

The Impact of Supply Chain Management Practices on Supply Chain Performance in Chinese Manufacturing Companies

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Abstract: Supply Chain Management Practices (SCMP) and its positive effect on Supply Chain Performance (SCP) has been well addressed in manufacturing companies operating in developed industrial area. However, this association in manufacturing companies operating in developing industrial area is less emphasized. Therefore, this study aims to investigate the impact of SCMP on SCP for Chinese manufacturing companies in Lanzhou, the capital city of Gansu province, China. Based on the review of literature related to SCMP and SCP in developed industrial area, a conceptual model was established to determine the impact of SCMP on SCP for the companies. The model features five practices of SCMP - Customer-Supplier Relationship (CSR), Information Systems and Technology (IS/IT), Quality Management (QM), Corporate Culture (CC), Material Flow Management (MFM) and six items of SCP. A questionnaire was developed and distributed to all 156 manufacturing companies in Lanzhou. Analysis on the 112 completed questionnaires indicated that all the five SCMP are positively and significantly affect SCP. This means that, regardless of the state of industrial area, the SCMP were found to be important and have significant impact on SCP. This finding calls manufacturing companies in the developing industrial area to focus on SCMP to ensure the performance of supply chain management is sustained. Theoretical and managerial implication of the finding is discussed for measuring and improving the SCMP in manufacturing industry.

Key words: Supply chain management, supply chain management practices, supply chain performance, emphasized, sustained

INTRODUCTION

Before 1960s, traditionally, the production approach for most manufacturing companies was based on the concept of maximum production at the lowest cost. However, the companies suffered due to lack of the flexibility in production and huge investments in inventory process that caused the speed of producing new products to market became slow (Farmer *et al.* 1997). In 1980s, the focus was switched to producing products with best quality and high reliable goods, in which Total Quality Management (TQM) and Just-In-Time (JIT) approaches were extensively implemented. Zhou and Benton (2007) pointed out that TQM and JIT have enabled manufacturing companies to reduce their production cycle time and improve production efficiency.

In 1990s, manufacturing industry faced rapid and unpredictable changes in technology due to globalization of the world economy. Traditional business models could not adapt to these new changes. Thus to survive in this

competitive market, manufacturing companies had refocus their production approach to Supply Chain Management (SCM). SCM consists of several actions through a channel that company employees in the entire transformation process from raw material to the end-user to create a reliable product by thinking how business and marketing is performed at every level of organizations (Tummala *et al.*, 2006). The SCM focuses on providing customers with the right products, sufficient quantities in the most appropriate time and with ability to reduce the cost and improve the service levels. Successful SCM gives a guarantee to reduce cost of operation by canceling insufficient activities from supplier to final customers (Lee *et al.*, 2011). Recently, SCM has played essential roles in manufacturing companies and it emerged as a novel method of organizational suitability (Ganeshkumar and Nambirajan 2013).

According to the new Statistical Year's book of China for the past 30 years, the China economy has recorded an average growth rate of 10% and more growth is expected in the future. Currently, China is the largest manufacturer,

largest exporter of goods and second largest importer of primitive goods that make the country as a global hub for manufacturing and trading. China plays a very significant role in international trade of the global market. This trend led Chinese manufacturing companies to aggressively implement and maintain the SCM in their attempt to keep the position in the global market. SCM is regarded as an essential tool required by the companies to sustain their competitiveness in today's competitive market. This development had attracted many researchers to investigate and expand the SCM concept and implementation in Chinese manufacturing companies (Huam *et al.*, 2011; Tummala *et al.*, 2006).

Review of literature on SCM highlighted that SCMP and its significant and positive effect on SCP is well addressed in manufacturing companies. SCMP is interpreted as a whole set of actions in organizations to enhance the effectiveness of the in-house supply chain. It is considered as fundamental part of SCM that has significant impact on the operational efficiency of the companies by interacting with other SCMP in the total chain. Moreover, such SCMP yielded a high correlation with performance measures (Tummala *et al.*, 2006). From SCP perspectives, performance measurement is defined as the process through which an organization setting up parameters to quantify the efficiency and effectiveness of its action. Efficiency is a measure of how well a firm's resources are utilized to provide a desired or the intended level of customer satisfaction, whereas, effectiveness is the degree in which the needs of the customer are met (Huam *et al.*, 2011).

In China, most previous studies addressed the association between SCMP and SCP of SCM in the developed region in China (Huam *et al.*, 2011) where manufacturing companies treated the SCM as an essential tool to achieve and maintain the high performance of the SCM. A research question arises, i.e. does the SCM model established in the developed industrial area also workable for the companies operating in developing area? There are some limitations when applying the model to the manufacturing companies in developing industrial area. Generally, the practices of supply chain management do not take into consideration the state of industry area in which manufacturing companies is operating. Some practices are irrelevant and some of them need to be reconstructed to measure the SCMP being practiced by the companies in developing area. For example, applying electronic interchange between upstream and downstream partner is widely used by manufacturing companies in developed region but this measurement is not performed by the companies in developing region of China. Therefore, this paper aims to investigate and examine the

effect of SCMP on SCP in Chinese manufacturing companies operating in Lanzhou. It is the capital city of Gansu province and is recognized as developing industrial region in China.

This study employs the established model of SCMP and SCP in manufacturing companies operating in developed industry areas. This research is significant in the study of SCM by extending the association between SCMP and SCP in the context of Chinese manufacturing companies operating in developing industry area. For the management of the companies, this study provides valuable input for effective implementation of SCM by addressing any deficiencies in SCMP.

Literature review: Globalization has caused a rapid and growing competition among companies in manufacturing industry. Manufacturing companies in the developing countries are facing drastic challenges and they are relying on effective handling of SCM to remain competitive in the global market. However, applying practices of SCM is not easy, since it involves many parties pursuing different objectives in the supply chain. It is necessary to find new ways of implementing SCM and improving the performance of SCM. Further, some adjustments to the practices of SCM (SCMP), established in developed industrial area are required to ensure suitability of these practices in developing industrial area.

SCM is described as a unifying managerial concept of the whole supply chain channels from the supplier to the ultimate customer. It correlates every stage of the process from raw material procurement to manufacturing, inventory, currency and delivers to the ultimate customer. In other words, SCM involve communication over all channels in the supply chain to contribute to the highest level of services and products to eventual customers (Sheperd 1994). It enhances the performance of the entire chain, as well as the efficiency among members in the chain (Tan *et al.*, 2006).

In the business view, SCM is an integrated business workflow for effective handling of products, services and information from supplier to final customer. Farmer (1997) argued that the term "Supply Chain Management" is not a precise term and it should be replaced by "seamless demand pipeline". Later, Stevens (1989) extended the concept to include logistics that need to be incorporated in the supply chain to coordinate all the members of the supply chain in an integrated manner. This allows the members to pursue a common goal, i.e. higher efficiency low cost and low inventory in handling and distributing products and services to the final consumers. It facilitates effective flow of information and communication among

the members, allowing them to resolve any vertical and horizontal conflicts among them. SCM generates value for all of the stakeholders or members within the chain. A good, trust-based and long term relationship among members of SCM is necessary to achieve competitive advantage in SCM (Tummala *et al.*, 2006). To establish and sustain this relationship, all members must understand all processes and workflows within the SCM and try to deliver their role efficiently. That is why most SCM related studies focused on the working flow of SCM and the functional parts delivered by members in the supply chain. Some authors concentrated on the whole SCM (Tan, 2001); while other authors focused on a certain element of SCM (Sheperd, 1994). Besides, some of them examined the different functions of SCM (Farmer, 1997; Stevens, 1989) and actions in the supply chain.

In examining effective SCM, it is important to determine and analyze relevant factors, including SCMP that influence SCP. Tan (2002) defines the SCMP as a set of actions engaged in an organization to improve effectiveness of managing over the supply chain. It is a coordinated strategy and planning for the involved companies in the supply chain to include the collaboration functions in their internal company and across the company.

Review on the literature related to SCM produced a number of SCM practices (SCMP). The most common and popular SCMP, as presented in Table 1, are Customer-Supplier Relationship (CSR), Information System and Technology (IS/IT), Quality Management (QM), Corporate Culture (CC) and Material Flow Management (MFM). These SCMP are widely practiced by manufacturing companies in developed industry area and adherence to them had resulted in higher performance of SCM in term of effective handling of products to consumers, up-to-date information about the products, flexible and just-in-time inventory, low holding cost and better communication between channel members.

CSR is defined as a relationship between upstream and downstream partners with manufacturing companies in which cross-functional team consisting of a group of various functions that are working in the integrated supply chain through various processes that aim to enhance organization's performance (Tan *et al.*, 1998; Tummala *et al.*, 2006). Measure of CSR involves maintaining open and cross-functional communication among the company, customers, suppliers, engaging in managing conflict solving between customers and suppliers in the supply chain, maintaining a long term commitment with customers and suppliers, conveying correct information to suppliers and customers,

Table 1: Popularity of SCMP among scholars

Scholars	Supply Chain Management Practices (SCMP)				
	CSR	IS/IT	QM	CC	MFM
Tan <i>et al.</i> 1998	✓		✓		
Huam <i>et al.</i> (2010)	✓	✓		✓	✓
Li <i>et al.</i> (2006)					
Tummala <i>et al.</i> (2006)					
Thoo <i>et al.</i> 2011					
Zheng (2010)	✓	✓	✓		
Hemsworth <i>et al.</i> (2005)			✓		
Chang (2009)					
Talib <i>et al.</i> (2010)					
Talib <i>et al.</i> (2011)					
Sukati <i>et al.</i> (2010)	✓				
Chou <i>et al.</i> (2008)					
McMullan (1996)					
Tan (2002)					✓

evaluating supplier's performance and using compatible technology in dealing with customers and suppliers (Tummala *et al.*, 2006).

In SCMP, IS/IT refer to disseminator and enabler for processing and producing communication (Tummala *et al.*, 2006). IS/IT is recognized as a tool in SCM involving Electronic Data Interchange (EDI) and Enterprise Resource Planning (ERP) which are managed through implementing safe electronic data transferring. Practices of IT/IS in SCM is measured by enhancing the effectiveness of SCM, making easier supply chain coordination, tracking inventory across ownership boundaries, reducing SCM cost and managing quick changes in volume demands for products (Tummala *et al.*, 2006).

QM of SCMP is the overall blends of product and services of marketing, engineering, manufacturing and maintenance to satisfy customer (Tan *et al.* 1998; Hemsworth *et al.*, 2005). It is about focusing on sustainability issue along with other thinking regarding to the quality. Measures of QM of SCMP include visiting and assessing suppliers facilities on a continuous basis, recognizing and rewarding suppliers for quality of materials, improving and developing new raw materials by collaborating with suppliers and ensuring suppliers by certifying to quality management systems/standard (ISO certification).

The CC is recognized as the behavior of employees within an organization who have common practice and goals. It is defined as modifying habits and knowledge of the people to modify their business practices and values (Tummala *et al.*, 2006). This practice includes valuing the idea of workers at every level, existing of atmosphere of trust among upstream and downstream partners, introducing a clear supply chain plan/agenda and commitment to fulfill SCM objectives (Li *et al.* 2006 and Tummala *et al.*, 2006).

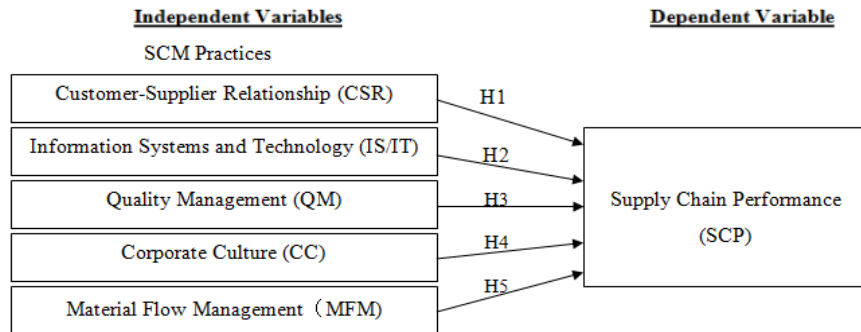


Fig. 1: The Conceptual model

The MFM is focusing on managing material from raw to finishing state by planning effective logistical network and inventory control. MFM is defined as managing inventory flow and supply in supply channel and it is an important factor in evaluating and reducing resource consuming process (Tummala *et al.*, 2006). The practice of MFM involves engaging of internal logistics activities to meet SCM goal, evaluating the criteria of supplier performance, replenishing the level of stock while maintaining inventory level and having a program to enhance supplier performance (Li *et al.*, 2006)

According to Huam *et al.* (2011), SCM performance measurement is defined as the process through which an organization setting up parameters to quantify the efficiency and effectiveness of its action. The SCP measures include time, cost, innovativeness and flexibility (Huan *et al.* 2004; Toyin, 2012) and improved team work (Huan *et al.*, 2001).

Table 1 summarizes the popularity of SCMP used in SCM researches from 1996 until 2011. It was found that, based on the researches presented in Table 1, all these practices were positively and significantly contributed to the SCP in developed industrial region. This shows that, SCP is predictable via these SCMP. Thus, a conceptual model of this study is developed as shown in Fig. 1.

It is well recognized that SCMP will contribute to the SCP (Tummala *et al.*, 2006). It creates a good, trust-based and long term relationship among supply chain partners, thus contributing to the higher efficiency in handling of products to consumers. Previous studies revealed that the practice of CSR positively affect SCP (Tan, *et al.* 1998, Huam *et al.*, 2011; Tummala *et al.*, 2006; Hemsworth *et al.*, 2005; Li *et al.*, 2006; Sukati *et al.*, 2011). Thus:

- H₁ is proposed: there is a positive and significant effect of customer-supplier relationship on supply chain performance

IS/IT is recognized as essential tool and acts as disseminator and enabler for process and product

communication by reducing time and paperwork (Huam *et al.* 2011; Tummala *et al.*, 2006; Hemsworth *et al.* 2005; Li *et al.* 2006). Therefore, the usage of IS/IT in SCM will influence the performance of SCM. Thus, the second hypothesis is proposed:

- H₂: There is a positive and significant effect of information systems/technology on supply chain performance

The QM is constant fulfillment of quality specification of the organizations toward boosting the value of their purchase and manufacturing efficiency (Tan, *et al.* 1998, Hemsworth *et al.* 2005, Chang, 2009; Talib *et al.* 2010, 2011; Zheng, 2010). The continuous evaluation and accomplishment of the quality leads to higher efficiency, performance and improvement. Therefore, the third hypothesis is proposed:

- H₃: There is a positive and significant effect of quality management on supply chain performance

The CC is regarded as the spirit of every organization in SCM that is followed by commitment and involvement by senior and middle managers by keeping long-term relationship among them. This commitment is a set of actions that strengthen mutual collaboration between them (Huam *et al.*, 2011; Tummala *et al.*, 2006; Hemsworth *et al.* 2005; Li *et al.* 2006; Cooper, 1993) and this will lead to the better performance in SCM. Thus:

- H₄ is established: there is a positive and significant effect of corporate culture on the supply chain performance

The MFM is one of the strategic factors in which the final stage of supply chain ended by receiving the product to the final customer. This practice helps companies to reduces their logistics cost by transferring

materials and goods efficiently across the supply chain (McMullan, 1996, Tan, 2002, Chou *et al.*, 2008, Huam *et al.*, 2011; Tummala *et al.*, 2006; Hemsworth *et al.*, 2005; Li *et al.*, 2006). Thus, the fifth hypothesis is proposed:

- H5: There is a positive and significant effect of Material flow management on supply chain performance

MATERIALS AND METHODS

Questionnaire is a major instrument used in this study and it encompassed dimensions and items of the independent variables (SCMP) and items for the dependent variable (SCP). CSR with five items were constructed based on the work of (Tummala *et al.*, 2006 and Hemsworth *et al.*, 2005) IS/IT with seven items which were adapted from (Tummala *et al.*, 2006), QM with five items (Tan *et al.*, 1998; Tummala *et al.* 2006), CC with seven items (Haum *et al.*, 2011), MFM with five items as proposed by (Tummala *et al.*, 2006) and six items for SCP (Tummala *et al.*, 2006; Hemsworth 2005). The measurements for both SCMP and SCP were based on five points Likert Scales of 1 = strongly agree, 2 = Disagree, 3 = somewhat agree, 4 = Agree and 5 = strongly agree.

There are 156 manufacturing companies in Lanzhou Statistical Year's book of China in 2014 involving in SCM therefore, the similarities exists among them to serve as respondents in this study. Further, a filter question was added in the questionnaire asking the respondents to state their involvements in SCM to ensure that the companies participated in this study are directly involved in SCM. A sample size of 113 companies is required to participate in this study, as suggested by Morgan (1970). It was decided to distribute the questionnaires to all the 156 companies by email and fax. It took two weeks to collect completed questionnaires from the companies. Based on the 113 returned questions, it was observed that all the companies mentioned that SCM is well practiced.

RESULTS AND DISCUSSION

To examine the validity of measurements as well as to obtain data reduction, the Exploratory Factor Analyses (EFA) have been performed (Hair *et al.*, 2010). In the first round of the EFA, for the independent variable, the KMO is 0.703 with Bartlett's test of Sphericity of 0.001. Some incompatible questions (variables) are detected and separated from other variables. The new arrangement was made in which: Item Q8 of CC was moved to CSR and has

Table 2: Result of Multiple Regression Analysis

Parameter	B	SE	β	t	Sig.	VIF
Constant	0.382	0.259		1.721	0.046	
CSR	0.261	0.052	0.343*	5.013	0.000	1.965
IS/IT	0.141	0.057	0.160**	2.472	0.015	1.755
QM	0.169	0.054	0.194*	3.110	0.002	1.639
CC	0.159	0.045	0.218*	3.567	0.001	1.577
MFM	0.161	0.056	0.186*	0.007	1.907	
F	62.885					
R ²	0.7480					

**.*Significant at 0.001, 0.005

been reinterpreted to suit with CSR; The same treatment was applied to item Q7 of QM which was transferred to MFM; Items Q5and Q8 of CSR were deleted because the factor loading scores of <0.5 and Likewise, items Q6 of QM, Q3 of MFM, are deleted due to having the factor loading of <0.5, respectively.

The Kaiser-Meyer-Olkin (KMO) for the second round of EFA is 0.755 with Bartlett's test of Sphericity of 0.001. The outcome of the EFA is the five dimensions of SCMP CSR, IT/IS, QM, CC and MFM with eigenvalue of >1. The total variance explained is 76.682%. All items were well arranged in the five components with factor loading scores of >0.5. For the dependent variable, the KMO is 0.782 with Bartlett's test of Sphericity of 0.001. The result of the EFA produced one component, i.e., the SCP with eigenvalue of >1. Five items (item Q8 was removed with factor loading of <0.5) were retained as their factor loading are >0.5. The cumulative total variance explained is 60.008%.

The normality test, linearity test and multicollinearity test were also performed to ensure all variables satisfy the underlying assumption of correlation and regression analyses. The results showed all the assumption are met and the linear correlation was observed. Assessment of the reliability of the questionnaire was carried using reliability test. As a rule of thumb any measurement is reliable when the Cronbach's alpha value is 0.7 or more. The result of reliability test shows all measurements are strongly reliable; CSR (0.868), IS/IT (0.906), QM (0.863), CC (0.971), MFM (0.909) and SCP (0.850).

To examine how SCMP impact on SCP, the multiple linear regression was performed. The result indicates that all the SCMP are found to have a positive and significant impact on SCP. As shown in Table 2, CSR (β 0.343, t 5.013, p<.01), IS/IT (β 0.160, t2.472, p<0.05), QM (β 0.194, t3.110, p<0.05), CC (β 0.218, t 3.567, p<0.05) and MFM (β 0.186, t 2.755, p<0.05). Thus, all hypotheses namely, H₁-H₅ are accepted. In addition, CSR was found to give the greatest effect on SCP as compared to the other SCMP. The least effect between SCMP and SCP was observed for IT/IS.

This research examined the SCMP and their effect on SCP for Chinese manufacturing companies operating in a developing industrial area in China. As mentioned in the introduction, this research analyzed five practices of SCM to determine their effect on SCP based on the established SCM model in the developed industrial area. It was found that all the SCMP were positively and significantly affect SCP. It shows that this model works for manufacturing companies operating in developing industrial area. Thus, it is important for manufacturing companies to focus on SCM regardless of the state of industrial area. Such effort should focus on effective practicing of SCR, QM, CC, IS/IT and MFM in the whole supply chain channels. A unified and concerted effort on building and maintaining trust, information flow, adherence to quality standard, culture of SCM excellence and work flow among members of the supply chain should be emphasized.

The positive effect of SCMP on SCP is consistent with previous studies by Tan *et al.* (1998), Huam *et al.* (2011), Tummala *et al.* (2006), Hemsworth *et al.* (2005) and Li *et al.* (2006). In this study, it was found that CSR has the greatest impact on the SCP as compared to the other practices of SCM. This is consistent with the works of Huam *et al.* (2011), Tummala *et al.* (2006) who addressed the positive impact of SCMP on SCP for manufacturing companies in developed industrial area in China. Specifically, similar association is observed between IS/IT (Tummala *et al.* 2006, Hemsworth *et al.*, 2005; Li *et al.*, 2006), QM (Tan *et al.* 1998, Hemsworth *et al.* 2005; Chang, 2009; Talib, *et al.* 2010, 2011), CC (Huam *et al.*, 2011; Tummala *et al.*, 2006; Hemsworth *et al.* 2005; Li *et al.* 2006) and MFM (McMullan, 1996, Tan, 2002, Chou *et al.*, 2008, Huam *et al.* 2011; Tummala *et al.*, 2006; Hemsworth *et al.*, 2005; Li *et al.*, 2006 and Thoo *et al.*, 2011) of SCMP on SCP. Theoretically, this implies that the SCMP is able to predict the performance of supply chain management for manufacturing companies regardless of industrial area they are operating. This study revealed that SCMP is positively and significantly affect SCP for manufacturing companies in developing industry area, which is similar with the manufacturing companies operating in developed industry area (Tummala *et al.*, 2006).

The IS/IT of SCMP recorded the least association with SCP. In developed industrial area, according to Tummala *et al.* (2006), IS/IT is one of the key factors of SCM which enriches the other practices of SCM. In other words, IS/IT helps the transfer of information from suppliers to companies and from companies to the final consumers. Moreover, it eases the inventory tracking for companies resulting in less unfold materially. Thus, it is

vital for manufacturing companies operating SCM in developing area to consider the role of IS/IT for improving SCP.

CONCLUSION

This study investigated the impact of SCMP on SCP in Chinese manufacturing companies located in the developing industrial area in Lanzhou, China. The major finding is that the current conceptualization of SCMP and SCP of SCM model, established in developed industry area, is also observed in manufacturing companies operating in developing industry area. Thus, it is justified for Chinese manufacturing companies investing on SCM to elevate their position in the international market. Future studies should expand the current research model to other developing industry areas to validate the finding. Such researches are important because they provide additional insight on SCM realm and its application in different characteristics of industry area. Further, it is recommended to investigate characteristics of developing industry area, such as IT/IS facilities, infrastructure, customer relationship management, supply chain members' knowledge and skills of SCM and how they affect the implementation of SCM.

In this study, it was found that CSR has the strongest effect on SCP. It shows that supplier-customer relationship is crucial in determine the effective implementation of SCM. Thus, examining factors contributing to the effective supplier-customer relationship should be interesting to research.

The construct of IS/IT of SCMP should be further enhanced to ensure it significant and vital contribution to the SCP. IS/IT is important component of SCMP in SCM model and most manufacturing companies in developed industrial area had successfully utilizing IS/IT in their SCM effort. For further study more items related to the IS/IT should be taken into account to examine the important role of IS/IT in other developing industrial region in China.

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