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The Role of Information Technology and Supply Chain Collaboration in Enhancing Innovation

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ABSTRACT

The impact of information technology on innovation has been extensively examined in recent scholarly works. However, there is limited research explaining its entire supply chain process. To address this deficiency, the purpose of the current study is to evaluate the impact of information technology on supply chain collaboration and supply chain collaboration on innovation. The study also aims to determine the indirect impact of information technology on innovation via supply chain collaboration. A quantitative research design has been adopted to achieve the study's objectives. The data was collected from 348 employees in Indonesia using a basic random sampling technique. This study evaluates the research model using the partial least squares structural equation model (PLS-SEM) method. This study confirms the direct connection between information technology and supply chain collaboration and between supply chain collaboration and innovation. This paper provides empirical support for mediating information technology and innovation relationships in supply chain collaboration.

KEYWORDS: Information technology, supply chain collaboration, and innovation

1. INTRODUCTION

Supply chain management aims to synchronize a product's production, delivery, and distribution processes. By managing the supply chain, businesses can reduce expenses, become more efficient, and deliver products to consumers more quickly. This is achieved by maintaining strict control over the organization's internal inventory, production, distribution, sales, and vendor inventory (Jimenez-Jimenez, Martínez-Costa, & Sanchez Rodriguez, 2019). The premise of supply chain management is that virtually every product that reaches the market results from the efforts of various supply chain organizations. Even though supply chain management has existed for millennia, most businesses have only recently begun to view it as a strategic asset (Hong et al., 2019).

Businesses innovate to survive in a competitive business environment and achieve a strategic competitive advantage (Wu, Ai, & Chang, 2022). Business innovative initiatives are among the essential value-creation duties for any organization, and their comprehension remains an active area of study (Bogers et al., 2019). The information necessary to generate growth in businesses may originate from within the organization, such as the business's personnel, or from outside the organization, such as research institutes, universities, consultants, and

government agencies; however, suppliers and customers are the most common sources of external information (Aviv, Hadar, & Levy, 2021). Supply chain collaboration (SCC) is an example of joint technological cooperation between customers and suppliers (Guo et al., 2022).

The results of previous studies are consistent with the notion that innovative techniques based on external Collaboration can lead to positive innovation outcomes and that these collaborative efforts are enabled by the use of information technologies (ITs) (Saeidi et al., 2019). It is similar to how personal computers, voice networks, data, and laptops, as well as marketing communications programs (e.g., e-mail), play a crucial connectivity role in facilitating the sharing of information to and from supply chain participants engaged in cooperative endeavors, which is crucial for cooperative innovation initiatives (Papa et al., 2020). IT contributes to the strengthening of relationships between supply chain participants. However, previous research provides a limited understanding of the impact of IT on innovation through these collaborative supply chain measures (Daddi et al., 2021). This comprehension is essential for businesses to comprehend the full significance of IT's contribution to technological development and to develop and leverage their IT and SCC skills intelligently.

Thus, this study emphasizes an important gap in the literature: the lack of interest in the contribution of IT to the improvement of collaborative relationships with supply chain partners and the resulting impact on a company's innovation. Furthermore, it is pertinent to study innovation in both exploratory and exploitative developments (Nayal et al., 2022). Exploitative innovation utilizes a company's existing capabilities and resources to enhance a particular area. Explorative innovation, for distinction, is defined as innovative developments that break with an organization's current knowledge and practices, resulting in wholly new products. Even though previous scientific research has addressed exploitative and explorative innovation in the field of SCC, no such research has been conducted regarding IT. In addition, empirical evidence concerning SCC continues to be rotated about innovative exploratory developments (Awan, Kraslawski, & Huiskonen, 2017).

To address a gap in the literature, the present study employs the resource-based view (RVB) to propose a model in which IT and SCC are characterized as features and linked to exploitative and explorative innovation. The RBV argues that a company's extant competencies are the foundation upon which it builds and strengthens the competencies of its employees through consistent, cooperative understanding (Bogers et al., 2019; Lopes, Ferreira, & Farinha, 2021).

The current study utilizes data gathered from IT, innovation, and SCC questionnaires distributed to employees of Indonesian businesses. Notably, we contribute to the supply chain literature by applying the RBV principle to evaluate the moderating influence of SCC on the relationship between innovation and IT. Our model suggests that IT has a significant and positive impact on innovation and that SCC partially mediates the connection between innovation and IT.

2. LITERATURE REVIEW

This analysis proposed a research design in which IT skill is a primary factor in innovation and SCC, and innovation is an immediate result of SCC. The unit is further enhanced by incorporating innovative exploitative and exploratory components. Based on the RBV, an organization's capabilities are the foundation upon which it further develops and fortifies the competencies of its personnel through the application of constant, cooperative knowledge and understanding

(Bogers et al., 2019). An SCC capability can be defined as a company's strategic association procedure in which supply chain associates with similar objectives work together to achieve more excellent combined benefits than the companies could achieve individually (Guo et al., 2022). SCC comprises numerous interrelated elements, including knowledge transfer, real consistency, decision modernization, inducement positioning, applicable resource transfer, cooperative joint, and growth of communication expertise (Daddi et al., 2021). Literature indicates that companies that increase their involvement in information networks are likely to increase their innovative potential in the long term (Kumar et al., 2022; Wu et al., 2022).

To increase cooperation within the supply chain, recommendations regarding the use of IT in organizations are frequently made. According to the RBV, it is both a capability and a resource. IT can be defined as a company's IT utilization, including devices, networks, software, information control, and services. IT is a valuable resource. As a skill, it is the combination of IT assets to acquire, develop, and disseminate knowledge to aid in decision-making, simplify business processes, and facilitate coordination and communication within an organization and with external partners (Missimer, Robèrt, & Broman, 2017). Recent research indicates that the enhancement of IT skills has the potential to facilitate information cooperation and innovation (Al-Jabri, 2020).

Prior studies on innovation have typically focused on exploratory innovation, characterized by the introduction or use of radically new technologies or ideas in markets that are hypothetical or call for substantial adjustments to pre-existing markets (Chemmanur et al., 2019). This type of development offers a high potential for industry growth, significantly increasing the current market's size. Comparatively, exploitative innovative developments are typically minor modifications to an existing product or method (Kava & Didonet, 2019). Exploitative innovative developments are more likely to redistribute shares within an existing market than to expand it.

IT proficiency is essential to SCC because it enables the transfer of knowledge and the collective transmission of ideas that make SCC activities possible (Siawsh et al., 2021). Open, two-way, balanced, frequent, multilevel interaction is recognized as one of the primary essential characteristics of a collaborative supply chain organization. This communication enables partners to build loyalty, determination, interdependence, a shared perspective, and environmental harmony, laying the groundwork for transmitting knowledge to benefit supply chain associates. For example, IT, such as computers, laptops, data and audio networks, and marketing and sales communications programs facilitate the communication and transmission of real-time supply chain knowledge among supply chain participants (Guersola, Lima, & Steiner, 2018). Knowledge such as procurement information, scheduled orders, stock levels, product design requirements, manufacturing preparation, supply chain efficiency, purchase forecasting, an overhead expense system, and the capacity to grow can be discussed among supply chain participants. This specific knowledge makes it possible for supply chain members to design potential orders, output, and cooperation expansion effectively. In addition, using purchase sites enables companies to communicate forecasting and planning production with supply chain partners, resulting in enhanced control of interfirm functional tasks (Daddi et al., 2021; Dugar & Fox, 2022).

Preliminary empirical evidence from previous studies supports a confident relationship between IT skills and cooperative supply chain associations. For instance, Daddi et al. (2021) found that IT skills and knowledge transfer substantially affect the development of strategies. Guersola et al. (2018) discovered that managing support and IT are essential to supply chain

collaboration. Both strategy development and supply chain collaboration skills share several defining characteristics of SCC (e.g., knowledge transfer, collective interaction, and common objectives). Therefore, it is reasonable to assume that IT skills will positively affect SCC. Therefore, we hypothesize:

H1: Information technology is favorably linked with supply chain collaboration

SCC is a long-term association process in which supply chain associates with shared objectives work directly together to achieve expected benefits more significantly than the companies could achieve individually (Belhadi et al., 2021). SCC comprises several components that play an instantaneous role in accumulating, developing, and disseminating new knowledge: knowledge transfer, cooperative joint, and communication expertise development (Younis & Sundarakani, 2020).

Information dissemination can increase executives' awareness of the entire business environment and absorption capacity. A clear understanding of a collective context and increased openness are anticipated to affect inter-organizational characteristics positively and shared understanding. For innovation efficiency (Aslam et al., 2020) and services innovation, external knowledge accumulation through active cohesiveness is crucial in the current scenario (Ghaderi et al., 2021). Furthermore, the literature demonstrates that a comprehensive knowledge search is more effective for firms that innovate new products (Wu et al., 2022). Within a supply chain context, the transmission of performance information must be viewed as an incentive for inter-organizational knowledge sharing and comprehension (Siawsh et al., 2021). According to Guersola et al. (2018)'s study, a collection of industry resources is positively associated with the launch of new-to-firm and new-to-market innovative developments, as are internal resources with the launch of new-to-industry innovative developments.

Cooperative correspondence can aid the environmental capability of associates (i.e., organizational environment, technical skills) and their values, reducing uncertainty and expediting the sharing of information among supply chain associates (Angelidou, 2017). For instance, invention ideas communicated from vendors to purchasing companies are likely to benefit the purchasing company and contribute to innovative products or developments (Singh & Hong, 2020).

Previous research shows that knowledge from external networks, particularly from customers and suppliers, can increase innovation performance (Iyer et al., 2019). The evidence from previous studies indicates that cooperative relationships with purveyors or customers are more likely to result in exploratory innovations than exploitative ones. For example, Chemmanur et al. (2019) found that firms that enhanced explorative, innovative developments were likelier to collaborate with customers and suppliers than with other types of partners, such as institutions and competitors. Kava and Didonet (2019) found that Collaboration with suppliers and consumers was more valuable than Collaboration with competitors or other research organizations to develop exploratory innovations. Rha (2020) discovered that cooperative relationships between the consumer and the vendor stimulate both exploratory and exploitative product innovation, although most innovations were exploitative. Based on the preceding discussion and the premise that cooperative relationships with clients and vendors are a defining aspect of SCC, it is expected that SCC permits both exploitative and exploratory innovations; consequently, we hypothesize:

H2: Supply chain effort has a favorable impact on innovation.

IT can instantly affect innovation by facilitating interaction, control, cooperation, information evaluation, and expertise control functions within the most recent product development system (Wu et al., 2022). IT tools such as e-mail, data transmission, and computer access programs can enhance the communication and cooperation between individuals in the modern product development system. Such methods enable employees to collaborate on innovative projects by searching for, acquiring, and sharing pertinent information swiftly and efficiently (Daddi et al., 2021).

IT can also support the innovation process by assisting with information evaluation responsibilities associated with the most recent product development system (Saeidi et al., 2019). With the aid of IT applications, tasks such as computer-aided design, cost evaluation, forecasting, and sensitivity analysis can now be completed more efficiently and quickly. Similarly, client information captured by CRM methods or a company's web-based model can be utilized in new product development endeavors, examining whether existing services and products meet client preferences (Aljawarneh & Al-Omari, 2018). These technologies enable a company to cultivate an in-depth comprehension of its customers and to steer the development of new, innovative products that better meet consumer needs.

Several studies have found support for a positive relationship between the utilization of ITs and their application to various phases of the product development process (Hussein et al., 2023). Moreover, empirical research has uncovered comparable findings regarding innovative operational developments. For instance, Saeidi et al. (2019) found that IT capabilities can significantly influence the conception, implementation, and development of novel procedural innovations. Daddi et al. (2021) found that IT skills result in innovative service procedure development. Similarly, Saeidi et al. (2019) identified a positive impact of IT skills on innovation efficiency in competitive intensity and corporate entrepreneurship. Even though the literature has not primarily addressed the relationship between IT capability and exploitative and explorative features, recent research has demonstrated that the infrastructure enables the organization to explore new knowledge and then leverage existing/new expertise to innovate IT more effectively (Chemmanur et al., 2019). Thus, IT proficiency is anticipated to have a positive relationship with exploitative and exploratory innovation. Consequently, we hypothesize:

H3: Information technology is favorably associated with innovation.

When combining hypotheses 1 and 2, it is envisaged that SCC will function as an intervention in the relationship between innovation and IT capabilities. Companies can achieve greater SCC levels when they utilize their IT system effectively. The arguments indicate that SCC mediates the relationship between a company's innovation and IT capabilities. Companies with a higher level of IT expertise may participate in SCC in a manner that generates new products and initiatives in new markets and renews the current performance. Consequently, we hypothesize:

H4: SCC partly mediates the connection between innovation and information technology.

3. METHOD

One-time, personally administered questionnaires were utilized to collect the data from the respondents. Therefore, the current investigation is quantitative and cross-sectional. Indonesian employees were the subjects of the analysis. Using direct random sampling, 700 questionnaires were sent to Indonesian businesses. The data was gathered through the use of questionnaires. Seven days were provided for respondents to complete the surveys, after which they were collected from the company's relationship office. In total, 348 questionnaires were obtained,

representing a response rate of nearly 50 percent. The SCC construct was measured using a 28-item multidimensional scale (Chen et al., 2017). Each of the seven dimensions on the SCC scale consisted of four elements. The IT concept was evaluated using a 4-item unidimensional scale (Wang et al., 2015). The innovation concept was evaluated using a 12-item multidimensional scale. The scale has two dimensions, each with six objects (Jansen, Van Den Bosch, & Volberda, 2006). All scales were evaluated on a Likert scale ranging from 1 ("strongly disagree") to 5 ("strongly concur") ("strongly agree"). The collected data were analyzed using the PLS-SEM methodology and SmartPLS 3.2.8.

4. RESULT

4.1 Construct Reliability and Validity

The construct reliability and validity must be established before evaluating the study design (Hair Jr et al., 2014). Consequently, the convergent and discriminant validity of the measurement design was evaluated initially. Table 1 describes the research's measurement strategy. All loadings were more significant for this external design than 0.5, which is required to establish all elements' reliability. Each construct has a "Cronbach's alpha" of greater than 0.70, the "average variance extracted" is more significant than 0.5, and the "composite reliability" is more significant than 0.60, establishing the convergent validity of the research framework (Hair Jr et al., 2014).

Similarly, to ensure the "convergent validity" of internal design, all "standardized loadings" were squared and then divided by their total amount to calculate the AVE of higher-order variables. For determining the discriminant validity of a research framework, the diagonal values of the "Fornell and Larcker criterion" must be greater than the constructs' correlation with other variables, and the "Heterotrait Monotrait Criterion" values must be significantly less than 0.85. (Hair Jr et al., 2017). In addition, Tables 2 and 3 displayed the results of the "Fornell and Larcker Criterion" and the Heterotrait Monotrait Criterion, which determined the construct's discriminant validity.

Table 1: Measurement Model"

Construct	Items	Loadings	Cronbach's Alpha	CR	AVE
Collaborative Communication	CC1	0.805	**0.769**	**0.853**	**0.591**
	CC2	0.758			
	CC3	0.741			
	CC4	0.770			
Decision Synchronization	DS1	0.801	**0.764**	**0.750**	**0.538**
	DS2	0.502			
	DS3	0.555			
	DS4	0.742			
Exploitative	EP1	0.780	**0.862**	**0.897**	**0.592**
	EP2	0.759			
	EP3	0.762			
	EP4	0.787			
	EP5	0.732			
	EP6	0.793			
Explorative	EX1	0.721	**0.839**	**0.882**	**0.555**
	EX2	0.715			
	EX3	0.766			
	EX4	0.773			
	EX5	0.764			
	EX6	0.727			

Construct	Items	Loadings	Cronbach's Alpha	CR	AVE
Goal Congruence	GC1	0.547	**0.751**	**0.811**	**0.526**
	GC2	0.842			
	GC3	0.628			
	GC4	0.839			
Incentive Alignment	IA1	0.781	**0.669**	**0.800**	**0.503**
	IA2	0.747			
	IA3	0.713			
	IA4	0.579			
Information Sharing	IS1	0.804	**0.762**	**0.847**	**0.581**
	IS2	0.699			
	IS3	0.767			
	IS4	0.775			
Information Technology	IT1	0.803	**0.808**	**0.873**	**0.632**
	IT2	0.771			
	IT3	0.788			
	IT4	0.819			
Joint Knowledge Creation	JKC1	0.816	**0.790**	**0.864**	**0.615**
	JKC2	0.727			
	JKC3	0.773			
	JKC4	0.817			
Resource Sharing	RS1	0.796	**0.772**	**0.853**	**0.593**
	RS2	0.738			
	RS3	0.744			
	RS4	0.800			
Supply Chain Collaboration*	Collaborative Communication	0.935	**0.856**	**0.883**	**0.515**
	Decision Synchronization	0.853			
	Goal Congruence	0.863			
	Incentive Alignment	0.810			
	Information Sharing	0.725			
	Joint Knowledge Creation	0.928			
	Resource Sharing	0.628			
Innovation*	Exploitative	0.864	**0.818**	**0.834**	**0.503**
	Explorative	0.806			

*Second-order construct

"Table 2: Fornell and Larcker Criterion for Discriminant Validity"

	CC	DS	EP	EX	GC	IT	IA	IS	JKC	RS
CC	**0.769**									
DS	0.095	**0.762**								
EP	0.159	0.192	**0.769**							
EX	0.055	0.254	0.088	**0.745**						
GC	0.117	0.199	0.074	0.563	**0.726**					
IT	0.175	0.207	0.577	0.135	0.111	**0.795**				
IA	0.059	0.211	0.167	0.236	0.219	0.176	**0.709**			
IS	0.093	0.005	-0.01	-0.04	0.111	0.002	0.032	**0.762**		
JKS	0.67	0.138	0.114	0.078	0.136	0.128	0.122	0.067	**0.784**	
RS	0.088	0.016	-0.03	0.053	0.118	0.002	0.058	0.543	0.089	**0.77**

Note: CC = Collaborative Communication, DS = Decision Synchronization, EP = Exploitative, EX = Explorative, GC = Goal Congruence, IT = Information Technology, IA = Incentive Alignment, IS = Information sharing, JKS = Joint Knowledge Creation RS=Resource Sharing

"Table 3: Heterotrait-Monotrait Criterion for Discriminant Validity"

	CC	DS	EP	EX	GC	IT	IA	IS	JKC	RS
CC										
DS	0.164									
EP	0.193	0.299								
EX	0.092	0.409	0.122							
GC	0.14	0.37	0.11	0.008						
IT	0.221	0.302	0.054	0.159	0.138					
IA	0.117	0.385	0.222	0.312	0.244	0.245				
IS	0.129	0.102	0.106	0.089	0.135	0.086	0.109			
JKS	0.116	0.21	0.141	0.113	0.147	0.156	0.164	0.134		
RS	0.11	0.154	0.092	0.112	0.128	0.085	0.112	0.109	0.149	

Note: CC = Collaborative Communication, DS = Decision Synchronization, EP = Exploitative, EX = Explorative, GC = Goal Congruence, IT = Information Technology, IA = Incentive Alignment, IS = Information sharing, JKS = Joint Knowledge Creation RS=Resource Sharing.

4.2 Hypotheses Testing."

To evaluate the hypotheses established in the literature review section, the present study has applied PLS-SEM using SmartPLS 3.2.8 software. The bootstrap procedure was used by applying the blindfolding technique to evaluate the structural design of the study. The research framework consists of two endogenous variables: the mediator (i.e. SCC) and the study's dependent variable (i.e., innovation). The model explains 29 percent variance in SCC due to IT and 33 percent variance in innovation due to exogenous variables of the study (reflected in the values of coefficient of determination R^2). At the same time, the value of Q^2 is 0.16 and 0.19 of SCC and innovation that established the predictive relevance of the research framework (Sarstedt et al., 2022).

Additionally, the result of the PLS bootstrap procedure approves the significant association of IT with SCC with a beta value of 0.16, t-value of 2.51, and p-value < 0.05, and SCC with innovation with a beta value of 0.18, t-value of 1.97 and p-value < 0.05. The results likewise verify the substantial mediating effect of SCC between the relationship of IT and innovation with a beta value of 0.029, a t-value of 1.98, and a p-value < 0.05. Thus, all of the research hypotheses depend on the outcomes of the PLS-SEM findings.

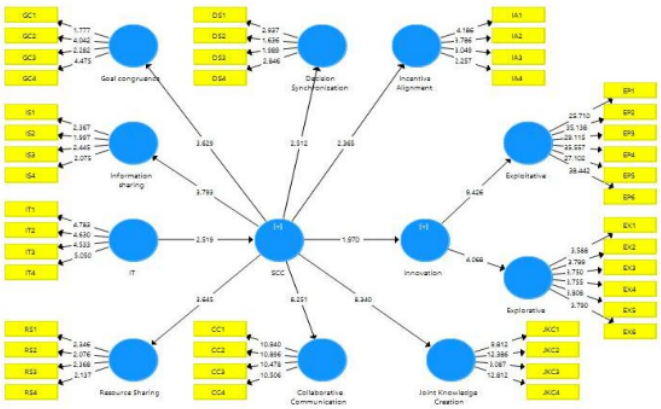

Figure 1: Estimations of Structural Model

Table 4: Hypotheses Results

Hypothesis	Beta	S.E	T Value	P Value	CI^{BCa} Low	CI^{BCa} High	Decision
IT -> SCC	0.163	0.065	2.519	0.012	0.059	0.286	Supported
SCC -> Innovation	0.175	0.089	1.970	0.049	0.045	0.333	Supported
IT -> SCC -> Innovation	0.029	0.140	1.980	0.047	0.006	0.095	Supported

Note: IT = Information Technology, SCC = Supply Chain Collaborations
* Significance level < 0.05

5. DISCUSSION

In this study, we examined the relationship between the IT competence of Indonesian businesses and their levels of SCC and innovation. The dynamic effects generated by IT capabilities and SCC were shown to have a positive relationship with innovation. This was demonstrated through a series of examples. As stated previously, the evidence provided substantial support for our hypotheses. Information technology proficiency substantially impacts SCC and directly and indirectly affects innovation. The SCC is a mediator for the indirect effect and influences the firm's creativity.

This paper makes several significant contributions to IT and SCC capabilities research in information systems. In response to the escalating competition, many businesses are turning to collaborative connections within the supply chain to integrate vital operations and increase the work accomplished by Collaboration (Panahifar et al., 2018). Information technology (IT) is frequently required to coordinate business operations and decision-making among several stakeholders due to the nature of these collaborative relationships. According to the findings of this study, an IT capability and its constituent elements (including optimized business processes, data analysis and decision-making, communication with external partners, and inter-organizational coordination) are essential for supporting SCC. This result lends credibility to previously published research linking information technology to external Collaboration (Maskey, Fei, & Nguyen, 2020) and supply chain management (Alzoubi et al., 2022) and extends that research by concentrating on the relationship between SCC and innovation.

This study's findings support that Collaboration with supply chain members can be a source of external knowledge through information sharing, collaborative communication, and joint knowledge creation efforts. They contribute to the growing body of literature on the significance of external knowledge as an input to the innovation process (Kumar et al., 2020). This research expands on previous findings by examining the connections between SCC and both exploratory and exploitative forms of innovation. According to the findings, SCC permits a focal firm and its supply chain partners (customers and suppliers) to pool their resources and expertise to develop the novel understanding necessary for game-changing innovations and incremental enhancements to existing products and services. Both knowledge creation and incremental enhancements to extant offerings are viable strategies for achieving this objective. These findings contradict previous research and suggest that SCC facilitates the emergence of novel concepts through exploratory analysis (Weber & Heidenreich, 2018). Future research may endeavor to explain these differences. The findings concur with other empirical research highlighting the direct role of IT in fostering innovation (Sharma et al., 2022).

In addition, the findings contribute to the expanding body of research connecting IT with disruptive and incremental innovation. The findings of the study indicate that both exploratory and exploitative forms of innovation benefit from an IT system's proficiency in supporting

business processes, decision-making, engagement with external partners, and inter-organizational coordination. Significantly, our research contributes to the expanding literature on the relationship between IT competence and external knowledge acquisition by demonstrating that IT mediates creativity through SCC (Enkel et al., 2017). Earlier research Ilmudeen et al. (2021) demonstrating that an IT capability can facilitate Collaboration among supply chain members is validated by these findings, making them pertinent within the context of the RBV. This result is significant because it confirms the findings of previous studies that an IT capacity can facilitate cooperation among supply chain participants (Nazam et al., 2020).

6. CONCLUSION

This study investigates how IT potential influences innovation and SCC in Indonesian businesses. It has been demonstrated that the powerful effects of IT potential and SCC have a positive relationship with organizational innovation development. As previously stated, research hypotheses are typically supported by solid evidence. IT capabilities have a significant impact on SCC and have both indirect and direct effects on innovation developments within an organization. This study contributes in several ways to the study of IS, specifically on IT and SCC efficiency. Such cooperative associations frequently necessitate information technology to organize business procedures and decision-making across multiple individuals. The present study expands on previous research by examining the precise associations between SCC and innovation development. The results indicate that SCC enables a company and its supply chain partners (customers and suppliers) to access and combine one another's capabilities and resources to produce the new knowledge required for innovative developments.

7. RESEARCH IMPLICATIONS

In addition, the current study has many practical implications. Specifically, the research has demonstrated that IT is an essential strategic tool for fostering Collaboration between supply chain participants and achieving innovation development within an organization. It has been noted that the impact of IT potential on productivity is not immediate. Nonetheless, indirect variables Halim, Ahmad, and Ramayah (2019) have led to innovation being recognized as one of the factors. The outcomes of this analysis provide executives with a deeper understanding of the systems through which IT can influence innovation. Administrators seeking innovation advancement can use the findings of this study to rationalize investments in IT and enhance Collaboration with supply chain participants. The study's findings highlighted the function and importance of a company's SCC as a result of the effective implementation of IT to gain access to, communicate, and improve the accomplishment and external knowledge of innovative developments. In general, the results of this analysis are consistent with the notion that successful development will result from a combination of factors in which the utilization of IT engineering resources and the company's network of relationships play a significant role (Chen et al., 2017).

8. LIMITATIONS

This research conforms to the hypothesis. Even though the proposed structural design is composed of sequential functions, the information procedure leading to innovation is highly nonlinear (Angelidou, 2017), with measures mixing and responses occurring multiple times within the innovation system. Therefore, the linear illustration provided is insufficient for comprehending the complexity of the development procedure. Moreover, even though the

primary informant in the analysis was the innovation administrator and possibly the most reliable source of information for the study's variables, there is still a possibility of bias in the data obtained due to its cross-sectional nature. Future must incorporate information from external current sources, such as suppliers and consumers. Finally, highly subjective innovation methods were used, and future research should seek to increase the validity of the results by incorporating additional statistical information. Additionally, numerous novel constructs may be incorporated into the research framework.

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