



Application of Internet of Things to Ensure Improved Performance within the Internal Supply Chain Unit of an Organization

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<i>Article History</i>	<i>Abstract</i>
<p>Received: 13 July 2022 Revised: 20 September 2022 Accepted: 30 October 2022</p> <p>CC License CC-BY-NC-SA 4.</p>	<p>With the rapidly changing business world, technology adapted for doing business has also undergone rapid transformation leading to use Internet of Things as an advanced technological innovation required to connect production units to internet devices for smooth production and operation, with enhanced ICT systems and infrastructure. Internet of Things is considered to be an advanced information and communication technology, whose applicability is highly needed to ensure smart performance of organizations in Indonesia. Indonesia, being a developing country, adapting to new ways of doing things, including the use of IoT takes time, hence affecting studies regarding the use of IoT in business units, such as the internal supply chain sector. Thus, there is no much studies from a localized perspective, measuring the importance and using IoT as well as supply chain performance of the country. The present paper applied an organizational capacity theory to establish the Internet of Things impact on varying dimensions of Supply Chain, which included supply chain integration process, organizational performance of supply chain and the capacity to the influence production. The research applied a survey of cross-section on several companies within the Greater Jakarta area as the research approach. Data was obtained from over 161 companies from across Jakarta. Finally, the data was analyzed with the help of the structural equation modelling (SEM-AMOS) for the development of an empirical structural model.</p> <p>Keywords: <i>Supply chain, Production, Organizational Performance, Organizational capacity theory, Innovation, Internet of Things.</i></p>

1. Introduction

The transformation and advanced technologies of innovation connecting the devices and objects through the internet is referred as Internet of Things (Drepaul, 2020). The network of objects consists of containers, machines, vehicles, and devices embedded in sensors and software which can potentially collect and communicate data through the Internet (Ferguson, 2016). Studies have revealed that entrepreneurs using IoT facilities are able to identify, establish, and control things that include various objects which require the Internet (Chivunga & Tempest, 2021). Owing to rapid changes, IoT is considered an advanced form of applied information and communication technology (ICT)

functions to help record and disseminate data (Esty, 2017) in organizational networks on a direct or real-time basis (Pentland, 2010). Internet of Things is believed to have better capabilities than other ICTs because of its intelligent, autonomous, and broader surveillance capabilities that can reach wider coverage (Ünver, 2018; Nizetic et al., 2020).

It has been established that conventional ICT technologies have supported companies in monitoring the functions of supply chain include sales, distribution, returns, purchasing and storage (Ritchie & Brindley, 2007). However, the presence of many other smart devices that fall under the umbrella of new IoT technologies (Kovalsky, Ross & Lindsay, 2020) has recently increased the company's capabilities in terms of recording and exchanging data in real time (Arcidiacono & Podda, 2017). Even though the advancement in applications of IoT in sensor form are expected for revolutionizing the sectors of retail (Kahlert, Constantinides & de Vries., 2017) their efforts and acceptance for integrating them into the process of the supply chain still need to be evaluated. Although several studies are conducted for investigating the process of supply chain integration process enabled by ICT in the improvement of performance of the company (Vanpoucke et al., 2017; Rai, Patnayakuni, & Seth, 2006; Qrunfleh & Tarafdar, 2014; Li, Yang, Sun, & Sohal, 2009), some of the empirical studies investigated effect of adopting IoT on integration of supply chains (de Vass et al., 2018).

Alfalla-Luque, Medina-Lopez & Dey (2013), stated that inclusion of SC integration with the integration within and among the organizations in SC through collaborating mechanisms which produce a higher value for the customers through superior services (Christopher & Towill., 2001). By use and adoption of IoT helps in organizations building the capabilities. Through the perspective of the theory of organization capability, IoT is the most likely to be increasing ability for integration of customers, suppliers and intra organizational logistic process. IoT reduces gaps between physical world and digital world for digital and physical world with synchronization of information flow of the physical/real objects to create a more optimal SC integration (Ping et al., 2011). The paradigm of IoT plays the major role in retail industries in managing the networks of supply in responding to the demand of the customer (Yu, Subramanian, Ning & Edwards., 2015) for managing supply networks in response to the demand of customers (Yu, Subramanian, Ning, & Edwards, 2015). Research on the effectiveness of IoT is needed, and it is the perfect time to do so because of the enthusiasm to adopt technology that results in visibility and data transparency to reach integration in the supply chain process (Tu, 2018; Mishra et al., 2016; Dubey, Gunasekaran, Childe, Papadopoulos & Wamba., 2017; Ben-Daya, Hassini, & Bahroun, 2017).

Most of the IoT researches solely on perspectives of technology and there is very little research that recognises relationship among the IoT for increasing the performance and supply chain of a company or organisation. There is also very little literature discussing the fundamental relationship between adopting IoT and improving supply chain capability. This leaves the question: to what extent can various emerging technologies which are classified as an "IoT" facilitate or ease the internal integration process (cross-functional operations) so that it has the ability to increase the SC capability and result in improved company performance. Therefore, the goal of the research study by empirical investigation of the effects of implementation of capabilities of IoT and integration capability of the supply chain process which results in an increase in supply chain capability that affects the internal performance of the company. Research aim for gaining the knowledge gap through empirical testing by which IoT can able to strengthening the process of SC integration to the influence of capabilities as well as performance in supply chain of retail industries in Indonesia. This article is organised in the following stages. First, we will find an introduction which describes the background and objectives of this research. Second, this research explains literature studies on integration of supply chain, IoT capabilities as well as organisational capability theory to create a conceptual framework on IoT capabilities in integration and process, along with the IoT enabled supply chain process capabilities and integration. Third, we explain the techniques of analysis and methods for data collection using the SEM-AMOS model. Fourth, we discuss the results, theoretical implications, and practices, along with the research findings. Finally, a summary, suggestions, and a discussion are provided.

2. Literature Review

2.1 Integration of Supply Chain

A number of studies have shown that in today's competitive and dynamic environment for business, competition occurs in supply chain rather than the individuals in the organisation (Christopher & Towill, 2001; Christopher, 2016), and improving the supply chain performance also increases advantages of sustainable competitive supply chain (Spekman, Kmatiff Jr & Myhr., 1998; Seuring & Muller., 2008). In management of supply chain, mechanism of integration of SC is improving performance of the Supply Chain (Ellram & Cooper., 1993; Ataseven & Nair, 2017; Christopher, Crum & Holweg, 2011; Alfalla-Luque et al., 2013; Ho, Au, & Newton, 2002).

Collaborative management within as well as between the organisations on strategy of business process, operational, tactical strategy for achieving the effective and efficient flow of fund, information, and products for giving the maximum values to the customers at optimal speed and lowest cost is referred as supply chain (Huo, 2012; Yu, 2015; Alfalla-Luque et al., 2015). Integration of supply chain is seen as the digital connection from the business process in an organisation and between organisations that involve downstream customers and upstream suppliers (Ataseven & Nair, 2017). Several sources state that supply chain with at three-dimensions, internal process, upstream process and customer downstream integration (Näslund & Hulthen, 2012; Atasevan & Nair, 2017; Alfalla -Luque et al., 2013).

The effort for eliminating the cross-functional barriers within the organization through the processes of facilitating the information on real time and sharing across the coordination, strategic collaboration and business functions for achieving the superior performance (Yu, 2015). Conceptually, the integration goal for achieving the delivery effectiveness and efficient funds throughout supply chain for creating the value for the customers (Frohlich & Westbrook., 2001; Naslund and Hulthen., 2012) suggested for the theory "Arcs of integration" in which the organizations with integration of more solid advantages of supply chain than the effects of the superior performance. Many research studies show performance and integration of the supply chain positive effects (Huo, 2012; Flynn, Huo & Zhao, 2010; Ataseven & Nair, 2017).

2.2 IOT Capabilities in Supply Chain Process Integration

The IoT has a wide range of intelligence capabilities and autonomous applications which has made it popular (Uckelmann, Harrison, & Michaelles, 2011). In recent years, the IoT has become increasingly effective and affordable, the adoption and its spread in operations of supply chain have grown despite of the challenges (Verdouw et al., 2016). ICT functions as the digital enabler for the integration of supply chain and supports the effectiveness of the information flow and additional capabilities contributed by IoT technology, is considered to have the potential to facilitate data capture and dissemination among partners (Rai et al., 2006; Yu, 2015; Ben-Daya et al., 2017; Tu, 2018). Therefore, IoT has ability for sensing and processes of the supply chain with increased accuracy, collaborative decisions, interoperability, visibility, traceability throughout supply chain (Reaidy, Gunasekaran & Spalanzani., 2015). Liu & Zhou., (2015) argued that integration of IoT in to the information of logistics has helped partners for receiving the data and using it effectively for making decisions. Ping et al. (2011) suggested the idea of management of agile supply chain as set by the few researchers who tried to explain the way of the IoT which could strengthen and synchronise the product flow and the information for increasing the integration of supply chain.

Digitisation has made the supply chain an integrated and transparent ecosystem for all players involved, from raw materials suppliers as well as components and spare parts to the supply and finished goods transporters, finally with the customers. With supply chain theory perspective, the implementation of ICT as a digital enabler in the retail industry can improve the supply chain integration performance with increasing the information flow (Li et al., 2008., Rai et al., 2006). Huo., 2012 in De Vass et al., (2018) explained that the IoT has an influence on integration of SC which is related to the three aspects, namely: 1) customer integration, 2) supplier integration, and 3) intra-organizational integration.

2.3 Organizational Capability Theory

The adoption of IoT aims to provide additional capabilities that can increase the value of ICT already available within the company. IoT is seen as an advancement in ICT capabilities that can further ease communication and the flow of information within and between organisations in a more integrated manner (Borgia, 2014). Companies can create additional capabilities by adopting IoT in their businesses. Therefore, the organizational capability theory is used as the foundation of this research. This theory states that companies must develop their capabilities and resources to improve their performance (Rai et al., 2006; Huo, 2012; Anggadini & Susanto, 2017). The capability of integration depending upon the direct effect of the company's performance (Verona., 1999; Huo., 2012).

Furthermore, the theory of organizational capability shows internal integration can affect the integration externally directly whereas the process of internal integration basis for the development of company's external process integration (Huo, 2012). Verona., (1999) suggested that that capability of internal integration includes job training, processes, internal communication where is the external capabilities include the partner networking and communication. Meanwhile, Bharadwaj (2000) argues the implementation of ICT which does not have the direct effect on the performance but do rather needs of the combined and organizational resources that include financial and human resources for the improvement of performance. Therefore, IoT can be considered as an increase in organizational integration capabilities. With perspective nature of resource based theory, resources and capabilities are the basic foundation of the advantage of source of competition. The term 'resources' is considered as almost anything good in the form of assets, capabilities, organizational process, company attributes, information, knowledge, and more; which enables companies to develop and implement strategies for increasing their capabilities, effectiveness and efficiency.

From the perspective of dynamic capability, organizational capability is defined as a ability of the company for managing, organising, coordinating and carrying out a certain series of activities. The routines of high-level capabilities 'high-level (or collections of routines), together with their implementation input streams, provide organizational management with a set of options for decisions to produce significant outputs from a particular area. Resources and capabilities become valuable if they are capable of helping organisations improve their performance relative to their competitors. This means that valuable resources and capabilities can be used to implement new strategies to 1) increase efficiency and effectiveness, 2) increase customer satisfaction, and 3) reduce customer satisfaction costs (relative to competitors). Organizational capabilities theory states that the the internal integration capabilities can able to affect the capabilities of external integration directly where is the management of internal process act as the foundation for company's development for the management of external process. This is due to the culture in exchanging the information and the partnerships which can spread from or within the organizations of supply chain (Huo., 2012).

2.4 The Creation of Capabilities in Supply Chain of Retail Industries

The implementation of ICT (IoT) in retail business is driving a change in the retail environment because it allows the traditional retail industry to coexist with the online retail world through an omni-channel shopping mechanism to erase the difference between online (brick and mortar) and offline (click and mortar) shops. IoT technology can also provide data to optimise the layout of a store, enable automatic checkouts, and improve the management of inventories. The innovation can enable the new business model and retail industry for increasing the sales and productivity and reduction of cost. The IoT can also be used to improve customer relationships. Through e-commerce, store owners can obtain information from customers and adopt targeted strategies. IoT implementation can help understand consumer needs, provide them with all kinds of products that have a wider variety (e.g. visual merchandising), offer products at lower costs (e.g. robotics and automation processes), increase loyalty (e.g. blockchain), and improve customer service (e.g. artificial intelligence-based self-learning systems).

The IoT is also capable of encouraging businesses to set prices dynamically by continuously updating prices on e-commerce platforms or in real time to ensure the best deals and provide a unified experience across platforms. Determining dynamic pricing can also communicate greater value by responding to requests and determining prices to reflect consumers' willingness to pay for the perceived value of a product or service. Flexibility in determining pricing also extends to individual customer experiences (Dinesh et al., 2018 and Sri Dewi Anggadini, 2015). A number of IoT

technology which include techniques of radio frequency identification are considered as the very important for the promotion of efficient as well as effective communication and coordination in the supply chain specifically in the spheres of operation. Finally, the transparency, competition, volatility and complexity of the retail industries have increased substantially in the supply chain. In addition to improving customer experience, IoT implementation offers important opportunities for the retail industry to develop supply chains and generate new revenue streams.

3. Conceptual Framework And Development Of Hypothesis

The conceptual framework is proposed in the study for building up of the model of integration process (Huo., 2012) which investigated empirically about the performance of a company in the industry is significantly influenced by the integration mechanism. Huo (2012) include 3 sub dimensions of integration, intra organisational integration, customers and suppliers. Various research studies on the integration are mainly focused upon the relationship between the performance and supply chain integration (Fabbe-Costes & Jahre., 2008, Kim., 2009., Huo., 2012). Several studies suggest that the IoT has ability for retrieving the real time data through facilitating the integration and communication among the companies (Ping et al., 2011; Yan et al., 2014). IoT are able to support the customers through integration into the shopping guides, product delivery processes, shopping behaviour of customer and tracking of products. Based on the review of literature and the previous researchers, this study formulated the following hypotheses:

3.1 First Hypothesis: Explains the relationship between variables IOT Capabilities in Supply Chain

Hypothesis 1: IOT Capability in the internal supply chain has the positive effect on the internal supply chain process integration (SCPI).

Flynn et al., (2010) explains the process of integration of supply chain is a key component of SCM. SC process integration includes the dimensions of internal and external SC process integration, both of which can contribute to achieving cost reductions, identifying out-of-stock conditions, and shortening lead-times, thereby leading to competitive advantage. A company tends to achieve superior performance when it achieves the high level of external and internal SC integration. All the perspectives for enabling the members of supply chain are more significant for performing in an integrated manner to maximise supply chain value (Flynn et al., 2010). Integration of internal SC process relates to the integration process between internal functions, which is, the interaction and collaboration between different departments. The focus of internal SC process integration lies in activities within the company's manufacturing, namely, the extent for which the development of manufacturers in their organizational practices, process and strategies in to the synchronised collaborative process to meet the needs of their customers while simultaneously interacting efficiently with their suppliers.

IoT capabilities have positive effect on SC processes integration because they can able to break down the barriers of cross functional and facilitating the information on real time sharing across the key functions of supply chain (De Vass et al., 2018). Among supply chain members sharing the relevant information is a key success factor (Anggadini S D et al., 2022). Several studies have proven that the strategy for implementing IoT capabilities in SC can strengthening of SSC process through integration by connecting the objects through the Internet (Ping et al., and Tu, 2018). Huo (2012), Alfalla-Luque et al., (2013) and De Vass et al., (2018) show that IoT capabilities have the positive effect on the process of SC integration both in internal and external integration process of SC. customers, managing trade and promotions (merchandising and promotions), loyalty programmes, and pricing (pricing and post solutions) (GJ ten Bok, 2016; Dinesh et al., 2018). Thus, the IoT implementation strategy for internal supply chain integration process of the retail companies can be encouraged and developed with the integrating of internal supply chain of the company and the process of internal supply chain and the process of external integration of supply chain, namely suppliers and customers. Based on the flow of thought above, the conceptual framework model for supply chain process integration variables (SC process integration). The use of internal IoT can be the basis for developing IoT capabilities throughout the supply chain, on that basis, it can be hypothesized as follows:

3.2 The Second, Third, And Fourth Hypotheses Explain The Relationship Between Iot Capabilities In The Supply Chain (SC) And Internal Supply Chain Process Integration (SCPI) And The Relationship Between Internal And External SCPI.

Hypothesis 2: Internal SCPI has the positive effect on the supplier SCPI

Hypothesis 3: Internal SCPI has the positive effect on the customer SCPI

They concluded that the alignment of structure and strategy is only a basic requirement for company performance. If the company wants to develop a competitive advantage, it must be able to build the necessary capabilities as a result of the conformity of the strategy and structure. Therefore, the relationship between the development of company performance, which has a competitive advantage through the SSP development approach, needs to be strengthened by developing the company's capabilities. This means that it can be articulated by combining the two basic principles of resource-based view theory and contingency theory. Due to do perspective of the organisational capability theory for the integration of internal SC process can directly affect the SC process integration capability externally whereas the management of the internal process is the foundation for developing external process management of company. Due to the information exchange culture and the partnerships can spread from or within the organization throughout the supply chain (Huo., 2012). A number of empirical studies that have been carried out by researchers prove that adopting ICT (IoT) resources to integrate supply chain processes (both internal and external) in the retail industry can further encourage supply chain capabilities (SCC), namely internal SC capabilities. and external SC capabilities which include customer and supplier SC capabilities. Research findings show positive relations between the integration of supply chain process initiated with the application of ICT (IoT) to the capabilities of supply chains, so that the following hypothesis can be formulated:

3.3 The Fourth, Fifth and Sixth Hypotheses: Explain Relationship between the Supply Chain Process Integration and the Supply Chain Capabilities and the Relationship between Internal and External Capabilities

Hypothesis 4: Internal Supply Chain Process Integration (SCPI) has a positive effect on the Internal Supply Chain Capability (SCC)

Hypothesis 5: Internal Supply Chain Capability (SCC) has the positive effect on the supply chain capability of the supplier (SCC).

Hypothesis 6: Internal Supply Chain Capability (SCC) has the positive effect on the supply chain capability of the customer (SCC).

Various empirical studies that have been carried out by researchers have proven that increasing integration of the supply chain has the positive effect on improving customer service performance as well as being able to increase cost-efficiency. The impact of this condition results in an increase in a company's operational and business performance. If this condition can occur continuously, it will be able to create and maintain competitive advantage. Flynn et al. (2010:68) carried out a literature review that proves that there is that positive relationship between the ability of the company to develop supply chain integration (SCI) and company performance-- both related to company performance and business performance. If examined from the RBV theory approach, the company must have a unique set of resources that must be adapted to the company structure to maximise the capabilities of these resources. This results in relevant capabilities of superior performance through the development, aspects of which are widely recognised as the source of competitive advantage. Based on the conceptual background described above, the conceptual model of the relationship between the firm performance and the supply chain capability can be formulated as the following hypothesis:

3.4 Seventh Hypothesis: Explaining Relationship between the Supply Chain Capability (SCC) and the Company Performance (CP):

Hypothesis 7: Internal supply chain capability has the effect on the performance of the company.

Based up on numerous hypotheses stated in the above hypothesis, the proposed study a temporary framework model that will be tested based on field data and then analysed with a structural equation model (SEM-AMOS) to determine whether the proposed model is supported by available data, as described as below fig.1:

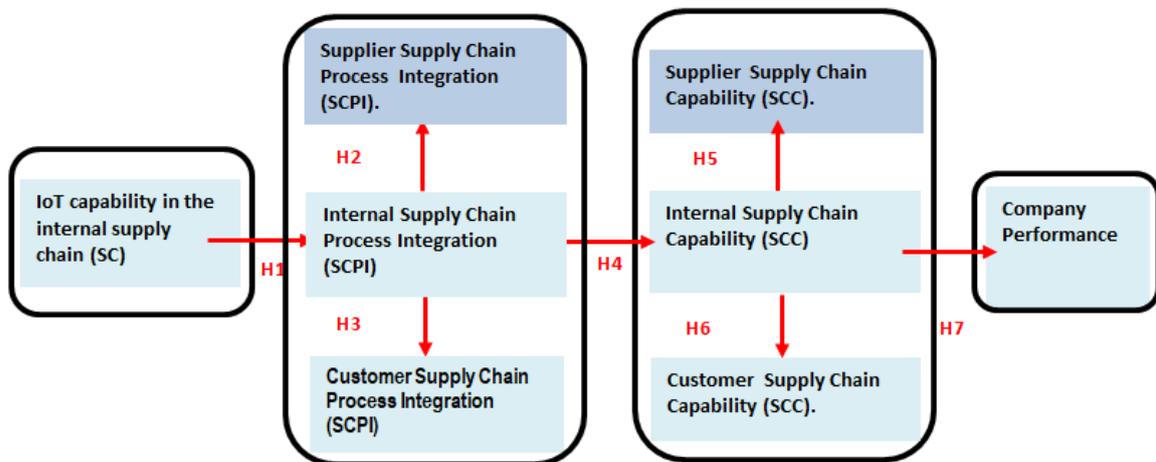


Figure 1. Proposed research model

4. Data and Methodology

The study used survey method for collecting the data for the respondents filled out a self-reported questionnaire that was distributed online using Google Forms. The respondents were from various retail companies in Jakarta. Researchers used a purposive sampling technique in which the respondents were sorted according to the criteria or characteristics determined by the researcher. The target respondents, the research unit or sample, are retail companies in Jakarta, which in this case are officials who have authority or are appointed and authorised officers who come from sections related to supply chain operations within the retail company that enable them to understand and answer questionnaires containing various questions about IoT in their company.

4.1 Measurement

The measurement is done by asking a number of valid and reliable questions, most of which are adapted from existing literature that has been discussed and reviewed in-depth. A few changes are made in the items of the questionnaire for ensuring the align with objectives, research questions and methods used. The capability of IoT as a company's internal SC enabler is measured based on its function using three question items referring to the nomenclature of SC capability dimensions which are adapted to eight aspects of the SCM process based on the Global Supply Chain Forum framework and various academic studies, especially the work of Bok (2016), Dinesh et al. (2018), DeVass et al., (2018), Huo (2012), and Rai et al., (2006). The first operational construct/variable (IoT capability in the company's internal supply chain (SC) is shown in Table 1.

Table 1. Operationalization of IOT capability variables in the supply chain (SC)

Variable 1	IoT capability in the internal supply chain (SC)
Indicator	Demand management
Sub-indicator	Define demand management goals and strategies
Indicator	Order fulfilment
Sub-indicator	Define requirements for order fulfilment
Indicator	Manufacturing flow management
Sub-indicator	Review logistics strategies, marketing, sourcing, and manufacturing

The measurement of supply chain integration process was adapted mainly from Flynn, Huo, and Zhao (2010), and the operations of the second, third, and fourth constructs/variables (IoT capabilities in the company's internal supply chain (SC)), as shown as in Table 2:

Table 2. Operationalization of the Supply chain Integration Process (SCPI) variables

Variable 2: Supplier supply chain process integration (SCPI)	
Indicator	Supply Chain process integration to improve information exchange
Sub-indicator	The level of exchange of information with the major suppliers through network of information
Indicator	Supply chain process integration helps increase supplier participation in procurement
Sub-indicator	The level of participation of key suppliers in procurement and production processes.
Indicator	Supply chain process integration to help enhance strategic partnerships
Sub-indicator	Strategic partnership level with key suppliers
Variable 3: Internal Supply Chain Process Integration (SCPI)	
Indicator	SCPI to improve data integration between functions/sections
Sub-indicator	Data integration between internal functions
Indicator	Supply chain process integration to accelerate data processing (real-time)
Sub-indicator	Real-time search of inventory levels.
Variable 4: Customer Supply Chain Process Integration (SCPI)	
Indicator	SCPI to improve communication with key customers
Sub-indicator	The degree of linkages with customers through network of information
Indicator	The integration of processes within supply chain for improving linkages with key customers
Sub-indicator	The company shares production plans with key customers
Indicator	Integration of processes in supply chain to get feedback from customers
Sub-indicator	Follow up for the key customers feedback

Source: Flynn., Huo & Zhao (2010)

The measurement of supply chain capability was adapted from various academic studies, especially Gregory (2015) in Bok (2016), Dinesh et al. (2018), DeVass et al., (2018), Huo (2012), Rai et al., (2006) Bok (2016), De Vass et al., (2018). Meanwhile, the company performance measurement was adopted from Flynn, Huo, and Zhao (2010). The operations of the fifth, sixth, and seventh constructs or variables (supply chain capability (SCC) at supplier SC, company internal SC, and customer SC) are shown in table 3 as follows:

Table 3. The operationalization of the supply chain capability (SCC) variables

Variable 5: Supply Chain Capability (SCC) of Suppliers	
Indicator	Supplier relationship management capabilities
Sub-indicator	Differentiating suppliers
Indicator	Product development and commercialization capabilities
Sub-indicator	Defining new products and assessing suitability
Indicator	Return management capabilities
Sub-indicator	Receiving return requests
Indicator	Supply chain capability in assessing supplier suitability and performance

Sub-indicator	Identify opportunities with suppliers
Variable 6: Internal Supply Chain Capability (SCC)	
Indicator	Demand management capabilities
Sub-indicator	Synchronizing requests and Measuring demand management performance
Indicator	Order fulfilment capability
Sub-indicator	Generate and communicate orders
Indicator	Manufacturing flow management capabilities
Sub-indicator	Measuring manufacturing flow management performance
Variable 7: Customer Supply Chain Capability (SCC)	
Indicator	Customer relationship management capabilities
Sub-indicator	Differentiating customers
Indicator	Customer service management capabilities
Sub-indicator	Implement solutions, monitor and report on customer service

The operationalisation of the company performance variables is described in detail in Table 4.

Table 4. Operationalization of Company Performance Variables

Variable 8: Company Operational Performance	
Indicator	Customer Service Management: provide better service
Sub-indicator	Have a record of timely delivery to key customers
Indicator	Quick Response Demand: responds quickly for changing demands in market
Sub-indicator	Companies responding quickly to the changing demands in market

Source: Flynn, Huo, dan Zhao (2010)

Following similar previous studies through Six-point Likert scale the items are measured ranges from strongly disagree to Strongly Agree (Huo., 2012; Yu., 2015).

4.2 Data Analysis

This study proposes the structural model which explains the relationship among the involved variables searches supply chain capabilities, supply chain integration process, IoT capabilities and company performance in the retail industry sectors through the use of structural equation modelling approach for combining the power factor analysis as well as path analysis. SEM is the more advanced technique than any other multivariate techniques because it is able to estimate the series of interrelated relationships of dependency simultaneously. Byrne (2013) stated that SEM has the advantages because the same technique takes the errors of measurement during the testing of model process and can combine the observed variables and the latent variables simultaneously during the testing of model. SEM analysis are able to carry out in two steps; the first step includes the testing the structural model and measurement model was tested. The measurement model provides the safety of relationship which shows the observed variable represent the latent variable and testing using the confirmatory factor analysis. The structural model examines the conceptual representation of latent variables relationship for determining whether the proposed structural models and the relationship meets the specific requirements.

4.3 Results

Based on the results of data processing using SEM-AMOS, the goodness-of-fit index results from all GOFI parameters have been met with results above the cutoff value required in SEM-AMOS (DF = 154 (> 0), Chi-Square = 182,014 (< . df), Probability = 0.061 (> 0.05), CMIN/DF= 1.182 (< 2), RMR=0.021 (< 0.05), RMSEA = 0.034 (< 0.08), GFI= 0.901 (> 0.90), AGFI= 0.821 (> 0.90), NFI = 0.852 (> 0.90), IFI = 0.979 (> 0.90), TLI or NNFI = 0.974 (> 0.90), CFI = 0.97 (> 0.90) so that this

research model can be used. Standardised regression weights show the loading factor value of each indicator above 0.5 and construct reliability above 0.7, indicating that the data are valid and reliable, as illustrated in Table 5.

Table 5. Loading Factors and Construct Reliability

Construct	Indicators Code	Loading Factor	Construct Reliability
CAP-IOT INTERNAL	IOT DMM	.501	0.75
	IOT MFM	.668	
	IOT OFF	.591	
SCPI CUSTOMER	SCPI CIS	.642	0.76
	SCPI CPS	.741	
	SCPI LCC	.696	
SCPI INTERNAL	SCPI RIF	.656	0.70
	SCPI DIF	.607	
SCPI SUPPLIER	SCPI LSP	.852	0.75
	SCPI FOS	.676	
	SCPI IIN	.719	
SCC CUSTOMER	SCC CRC	.770	0.70
	SCC CSC	.780	
SCC INTERNAL	SCC MFC	.649	0.74
	SCC OFC	.694	
	SCC DMC	.630	
SCC SUPPLIER	SCC RMC	.694	0.79
	SCC ISC	.821	
	SCC PDC	.741	
	SCC SRC	.652	
COMPANY PERFORMANCE	KP QRD	.800	0.70
	KP CSM	.775	

The results of data processing also show that the estimation and critical ratio are known to have an estimated value of > 0.5, so it can be said that there is an influence or a relationship between the variables, and all variables have a critical ratio value that is above 1.96, so it can be considered as a significant effect. Thus, it can be concluded that all hypotheses H_0 are rejected and H_a is accepted, meaning that there is a significant influence between these variables, as illustrated in table 6.

Table 6. Hypothesis Test Results

No	Hypothesis	Estimate ($\geq 0,5$)	CR	Cut Off Value CR (Std CR or T test)	Conclusion
1	IoT Capability in Internal supply chain positive effect on SCPI	1	5,323	> 1.96	H_0 rejected and H_a accepted
2	Internal supply chain process integration positive effect on SCPI of supplier	0,809	8,561	> 1.96	H_0 rejected and H_a accepted
3	Internal supply chain process integration positive effect on SCPI of customer	0,874	7,661	> 1.96	H_0 rejected and H_a accepted

4	Internal supply chain process integration positive effect on internal SCC	0,905	11,091	> 1.96	H0 rejected and Ha accepted
5	Internal Supply Chain Capability (SCC) positive effect on supplier SCC	0,862	9,075	> 1.96	H0 rejected and Ha accepted
6	Internal Supply Chain Capability (SCC) positive effect on customer SCC	0,867	9,435	> 1.96	H0 rejected and Ha accepted
7	Internal supply chain capability positive effect on performance of the company.	0,749	8,767	> 1.96	H0 rejected and Ha accepted

Based on the results of the calculation of the structural equation, it can be described as follows:

In this study, it can be described that the company's internal supply chain (SC) which is enabled by IoT capabilities will have significant and positive effect on the internal SCPI of the company (SCPI). Meanwhile, the company's supply chain process integration internally (SCPI), which is affected by SC, has enabled IoT capability to significantly and positively affect the SCPI of suppliers and customers.

The study also found a significant influence on the development of supply chain capabilities (SCC) as a result of strengthening IoT capabilities in the company's internal supply chain processes (SCPI), and in this study, it was also found that strengthening the company's internal supply chain capabilities (SCC) turned out to also have the significant effect on SC capability of supplier and has significant effect on SC capability of the customer. Additionally, company's supply chain internal capability which has been activated with IoT capability, has significant effect on the performance of the company. Thus, it can be concluded that IoT capability which has been used as a supply chain (SC) enabler in an internal retail company, can improve a company's internal supply chain process integration (SCPI) which in turn affects the supplier's SCPI and significantly affects the company's internal supply chain capability (SCC) and affects the supplier's SCC and customer SCC, ultimately affecting the company's performance. The IoT capabilities adopted in the supply chain (SC) in retail businesses can create added economic value from the internal interests of the company, suppliers, and customers. Supply chain management enabled by IoT capabilities is becoming an increasingly important management tool for improving the operational capabilities of retail companies.

The development of supply chain integration enabled by digital technology, especially the application of IoT, is very important and necessary, and is part of the company's current business model, which is in line with e-commerce practices in the retail industry.

4.4 Discussion

This study was created in an effort to fill the literature are examined with the effect of capabilities of IoT on 3 dimensions on integration of supply chain (suppliers, internals, and customers) and examining their subsequent effects on the company performance and the supply chain capabilities. By analysing all the research is regarding the supply chain results and findings concludes that IoT capabilities can be an enabler that significantly affects the internal supply chain of the company. Thus, company's internal SC significantly affects the development of the company's internal SCPI, SCPI of supplier, and SCPI of customer. Furthermore, internal supply chain process (SCPI) integration of the company that adopts IoT capability affects and builds the company's internal supply chain capability (SCC), supplier SCC, and customer SCC; in turn, the supply chain capability (SCC) that has been activated with IoT capability significantly affects performance of the company.

Through analysis of the literature review, it is concluded that there are still weak and limited research studies related to influencing the ICT capabilities, especially IoT, performance and capabilities of SC. The scope of SC Management is very broad, covering business processes from upstream to downstream, including planning and management as well as the complete activities involved in conversions as well as logistics management, channel partners collaboration, coordination, procurement including intermediaries' suppliers and third-party service providers. Therefore, it is still

open, and further research is needed not only in the retail industry but also in other industries, including agriculture, mining, and construction, so it is hoped that this research will lead to more in-depth and comprehensive studies.

5. Conclusion

From the literature review, researchers can also make several conclusions: (1) It is visualized in retail industry plays an important role in the community's economy. In Industry 4.0, the retail industry has entered a business ecosystem that has changed completely when compared to previous times. (2) The major impacts on adoption of IoT and supply chain capabilities of retail business can create added economic value. The IoT utilisation capabilities in supply chain has proven to make the strategy and business model of retail companies change from traditional and multichannel to omni-channel which makes it possible to use and combine all channels so that SC management is increasingly is visualized integrated entity that can drive competitive advantage, reduce dispersion costs, and help maintain a loyal customer base.

The research study concludes based on the results, the researcher can submit several suggestions as well as materials for further research discussions, as follows:

From the literature that researchers are aware of, previous studies have only examined the relationship between the effect of IoT capabilities on the dimension of integration of supply chain, which are directly related with improving the company performance and performance of supply chain. Therefore, through the research study, the researcher attempts to explain how the influence or relationship of supply chain process integration enabled by IoT is associated with the development of SC capabilities so that they can develop supply chain performance and subsequently affect the strengthening of company performance.

The flow of goods distribution, the process of product logistics, and the process of obtaining products from producers to final consumers requires speed and handling to maximise profits and customer satisfaction. Supply chain management enabled by IoT capabilities is becoming an increasingly important and necessary management tool to help organisations improve their business operations. The development of supply chain integration enabled by digital technology, especially the application of IoT, is relevant and in line with e-commerce practices in the retail industry today. Retail business managers need to be given a new understanding and awareness of the importance of implementing digital technology (IoT and e-commerce) in managing integration of supply chain and developing capabilities of supply chain as drivers of a company's sustainable competitiveness. For regulators, the results of the present study is used for improving the planning and implementation of policies or programs related to the implementation through digital technologies, especially in using IoT in retail industries.

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Authors' contributions

All authors contributed toward data analysis, drafting and revising the paper and agreed to be responsible for all the aspects of this work.

Declaration of Conflicts of Interests

Authors declare that they have no conflict of interest.

Data Availability Statement

The database generated and /or analysed during the current study are not publicly available due to privacy, but are available from the corresponding author on reasonable request.

Declarations

Author(s) declare that all works are original and this manuscript has not been published in any other journal.

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