OP
EI4	Exchange information with the main supplier	4.05	0.435	0.448	**0.850**	0.583
EI5	Collaboration with the supplier	3.83	0.497	0.353	**0.817**	0.514
EI6	Joint decision making with the supplier	4.10	0.436	0.411	**0.833**	0.554
OP1	Quick response to market change	4.17	0.484	0.589	0.619	**0.811**
OP2	Reliable delivery services to customers	3.96	0.488	0.610	0.566	**0.801**
OP3	Reduced production cost	4.02	0.531	0.585	0.523	**0.817**
OP4	Maintaining the unit cost at a minimum level	3.72	0.558	0.651	0.568	0.832
OP5	Achieving productivity target	4.05	0.379	0.480	0.533	**0.759**
OP6	Maintaining productive working hour as planned	3.51	0.413	0.491	0.445	**0.782**
OP7	Achieving product quality as targetted	3.94	0.439	0.540	0.491	**0.798**
OP8	Achieving defective product rate as low as possible	3.93	0.387	0.547	0.485	**0.807**

Note. The values written in bold are outer loading, and other values represent cross-loading value.

Table 2 presents the results of the indicators validity test. Since the value of outer loading (written in bold) is greater than 0.50 in all cases, those indicators are valid in terms of convergent validity. Furthermore, the values written not in bold are less than the outer loading value of each corresponding indicator, which means indicators are valid. The minimum value on the IT capability indicator is 0.755, corresponding to the IC4 indicator. Internal integration has the lowest value of 0.793 on indicator II2, external integration with a value of 0.753 on the EI2 indicator, and operational performance with a value of 0.759 on the OP5 indicator. Another measurement of the convergent validity is the average variance extracted (AVE), which indicates the average percentage of variation explained among the construct item. The recommended value of AVE is greater than 0.50 (Fornell & Larcker, 1981). Table 3 demonstrates the AVE calculation, and the result is greater than 0.50, which satisfies the requirement. Based on these two findings, all indicators are valid with convergent and discriminant validity.

A reliability test assesses the consistency, precision, and dependability of measurement for the block indicator of each construct. Composite reliability (CR) and Cronbach's alpha (CA) criteria are used in this reliability test. When the CR and CA values exceed 0.7, the block of indicators is considered reliable (J. F. Jr. Hair et al., 2014). The higher the composite reliability value, the better the variable indicators' consistency,

correctness, and reliability. The CA and CR values are shown in Table 3, and all values exceed the minimum requirement. Hence, all of the indications were found to be reliable, and further analysis can continue.

Table 3
Reliability Test Result

Construct	Cronbach's Alpha	Comp. Reliability	AVE
IT Capability	0.828	0.886	0.659
Internal Integration	0.865	0.908	0.712
External Integration	0.893	0.918	0.651
Operational Performance	0.920	0.935	0.642

The next stage is the evaluation of the structural model to determine the coefficient determinant (R^2), Stone-Geisser indicator or predictive relevance (Q^2), and Goodness of Fit (GoF).

Table 4
R Square and Q Square Values

Construct	R Square	Q Square
IT Capability	-	-
Internal Integration	0.236	0.161
External Integration	0.347	0.216
Operational Performance	0.656	0.407

The R^2 assesses the portion of the variance of the endogenous variables explained by other variables in the structural model. It evaluates the quality of the adjusted model. For the area of social and behavioral science, Cohen (1988) suggests that R2 = 0.02 is classified as having a small effect, 0.13 as a medium, and 0.26 as having a significant impact. The analysis in Table 4 indicated that all R2 values have medium and large effects, ranging from 0.236 up to 0.656. In addition, the structural model assessment is evaluated using the Stone-Geiser indicator (Q^2), which defines how much the model approaches what was expected, which is called the model prediction quality or accuracy of the adjusted model. The criteria of the evaluation values greater than zero should be obtained (Hair et al., 2014). The result demonstrated in Table 4 shows that all values are greater than zero, which satisfies the criteria. The last evaluation for the model goodness of fit (GoF) used the method proposed by Tenenhuaus et al. (2005), which is the geometric mean (square root of the product of two indicators) between the average value of R2 and the average value of the AVE. Wetzels et al. (2009) suggest that the

value of 0.36 is adequate for the social and behavioral sciences. The average value of R^2 is obtained from Table 4, which is 0.413, and the average value of AVE is obtained from Table 3, which is 0.666. Using the formula proposed by Tenenhaus et al. (2005), the value of Goodness of Fit (GoF) for the model is found to be 0.524. This value satisfies the good criterion of 0.36 for social and behavioral science.

5.2 Hypotheses Test Results

Hypotheses testing is done by examining the t-statistics value of each path coefficient. PLS assesses the t-statistic or p-value through a bootstrapping approach with smartPLS software. At the same time, the path coefficient reflects the magnitude and the direction of the path coefficient obtained (positive or negative). As mentioned before, a hypothesis is supported when the t-statistic value exceeds 1.96. Table 4 showed that all six direct relationship hypotheses were supported by research data obtained.

Table 5

Test Results of Direct and Indirect Effect Relationship

Hypothesis	Path Coefficient	T Statistics	Result
IT Capability -> Operational Performance (H1)	0.197	2.154	Supported
IT Capability -> External Integration (H2)	0.384	5.169	Supported
IT Capability -> Internal Integration (H3)	0.453	5.330	Supported
External Integration ->Operational Performance (H4)	0.338	4.245	Supported
Internal Integration -> Operational Performance (H5)	0.450	5.288	Supported
Internal Integration -> External Integration (H6)	0.318	3.929	Supported
IT Capability ->Internal Integration -> Operational Performance (H7)	0.204	3.549	Supported
IT Capability ->External Integration -> Operational Performance (H8)	0.130	3.012	Supported
IT Capability ->Internal Integration -> External Integration -> Operational Performance (H9)	0.049	2.504	Supported

The results showed that the IT capability influences operational performance (H1) with a t-value of 2.154>1.96. These results indicate that IT capability directly improves operational performance. Furthermore, hypothesis H2 that IT capability affects external integration is supported with a t-value of 5.169>1.96. Similarly, IT capability positively affects internal integration (H3) with a t-value of 5.330>1.96. The fourth hypoth-

esis (H4) that external integration affects operational performance is accepted with a value of 4.245> 1.96. At the same time, hypothesis H5 is accepted with the t-value of 5.288>1.96. These results showed that internal integration improved operational performance. The last result in Table 4 that internal integration directly affects operational performance (H6) is accepted with a t-value of 3.929 > 1.96.

Besides the direct relationship between the constructs, as demonstrated in Table 4, this study also developed an indirect relationship between two constructs with the test result shown in Table 4. There are three indirect effects on IT capability on operational performance, and all hypotheses were supported as the t-values exceed 1.96. First, it shows that the IT capability influence on operational performance mediated by internal integration (H7) is supported with the t-value of 3.549 > 1.96. These results are consistent with the previous research, which found that internal integration mediates the effect of IT capability and operational performance (Kala Kamdjoug et al., 2018). Hypothesis H8, IT capability indirectly influences operational performance through external integration, is supported in this study with the t-value of 3.012 > 1.96. The last hypothesis, H9, states that IT capability indirectly affects operational performance through external and internal integration, which is supported in this research.

6. Discussion

The analysis results show that all hypotheses were supported. The first result indicated that IT capability affects operational performance. These results support previous research (Prajogo & Olhager, 2012; Yu et al., 2021). A company with an information system compatible with its business processes can quickly cope with market changes. Besides, with sophisticated information technology, companies can exchange information with partners quickly, flexibly, and efficiently to find out the current market conditions and quickly meet customer needs. The second finding showed that IT capability affects external integration. This finding is supported by previous research (Liu et al., 2015; Yu, 2015). Companies with an adequate information system can easily exchange sales forecasts and production plans with external partners, particularly their major suppliers. Using up-to-date software makes sharing information easy due to the same format or language used so that supply chain partners can understand it and minimize misunderstandings.

Furthermore, the finding also indicated that IT capability improves internal integration (H3). This result is supported by previous research (Yu, 2015; Yu et al., 2016). Companies with information systems that are compatible with their business processes can have real-time integration and connection of functions in terms of integrated inventory system, real-time inventory availability, real-time logistic information, and essential real-time information sharing internal functions. At the same time, external integration influences operational performance (H4), which is in line with the previous studies (Demeter et al., 2016; Reaidy et al., 2015; Zhao et al., 2011), as expected. This

finding implied that companies that perform information exchange such as inventory level, sales forecast, and production plan with their major suppliers could achieve better operational performance in quick response to market changes or customer demand. The information exchange is critical, especially at this pandemic due to uncertain market conditions. By exchanging information with major suppliers and customers, companies can cope with current market conditions to prioritize what requests need to be met and sort out what production is feasible.

Besides, the fifth finding states that internal integration also improves operational performance (H5). This finding supported previous studies conducted by Wong et al. (2011) and Yu (2015). The presence of internal integration within a company enables *real-time* communication among all internal functions. This integration enables the organization to respond to market changes quickly. One of the main problems emerging in a current uncertain market condition is the decision-making process. Sometimes decisions are made too late, so that market trends have changed when decisions are made, and the company will miss opportunities. Integration of internal departmental functions can overcome this constraint. With an excellent internal integration, all departments will be connected in *real-time* to respond to market changes quickly.

The sixth hypothesis (H6) states that internal integration influences external integration. This result supports previous research (Flynn et al., 2010; Yu et al., 2021). This finding could be interpreted that when a company's internal function is appropriately integrated into real-time information sharing, it will enable the organization to efficiently exchange information with its external partners, particularly leading suppliers. The information-sharing includes sales forecasts, production plans, goods tracking, tracing, and inventory availability. True collaboration with supply chain partners can increase the company's competence and reduce transaction costs. In addition, internal integration assisted by the company's information technology capabilities can accelerate the information exchange required for decision-making.

One of the novelties of our research, as defined previously, is the presence of the intervening role of internal and external integration. These indirect effects are the response to research question number three. As expected, the three indirect hypotheses proposed were supported in this study. Firstly, IT capability indirectly influences operational performance via the mediating role of external integration (H7). The interpretation of this finding is as follows: When a company has improved its IT capability, a compatible and sophisticated information system will enhance the external integration in terms of information exchange. This information exchange with its external partner, such as its leading suppliers, will enable the company to cope with customer needs, reflecting the operational performance.

The external integration assisted by information technology can help companies access much more information, increase flexibility in market changes, and reduce costs, which is essential in the company's operational performance. Information from external parties can help companies plan for changes in market demand, such as during this pan-

demic. Secondly, IT capability also indirectly affects operational performance through internal integration (H8). A sophisticated and compatible IT in terms of software and hardware allows the organization to quickly coordinate its internal functions essential to fulfilling customer needs. The last finding of this study is the indirect effect of IT capability on operational performance through internal integration and external integration (H9). This last finding is the further consequence of the previous two indirect effects. IT capability improves internal integration, internal integration affects external integration, and external integration affects operational performance. With well-integrated functions, the organization will be able to achieve good integration with external parties. Therefore, companies appropriately collaborating internally and externally in their business processes can improve their performance.

These findings highlighted the crucial role of IT capability in improving operational performance. Besides, the organization needs to integrate internal functions for quick coordination to cope with customer demand. The integration with external partners allows the company to cope with external uncertainties such as demand fluctuation and demand shifting. The collaboration with an external partner, particularly its major suppliers, enables the joint forecast, plan, and adjustment to demand variation. When a company has used sophisticated IT, establishing internal and external integration will improve its operational performance during the current pandemic. An interesting finding of this study indicates that IT capability provides multiple effects (direct and indirect) on its performance. Therefore, each manufacturing company needs to upgrade its IT capability and establish internal and external integration to improve performance.

7. Conclusion

As previously defined, this study examines the effect of IT capability on operational performance through internal integration and external integration. Based on previous research, this study has proposed nine hypotheses as theoretical-based responses to the research questions. The conclusion of the study can be drawn as follows. IT capability directly improves operational performance (H1). IT capability influences internal integration (H2). IT capability influences external integration (H3). External integration influences operational performance (H4). Internal integration improves operational performance (H5). Internal integration affects eternal integration. The exciting finding of this study is the existence of mediating role of external integration and internal integration. IT capability indirectly improves operational performance through external integration (H7). Besides, IT capability enhances operational performance through internal integration (H8). IT capability indirectly affects operational performance through external integration and internal integration (H9). These results imply that ITT capability has multiple effects on operational performance.

There are three novelties found from this study as follows: First, this study extends the acceptance of previous studies, namely, the direct relationship between constructs

on the population of manufacturing industry in Indonesia. Second, this study shows that the internal integration and external integration mediate the influence of IT capability on operational performance, which was not identified before, to the best knowledge of the authors. Third, this study shows that the research model created in this study, which involves four constructs simultaneously, could be used for the industry practitioner on how to enhance the operational performance. Therefore, this study provides a managerial implication for the manufacturing industry on how to enhance the operational performance during the disruption era such as the current pandemic. The adoption of sophisticated IT capability, internal functions integration, and integration with the external party enable the manufacturing company to enhance its operational performance. However, this study has limitations, especially in terms of the population and the construct. Future research may include additional variables such as top management engagement and leadership to cover more stakeholders and roles in the supply chain network.

References

Alfalla-Luque, R., Marin-Garcia, J. A., & Medina-Lopez, C. (2015). An analysis of the direct and mediated effects of employee commitment and supply chain integration on organisational performance. *International Journal of Production Economics*, *162*, 242–257. https://doi.org/10.1016/J.IJPE.2014.07.004

Apulu, I., Latham, A., & Moreton, R. (2011). Factors affecting the effective utilisation and adoption of sophisticated ICT solutions: Case studies of SMEs in Lagos, Nigeria. *Journal of Systems and Information Technology*, *13*(2), 125–143. https://doi.org/10.1108/13287261111135972

Chopra, S., & Meindl, P. (2012). *Supply Chain Management: Strategy, Planning and Operation*. Prentice Hall.

Christopher, M. (2011). *Logistics and Supply Chain Management: Creating Value-Adding Networks* (4th ed.). Prentice Hall.

Demeter, K., Szász, L., & Rácz, B. G. (2016). The impact of subsidiaries' internal and external integration on operational performance. *International Journal of Production Economics*, *182*, 73–85. https://doi.org/10.1016/J.IJPE.2016.08.014

de Vass, T., Shee, H., & Miah, S. (2018). The effect of "Internet of Things" on supply chain integration and performance: An organisational capability perspective. *Australasian Journal of Information Systems*, *22*. https://doi.org/10.3127/ajis.v22i0.1734

Droge, C., Jayaram, J., & Vickery, S. K. (2004). The effects of internal versus external integration practices on time-based performance and overall firm performance. *Journal of Operations Management*, *22*(6), 557–573. https://doi.org/10.1016/J.JOM.2004.08.001

Flynn, B. B., Huo, B., & Zhao, X. (2010). The impact of supply chain integration on performance: A contingency and configuration approach. *Journal of Operations Management*, *28*(1), 58–71. https://doi.org/10.1016/j.jom.2009.06.001

Fornell, C., & Larcker, D. F. (1981). Evaluating Structural Equation Models with Unobservable Variables and Measurement Error. *Journal of Marketing Research*, *18*(1), 39. https://doi.org/10.2307/3151312

Ganbold, O., Matsui, Y., & Rotaru, K. (2020). Effect of information technology-enabled supply chain integration on firm's operational performance. *Journal of Enterprise Information Management*, *34*(3), 948–989. https://doi.org/10.1108/JEIM-10-2019-0332

Ginting, K. (2020). *Terdampak Covid-19, PMI Manufaktur Turun di April 2020 - Iconomics*. THE ICONOMICS. https://www.theiconomics.com/art-of-execution/terdampak-covid-19-pmi-manufaktur-turun-di-april-2020/

Gunasekaran, A., Patel, C., & Tirtiroglu, E. (2001). Performance measures and metrics in a supply chain environment. *International Journal of Operations & Production Management*, *21*(1/2), 71–87. https://doi.org/10.1108/01443570110358468

Hair, J. F. Jr., Hult, G. T. M., Ringle, C. M., & Sarstedt, M. (2014). A Primer on Partial Least Squares Structural Equation Modeling (PLS-SEM). In *Long Range Planning* (Vol. 46, Issues 1–2). Thousand Oaks: Sage. https://doi.org/10.1016/j.lrp.2013.01.002

Hair, J. F., Risher, J. J., Sarstedt, M., & Ringle, C. M. (2019). When to use and how to report the results of PLS-SEM. *European Business Review*, *31*(1), 2–24. https://doi.org/10.1108/EBR-11-2018-0203

Hair, J. F., Sarstedt, M., Hopkins, L., & Kuppelwieser, V. G. (2014). Partial least squares structural equation modeling (PLS-SEM): An emerging tool in business research. *European Business Review*, *26*(2), 106–121. https://doi.org/10.1108/EBR-10-2013-0128

Hair, J. F., Sarstedt, M., Ringle, C. M., & Mena, J. A. (2012). An assessment of the use of partial least squares structural equation modeling in marketing research. *Journal of the Academy of Marketing Science*, *40*(3), 414–433. https://doi.org/10.1007/s11747-011-0261-6

Han, J., Lu, H., Trienekens, J. H., & Omta, S. W. F. (Onno). (2013). The impact of supply chain integration on firm performance in the pork processing industry in China. *Chinese Management Studies*, *7*(2), 230–252. https://doi.org/10.1108/CMS-JUN-2011-0034

Horn, P., Scheffler, P., & Schiele, H. (2014). Internal integration as a pre-condition for external integration in global sourcing: A social capital perspective. *International Journal of Production Economics*, *153*, 54–65. https://doi.org/10.1016/j.ijpe.2014.03.020

Jabbour, C. J. C., de Sousa Jabbour, A. B. L., Govindan, K., Teixeira, A. A., & de Souza Freitas, W. R. (2013). Environmental management and operational performance in automotive companies in Brazil: The role of human resource management and lean manufacturing. *Journal of Cleaner Production*, *47*, 129–140. https://doi.org/10.1016/J.JCLEPRO.2012.07.010

Joshi, A., Benitez, J., Huygh, T., Ruiz, L., & De Haes, S. (2022). Impact of IT governance process capability on business performance: Theory and empirical evidence. *Decision Support Systems*, *153*, 113668. https://doi.org/10.1016/J.DSS.2021.113668

Kala Kamdjoug, J. R., Nguegang Tewamba, H. J., & Fosso Wamba, S. (2018). IT capabilities, firm performance and the mediating role of ISRM: A case study from a developing country. *Business Process Management Journal*, *25*(3), 476–494. https://doi.org/10.1108/BPMJ-11-2017-0297

Kebede Adem, M., & Virdi, S. S. (2020). The effect of TQM practices on operational performance: an empirical analysis of ISO 9001: 2008 certified manufacturing organizations in Ethiopia. *The TQM Journal*, *33*(2), 407–440. https://doi.org/10.1108/TQM-03-2019-0076

Liu, C. L., & Lai, P. Y. (2016). Impact of external integration capabilities of third-party logistics providers on their financial performance. *International Journal of Logistics Management*, *27*(2), 263–283. https://doi.org/10.1108/IJLM-09-2014-0155

Liu, H., Huang, Q., Wei, S., & Huang, L. (2015). The impacts of IT capability on internet-enabled supply and demand process integration, and firm performance in manufacturing and services. *The International Journal of Logistics Management*, *26*(1), 172–194. https://doi.org/10.1108/IJLM-11-2013-0132

Omar, R., Lo, M.-C., Yen Sang, T., & Siron, R. (2010). Information sharing, information quality and usage of information technology (IT) tools in Malaysian organizations. *African Journal of Business Management*, *4*(12), 2486–2499.

Prajogo, D., & Olhager, J. (2012). Supply chain integration and performance: The effects of long-

term relationships, information technology and sharing, and logistics integration. *International Journal of Production Economics*, *135*(1), 514–522. https://doi.org/10.1016/J.IJPE.2011.09.001

Prajogo, D., Toy, J., Bhattacharya, A., Oke, A., & Cheng, T. C. E. (2018). The relationships between information management, process management and operational performance: Internal and external contexts. *International Journal of Production Economics*, *199*, 95–103. https://doi.org/10.1016/J.IJPE.2018.02.019

Reaidy, P. J., Gunasekaran, A., & Spalanzani, A. (2015). Bottom-up approach based on Internet of Things for order fulfillment in a collaborative warehousing environment. *International Journal of Production Economics*, *159*, 29–40. https://doi.org/10.1016/J.IJPE.2014.02.017

Sherman, E. (2020). *94% of the Fortune 1000 are seeing coronavirus supply chain disruptions: Report, Forbes (Hrsg.), o.O. 2021, abrufbar unter: https://fortune.com/2020/02/21/fortune-1000-coronavirus-china-supply-chain-impact/, Stand 19.06.2021*. FORTUNE. https://fortune.com/2020/02/21/fortune-1000-coronavirus-china-supply-chain-impact/

Tarigan, Z. J. H., & Siagian, H. (2021). The effects of strategic planning, purchasing strategy and strategic partnership on operational performance. *Uncertain Supply Chain Management*, *9*(2), 363–372. https://doi.org/10.5267/j.uscm.2021.2.006

Tarigan, Z. J. H., Siagian, H., & Jie, F. (2021). Impact of Enhanced Enterprise Resource Planning (ERP) on Firm Performance through Green Supply Chain Management. *Sustainability 13*(8), 4358. https://doi.org/10.3390/SU13084358

Tarigan, Z. J. H., Siagian, H., & Sebayang, P. (2020). The impact of implementing enterprise resources planning (ERP) project on firm performance and organizational citizenship behavior as a moderating. *Journal of Project Management*, *5*, 227–236. https://doi.org/10.5267/j.jpm.2020.8.001

Tenenhaus, M., Vinzi, V. E., Chatelin, Y. M., & Lauro, C. (2005). PLS path modeling. *Computational Statistics & Data Analysis*, *48*(1), 159–205. https://doi.org/10.1016/J.CSDA.2004.03.005

Wetzels, M., Odekerken-Schröder, G., & van Oppen, C. (2009). Assessing Using PLS Path Modeling Hierarchical and Empirical Construct Models: Guidelines. *MIS Quarterly*, *33*(1), 177–195.

Wong, C. Y., Boon-Itt, S., & Wong, C. W. Y. (2011). The contingency effects of environmental uncertainty on the relationship between supply chain integration and operational performance. *Journal of Operations Management*, *29*(6), 604–615. https://doi.org/10.1016/J.JOM.2011.01.003

Xu, D., Huo, B., & Sun, L. (2014). Relationships between intra-organizational resources, supply chain integration and business performance: An extended resource-based view. *Industrial Management & Data Systems*, *114*(8), 1186–1206. https://doi.org/10.1108/IMDS-05-2014-0156

Yen, Y. S., & Wu, F. S. (2016). Predicting the adoption of mobile financial services: The impacts of perceived mobility and personal habit. *Computers in Human Behavior*, *65*, 31–42. https://doi.org/10.1016/J.CHB.2016.08.017

Yu, W. (2015). The effect of IT-enabled supply chain integration on performance. *Production Planning & Control, 26*(12), 945–957. https://doi.org/10.1080/09537287.2014.1002021

Yu, W., Jacobs, M. A., Chavez, R., & Feng, M. (2016). The impacts of IT capability and marketing capability on supply chain integration: a resource-based perspective. *International Journal of Production Research*, *55*(14), 4196–4211. https://doi.org/10.1080/00207543.2016.1275874

Yu, Y., Huo, B., & Zhang, Z. (2021). Impact of information technology on supply chain integration and company performance: Evidence from cross-border e-commerce companies in China. *Journal of Enterprise Information Management*, *34*(1), 460–489. https://doi.org/10.1108/JEIM-03-2020-0101

Zhang, M., Lettice, F., Chan, H. K., & Nguyen, H. T. (2018). Supplier integration and firm performance: the moderating effects of internal integration and trust. *Production Planning & Control, 29*(10), 802–813. https://doi.org/10.1080/09537287.2018.1474394

Zhang, X., Van Donk, D. P., & van der Vaart, T. (2016). The different impact of inter-organizational and intra-organizational ICT on supply chain performance. *International Journal of Operations & Production Management, 36*(7), 803–824. https://doi.org/10.1108/IJOPM-11-2014-0516

Zhao, X., Huo, B., Selen, W., & Yeung, J. H. Y. (2011). The impact of internal integration and relationship commitment on external integration. *Journal of Operations Management, 29*(1–2), 17–32. https://doi.org/10.1016/J.JOM.2010.04.004