International Journal of Innovation, Creativity and Change. www.ijicc.net
Volume 8, Issue 8, 2019

The Mediating Role of Knowledge Management and the Moderating Role of Additive Manufacturing (Industry 4.0) in the Relationship between Knowledge Management Capability and Firm Performance: A Case of KPMG Thailand

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The current study is interested in examining the mediating role of knowledge management and the moderating role of additive manufacturing (Industry 4.0) in the relationship between knowledge management capability and firm performance of KPMG Thailand. KPMG is one of the leading manufacturers in Thailand. Several researchers have shown interest in investigating how supply chain management approaches influence organisational performance using a non-integrative outlook. For instance, examining the linkage among knowledge management and organisational performance, while attempting to analyse the association among organisational performance and supply chain management. However, these researchers also ignored knowledge management and the emerging role of additive manufacturing. Thus, the current study is planned to bridge the gap and to highlight the issue of additive manufacturing as KPMG established a new Speedfactory in Thailand in 2018. The present study selected Partial Least Square Structural Equation Modeling for analysing the relationships between the variables involved in this study. Partial Least Squares regression is a second-generation statistical technique for structural equation modelling. The results have shown another interesting finding of the validity and

reliability of the developed measures; these measures act as useful tools to assess the KM's capability perspective. The results also indicated that it is essential for managers to understand a firm's existing knowledge capability before setting any expectations. Furthermore, the results also offer vital insights to determine the organisational ability to grasp the existing set of knowledge.

Key words: *Supply chain, knowledge management, industry 4.0, Thailand.*

Background

Knowledge management (KM) and supply chain management (SCM) are alternative concepts which have drawn the considerable interest of researchers and scholars. However, the difference in objectives and motivation of these concepts, has introduced them as separate and distinct concepts, even though they are closely connected and share some of the frequent groundings. Such as, SCM and KM address information sharing and knowledge acquisition in their system between the members, despite various research been conducted to assess both approaches using a different platform. Therefore, there is no such systematic study found in the literature which has analysed the relationship between these approaches. However, a few studies (Prajogo, Oke, & Olhager, 2016) attempted to examine the relationship of SCM with other methods. For instance, organisational structure (Jermsittiparsert, Sriyakul, & Sangperm, 2019), and quality management (Jermsittiparsert, Namdej, & Somjai, 2019; Jermsittiparsert, Namdej, & Sriyakul, 2019), although the ones which analysed the relationship among KM and SCM are quite limited in the available set of literature. Several researchers have shown interest to investigate how these approaches influence the organisational performance using a non-integrative outlook. For example, one study investigated the linkage between KM and organisational performance, while attempting to analyse the association among organisational performance and SCM. However, they also ignored KM. Similar studies were conducted by other researchers (Heisig et al., 2016). Thus, so far, only limited studies are available providing inconclusive findings concerning the impact of SCM on organisational performance and KM capability.

According to Gutiérrez, Alcaraz, Susaeta, Suárez, and Pin (2015), a firm's resource-based view (RBV) suggests that developing and maintaining a competitive advantage is a core capability and a resource function provided by the SC members in a given environment. Several types of research stem from the debate that resource heterogeneity in organisations results in a differentiated competitive advantage. Firms in the modern competitive market are required to integrate SC members' knowledge capabilities for simultaneously providing high quality and low-cost goods and services. It has been indicated by the research of Mascarenhas and Mascarenhas (2019) that firms which share similar knowledge capabilities in the same

market, may exhibit different levels of performance. Besides, the knowledge capability of a firm can add value to its customers, suppliers, and the firm (Brewster, 2017).

In recent times, the business practices evaluate the business performance of an enterprise using a value chain perspective, instead of considering unit-level performance. Therefore, it is essential to analyse knowledge management in terms of the supply chain. Similarly, the firm-level KM philosophy cannot be directly applied at the SC level. This is due to the different roles of knowledge at both firm and SC levels, which may result in a different impact using a SC and firm-level perspective. The present research contributes in two ways. Firstly, this study analyses the association among SCM, KM, and organisational performance, and the findings obtained from this will develop an understanding about effectively handling knowledge in an SC. Secondly, the present research aims to fill the existing research gap through examining the SCM practices and KM capability's roles and contributions in the performance of an organisation. Thus, it will provide clues regarding the means for improving the effectiveness of a firm, since it acts as a nucleus of management.

KM capability

Knowledge management capability refers to the absorptive capacity of making use of the prior knowledge for identifying and acknowledging the value of obtained information, comprehending it and then using it for developing new capabilities and in the process of knowledge creation (Martín-de Castro, 2015). Two common processes are used to create knowledge: exchange and combination. The KM capability is associated with the social capital concept, where the term social capital is defined as the actual and potential resource aggregate which arises from a chain of relationships in a social unit. Meanwhile, social capital can be maximised through infrastructure capabilities, comprising of technological, cultural, and structural infrastructure. Technical infrastructure is defined as technology-based relationships within an organisation (Martín-de Castro, 2015); cultural infrastructure refers to the shared contexts; and structural infrastructure explains the existing mechanism of procedures and norms. For infrastructure leveraging, the knowledge management processes should be there to conserve, modify and transfer knowledge within a firm. Thus, all these processes are concerned with the knowledge management process. Several firms in the modern business environment depend upon the decision of developing and practicing knowledge development power to achieve a competitive advantage. According to Cerchione and Esposito (2016), the process of such development begins from the knowledge creation at the individual level, and moves towards its distribution, revision, and reviewing at the firm level, thereby transforming individual knowledge into organisational knowledge. Therefore, KM capability that is modified through process and infrastructure, would give rise to knowledge integration. Furthermore, the knowledge integration will become more efficient with the multiple KM processes performed by the company. In terms of process and

infrastructure perspectives, an advantageous theoretical base can be obtained for explaining important KM aspects. 3D printing technology has been adopted by Adidas Speedfactory into its manufacturing process, enabling it to reach to fully automatic and high-tech manufacturing. Automatic production process forms the basis for Speedfactory, thereby allowing the process of manufacturing to come into contact with consumer markets and offer faster manufacturing than before. Adidas manufacturing facilities were previously located in China, Indonesia, Vietnam and Asia. Therefore, it took three months for delivering finished sneakers to Germany. Thus, KPMG established a new Speedfactory in Thailand in 2018, which has reduced completion time for making one pair of shoes to just five hours. It also enabled Adidas to modify its production in accordance with customer wishes and demands.

Hypotheses development

Firm performance and KM Capability

The basic doctrine behind KM capabilities is the relationship it shares with a firm's performance. According to Giampaoli, Ciambotti, and Bontis (2017), KM capabilities have been reported to enhance the performance of an organisation. Firm performance is not just the financial ratios, rather it covers several other dimensions, including the overall competitive position of the firm and the overall product quality. The recent literature (Biloslavo, Kljajić-Dervić, & Dervić, 2019; Norbert Jr, Bischoff, & Willy, 2018) has identified various contributions that knowledge capabilities have made in the firm performance, such as better decision making, improving competitiveness and productivity, service and product quality, cost efficiency, flexibility and innovation (Norbert Jr et al., 2018). The case studies that were carried out in the industrial sector have shown that companies which adopted KM have exhibited significant improvement in organisational performance.

In a similar context, firms can gain various values and benefits through integrating proactive KM capabilities and efforts. Considering each KM capability's element, we begin with technological capability. Past researchers indicated in their study that organisational performance improves through KM. Such as, Reus, Lamont, and Ellis (2016) in their study identified that technology allows firms to learn and enhance new and existing capabilities, which result in the improvement of firm performance. Another study indicated the impact of KM's technological capabilities on the performance of a modern firm, using a dynamic learning process. Recently conducted studies indicate that KM and firm performance linkage turns out to be more critical while moving towards a k-economy. Technology plays an essential role in transferring knowledge and obtaining tangible benefits, since these act as essential sources for leading firms to develop a competitive advantage. Omotayo (2015) stated that structural capability can be considered using process and product perspectives.

Such as, firms may quickly adapt to new business environments through product modularity and flexibility.

Moreover, process and product modularity and flexibility are expected to reduce adaptation and coordination costs (Nambisan, Lyytinen, Majchrzak, & Song, 2017). In addition, greater customer satisfaction is associated with a flexible process and product designs. Similarly, a knowledge friendly structure tries to integrate elements of high decentralisation, wider control, low formalisation, cross-functional teams, and information flow, which are expected to enhance firm's responsiveness and innovativeness. The literature has indicated that organisational performance is positively influenced by the structural capability. Studies by Kianto, Vanhala, and Heilmann (2016) have also suggested that a firm which is possessed with a high cultural capability, will ultimately share greater knowledge and develop better linkages among its employees, thereby leading to improved decision making, greater responsiveness, competitiveness, innovation, higher productivity, and better service quality or product. Thus, a fertile culture that supports the KM adoption and possesses high knowledge values, provides help in striving for better organisational performance and prosperity (Cerchione & Esposito, 2016).

In view of Salunke, Weerawardena, and McColl-Kennedy (2019), process capability brings together knowledge assets, which in turn facilitate to achieve enhanced market and organisational performance. In addition, that KM process capability plays a significant role in enhancing the performance of an organisation by incorporating value adding and innovative practices. For example, process innovation and improvement can be achieved through lower production systems and better quality. Some of the recent studies also suggested that output arising from KM process capability acts as one of the important means for achieving competitive advantage, which consequently improves the overall organisational performance and brings benefits to the firms. Meanwhile, Biloslavo et al. (2019) concluded the systematic KM process capability as a key element of improving performance by collecting, storing, classifying, managing and reviewing knowledge. Enough empirical evidence has been obtained from the above-mentioned studies regarding the firm performance and KM capabilities relationship. Thus, we use a resource-based view (RBV) for conceptualising this relationship. This theory suggests that firms which possess unique capabilities, creating and exploiting resources would help them to enhance their performance. For many firms, achieving a competitive advantage depends upon knowledge development. Therefore, it can be taken as an important resource. The penetration of this capability in an organisation would result in value-adding activities and innovation. Such as, knowledge sharing between employees in their working environment may result in lower cost products with better quality, resulting in a better production system through innovation.

H1: KM has a significant impact on the FP of ***KPMG Thailand***

Firm performance, KM Capabilities and SCM

As mentioned earlier, firm performance is related to the KM capability. In addition, it is also influenced by several factors, one of which is SCM practices (Chetthamrongchai & Jermsittiparsert, 2019; Ploenhad, Laoprawatchai, Thongrawd, & Jermsittiparsert, 2019; Sutduean, Joemsittiprasert, & Jermsittiparsert, 2019). Several researchers have analysed the SCM practices and firm performance relationship. For instance, a study reported improvement in business and financial performance through SCM practices; Sabherwal and Jeyaraj (2015) found both indirect and direct positive association among financial performance and SCI. A few recent studies have also shown significant association among firm performance and SCM, in terms of outsourcing activities, partnership ties, and other SCM practices within an organisation.

Alternatively, several prior empirical research studies also exhibited that SCM and knowledge capabilities are related. Such as, an integrated framework was proposed as signifying the SCM and knowledge development relationship. Furthermore, it found an intense impact of KM capabilities on the SCM through technology, such as the internet or web browsing. Attia and Essam Eldin (2018) also exhibited in their study that penetration or early implementation of knowledge management may lead to quality, cycle time, and cost improvements throughout the SC. Another study reported on the improvement in inter-organisational linkages through SCM practices, by incorporating knowledge into the SC functioning for achieving competitiveness and innovation. Augmenting KM into learning chains has also been highlighted by Pun and Yiu (2019). They reported that in a SC, long-term linkages between customers, firms and suppliers can be more common through knowledge-sharing.

In particular, the association of SCM practices with each KM capabilities element is explained as follows. In the instance of technology capability, it has been argued that the effects of SC efficiency cannot be anticipated in terms of individual SC member's ability and effectiveness to collaborate. Zhao-Meunier, Moatti, Lemieux, and Abecassis-Moedas (2019) have proposed technological infrastructure or information technology (IT) since it may help in the knowledge sharing process among partnering firms. In case of the KM capabilities structural element, Nambisan et al. (2017) suggested that structural flexibility in the form of process and product modularity improves SC collaboration among the members of the SC. Practicing process and product modularity may lead to the reduction in material movements, removal of certain processes, and adoption of information and knowledge sharing relationships among key suppliers. Contrarily, a company's value and vision can be used to assess the impact on cultural capability. For instance, the production system of Toyota and TQM encourages a knowledge-sharing network for elevating suppliers' involvement and

enhancing valuable knowledge-sharing within the SC (Prajogo et al., 2016). Besides, various studies also highlighted the cultural factor as a means for improving management practices and competitive capabilities of the SC, since it also encourages dynamic learning (Vanichchinchai, 2019).

The KM's effective process capability would result in reducing cost, improved innovative ability, increased productivity and improved product quality (Dang, Le-Hoai, & Kim, 2018; Dziallas & Blind, 2019). According to Donate and de Pablo (2015), such positive influences may cause a spilling effect at the SC level. Such as, firms would feel encouraged to develop a collaborative relationship with the suppliers for developing new product designs and sharing information technology and knowledge.

The above discussion regarding KM capabilities, firm performance, and SCM practices supports the following argument regarding the effects of SCM practices on the KM capabilities-organisational performance relationship; KM capability explains the doctrine of RBV. According to Cortimiglia, Ghezzi, and Frank (2016) the SCM practices are representative of a competence-based view, comprising of a firm's strategy to connect with the firm's external environment. These act as major aspects of managerial actions and decisions which regulates the firm's long-term performance. Furthermore, unique SC capabilities enable the development and exploitation of valuable knowledge sharing, resulting in better performance outcomes. In addition, this indicates that placing KM capabilities in SCM practices would likely create SC values, and consequently, lead to better performance. The existing literature on these relationships includes studies by Chen (2016). This research has supported and confirmed that these two practices, in terms of organisational performance, are associated to one another. With respect to these findings, the following hypotheses are proposed:

H2: KM has a significant impact on the SCM of ***KPMG Thailand***
H3: SCMM has a significant impact on the FP of ***KPMG Thailand***
H4: SCM mediates the relationship between KM and FP of ***KPMG Thailand***

The moderating role of additive manufacturing

The term additive manufacturing or 3D printing refers to a process of combining materials through multiple layering, in contrast to the methods of sub-tractive manufacturing, e.g. machining (International Organization for Standardization, 2017). The additive manufacturing's application in the SCM operations was discussed by several researchers including Holmström and Gutowski (2017), and Feldmann and Pumpe (2017). The application of such manufacturing ranges from spare part logistics towards sourcing and redesigning production strategy. The basic element of applying additive manufacturing in

SCM is the adoption of 3D printers in various SC manufacturing stages to achieve improved product individualisation, increasing flexibility in manufacturing, reducing inventory and shorter lead times. Such projects offer numerous advantages. It has made the storage of finished goods as unnecessary and less important because of the fast and local production of an exact number of shoes offered by the Speedfactory. Furthermore, it also enabled quick and easy delivery of personalised models to the customers, due to the short distance between the customer and the manufacturing unit. The Speedfactory also offers an economic advantage; increased efficiency due to a continuous working process of the machines. The relationship between additive manufacturing and the supply chain is shown in Figure 1 below.

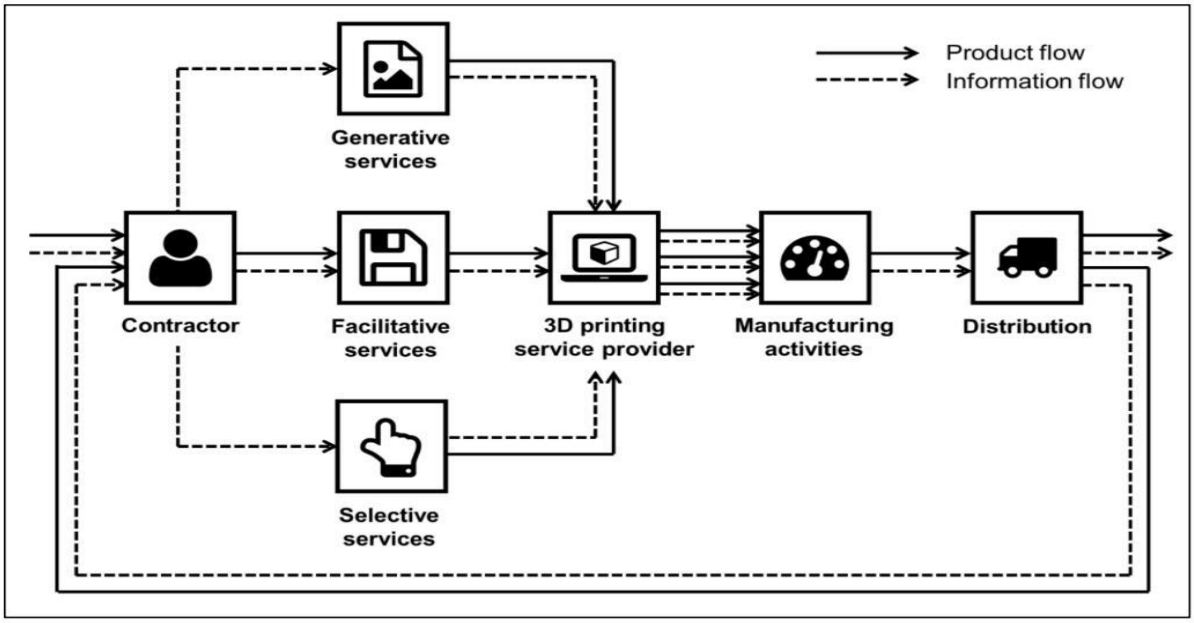


Figure 1: The 3D printing service provider supply chain

Source: Enprints

3D printing technology has been also adopted by Adidas Speedfactory into its manufacturing process, enabling it to achieve fully automatic and high-tech manufacturing. An automatic production process forms the basis for Speedfactory, thereby allowing the process of manufacturing to engage with consumer markets and offer faster manufacturing than before. Adidas manufacturing facilities were previously located in China, Indonesia, Vietnam and Asia. Therefore, it took three months for delivering finished sneakers to Germany. Thus, KPMG established a new Speedfactory in Thailand in 2018, which has reduced completion times for making one pair of shoes to only five hours. It also enabled Adidas to modify its production in accordance with customer wishes and demands. Thus, we have proposed the following hypothesis:

H5: Additive manufacturing (IN4) moderates the relationship between KM and FM of ***KPMG Thailand***

Methodology

This section involves discussion about the statistical techniques employed in this study and discussion regarding the results and findings obtained through performing statistical procedures. The present study selected Partial Least Square Structural Equation Modeling for analysing the relationships between the variables involved in the study. Partial Least Squares regression, is a second generation statistical technique for structural equation modelling (Shiau, Sarstedt, & Hair, 2019). It is coherent to structural equation models having cause and effect associations and latent variables (Klein & Depreitere, 2018). Therefore, PLS is considered an ideal method for predicting and statistical modelling.

PLS-SEM is preferable to adopt since it is favourable for complex models and provides powerful results when applied to real-world scenarios (Davcik & Sharma, 2016; Wamba et al., 2017). The present research attempts to analyse the association among dependent and independent variables. Besides, it also determines any moderating effects on independent and dependent variables' relationships. In addition, PLS path modelling is compatible with non-normal and normal data set. Many research studies in the social sciences encounter an issue of non-normality of data, which can be easily addressed through PLS. Furthermore, PLS path modelling offers an important feature. It simultaneously estimates both structural and measurement models, such that it estimates the relation among constructs as well as the relation among indicators and their respective latent variables (Becker, Ringle, & Sarstedt, 2018; Shah & Rahim, 2019). This feature makes PLS one of the most robust statistical methods. Thus, the above discussion supports the use of PLS path modelling, for analysing the existence of proposed relationships, and validity and reliability of the constructs.

Measurement

For each measuring construct, a five-point Likert scale was used to measure responses ranging from 1–5, where 1 shows strongly disagree and 5 shows strongly agree. In the instance of firm performance, each respondent is asked to compare its company's performance with its competitor company's performance. For each construct, the measured items are presented in Table 1, however these items are indicative of the deductive model inferred from the theoretical construct. For developing a construct, the confirmatory factor analysis is used which offers suitable sources to analyse measurement efficacy between items of the scale (Chuang, Shen, & Judge, 2016). Therefore, each scaled item is expected to uniquely measure the corresponding construct. Afterwards, a correlation analysis was

performed for comparing firms' sample to the financial data obtained from the publications. A statistically significant correlation is obtained from the results.

Data analysis

The PLS-SEM path model initially involves the measurement model's estimation, followed by the structural model estimation (Henseler, Hubona, & Ray, 2016). The most important criteria in the estimation of the measurement model is the reliability and validity (Ngah, Zainuddin, & Thurasamy, 2017). Thus, the present study employed internal consistency reliability, individual item reliability, content validity, and convergent and discriminant validity measures for estimating the measurement model, as suggested by Hair, Sarstedt, Hopkins, and G. Kuppelwieser (2014) and Henseler et al. (2016). The following figure presents the measurement model for this study.

Figure 2. Measurement Model

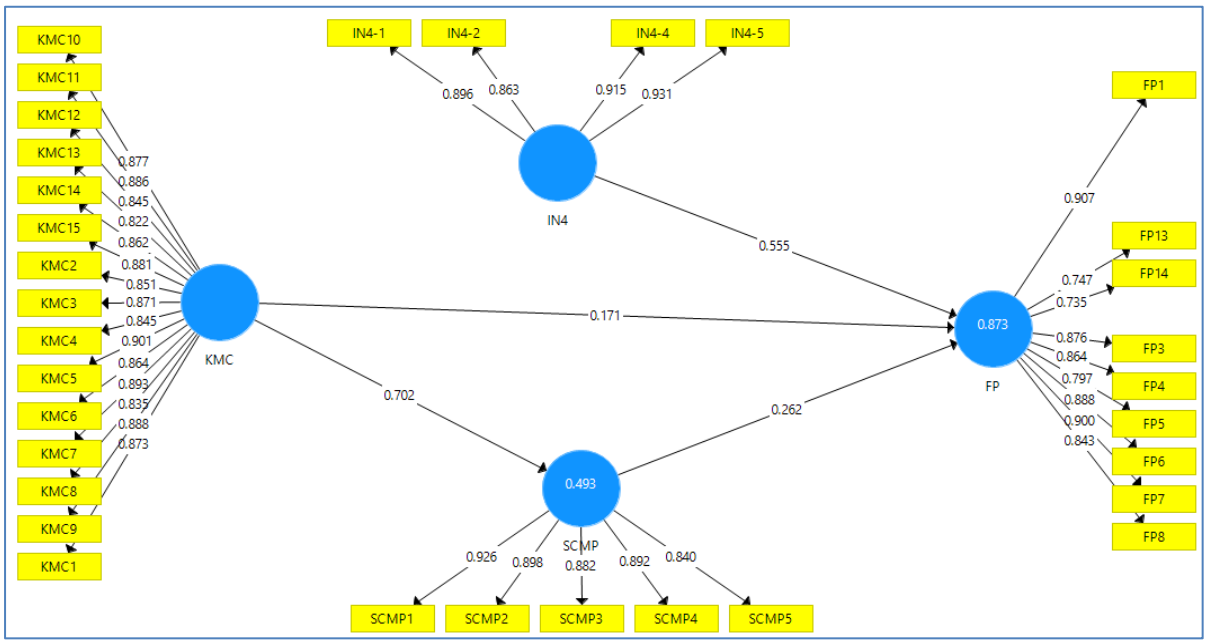


Table 1: Outer loading

	FP	IN4	KMC	SCMP
FP1	0.907			
FP13	0.747			
FP14	0.735			
FP3	0.876			
FP4	0.864			
FP5	0.797			
FP6	0.888			
FP7	0.900			
FP8	0.843			
IN4-1		0.896		
IN4-2		0.863		
IN4-4		0.915		
IN4-5		0.931		
KMC10			0.877	
KMC11			0.886	
KMC12			0.845	
KMC13			0.822	
KMC14			0.862	
KMC15			0.881	
KMC2			0.851	
KMC3			0.871	
KMC4			0.845	
KMC5			0.901	
KMC6			0.864	
KMC7			0.893	
KMC8			0.835	
KMC9			0.888	
SCMP1				0.926
SCMP2				0.898
SCMP3				0.882
SCMP4				0.892
SCMP5				0.840
KMC1			0.873	

Individual item reliability for each item was determined through observing item loadings, following the recommendation of Shah and Rahim (2019), and Davcik and Sharma (2016). According to Hair et al. (2014), those items which exhibit less than 0.70 item loadings were

omitted from the model. The composite reliability was also assessed, since it is a suitable measure to determine internal consistency of the PLS path model (Wong, 2016) and is interpreted as Cronbach alpha. Lonial and Carter (2015) suggested that composite reliability must exhibit above 0.70 value to be acceptable. The table below shows the composite reliability for each variable, which lies within 0.844–0.985. Thus, the composite reliability values are in line with the threshold level, i.e. equal or above 0.70. Ngah et al. (2017) described convergent validity as the extent to which the same variable is measured by various items. For checking convergent validity, average variance extracted (AVE) is used in this study, following the recommendation of Tzempelikos and Gounaris (2017). For establishing adequate convergent validity, for each variable the value for AVE must not be less than 0.50. Thus, for the purpose of improving the value of AVE, those items with lower loadings were excluded.

Table 2: Reliability

	Cronbach's Alpha	rho_A	CR	(AVE)
FP	**0.948**	**0.953**	**0.956**	**0.709**
IN4	**0.923**	**0.925**	**0.945**	**0.813**
KMC	**0.976**	**0.977**	**0.978**	**0.751**
SCMP	**0.933**	**0.934**	**0.949**	**0.789**

The term discriminant validity refers to the degree that each variable involved in the study is different from the other variable (Shah & Rahim, 2019). For checking discriminant validity, two measures were employed: cross-loadings and Fornell-Larkcker's criterion. According to the Fornell-Larcker criteria, the square roots of AVE values must exceed the correlation between other variables. Thus, the AVE's square root values were found to be compatible, as these values exceed the correlations between other variables.

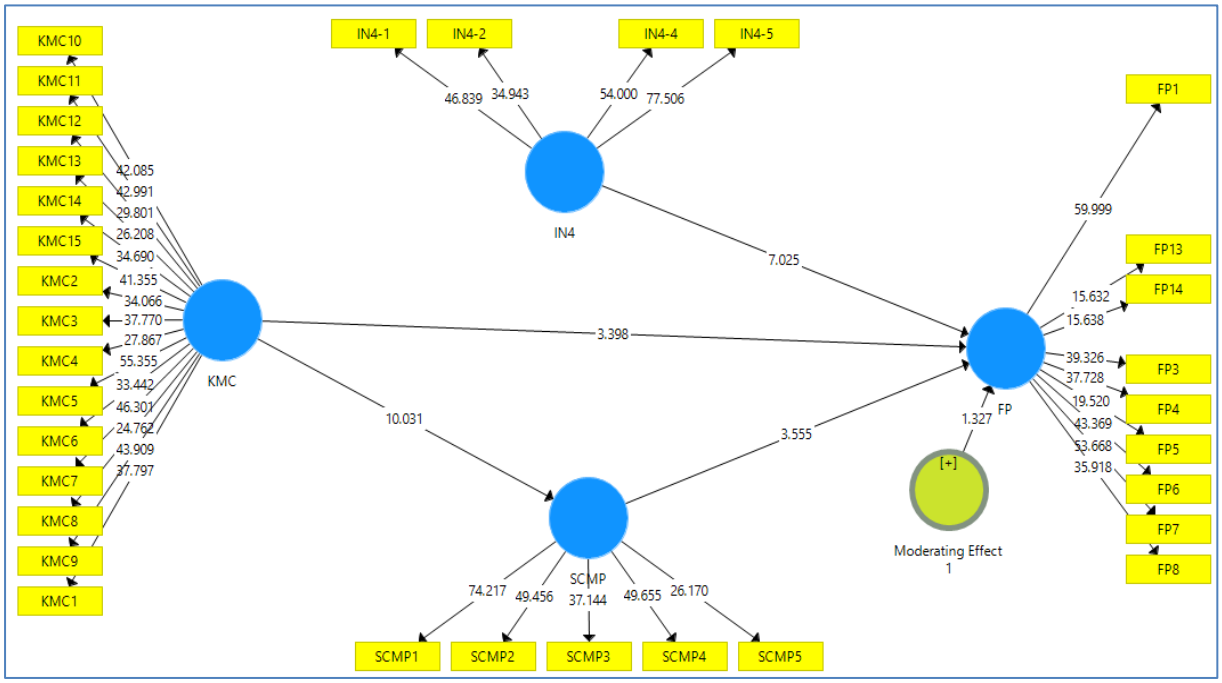
Table 3: Validity matrix

	FP	IN4	KMC	SCMP
FP	0.842			
IN4	0.719	0.801		
KMC	0.751	0.714	0.867	
SCMP	0.793	0.720	0.702	0.888

For the structural model estimation, it is important to look for any collinearity issues, including if the indicators are highly associated with each other (Hair et al., 2014). The value for VIF should be < 0.05 and tolerance level must be > 0.20. The obtained range for tolerance level and VIF came out to be 0.243–0.439 and 2.278–4.122 respectively, indicating the absence of multicollinearity issue.

For evaluating the structural model, the significance of path coefficients, R^2 values, predictive relevance, effect size, and moderating effects must be considered (Henseler et al., 2016). The following figure shows the structural model for this study.

Figure 3. Structural model



Therefore, the significance of path coefficients was estimated through the bootstrapping method, by including 5000 samples (Hair, Hult, Ringle, & Sarstedt, 2016; Henseler et al., 2016).

Table 4: Direct relationships

	(O)	(M)	STDEV)	T Statistics	P Values
IN4 -> FP	0.551	0.546	0.078	7.025	**0.000**
KMC -> FP	0.179	0.186	0.053	3.398	**0.000**
KMC -> SCMP	0.202	0.703	0.070	10.031	**0.000**
Moderating Effect 1 -> FP	0.227	0.030	0.020	1.827	**0.092**
SCMP -> FP	0.273	0.271	0.077	3.555	**0.000**

Figure 4. Moderating effect of additive manufacturing

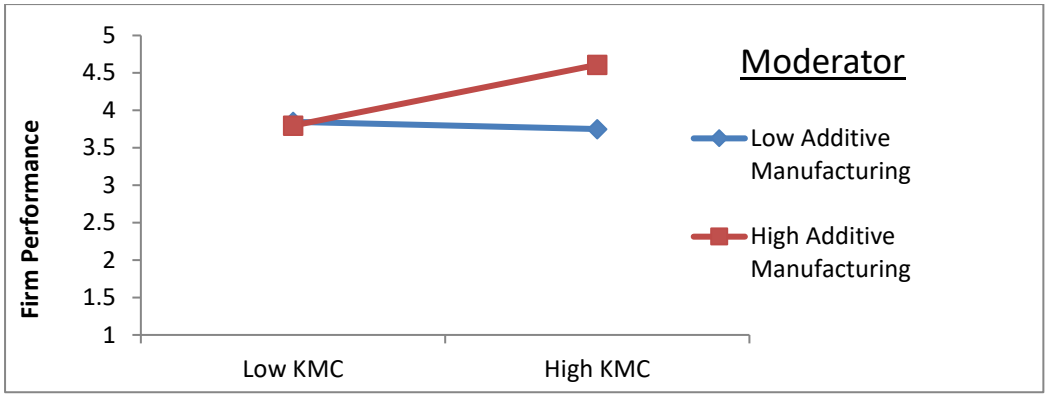


Table 5: Mediation

	(O)	(M)	STDEV)	T Statistics	P Values
KMC -> SCMP -> FP	0.192	0.190	0.055	3.469	**0.000**

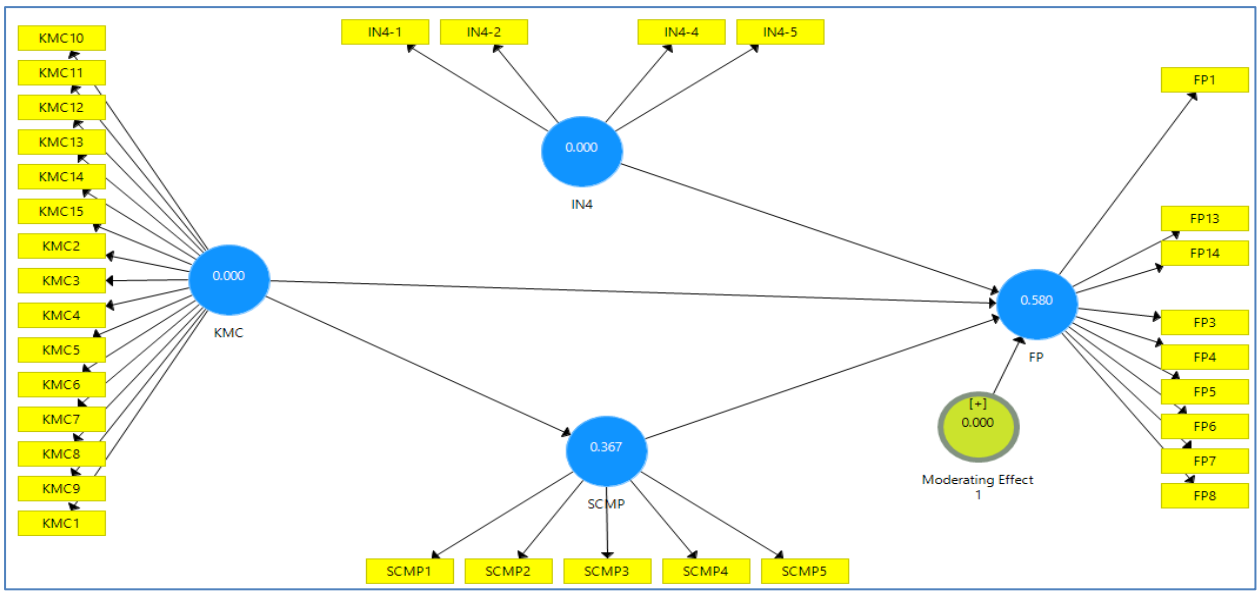
After assessing the significance of path coefficients, another important criteria is the R^2 criteria for assessing the variance in endogenous variables (Hair et al., 2014). The R-square or coefficient of determination explains the proportion of variation in the endogenous variable, that is explained by one or more exogenous variables (Hair et al., 2014). In the structural model, the values of R^2 for the endogenous variable may exhibit values indicating, substantial (0.75), moderate (0.50) or weak (0.25) predictive power.

Table 6: R-Square

	R Square
FP	0.873
SCMP	0.493

Due to the reflective nature of the endogenous latent construct, the blindfolding procedure was used for the given variable. Besides the size of R^2, a cross-validated redundancy (Q^2) measure is specifically employed for analysing the predictive relevance of the underlying model (Hair et al., 2014; Sarstedt, Hair, Ringle, Thiele, & Gudergan, 2016).

Figure 5. Blindfolding



According to a rule of thumb, if Q^2>0.00, then it indicates that the model can be referred to as a predictive model, whereas, less than 0 value indicates no predictive relevance (Hair et al., 2014). However, it can only be applied to reflective constructs or a single item endogenous construct. The Q^2 values are presented in the table below.

Table 7: Q^2

	SSO	SSE	Q^2 (=1-SSE/SSO)
FP	1,953.000	820.173	0.580
IN4	868.000	868.000	
KMC	3,255.000	3,255.000	
Moderating Effect 1	217.000	217.000	
SCMP	1,085.000	687.253	0.367

Conclusions

The present study empirically supports the hypothesis of a linkage between SCM, firm performance and knowledge management. This linkage can be explained as the impact of KM's capability on the firm performance and is mediated by supply chain management practices. It is compatible to the firm's competence-based view and RBV, with respect to the success of a firm. SCM practices enables a full benefit from the internal capabilities through cooperation of SC members and investing in expertise. Thus, allowing firms to achieve high level performance greater to which will be achieved by solely depending upon internal capabilities. It is a significant finding, since it would enable managers to acknowledge means for grasping internal capabilities, using SC linkages with partnering firms, and also

emphasises the strengthening of these capabilities before considering the extended firms. For understanding means to achieve better knowledge management, it is important to consider how SCM practices are affected through knowledge. The results indicated process and technological capabilities as the important KM capability dimensions which influence the SCM practices. These dimensions act in the following ways. High process and technological capabilities enable knowledge sharing between the organisational employees and between different organisations to create customer value. Besides, these capabilities also facilitate in developing long-term and close associations between the partnering firms, particularly by adding these firms into a knowledge development cycle, resulting in increased SC effectiveness and efficiency. SCM effectiveness can also be improved through these dimensions by engaging in inter-organisational linkages, since these relationships are crucial to achieve competitiveness and innovation (Yeniyurt, Wu, Kim, & Cavusgil, 2019). Integrating the dimensions of knowledge capabilities also facilitates in aligning and synchronising the knowledge flow, for developing value-added goods and minimising the bull-whip effect.

The results have shown another interesting finding about the validity and reliability of the developed measures; these measures act as useful tools to assess the KM's capability perspective. The results also indicated that it is important for managers to understand a firm's existing knowledge capability before setting any expectations. Furthermore, the results also offer key insights to determine the organisational ability of grasping the existing set of knowledge. Instead of emphasising particularly on only one dimension, rather, another successful approach must be used; investing in both dimensions, such as process and infrastructure. This is particularly because the process and infrastructure capabilities anticipate the organisational performance, as mentioned earlier. Therefore, Sani (2015) suggested that careful consideration is needed by the managers to avoid optimisation of KM's one aspect, as it may destroy all the organisational efforts. Thus, optimising one KM aspect may bring detrimental effects in terms of innovation and customer service.

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