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

The Role of Additive Manufacturing and Supply Chain Management in Improving the Supply Chain Performance: A Case of Industry 4.0 in DKSH Thailand

Kittisak Jermsittiparsert[a], Chanatat Boonratanakittiphumi[b*], [a]Social Research Institute, Chulalongkorn University, Bangkok, Thailand, [b]King Mongkul's Institute of Technology Ladkrabang, Prince of Chumphon Campus, Chumphon, Thailand, Email: [a]kittisak.j@chula.ac.th, [b*]b.dr.chanathat2013@gmail.com

The aim of this study is to examine the role of additive manufacturing (industry 4.0) and supply chain management in improving supply chain performance. In this research, the supply flexibility has been investigated through the lens of RBV, and in this regard, contributions have been made to the existing literature on flexibility in supply chains. By recognising the role of resources in the flexibility of supply, the supply flexibility concept has been developed. The two distinct dimensions of supply flexibility were investigated: supply network flexibility and supplier flexibility. The complications in the network of the supplier can be explored with the instruments developed for supply flexibility. This can provide a great understanding of the contribution of supply flexibility in achieving competitive advantage. It is interesting to know whether the improvements in supply flexibility create an influence on product development and manufacturing flexibility. The SEM-PLS is used to analyse the data. The findings of the study have provided support to the hypothesised results. DKSH Thailand is taken as a final sample of the study. The results of the study have shown the relationship between supply flexibility, SC management and SC performance. It has been found that the current performance of the companies can be improved in the uncertain and dynamic business environment by linking the capabilities of supply network flexibility and practices of SC management. The industry 4.0 appeared as moderator.

Key words: *Supply chain, Industry 4.0, Thailand.*

Introduction

There is a need for the firms to adopt new ways of being flexible in dealing with increased uncertainty and complexity in this dynamic business world. Being flexible enables a firm to respond or react to the uncertainty in the external business environment (Haseeb, Hussain, Slusarczyk, & Jermsittiparsert, 2019; Haseeb, Hussain, Kot, Androniceanu, & Jermsittiparsert, 2019). It has been recognised by several firms, that it is crucial for them to achieve sustainable competitive advantage through supply chain flexibility in the uncertain marketplace (Sutduean, Joemsittiprasert, & Jermsittiparsert, 2019). Several industries including mobile phones, bicycle, and fashion sectors have tried to adopt strategies of supply chain flexibility with different levels of success (Chan, Ngai, & Moon, 2017; Harsasi, 2017). In order to create value, firm's emphasise responsive sourcing and delivery in the supply chain beyond the effectiveness of internal operations. Suppliers' flexible networks are used by firms to deliver a range of products. For dealing with uncertainty and complexity linked with the changing behaviour of customers, a crucial competitive factor is supply flexibility. Firms are required to manage their supply chain upstream with the responsive and changing demands of the market.

Firms are motivated to explore the management of supply to create synergy across the supply change with the use of outsourcing and information technology (Al-Shboul, 2017). Flexibility increases towards the changing requirements of the market related to speed and variety through inter-organisational efforts of collaboration (Akhavan & Beckmann, 2017). There is excellent literature available on supply management (SCMN), but the empirical investigation about the SCMN role in developing flexibility is rare to increase organisational performance. In literature, three gaps have been identified.

Recognised by several companies, flexibility is the key for achieving success (Chetthamrongchai & Jermsittiparsert, 2019; Jermsittiparsert & Pithuk, 2019). However, the role of SCMN as an enabler of supply flexibility has not been examined by many. However, it is not a random process. Years are required after investments to lead this strategic result. Supply flexibility has not been examined through the lens of RBV.

Moreover, one dimension of flexibility in the supply chain is referred to as supply flexibility and there are fewer studies on this area. The theoretical grounds for the supply flexibility concept are under development. Empirical investigations are required for the changing relation of supply flexibility and SCMN. A case study methodology has been used by several studies for supply flexibility. It will be valuable in terms of practice and theory to use a cross-industry analysis for ensuring the validity of the supply flexibility concept and the relation between supply performance, flexibility, and management. The essential 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 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. Speedfactory also offers an economic advantage, i.e. increased efficiency due to the continuous working process of machines.

Hypothesis development

SCMN

The typical purchasing focus has been extended in the SCMN concept. It involves a more strategic procurement focus. For increasing the responsiveness of a firm to maximum, SCMN has been integrated with the strategic plans of the company. A key liaison role is played by SCMN between the internal operations of the organisation and external suppliers through the creation of value and delivering it to customers. There are crucial roles in the selection of suppliers, development, and forming strategic alliances in the management of supply (Al-Shboul, 2017). The influence of sourcing practices on flexibility in supply has been addressed by a few researchers. It was implied by Shibin et al. (2016) that the responsibilities of achieving flexible sourcing are shared by the manufacturers and suppliers through an integrated flexibility framework. It was revealed by Schmidt, Foerstl, and Schaltenbrand (2017) that the contribution of SCMN in the performance of the business is based on the level of capabilities fitting of the SCMN with the business strategy. A difference is made by the firms with flexible strategies in managing the practices of supply in the overall capability to benefit from the dynamic business environment. Investments and commitment are required in a flexible supply base for developing and evaluating the performance capabilities and relation of suppliers. It has been proposed that the selected practices of SCMN develop capabilities in the supply base to react to the changes in the environment and improve the performance of the business.

It has been argued by previous research studies that knowledge resources and a set of capabilities are included in the supply base, which enable the firm in gaining competitive advantage (Sheel & Nath, 2019; Stylianou, Subramaniam, & Niu, 2019). Resource orientated flexibilities are possessed by the suppliers having flexible processes. Links can be established to outside sources of knowledge and capabilities with effective practices of supplier selection. These can result in the creation of diverse skills and expertise. The capability and knowledge of suppliers can reduce with time. The durability of flexible resources is enhanced through supplier development by considering the changing resources and nature of competition. The

best practices of manufacturing are disseminated by firms within their operational units to form internal strategic resources.

Supplier Selection

The criteria used for the process of selecting suppliers and evaluating them for achieving long term competitive advantage in the supply chain, is referred to as supplier selection (Prajogo, Oke, & Olhager, 2016). The selection of a supplier can influence the performance through different supply chain activities. It can create a direct operational and financial influence on the business. The suppliers' reaction capability for making changes determines the ability of a supply chain to respond to the demand of the market on time.

Supplier Development

The practices, which support suppliers improvement in achieving and sustaining competitive edge, is referred to as supplier development (Lii & Kuo, 2016). Supplier development is encouraged by firms to ensure the provision of goods and services by the supply sources with value. In this way, a network of suppliers, which are capable, is maintained for achieving competitive advantage for the long-term (Tachizawa, Gimenez, & Sierra, 2015). The significance of supplier development has been emphasised by the literature on supply chain management for supporting the time-based strategy of a firm. This is done through ensuring the capabilities and performance of suppliers fulfilling the needs of the buying firm.

Strategic Supplier Alliances

Maintaining long-term close association with the suppliers is referred to as strategic supplier alliances. It offers a framework for coordination, open channels of communication, and resolving issues with great responsiveness (Lee, Ooi, Chong, & Sohal, 2018). The long-term direct association is emphasised by the strategic alliance, which promotes efforts for problem-solving and mutual planning between the suppliers and firm.

Supply Flexibility and SNF

The concept of flexibility differs with the context. Concerning the resource-based flexibility nature, the previous researchers are consistent and clear (Khan & Wisner, 2019). The deployment and coordination of resources is the underlying condition of flexibility. Therefore, they can be combined to form a set of capabilities. From the perspective of the resource-based view, firms should be able to comply with the changes in the environment through supply flexibility by using resources in the supply base. Strategic flexibility was discussed by Chan et al. (2017) in the forms of coordination and resource flexibility. The

level at which a firm can respond using knowledge specific to the organisation and physical assets, is referred to as resource flexibility. The design and nature of a resource can become a limitation for the firm's use. The automatic flow of the resource capabilities is not done to the company, which owns the resources. The level of responsiveness to use collaborative capabilities, which are cross-functional, is referred to as coordination flexibility. To achieve a competitive edge in the changing business environment, strategic flexibility is not sufficient. It represents the ability of a firm to react to the environmental uncertainty using its capabilities and knowledge. However, there it is lacking. The level of responsiveness through using the capabilities specific to suppliers and skills of inter-organisational collaboration is referred to as supply flexibility. The concept of strategic flexibility has been extended by this study through the development of the concept of supply flexibility with reference to supply network and SF. Two primary aspects should be emphasised by a firm in order to maintain a responsive supply base. These aspects include the use of collaborative capabilities and the use of responsive capabilities specific to a supplier. In order words, these are the SF and supply network flexibility.

The level of responsive abilities by the capabilities specific to a supplier is referred to as SF. In RBV, the recent developments suggest that the relation between the performance and internal resources is emphasised by the firms, which generate value through partnership with the key suppliers (Moshtari, 2016). The firm addressable resources and firm-specific resources, are both used for the development of capabilities. It was proposed by Lavie (2016) that the resources of the focal organisation can be combined with the resources of partners in the supply chain to get a competitive advantage. The consistent level of performance is determined by the unique capabilities and supply resources of a firm. By sharing and spreading the responsibility across the supply base, firms can show responsiveness to the changing needs of customers. It is referred to as the supplier's ability, which constraint the manufacturer's ability to respond to the requirement of customers.

The potential of flexibility is limited by the suppliers, who do not have the ability to respond to the changes in an effective manner. Firms can manage the pressure of uncertainties in the environment by accruing the capabilities and resources from the suppliers. It has been suggested by the high-level flexibility of suppliers that a process can easily design files, communicate ideas, and show coordination for solving a problem. New materials are required by new design and it is easier to get the confirmation of supplier on the ability to supply those materials. With the increase in flexibility focusing on network, the performance of the supplier increases. This is the becoming of the integration of flexibly in the supply chain, which results in coordination and cross-functional collaboration. In reality, the capabilities of the supplier are bought by firms. A direct influence on time, quality, cost, and responsiveness is created by the suppliers in the downstream supply chain. It was found that the development of a product in terms of time, quality, and cost increases with the greater level of flexibility of

suppliers in the changing environment of the market. It was indicated by Ko, Liu, Ngugi, and Chapleo (2018) in their analysis on the role of suppliers in the process of product innovation, that the perceptions of buyers for the responsiveness of suppliers reflect the level of commitment to solve the problems in an innovative way. Suppliers deliver products and services with high responsiveness when they have a higher level of flexibility. A positive association between the performance of the supply chain and SF is suggested by these discussions.

Companies become responsive in the supply base through the flexibility of supply network for ensuring product supply. To achieve the objectives, managers develop and design the strategic resources of inter-organisational networks. The network participants are allowed to respond to take benefit of opportunities, improve the individual performance through the changes of competitors, and supply networks with time (Huggins & Thompson, 2015). It has been revealed through the simulation results, that a good performance based on time in the supply chain is provided through flexibility in supply network (Bruno, 2017).

Additive manufacturing in the industry (I-4.0) and SCPR

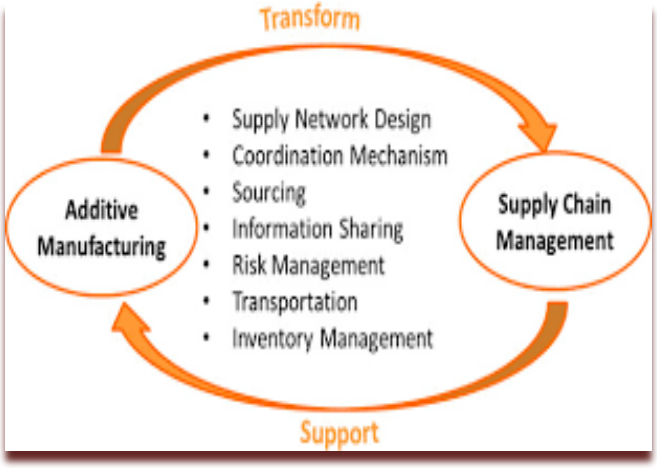
The level with which the requirements of the customer are met by a supply chain with operational efficiency for performance is referred to as SCPR (Saunila, 2016). It implies that efficiency and effectiveness are measured by SCPR in a way that the goals are achieved.
Four dimensions have been used in this study to measure SCPR. These dimensions are as follows:

(1) The level with which the responsiveness and speed of supply chain is improved is referred to as time-based performance
(2) The level with which the targeted services and activities are performed accurately is referred to as reliability defines
(3) The tangible and intangible outcomes of suppliers such as reliability of services, quality, and relation dependent are measured in supplier performance
(4) The effectiveness in cost management related to the supply chain operation is referred to as cost performance

The supply chain efficiency and effectiveness are captured by all these aspects and the inter-organisational characteristics of measuring SCPR are reflected. Industry 4.0 has no specific definition. The factory concepts have been considered by most of the researchers as those which share the features of smart networking (Strozzi, Paul, Wiesmann, Schellenberger, & Kääb, 2017). A smart network of manufacturing is represented by Industry 4.0 in which products and machines interact without the control of the workforce.

The process of combining materials with one layer over others in contrast to subtractive manufacturing is referred to as 3D printing, which is also known as additive manufacturing as per the International Organization for Standardization (ISO 2017). The additive manufacturing applications were described by Khajavi, Partanen, and Holmström (2014) and Holmström and Gutowski (2017) to SCM and operations. These applications react to the sourcing strategy and global SC production of redesigning from the logistics of spare parts. In the applications of additive manufacturing, the use of 3D printers is at the core of various levels in SC in order to increase the flexibility of manufacturing, improve individualisation of product, reduce lead times, and inventory. The 3D innovative technology has been introduced by Adidas Speedfactory in the process of production. This step has been taken to move towards an automatic and high-tech manufacturing process. The production process is automatic in the Speedfactory, which allows the close movement of manufacturing to the markets of the consumer, along with faster production. The major manufacturing activities of DKSH were previously based in Asia, predominantly in Vietnam, China, Malaysia, and Indonesia. Consequently, three months were required for the finished product to reach Germany. The completion time has been reduced to five hours for one pair of sneakers, through establishing a new Speedfactory in Germany. It is in the area which belongs to Oechseler, a German industrial company. The company is now able to ensure speedy production to fulfil the needs of customers through this new Speedfactory. The relationship between additive manufacturing and the supply chain is shown in figure 1.

Figure 1. The relationship between additive manufacturing and the supply chain



There are several advantages to this type of project. It becomes less important to store the finished products with the evolution of Speedfactory. It is fast and can manufacture the required number of shoes being sold.

Moreover, it can efficiently deliver the personalised models quickly to customers because of the short distance between the customer and production. It also increases efficiency with an increased number of machines, which is an economic advantage.

Based on the above discussion, the following hypothesis has been formulated:
H1: SCMN has a significant impact on SCPR.
H2: SF has a significant impact on SCPR.
H3: SNF has a significant impact on SCPR.
H4: SCMN has a significant impact on SF.
H5: SCMN has a significant impact on SNF.
H6: Additive manufacturing (I4.0) has a significant direct impact on SCPR.
H7: Additive manufacturing (I4.0) moderates the relationship between SCMN and SCPR.
H8: SCMN flexibility mediates the relationship between SCMN and SCPR.
H9: Supply network flexibility mediates the relationship between SCMN and SCPR

Methodology

Using a survey-based method, the study intends to examine the role of industry 4.0 in the supply chain management of DKSH Thailand, which has recently been exposed to additive manufacturing. The response rate is 63 percent, and we have employed the partial least square to analyse the data. It is stated that the partial least square technique is also regarded as a structural equation modelling of the second generation. The PLS technique is appropriate for analysing the latent variables and causal relations among the variables in structural equation models. It was claimed by Sarstedt, Hair, Ringle, Thiele, and Gudergan (2016) that PLS is most suitable for building a statistical model and prediction of variable association. The approach is useful in several ways. In this study, this method has been adopted, as it is advantageous in dealing with complicated models and is applicable in the real-world (Davcik & Sharma, 2016; Wamba et al., 2017). The relationship between the variables (exogenous and endogenous) will be explained in this study and the indirect influences created on them. Another possible reason for using the PLS method is the normality issue. Most of the time, the data is not distributed normally and the PLS method can be used for both. In social science, most of the studies have to deal with abnormal data and this issue can be resolved suitably with PLS. Another significant reason behind the use of PLS is its ability to estimate the relation between the constructs in the structural model and the association among the estimates and their unobserved constructs respectively (Hair, Hult, Ringle, & Sarstedt, 2016; Shah & Rahim, 2019). These attributes of the PLS method make it the best technique in statistics. Considering this discussion, the PLS method can be used to evaluate the reliability and validity of the constructs.

Data analysis

The measurement model is evaluated in the first step of PLS-SEM approach. This results in the structural model (Henseler, Hubona, & Ray, 2016). The basic standards for evaluating the measurement model are the determination of the reliability, as well as the validity of the model in the PLS method (Ngah, Zainuddin, & Thurasamy, 2017). It has been suggested by Henseler et al. (2016) and Hair et al. (2016) that the measurement model should be based on the reliability of every item, internal consistency reliability, and content validity, discriminant, and convergent validity. The following is the outer model of this study:

Figure 2. Measurement model

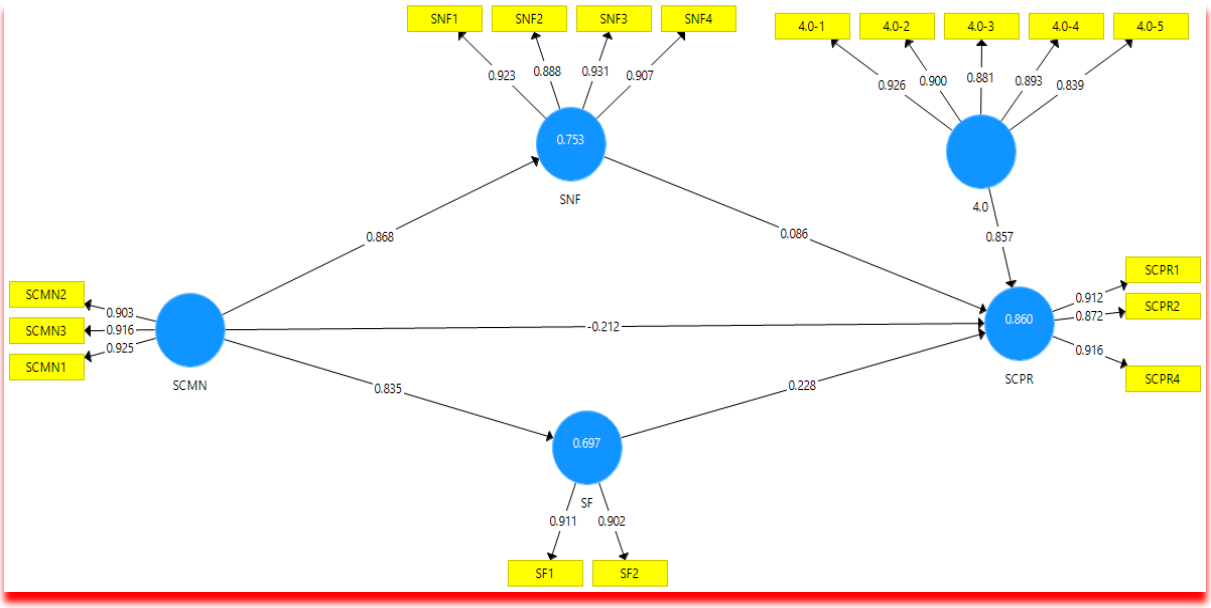


Table 1: Outer loading

	4.0	SCMN	SCPR	SF	SNF
4.0-1	**0.926**				
4.0-2	**0.900**				
4.0-3	**0.881**				
4.0-4	**0.893**				
4.0-5	**0.839**				
SCMN2		**0.903**			
SCMN3		**0.916**			
SCPR1			**0.912**		
SCPR2			**0.872**		
SCPR4			**0.916**		
SF1				**0.911**	

SF2				**0.902**	
SNF1					**0.923**
SNF2					**0.888**
SNF3					**0.931**
SNF4					**0.907**
SCMN1		**0.925**			

Several researchers have suggested that the reliability of every item should be determined by each item loading (Hair et al., 2016; Hair, Sarstedt, Hopkins, & G. Kuppelwieser, 2014; Shah & Rahim, 2019). The benchmark for item loadings is set at 0.70 and any value less than this should be eliminated as per the suggestion of Hair et al. (2016). Internal reliability can be determined through composite reliability in the PLS path model (Wong, 2016). This reliability is defined through the value of Cronbach's α. Its value should be higher than the benchmark 0.70 (Lonial & Carter, 2015). The composite reliability value for the variables is shown in Table 2, which reflects that the range of the values is 0.844-0.985 and these values are greater than 0.70 making it acceptable. Therefore, the reliability in the research is acceptable. The convergent validity has been described by Ngah et al. (2017) at the level with which an item is determined by multiple items. The convergent validity has been determined in this study based on the AVE as per the support of Tzempelikos and Gounaris (2017). It is recommended that the value of AVE should be greater than 0.5 and any value lesser than 0.5 should be eliminated to improve the value of AVE.

Table 2: Reliability table

	Cronbach's Alpha	**rho_A**	**CR**	**(AVE)**
4.0	**0.933**	**0.935**	**0.949**	**0.789**
SCMN	**0.902**	**0.903**	**0.939**	**0.837**
SCPR	**0.883**	**0.884**	**0.927**	**0.810**
SF	**0.783**	**0.784**	**0.902**	**0.822**
SNF	**0.933**	**0.934**	**0.952**	**0.832**

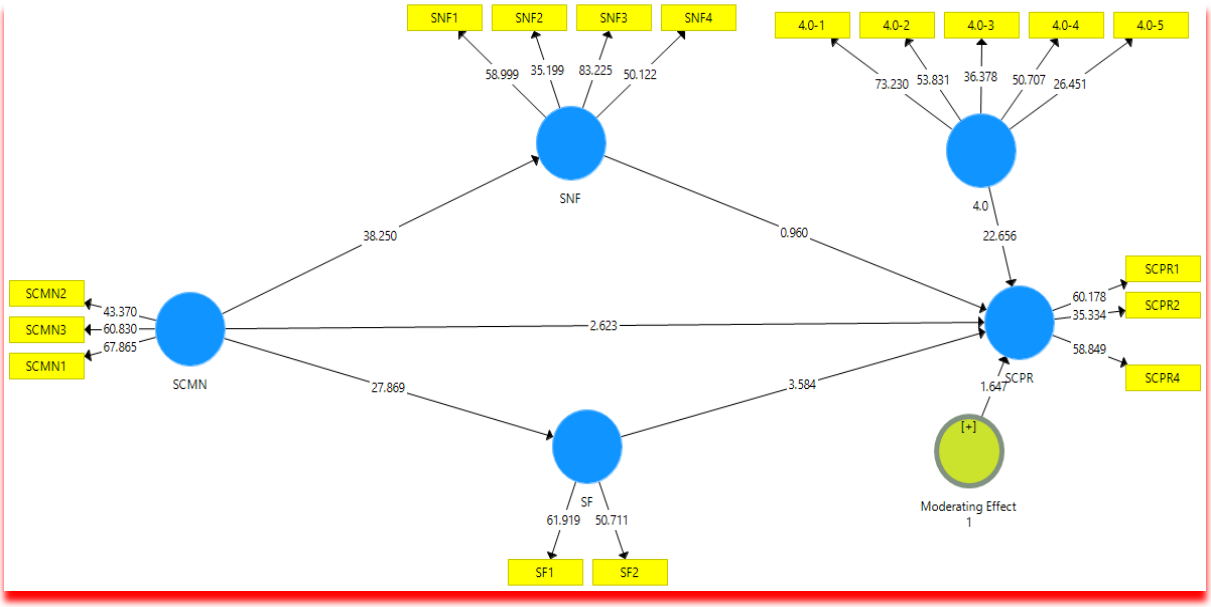
Discriminant validity is related to the level of items' difference among the constructs. This has been explained by Shah and Rahim (2019) as the difference of one item in the study from the other variables of the study. In order to evaluate the discriminant validity, there are two measures suggested by Hair et al. (2016). These measures are the criterion of Fornell-Larcker and square root of AVE value. In the measure of Fornell-Larcker, the value of AVE should be higher than the association among the variables (Tzempelikos & Gounaris, 2017).

Table 3: Validity matrix

	4.0	SCMN	SCPR	SF	SNF
4.0	0.888				
SCMN	0.770	0.815			
SCPR	0.715	0.727	0.880		
SF	0.737	0.735	0.771	0.907	
SNF	0.742	0.768	0.747	0.854	0.912

The second step in the PLS method is to assess the outer model, which is the structural model. As per the recommendations of Henseler et al. (2016), the effect size, value of R2, path coefficients, predictive relevance and moderating effect, have been determined to evaluate the outer model. The structural model of the study is represented below:

Figure 3. Structural model



For determining the path coefficient significance, the procedure of standard bootstrapping has been used. A sample based on 266 cases and 5000 bootstrap has been used (Hair et al., 2016; Hair et al., 2014; Henseler et al., 2016).

Table 4: Direct relation

	(O)	(M)	STDEV)	T Statistics	P Values
4.0 -> SCPR	0.364	0.858	0.038	22.656	**0.000**
Moderating Effect 1 -> SCPR	0.329	0.031	0.018	1.647	**0.050**
SCMN -> SCPR	0.265	0.072	0.043	2.505	**0.000**
SCMN -> SF	0.835	0.835	0.030	27.869	**0.000**
SCMN -> SNF	0.868	0.868	0.023	38.250	**0.000**
SF -> SCPR	0.235	0.236	0.065	3.584	**0.000**
SNF -> SCPR	0.075	0.079	0.078	0.960	**0.169**

Figure 4. Moderating effect of the additive manufacturing (I4.0)

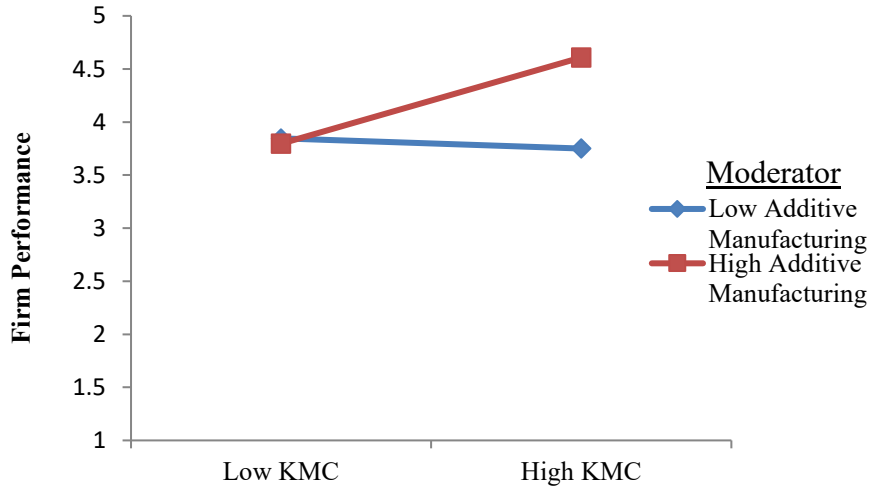


Table 5: Mediation

	(O)	(M)	STDEV)	T Statistics	P Values
SCMN -> SF -> SCPR	0.196	0.197	0.057	3.438	**0.000**
SCMN -> SNF -> SCPR	0.065	0.069	0.068	0.952	**0.170**

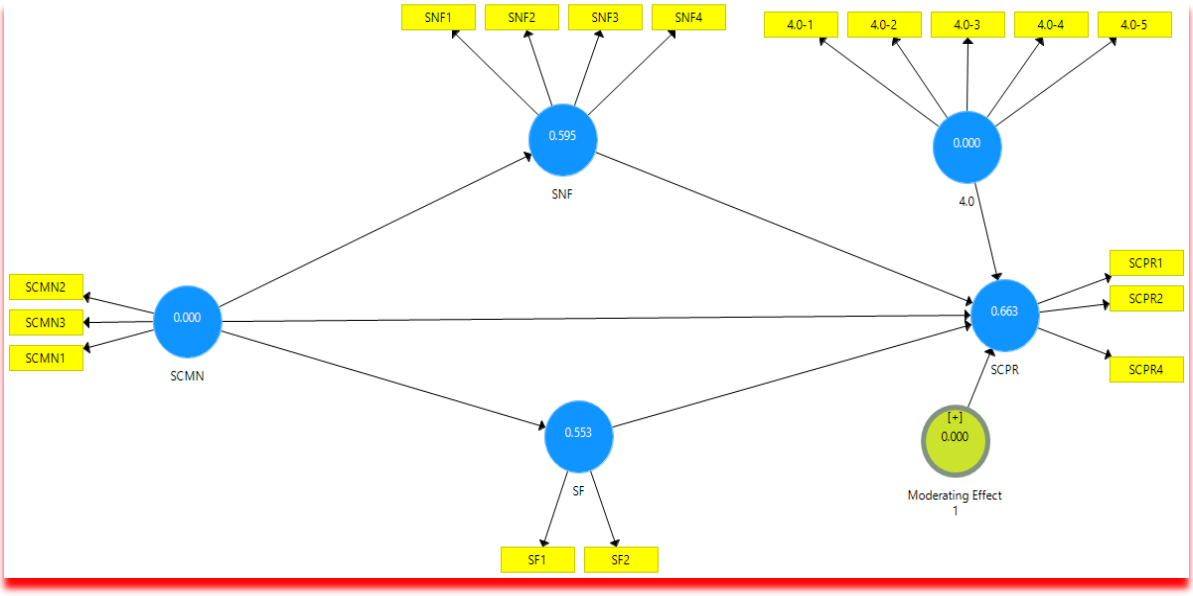
In the PLS-SEM method, the main criteria for the determination of the structural model is the variance in the dependent variable represented by R^2. It shows the variation in the dependent variance because of the independent variable (Hair et al., 2016; Hair et al., 2014). The value of R square is considered weak, moderate, and substantial when it comes out to be 0.24, 0.50, and 0.75.

Table 6: R-Square

	R Square
SCPR	0.860
SF	0.697
SNF	0.753

There is a need for the research to apply the measures that reflect the analytical significance for quality evaluation of the model during the use of PLS-SEM, as per the recommendation of Hair et al. (2016). The test of Stone-Geisser has been used for the blindfolding procedure. This test has been used in this study for testing the goodness of fit in the PLS method (Shah & Rahim, 2019). The blindfolding procedure is the only estimate of the dependent latent variables having a model with multi dimensions (Sarstedt et al., 2016).

Figure 5. Q-square



Latent variable is described as reflective measures that lead to a difference in indicators' set. The nature of study is reflective and blindfold method has been used. A cross-validated measure of redundancy has been used to evaluate the research model's analytical significance (Q^2) (Hair et al., 2016; Hair et al., 2014; Sarstedt et al., 2016).

Table 7: Q-square

	SSO	SSE	Q² (=1-SSE/SSO)
4.0	1,085.000	1,085.000	
Moderating Effect 1	217.000	217.000	
SCMN	651.000	651.000	
SCPR	651.000	219.245	0.663
SF	434.000	194.206	0.553
SNF	868.000	351.388	0.595

Conclusion and Discussion

In this research, the supply flexibility has been investigated through the lens of RBV. In this regard, contributions have been made to the existing literature on flexibility in supply chains. By recognising the role of resources in flexibility of supply, the supply flexibility concept has been developed. The two distinct dimensions of supply flexibility were investigated: supply network flexibility and SF. The complications in the network of the supplier can be explored with the instruments developed for supply flexibility. This can provide a great understanding of the contribution of supply flexibility in achieving competitive advantage. It is interesting to know whether the improvements in supply flexibility create an influence on the product development and manufacturing flexibility. This will benefit the practitioners in designing the flexibility of supply chain strategy by adding the internal capabilities and supply network. This can lead to the achievement of a competitive advantage through the competition of supply chains with one another. When the partners in supply coordinate on different processes, it can leverage the specialised capabilities in a better way. The results of the study have shown the relationship between supply flexibility, SCMN and SCPR. It has been found that the current performance of the companies can be improved in the uncertain and dynamic business environment by linking the capabilities of supply network flexibility and practices of SCMN.

Although, there is an increase in complexity and outsourcing in supply networks, there is limited empirical research on analysing the inter-organisational phenomenon of collaboration. The future research can be influenced by the incorporation of firm size as a moderator. The T&T technologies and BDA, along with additive manufacturing and industry 4.0, support a new quality of risk management infrastructure planning and the ability for resource utilisation at the stage of recovery. A new quality of SC visibility and data coordination is allowed by BDA and T&T technologies with the activation and simulation of recovery policies.

Firms may find this research interesting, as it considers the survival strategies important for dealing with downturns. There is need for the executives in the supply chain to formulate survival strategies for during a financial crisis. Moreover, a turnaround strategy should be

planned, which needs supply base contributions. There is a growing interest among the practitioners for adopting a flexibility strategy to understand the complementary relation of supply network and SF. It is critical for firms to establish supply base flexibility when suppliers do not possess sufficient capabilities for responsiveness to uncertainties. Therefore, firms explore capabilities from additional suppliers rather than maintaining focus on the existing supply base, reducing the supply network flexibility. There is need for the managers to understand the positive influence of SCMN practices on flexibility of supply that give additional insight for the strategic significance of SCMN function. The responsibilities of SCMN professionals should change in order to adapt to the flexibility business strategy.

REFERENCES

Akhavan, R. M., & Beckmann, M. (2017). A configuration of sustainable sourcing and supply management strategies. *Journal of Purchasing and Supply Management, 23*(2), 137-151.

Al-Shboul, M. d. A. (2017). Infrastructure framework and manufacturing supply chain agility: the role of delivery dependability and time to market. *Supply Chain Management: An International Journal, 22*(2), 172-185.

Bruno, C. (2017). Metro e stile nelle poesie di Vincenzo Cardarelli.

Chan, A. T., Ngai, E. W., & Moon, K. K. (2017). The effects of strategic and manufacturing flexibilities and supply chain agility on firm performance in the fashion industry. *European Journal of Operational Research, 259*(2), 486-499.

Chetthamrongchai, P. & Jermsittiparsert, K. (2019). The Mediating Role of Supply Chain Management Practices in the Relationship between Manufacturing Flexibility and Manufacturing Performance. *Humanities and Social Sciences Reviews, 7*(3), 736-743.

Davcik, N. S., & Sharma, P. (2016). Marketing resources, performance, and competitive advantage: A review and future research directions. *Journal of Business Research, 69*(12), 5547-5552.

Hair, Hult, G. T. M., Ringle, C., & Sarstedt, M. (2016). *A primer on partial least squares structural equation modeling (PLS-SEM)*: Sage publications.

Hair, Sarstedt, M., Hopkins, L., & G. Kuppelwieser, V. (2014). Partial least squares structural equation modeling (PLS-SEM) An emerging tool in business research. *European Business Review, 26*(2), 106-121.

Harsasi, M. (2017). Improving Supply Chain Performance Through the Implementation of Supply Flexibility.

Haseeb, M., Hussain, H., Kot, S., Androniceanu, A., & Jermsittiparsert, K. (2019). Role of Social and Technological Challenges in Achieving a Sustainable Competitive Advantage and Sustainable Business Performance. *Sustainability, 11*(14), 3811.

Haseeb, M., Hussain, H., Slusarczyk, B., & Jermsittiparsert, K. (2019). Industry 4.0: A Solution towards Technology Challenges of Sustainable Business Performance. *Social Sciences, 8*(5), 184.

Henseler, J., Hubona, G., & Ray, P. A. (2016). Using PLS path modeling in new technology research: updated guidelines. *Industrial Management & Data Systems, 116*(1), 2-20.

Holmström, J., & Gutowski, T. (2017). Additive manufacturing in operations and supply chain management: No sustainability benefit or virtuous knock-on opportunities? *Journal of Industrial Ecology, 21*(S1), S21-S24.

Huggins, R., & Thompson, P. (2015). Entrepreneurship, innovation and regional growth: a network theory. *Small Business Economics, 45*(1), 103-128.

Jermsittiparsert, K. & Pithuk, L. (2019). Exploring the Link between Adaptability, Information Technology, Agility, Mutual Trust, and Flexibility of a Humanitarian Supply Chain. *International Journal of Innovation, Creativity and Change, 5*(2), 432-447.

Khajavi, S. H., Partanen, J., & Holmström, J. (2014). Additive manufacturing in the spare parts supply chain. *Computers in Industry, 65*(1), 50-63.

Khan, H., & Wisner, J. D. (2019). Supply Chain Integration, Learning, and Agility: Effects on Performance. *Journal of Operations and Supply Chain Management, 12*(1), 14.

Ko, W. W. J., Liu, G., Ngugi, I. K., & Chapleo, C. (2018). External supply chain flexibility and product innovation performance: A study of small-and medium-sized UK-based manufacturers. *European journal of marketing, 52*(9/10), 1981-2004.

Lavie, D. (2016). Alliance capability. *The Palgrave encyclopedia of strategic management*, 1-4.

Lee, V.-H., Ooi, K.-B., Chong, A. Y.-L., & Sohal, A. (2018). The effects of supply chain management on technological innovation: The mediating role of guanxi. *International Journal of Production Economics, 205*, 15-29.

Lii, P., & Kuo, F.-I. (2016). Innovation-oriented supply chain integration for combined competitiveness and firm performance. *International Journal of Production Economics, 174*, 142-155.

Lonial, S. C., & Carter, R. E. (2015). The impact of organizational orientations on medium and small firm performance: A resource-based perspective. *Journal of Small Business Management, 53*(1), 94-113.

Moshtari, M. (2016). Inter-organizational fit, relationship management capability, and collaborative performance within a humanitarian setting. *Production and Operations management, 25*(9), 1542-1557.

Ngah, A. H., Zainuddin, Y., & Thurasamy, R. (2017). Applying the TOE framework in the Halal warehouse adoption study. *Journal of Islamic Accounting and Business Research, 8*(2), 161-181.

Prajogo, D., Oke, A., & Olhager, J. (2016). Supply chain processes: Linking supply logistics integration, supply performance, lean processes and competitive performance. *International Journal of Operations & Production Management, 36*(2), 220-238.

Sarstedt, M., Hair, J. F., Ringle, C. M., Thiele, K. O., & Gudergan, S. P. (2016). Estimation issues with PLS and CBSEM: Where the bias lies! *Journal of Business Research, 69*(10), 3998-4010.

Saunila, M. (2016). Performance measurement approach for innovation capability in SMEs. *International Journal of Productivity and Performance Management, 65*(2), 162-176.

Schmidt, C. G., Foerstl, K., & Schaltenbrand, B. (2017). The supply chain position paradox: green practices and firm performance. *Journal of Supply Chain Management, 53*(1), 3-25.

Shah, & Rahim, N. A. (2019). Effect of ethical climate on corporate financial performance in Pakistan: An application of confirmatory tetrad analysis (CTA-PLS) approach. *Journal of Studies in Social Sciences and Humanities, 5*(2), 53-67.

Sheel, A., & Nath, V. (2019). Effect of blockchain technology adoption on supply chain adaptability, agility, alignment and performance. *Management Research Review*.

Shibin, K., Gunasekaran, A., Papadopoulos, T., Dubey, R., Singh, M., & Wamba, S. F. (2016). Enablers and barriers of flexible green supply chain management: a total interpretive structural modeling approach. *Global Journal of Flexible Systems Management, 17*(2), 171-188.

Strozzi, T., Paul, F., Wiesmann, A., Schellenberger, T., & Kääb, A. (2017). Circum-Arctic changes in the flow of glaciers and ice caps from satellite SAR data between the 1990s and 2017. *Remote Sensing, 9*(9), 947.

Stylianou, A., Subramaniam, C., & Niu, Y. (2019). The Role of Knowledge Management in the Relationship between IT Capability and Interorganizational Performance: An Empirical Investigation. *Communications of the association for information systems, 45*(1), 4.

Sutduean, J., Joemsittiprasert, W., & Jermsittiparsert, K. (2019). Uncertainty As an Antecedent of the Supply Chain Risk: Does Supply Chain Flexibility Matter in Risk Mitigation?. *Humanities and Social Sciences Reviews, 7*(2), 503-509.

Tachizawa, E. M., Gimenez, C., & Sierra, V. (2015). Green supply chain management approaches: drivers and performance implications. *International Journal of Operations & Production Management, 35*(11), 1546-1566.

Tzempelikos, N., & Gounaris, S. (2017). A conceptual and empirical examination of key account management orientation and its implications–the role of trust *The Customer is*

NOT Always Right? Marketing Orientationsin a Dynamic Business World (pp. 673-681): Springer.

Wamba, S. F., Gunasekaran, A., Akter, S., Ren, S. J.-f., Dubey, R., & Childe, S. J. (2017). Big data analytics and firm performance: Effects of dynamic capabilities. *Journal of Business Research, 70*, 356-365.

Wong, K. K.-K. (2016). Mediation analysis, categorical moderation analysis, and higher-order constructs modeling in Partial Least Squares Structural Equation Modeling (PLS-SEM): A B2B Example using SmartPLS. *Marketing Bulletin, 26*.