

# Supply chain integration

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# Supply chain integration: value creation through managing inter-organizational learning

Supply chain  
integration

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## Abstract

**Purpose** – The purpose of this paper is to demonstrate how inter-organizational learning (including supply chain learning and imitation prevention) mediates the relationships between supply chain integration (SCI) and two dimensions of focal firm performance (i.e. customer service performance and innovation performance).

**Design/methodology/approach** – A cross-sectional approach was adopted with primary data collected through a survey in China. Data were analyzed using structural equation modeling with partial least-squares estimations.

**Findings** – The findings verify that inter-organizational learning mediates the relationship between SCI and focal firm performance. The results of sub-group model analysis illustrate that both powerful and weak focal firms benefit from inter-organizational learning, but in different ways.

**Research limitations/implications** – The responses were all from young executives who had four years' work experience on average. Top-level executives may provide more comprehensive and accurate input for similar future research.

**Practical implications** – The results suggest that successfully integrating the supply chain to create customer value requires both supply chain learning and imitation prevention.

**Originality/value** – This paper responds to calls for an inter-disciplinary research between supply chain management and inter-organizational learning by taking into account supply chain learning and imitation prevention as links between SCI and both customer service performance for current success and innovation performance for future prosperity.

**Keywords** Innovation performance, Supply chain integration, Supply chain learning, Customer service performance, Imitation prevention, Mediation effects

**Paper type** Research paper

## 1. Introduction

Nowadays, market competition takes place no longer between individual companies but supply chains (Farahani *et al.*, 2014). Since the introduction of supply chain management (SCM), one of the main themes has been the crucial role of supply chain integration (SCI) in value creation (e.g. Dyer and Singh, 1998; Cao and Zhang, 2011), and two recent meta-analyses (Leuschner *et al.*, 2013; Mackelprang *et al.*, 2014) have presented empirical generalizations on the SCI-performance relationship. Despite their rigorous execution, the two meta-analytic consolidations of the extant research “derive different conclusions pertaining to the overall ‘value proposition’ of SCI” (Autry *et al.*, 2014, p. 275). The inconsistent findings are largely due to the application of different definitions, operationalizations, and levels of analysis for SCI (Autry *et al.*, 2014). In order to understand SCI and its relationship to performance and value creation, we will first present our definition, operationalization, and level of analysis for SCI in the Literature Review section. Furthermore, failure to consider the mediating routes by which SCI affects firm performance may have constrained the researchers from coming to comprehensive and generalized conclusions about the benefits of SCI (Chavez *et al.*, 2015; Chang *et al.*, 2016). Grounded in the relational view (RV) and knowledge-based view (KBV) of the firm, we argue that one of the mediating factors may be the way in which inter-organizational learning is managed. SCI can potentially result in supply chain



learning (Bessant *et al.*, 2003; Flint *et al.*, 2008; Manuj *et al.*, 2013). However, such learning behavior may also trigger unwanted imitative efforts of competitors (Zander and Kogut, 1995). Although facilitating supply chain learning and preventing rival imitation are the twin elements of managing inter-organizational learning along the supply chain, there are few studies considering them at the same time. As more customer value may be achieved through superior management of inter-organizational learning (Esper *et al.*, 2009), there is a need to test the mediation effects of both supply chain learning and imitation prevention. In addition, as power can be the governance mechanism to promote SCI (Maloni and Benton, 2000) and there is a correlation between focal firms' ability to improve performance and their power circumstances (Cox *et al.*, 2004), different results may be found between powerful focal firms (that have the most negotiation power on the supply chain) and weak focal firms (that have less negotiation power on the supply chain) from the transition cost economics (TCE) perspective.

The main contribution of our study is that we respond to calls for an inter-disciplinary research between SCM and inter-organizational learning (e.g. Ketchen and Hult, 2007). In this way, we incorporate the KBV perspective into the discussion of the RV of the firm by investigating the mediating role of inter-organizational learning on the SCI-performance link. In addition, through evaluating powerful focal firms and weak focal firms separately, our research contributes to theory-building of "SCI improves firm performance" by considering power to control for opportunism in the transaction.

The paper is structured in the following way. In Section 2, we will give theoretical arguments as to how supply chain learning and imitation prevention may mediate the relationships between SCI and two dimensions of performance. Section 3 will discuss research methodology. This is followed by the statistical analysis of our data in Section 4. Finally, the paper will conclude with both discussion and implications in Section 5.

## 2. Literature review

### 2.1 Definition of SCI

Although there is an extensive body of research on SCI, its "conceptual vagueness" has remained for more than a decade (Gimenez and Ventura, 2005; Lau *et al.*, 2010; Tsinopoulos and Mena, 2015). Different definitions (the locus of integration, i.e. which functional groups are being integrated, vs the substance of integration, i.e. which information and organizational processes are being integrated) are related with different operationalizations of the SCI-performance relationship (the extent of integration vs the strength of linkages), which, in turn, are related with different levels of analysis (strategic, tactical, or operational level) (Autry *et al.*, 2014). To clarify the meanings and theoretical identities of different behaviors related to integration, Autry *et al.* (2014) summarize a continuum of interaction, from operational coordination (i.e. activities in support of planning, information exchanges, and system integration) to tactical cooperation (i.e. recognition and achievement of mutually beneficial activities) to strategic collaboration and integration (i.e. establishment and maintaining of collaborative relationships). Therefore, although operational coordination and tactical cooperation lay the foundation of integration, the level of analysis for integration is strategic in nature. This is in line with the RV of the firm, which postulates that firms can benefit from inter-firm integration and strategic partnerships to acquire valuable resources they lack in-house (Dyer and Singh, 1998). A definition of SCI should first highlight the significance of strategic collaboration, which engenders sharing of strategic information, risks, as well as rewards (Lee, 2004) on customer value creation to gain competitive advantages (Esper *et al.*, 2009). Second, based on the strategic focus, the definition of SCI should pay more attention to the locus of integration than the substance of integration (Mackelprang *et al.*, 2014). Instead of solely focusing on integrating with key suppliers or key customers (e.g. Swink *et al.*, 2007), SCI should consist of integration with both

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key suppliers and key customers to help the generation of relational rents (Flynn *et al.*, 2010). Therefore, based on Flynn *et al.* (2010)'s definition, we define SCI as the degree to which the focal firm strategically collaborates with its key supply chain partners and collaboratively manages inter-organizational processes to provide maximum value to the customer.

### 2.2 Dimensions of performance

When evaluating performance improvement by SCI, researchers take different types of performance into account: from pure operational logistics performance to broad strategic performance (Fabbe-Costes and Jahre, 2008). As our level of analysis is on strategic integration to maximize customer value, we will focus on the effects of SCI on customer service performance and innovation performance, for our operationalization of the SCI-performance relationship. Customer service performance refers to the yield of the entire supply chain on speed and quality control (Vickery *et al.*, 2003). It demonstrates current success on customer value creation. Innovation performance evaluates the ability of collaborating firms to quickly change process structures or adapt the information-sharing process for modifying the features of a product or service (Wu, 2013). It is reflected by the extent to which all the supply chain partners supporting changes in product/service offerings in response to customer needs (Cao and Zhang, 2011). It shows the ability to retain current customers and create more value in the future.

### 2.3 Inter-organizational learning along the supply chain

The KBV of the firm suggests that knowledge can serve as the basis for competition and is the most important strategic resource (Grant, 1996). Learning is the accumulation of knowledge and the understanding of its potential benefit, by individuals, groups, and organizations (Nonaka, 1994). At the organizational level, organizational learning is a process of acquiring, disseminating, interpreting, using, and storing information within organizations, leading to new knowledge or insights that affect organizational strategies (Mohr and Sengupta, 2002). One important research stream of organizational learning involves inter-organizational learning along the supply chain (Spekman *et al.*, 2002), which poses a double-edged sword. On the one hand, it is a desirable extension of organizational learning, developing a firm's knowledge base, and providing fresh insights into markets and strategies (Mohr and Sengupta, 2002). In the literature, such practice is termed as "supply chain learning" (Bessant *et al.*, 2003; Flint *et al.*, 2008; Manuj *et al.*, 2013). On the other hand, it can lead to unintended and undesirable knowledge transfer, resulting in the potential dilution of competitive advantage (van Wijk *et al.*, 2008). So, from first movers' point of view, it is equally vital to develop imitation prevention strategies. However, studies on imitation prevention form a separate research stream, which is not integrated with research on the management of inter-organizational learning along the supply chain. As knowledge transfer and imitation are the twin elements of market competition (Zander and Kogut, 1995), we will include imitation prevention as the second aspect to manage inter-organizational learning along the supply chain.

**2.3.1 Supply chain learning and its moderating role.** According to Flint *et al.* (2008, p. 264), supply chain learning is the practice that "firms look both up and down their supply chains to manage and monitor learning processes within and outside of the firm." The content of learning is knowledge, which is divided into two types: information and know-how (Kogut and Zander, 1992; Grant, 1996; Dyer and Singh, 1998). Information is easily codifiable knowledge that can be transmitted "without loss of integrity once the syntactical rules required for deciphering it are known. Information includes facts, axiomatic propositions, and symbols" (Kogut and Zander, 1992, p. 386). By comparison, know-how involves knowledge that is tacit, complex, and difficult to codify (Kogut and Zander, 1992).

The core idea behind supply chain learning is to let managers think in a boundary spanning way, both functionally and organizationally. In practice, this is reflected by three processes: knowledge generation involves co-recognizing innovation/market variables that may significantly impact the effectiveness and relevance of current and future organizational operations; knowledge transfer is the process by which applicable innovation/market information and know-how are shared throughout the supply chain; and knowledge application involves institutionalizing new product/market information and know-how by altering management behaviors and processes to enhance effectiveness and efficiency (Esper *et al.*, 2009).

The underlying assumption of SCI is the notion that customer value is created from both demand and supply areas of the focal firm. One of the key organizational processes within SCI is to facilitate information sharing, which refers to the sharing of technological, marketing, production, and inventory information across key suppliers and key customers (Lau *et al.*, 2010). Supply chain learning will use such information to further develop contextualized beliefs and subsequent strategic commitments (i.e. know-how generation and application) (Esper *et al.*, 2009). On the other hand, communication is an essential ingredient and lies at the heart of know-how transfer (Mohr and Spekman, 1994). The frequency, depth, and content of communication certainly affects the quality of know-how transfer (Spekman *et al.*, 2002). SCI brings members of key supply chain partners close to each other to communicate (Pagell, 2004), therefore facilitating frequent and in-depth cross-boundary communication and leading to a high level of know-how transfer. In sum, KBV states that SCI can help firms coordinate and deploy knowledge resources by exchanging valuable information and know-how across the organizational boundary with key suppliers and customers (Kogut and Zander, 1992; Grant, 1996).

Once knowledge is generated through demand- and supply-side observation and research, it is usually disseminated by cross-boundary meetings. Through these meetings, focal firms further engage in dialogs with key suppliers and key customers to learn better ways to serve each other and the end customers (Esper *et al.*, 2009). Supply chain learning fosters capability development and exploitation of current competences to cater for current customers, thus having important effects on current customer satisfaction (van Wijk *et al.*, 2008). In practice, it relates to on-time delivery, reducing shipping errors, and minimizing product damages to create customer value (Manuj *et al.*, 2013). Supply chain learning also enables the focal firm to change or react with little penalty in time, effort, cost, or performance during the period of product development and introduction to the market, as it stimulates the combination of existing and newly acquired knowledge and augments the focal firm's capacity for making novel linkages and associations (Jansen *et al.*, 2005). By altering their attitudes and behaviors based on lessons learned, managers and employees from the focal firm can uncover more opportunities from these cross-boundary interactions (Flint *et al.*, 2008). Thus, we hypothesize:

*H1.* Supply chain learning mediates the relationship between SCI and (a) customer service performance and (b) innovation performance.

*2.3.2 Imitation prevention and its moderating role.* The endeavors of firms to create, apply, and replicate knowledge do not go well together with rapid public dissemination. An interesting dilemma is that knowledge that is easily transferred and replicated may also be easily imitated (Simonin, 2004). As SCI facilitates supply chain learning with key suppliers and key customers, rivals that share the same suppliers and/or customers may have more incentives to imitate focal firms' products and production processes. However, competitors will get little benefit from imitation unless they imitate the focal firm's overall absorptive capacity, an ability to utilize external knowledge through the sequential processes of

exploratory, transformative, and exploitative learning (Lane *et al.*, 2006). To deter rivals' imitation, continuous improvement is considered as an effective way to create time compression diseconomies, which means it takes time to develop the familiarity and expertise for resource allocation (Dyer and Singh, 1998). At the time of introduction, innovations undergo a period of incremental improvement by the use of a number of tools and techniques (Tsinopoulos and Mena, 2015). The idea is that competitors may have the ability to imitate one product or process, but they cannot keep up with a high pace of product and process improvement. The ability of the focal firm to improve products and production processes should prevent rivals' imitation, even if important knowledge is widely diffused by key suppliers and/or key customers (Zander and Kogut, 1995). When facilitating supply chain learning, focal firms are aware of the threat of quick imitation, and will hence put more efforts in preventing such threat from happening (Mohr and Sengupta, 2002).

A number of studies have paid attention to the performance consequences of industry rivalry. In a study of software firms, Young *et al.* (1996) found that as industry rivalry increased, the focal firm performance decreased. Lee *et al.* (2000) provided evidence for the same idea by demonstrating that stock prices of focal firms were negatively affected by rivals' imitation. Derfus *et al.* (2008) further summarized this phenomenon as the Red Queen effect, a contest in which each firm's performance depended on the firm's matching or exceeding the actions of rivals. To prevent rivals' imitation, focal firms invest in continuous improvement of their products and processes, which, in turn, increases their performance with regard to innovation. Thus, we hypothesize:

*H2.* Imitation prevention mediates the relationship between supply chain learning and innovation performance.

#### 2.4 SCI and performance

According to the RV of the firm, the achievement of a competitive advantage via SCI is dependent on the generation of relational rents between integrated firms. In our definition, SCI includes both supplier integration and customer integration. A close relationship between key suppliers and the focal firm facilitates their mutual exchange of information about products, processes, schedules, and capabilities, helping develop their production plans, produce goods on time, and improve delivery performance. By developing a good understanding of the focal firm's operation, suppliers achieve a high level of customer value, which, in turn, helps the focal firm improve its customer value (Flynn *et al.*, 2010). In empirical studies, supplier integration has been found to be positively related to product development management (Koufteros *et al.*, 2007) and reliable delivery (Lee *et al.*, 2007). A strong relationship between customers and the focal firm offers opportunities for improving the accuracy of demand information, reducing product design time, production planning time, and inventory obsolescence, and facilitating responsiveness to customer needs (Flynn *et al.*, 2010). In empirical studies, customer integration has been found to be positively related to customer satisfaction (Homburg and Stock, 2004) and product development and innovation (Koufteros *et al.*, 2005).

By integrating with key suppliers and key customers, the focal firm can improve both customer service performance and innovation performance. Customer service performance is enhanced by the efforts of both reliable delivery from supplier integration and customer satisfaction from customer integration. The improvement of innovation performance is reflected by product/service development and innovation from both supplier and customer integration. Thus, we hypothesize:

*H3.* SCI is positively related to (a) customer service performance and (b) innovation performance.

### *2.5 Power position as the control variable*

Given our focus on strategic integration, the operationalization of the SCI-performance relationship should give extra emphasis to the extent of integration for different kinds of supply chain partners (Autry *et al.*, 2014). Following this logic, Mackelprang *et al.* (2014) find differences in performance based on which partners are doing SCI, so they suggest that power positions of supply chain partners may be a potential control variable. Moreover, the design and use of inter-organizational learning reflect the strategic interests of powerful supply chain partners. It involves economic and political processes in articulating interests, building alliances, and struggling over outcomes (Webster, 1995). Firms that have less negotiation power may fully accept the dominant supply chain partner's unreasonable allocation of benefits from SCI and inter-organizational learning, simply due to the concern that collaborative investments with the dominant partner has become sunk cost (Kim, 2006). What they can do, from the TCE perspective, is to protect their knowledge in order to maintain their competitive advantage, and to decrease the likelihood of the dominant partner using their knowledge in an opportunistic manner (Williamson, 1975). Following such a strategy, the less powerful firms invest more in imitation prevention to maintain their bargaining power and competitive position within the supply chain (Lawson and Potter, 2012). Although facilitating similar SCI and inter-organizational learning practices, the focal firm with/without negotiation power to influence its key supply chain partners might achieve different levels of mediation effects, customer service performance, and innovation performance, creating different sorts of value. Hence, we consider power position as the control variable and will evaluate two sub-group models (that are distinguished by whether or not the focal firm has the most negotiation power on the supply chain) after assessing our full model.

## **3. Research methodology**

### *3.1 Measurement development*

To test the proposed hypotheses, our survey has adopted measurement items from previous studies. The questionnaire was developed in English and then translated into Chinese. The Chinese version was then back translated into English by a third party to ensure the accuracy of translation. For all the items, a seven-point Likert scale was used, ranging from strongly disagree (1) to strongly agree (7).

We first focus on distinctive categories of SCI. Based on a close examination of all the items used in 33 selected surveys in SCI research, van der Vaart and van Donk (2008) proposed categorizing these items as attitude, practice, or pattern. The first category includes those items that measure the attitude of buyers and/or suppliers toward each other or toward SCI in general. Supply chain practices, the second category, are seen as tangible activities or technologies that play an important role in the collaboration of a focal firm with its suppliers and/or customers. Related to these practices are interaction patterns between the focal firm and its suppliers and/or customers (the third category). We follow van der Vaart and van Donk's (2008) arguments that it is not sufficient to show a positive relationship between attitudinal aspects and performance. Instead, it seems more logical, especially from a conceptual point of view, to focus on the relationship between supply chain practices or patterns and performance. Therefore, we selected measurement items of SCI patterns that cover the flows of product/service, information, and decision (Li *et al.*, 2006; Flynn *et al.*, 2010), as well as benefits allocation (Lee, 2004).

With regard to supply chain learning, we adopted the scale from Flint *et al.* (2008), in which supply chain learning was clearly defined for the first time. The measurement items covered five different processes aimed at ensuring that managers of the focal firm as well as key suppliers and key customers were engaged in active learning management. For imitation prevention, Zander and Kogut (1995) provided two classical measurement items (i.e. continuous

improvements of products/services and of manufacturing/distribution processes), which have been well discussed and are often used in the literature (e.g. Simonin, 2004; van Wijk *et al.*, 2008).

For performance, we evaluated customer service performance and innovation performance, respectively. Customer service performance is the yield of the entire supply chain on speed and quality control (Vickery *et al.*, 2003). Therefore, the aspects of customer service performance that we took into account were product/service reliability, product/service durability, and delivery speed (Li *et al.*, 2006). Innovation performance is a reflection to which all the supply chain partners supporting changes in product/service offerings in response to customer needs (Cao and Zhang, 2011). We assessed such changes in features, volume, and speed (Li *et al.*, 2006; Flynn *et al.*, 2010).

To distinguish between powerful focal firms and weak focal firms, we asked for the respondents' perception on whether their firms had the most negotiation power on the supply chain. If the respondent was not sure about whether his/her firm was powerful or weak, he/she was suggested to choose the option of N/A (i.e. not available).

### 3.2 Pilot test

The preliminary questionnaire had 18 items and was sent to firm managers and scholars to gain feedback. Altogether, 36 participants filled out the questionnaire. Two of the responses were found to be incomplete and thus were eliminated. In response to the feedback of the pilot group, minor revisions were made in the exact wording and layout of the questionnaire.

### 3.3 Data collection and sample

Data were first collected through a cross-sectional survey in China from August to September, 2013. We have not used a database of e-mail addresses or phone numbers to access managers in the Chinese industry, as these databases contain outdated and therefore unreliable data (Zhu and Sarkis, 2004). Instead, the questionnaire was distributed to 210 young executives from Beijing (149), Shenyang (28), and Nanjing (33), who attended executive classes. These managers are well equipped in terms of education, and hold a position to make decisions regarding SCI and inter-organizational learning. Furthermore, they will become the executives of the future. This group is quite homogeneous, given the common background and ambitions. In total, 159 questionnaires were returned, resulting in a response rate of 75.7 percent. After eliminating 42 invalid responses (due to lacking relevant experience, missing values, or failure to provide demographic data), we had 117 valid responses for further analysis.

In order to collect more responses to increase the confidence of model analysis, another 295 questionnaires were administered to young executives in seven classes in Beijing from March to May, 2015. A total of 254 questionnaires were returned, resulting in a response rate of 86.1 percent. After eliminating 5 invalid responses, 249 valid responses were included for further analysis.

Thus, in total, 366 usable questionnaires were collected which resulted in a high response rate of 81.8 percent. Of them, 180 respondents regarded their firms as powerful focal firms that have the most negotiation power on the supply chain, while 122 respondents considered their firms as weak focal firms that have less negotiation power on the supply chain; 64 respondents were not sure about whether their firms were powerful or weak. Their responses were included in full model analysis, but not in sub-group model analysis.

To check for differences between the first-wave and the second-wave respondents, a  $\chi^2$  test was performed on demographic variables (Shao, 2013) and no significant difference was found. Table I summarizes the characteristics of these respondents.

Since most data were collected from a single respondent of a focal firm, common method bias may be a problem. The potential for common method bias was assessed by Harmon's single-factor test (Podsakoff *et al.*, 2003). It consists of loading all of the variables into an



	Response count	Response percent
<i>Sectors</i>		
Automotive	23	6.3
Electro/electronics	39	10.7
Machinery	26	7.1
Chemicals and pharmaceutical	29	7.9
Information technology	57	15.6
Materials and metal production	14	3.8
Food	12	3.3
Paper, pulp, and printing	3	0.8
Construction	21	5.7
Appliances	6	1.6
Aerospace and defense	2	0.5
Medical devices	9	2.5
Other industry	36	9.8
Logistics services	12	3.3
Other services	53	14.5
Trading	24	6.6
<i>Sales volume (in US\$)</i>		
Less than 10 million	40	10.9
10-50 million	60	16.4
50-100 million	51	13.9
100-250 million	43	11.7
250-500 million	16	4.4
500-1 billion	26	7.1
1-under 10 billion	28	7.7
10 billion and more	28	7.7
N/A	74	20.2
<i>Number of employees</i>		
Less than 100	59	16.1
100-499	81	22.1
500-999	57	15.6
1,000-4,999	47	12.8
5,000-9,999	23	6.3
10,000 and more	48	13.1
N/A	51	13.9
<i>Position of informant</i>		
High-level senior management or owners	26	7.1
Logistics/supply chain	61	16.7
Purchasing/procurement	27	7.4
Production/operations	49	13.4
Sales, distribution, and service	66	18.0
Accounting/finance	31	8.5
Other management positions	68	18.6
N/A	38	10.4
<i>Years stayed in the organization</i>		
Under 2 years	74	20.2
2-5 years	179	48.9
6-10 years	78	21.3
Over 10 years	35	9.6

**Table I.**  
Sample  
demographic data

exploratory factor analysis and examining the unrotated factor solution. Results revealed five factors with eigenvalues above 1.0, explaining 60.8 percent of the variance. The first factor accounted for 34.3 percent of the variance. As a single factor did not emerge and the first factor did not account for most of the variance, common method bias is not a serious problem.

## 4. Results

To estimate structural equation models by means of empirical data, researchers can choose either covariance-based methods (e.g. LISREL and AMOS), or variance-based partial least squares (PLS) approach. Following the rules to select the more proper method to estimate structural equation models (Hair *et al.*, 2011), we decide to use the PLS approach. The first reason is that PLS is better suited to analyze exploratory models that are on the early stages of theory development and testing (Zack *et al.*, 2009), as is the case of this research. PLS is also an analysis technique that enables the simultaneous estimation of both the measurement and the structural models (Tenenhaus *et al.*, 2005), providing estimations that are robust against skewed data distributions and multicollinearity (Cassel *et al.*, 2000). In addition, in comparison to covariance-based methods, PLS is advantageous if the sample size is small (Chin, 1998), as is the case of our two sub-group models. The software we choose for this research is SmartPLS Version 2.0 M3 Beta (Ringle *et al.*, 2005). To estimate the significance of path coefficients and item loadings, we use a bootstrapping approach, where 500 random samples of observations with replacements are generated from the original data set (Chin, 1998). *t*-statistics are calculated for each parameter.

### 4.1 Measurement model

To ensure the appropriateness of the measurement model, the unidimensionality, reliability, and validity of the scale are assessed. Both Cronbach's  $\alpha$  and factor loadings are used to test the unidimensionality of the model. For Cronbach's  $\alpha$ , a typical threshold of 0.6-0.7 is required (Nunnally, 1978), which is met by all factors (Table II). All factor loadings are higher than the recommended value of 0.50 (Dunn *et al.*, 1994). Therefore, the unidimensionality of the model is warranted. The scales are reliable: all composite reliability values in Table II exceed the threshold value of 0.70 (Nunnally, 1978). Construct correlations, which are displayed in Table III, provide evidence for construct validity: the average variance extracted (AVE) exceeds 0.50 (Bagozzi and Youjae, 1988), and the square root of the AVE of an individual construct exceeds the correlation of that construct with the remaining constructs (Fornell and Larcker, 1981).

### 4.2 Structural model

To test the moderating effects (*H1* and *H2*) and the direct relationships (*H3*), we followed Chavez *et al.*'s (2015) suggestion to carry out three steps. In the first step, our predictor variables (i.e. SCI and supply chain learning) were regressed against the mediator variables (i.e. supply chain learning and imitation prevention), respectively. In the second step, the predictor variables were regressed against their corresponding dependent variables (i.e. customer service performance and innovation performance). Finally, in the third step, we regressed the dependent variables on both the mediator and predictor variables. All these effects must be significant to verify a mediation effect, with the significance of each association between the predictor and outcome variables reduced by adding the mediator variable (Baron and Kenny, 1986). The results of structural model analysis for the full model are summarized in Table IV.

The first step of analysis reveals that SCI is positively related to supply chain learning ( $\beta = 0.65, p < 0.001$ ), and supply chain learning is positively related to imitation prevention ( $\beta = 0.50, p < 0.001$ ). Next, the results of the second step illustrate that SCI is positively associated with customer service performance ( $\beta = 0.57, p < 0.001$ ) and innovation performance ( $\beta = 0.48, p < 0.001$ ). In the third step, upon the inclusion of supply chain learning ( $\beta = 0.23, p < 0.001$ ), SCI continues to be significantly related to customer service performance ( $\beta = 0.41, p < 0.001$ ), providing evidence of partial mediation and thus partial support for *H1a*, and full support for the direct relationship between SCI and customer service performance (*H3a*). Similarly, the association between SCI and innovation

Measured items	Cronbach's $\alpha$	Factor loading	Composite reliability
<i>Please indicate how the following statements apply to your business unit in the past three years (seven-point scale: strongly disagree – strongly agree)</i>			
Supply chain integration (SCI)	0.77		0.87
SCI1: we and our key supply chain partners inform each other in advance of changing needs		0.69	
SCI2: we include our key supply chain partners in our planning and goal-setting activities		0.65	
SCI3: we regularly solve problems jointly with our key suppliers		0.73	
SCI4: we facilitate our key customers' ability to seek assistance from us		0.75	
SCI5: we allocate benefits fairly to our key trading partners		0.68	
Supply chain learning (SCL)	0.80		0.86
SCL1: we ensure that our managers are constantly learning better ways to work with our key suppliers and serve our key customers		0.80	
SCL2: we ensure that managers in our key suppliers are learning better ways to operate and serve us		0.75	
SCL3: we ensure that managers in our key customers learn better ways to manage their business and work with us		0.68	
SCL4: we ensure that our employees and managers change their behaviors and processes appropriately as they gain new knowledge from our key supply chain partners		0.78	
SCL5: we ensure that our employees and managers change their attitudes about our market situation as they gain new knowledge from our key supply chain partners		0.70	
Imitation prevention (ImP)	0.87		0.94
ImP1: continuous modification of our products/services has been applied to prevent competitors' imitation		0.94	
ImP2: continuous development of our manufacturing/distribution processes has been applied to prevent competitors' imitation		0.94	
<i>Please evaluate your business unit's performance compared to industry average in the past three years (seven-point scale: much below average – much above average)</i>			
Customer service performance (CSP)	0.77		0.87
CSP1: we offer products/services that are reliable		0.85	
CSP2: we offer products/services that are durable		0.83	
CSP3: we deliver customer order on time		0.79	
Innovation performance (InP)	0.64		0.81
InP1: we alter our product/service offerings to meet customer needs		0.73	
InP2: we respond well to customer demand for "new" features		0.82	
InP3: we have time-to-market lower than industry average		0.73	

**Table II.**  
Item relevant statistics

	SCI	SCL	ImP	CSP	InP
Supply chain integration (SCI)	0.71*				
Supply chain learning (SCL)	0.64	0.74*			
Imitation prevention (ImP)	0.49	0.51	0.94*		
Customer service performance (CSP)	0.56	0.50	0.40	0.82*	
Innovation performance (InP)	0.49	0.45	0.37	0.61	0.76*
Average variance extracted (AVE)	0.50	0.55	0.89	0.68	0.58

**Table III.**  
Construct correlations

**Note:** \*Square root of AVE presented on the diagonal

	Step 1		Step 2		Step 3	
	SCL	ImP	CSP	InP	CSP	InP
<i>Direct effects</i>						
SCI	0.65***		0.57***	0.48***	0.41***	0.32***
SCL		0.50***				0.18**
<i>Mediating effects</i>						
SCL					0.23***	0.18**
ImP						0.13*
R <sup>2</sup> (%)	42	25	32	23	35	28

**Notes:** Supply chain integration (SCI); supply chain learning (SCL); imitation prevention (ImP); customer service performance (CSP); innovation performance (InP). \* $p < 0.05$ ; \*\* $p < 0.01$ ; \*\*\* $p < 0.001$

**Table IV.**  
Structure model  
analysis results  
(full model)

performance continues to be significant ( $\beta = 0.32$ ,  $p < 0.001$ ), once supply chain learning is included ( $\beta = 0.18$ ,  $p < 0.01$ ), which indicates that supply chain learning partially mediates the relationship between SCI and innovation performance (partial support for *H1b* and full support for *H3b*). The mediation of imitation prevention for the relationship between supply chain learning and innovation performance (*H2*) is also partially supported, as the association between supply chain learning and innovation performance remains significant ( $\beta = 0.18$ ,  $p < 0.01$ ) by adding imitation prevention ( $\beta = 0.13$ ,  $p < 0.05$ ).

The mediation effects are additionally evaluated by the Sobel test (Sobel, 1982). A Sobel test can tell whether a mediator variable significantly carries the influence of independent predictor variable to a dependent variable, i.e. whether the indirect effect of the predictor variable on the dependent variable through the mediator variable is significant. Using the interactive tool by Preacher and Leonardelli (2003), we find support for three mediation effects: supply chain learning partially mediates the relationships between SCI and customer service performance ( $t = 3.97$ ,  $p < 0.001$ ) and between SCI and innovation performance ( $t = 2.93$ ,  $p < 0.01$ ); and imitation prevention partially mediates the relationship between supply chain learning and innovation performance ( $t = 2.27$ ,  $p < 0.05$ ).

#### 4.3 Sub-group model analysis for the control variable

Before taking sub-group model analysis for the control variable, we first checked the invariance of measurement model across two sub-groups, because a failure to prove the measurement model invariance invalidates any further examination of model parameters (Cao and Zhang, 2011). A non-significant  $\chi^2$  difference was found, so we can proceed to conduct structure model analyses for two sub-groups.

Different from the full model, the sub-group model of powerful focal firms (Table V) shows non-significant relationships between supply chain learning and customer service performance ( $\beta = 0.09$ ) and between supply chain learning and innovation performance ( $\beta = -0.02$ ). Therefore, supply chain learning cannot mediate the relationships between SCI and customer service performance (*H1a*) and between SCI and innovation performance (*H1b*). In contrast, SCI has more direct impacts on customer service performance (*H3a*,  $\beta = 0.54$ ,  $p < 0.001$ ) and innovation performance (*H3b*,  $\beta = 0.43$ ,  $p < 0.001$ ). The mediation effect of imitation prevention on the relationship between supply chain learning and innovation prevention (*H2*) remains the same significance as the full model (i.e.  $p < 0.05$ ).

The structural model analysis results for weak focal firms (Table VI) are similar to those for the full model. The main difference lies on the more significant (though still partial) mediation effect of supply chain learning on the relationship between SCI and innovation performance (*H1b*,  $\beta = 0.35$ ,  $p < 0.001$ ).

Therefore, our analysis results show significant differences between two sub-groups. Powerful focal firms benefit from SCI mainly through direct effects (*H3a* and *H3b*, both  $p < 0.001$ ). Only the mediating role of imitation prevention (*H2*,  $p < 0.05$ ) is validated. In contrast, weak focal firms can benefit from both direct effects (*H3a* and *H3b*, both  $p < 0.001$ ) and the mediation effects of supply chain learning (*H1a* and *H1b*, both  $p < 0.001$ ) and imitation prevention (*H2*,  $p < 0.05$ ).

## 5. Discussion and conclusion

### 5.1 Discussion

Our paper has studied the mediation effects of inter-organizational learning via supply chain learning (*H1a* and *H1b*) and imitation prevention (*H2*), and the direct relationships between SCI and customer service performance (*H3a*) and between SCI and innovation performance (*H3b*) in a full model and two sub-group models (one for powerful focal firms, the other for weak focal firms). In this section, we will discuss the findings of the full model when all models have similar results (from the RV perspective), and separately discuss the findings of two sub-group models when they are significantly different (from the KBV and TCE perspectives).

First, only weak focal firms can take advantages from the mediation effects of supply chain learning on the relationships between SCI and customer service performance (*H1a*) and between SCI and innovation performance (*H1b*). On the one hand, firms with a high level of dependence (i.e. weak focal firms in our study) benefit more from system collaboration and innovation generation (i.e. supply chain learning in our study) (Jean *et al.*, 2012). On the other hand, a duality always exists between the ability and the willingness of weak

**Table V.**  
Structural model  
analysis results  
(sub-group: powerful  
focal firms)

	Step 1		Step 2		Step 3	
	SCL	ImP	CSP	InP	CSP	InP
<i>Direct effects</i>						
SCI	0.60***		0.65***	0.50***	0.54***	0.43***
SCL		0.39***				-0.02
<i>Mediating effects</i>						
SCL					0.09	-0.02
ImP						0.15*
$R^2$ (%)	37	15	42	25	36	26

**Notes:** Supply chain integration (SCI); supply chain learning (SCL); imitation prevention (ImP); customer service performance (CSP); innovation performance (InP). \* $p < 0.05$ ; \*\*\* $p < 0.001$

**Table VI.**  
Structural model  
analysis results  
(sub-group: weak  
focal firms)

	Step 1		Step 2		Step 3	
	SCL	ImP	CSP	InP	CSP	InP
<i>Direct effects</i>						
SCI	0.62***		0.47***	0.42***	0.32***	0.19***
SCL		0.57***				0.35***
<i>Mediating effects</i>						
SCL					0.26***	0.35***
ImP						0.10*
$R^2$ (%)	38	33	22	18	27	30

**Notes:** Supply chain integration (SCI); supply chain learning (SCL); imitation prevention (ImP); customer service performance (CSP); innovation performance (InP). \* $p < 0.05$ ; \*\*\* $p < 0.001$

firms to facilitate supply chain learning, which is likely to be an important determinant of the degree of inter-firm knowledge transfer and performance improvement (Mowery *et al.*, 1996). For a powerful focal firm, an overt learning strategy (to monitor transaction specific assets, i.e. information and know-how in our study) can be detrimental to supply chain learning: the weak partner may overestimate its ability on knowledge generation, and thus react by restricting the degree of knowledge transfer (i.e. safeguarding transaction specific assets) (Lawson and Potter, 2012). Such reaction will significantly erode the powerful focal firm's performance improvement from supply chain learning, as shown in our results.

Second, we find that imitation prevention mediates the relationship between supply chain learning and innovation performance (*H2*) in all models. But compared to the mediation effects of supply chain learning in the full model ( $p < 0.01$ ) and in the sub-group model for weak focal firms ( $p < 0.001$ ), the mediating role of imitation prevention is less significant in the sub-group model for powerful focal firms ( $p < 0.05$ ). These may be explained by Pil and Cohen's (2006) research results. Techniques to facilitate supply chain learning, for example, modularity, may also facilitate imitation. The reduction in complexity drives product and process innovativeness of focal firms. But there is still a time lag for knowledge application, which leads to innovation performance improvement. This is especially true for weak focal firms with limited research capabilities to harvest the knowledge. In contrast, for powerful focal firms, weak partners' restriction on knowledge transfer (as mentioned in the previous paragraph) leads to less reduction in complexity, which, in turn, leads to less product and process improvement efforts on imitation prevention. Although taking less improvement efforts, powerful focal firms are better in research capabilities to harvest new knowledge, and thus shorten the time lag for innovation performance improvement (Coyte *et al.*, 2012).

Third, in line with *H3a* and *H3b*, SCI is positively related to both customer service performance (Homburg and Stock, 2004; Vickery *et al.*, 2003) and innovation performance (Koufteros *et al.*, 2005; Koufteros *et al.*, 2007), respectively. SCI serves as a differentiator in the marketplace through superior customer value creation (i.e. the relational rents) (Chang *et al.*, 2016). We further investigated the effects on powerful focal firms and weak focal firms separately. We find that powerful focal firms benefit more from SCI than weak focal firms do. This may be due to using hierarchy as the governance form (Modi and Mabert, 2007). According to Zhao *et al.* (2008), powerful focal firms can control the supply chain by deciding whether and how much to use their power. Especially for a high power distance national culture like China, there is an acceptance of power inequalities (Hofstede, 1980). Weak focal firms expect and accept the decisions made by more powerful organizations on benefit allocation (Zhao *et al.*, 2008).

## 5.2 Theoretical contributions

To respond to calls for an inter-disciplinary research between SCM and inter-organizational learning (e.g. Ketchen and Hult, 2007), this study discusses the mediating role of inter-organizational learning on the SCI-performance link. Our definition of SCI is grounded in the RV perspective, which posits that relational rent can be generated by combining valuable, scarce, and complementary resources and capabilities with key supply chain partners (Manuj *et al.*, 2013). To successfully achieve such relation rent generation, knowledge exchange and learning between firms is recommended as a key facilitator (Kobashi and Fujikawa, 2009), which is verified by our empirical research. In this way, we incorporate the KBV perspective into the discussion of the RV of the firm and theoretically prove the necessity of considering the mediating routes in the framework of the SCI-performance relationship. Furthermore, we investigate inter-organization learning from two aspects – supply chain learning and imitation prevention – at the same time, which has empirically certified Zander and Kogut's (1995) argument that knowledge transfer and

imitation are the twin elements of market competition. In fact, the idea of three supply chain learning processes is in line with that of three imitation processes: knowledge transfer and application are close to transformative and exploitative learning, respectively; the only difference is that knowledge generation is within the firm, while exploratory learning is learning across the boundary. We are pleased to see more combinations of both research streams in the future.

Our study also contributes to the theory in the way to consider power position as the control variable. This responds to Mackelprang *et al.*'s (2014) call for assessments of moderating influences to enrich the framework of the SCI-performance relationship. Through the lens of the TCE perspective, we find differences in monitoring and safeguarding mechanisms between powerful and weak focal firms. Despite the growing debate between TCE and KBV in the strategy literature, we simultaneously apply these two views in our research framework and find interesting results. Similar to Modi and Mabert (2007), we argue that it is important to note that these two views are forming one framework for SCI research. Seeking the common ground while reserving differences may be a better way to facilitate the development of such theory.

### 5.3 Managerial implications

Our results also provide several managerial implications. First, supply chain learning is found to exert strong mediation effects on the relationships between SCI and customer service performance and between SCI and innovation performance for weak focal firms. In general, managers should pay attention to the importance of travail, of plain honest hard work by all parties (i.e. both the focal firm and its key supply chain partners), in generating the habituation between parties that drives trust and transparency during supply chain learning (Akkermans *et al.*, 2004). In practice, weak focal firms should identify and support informal controls, structures, and activities that encourage intensity in communication and dialog, both internally and with its key supply chain partners (Coyte *et al.*, 2012). In contrast, powerful focal firms should first deter from overusing their power. They should alleviate the pressure on their weak partners' knowledge transfer. For example, they can develop relationship-specific investments to build a supplier association and facilitate supplier team membership (Lawson and Potter, 2012). In this way, weak partners will have more willingness to share their knowledge that, in the end, benefits powerful focal firms' performance.

Second, both powerful focal firms and weak focal firms can benefit from imitation prevention, but in different ways. For powerful focal firms, their advantage is on knowledge application. Therefore, keeping their merits on research capabilities to harvest new knowledge, together with the facilitation of weak partners' knowledge transfer, will help them leverage more benefits. While for weak focal firms, their advantage is on managing knowledge transfer. Thus, maintaining their merits on knowledge transfer, with the improvement of their research capabilities for knowledge application, will guarantee their future prosperity. A fit between one organization's needs and another's resource requirements is thus an essential prerequisite in partner selection and relationship maintenance (Seabright *et al.*, 1992). Managers should be aware of this issue and engage into strategic collaborations (Caniëls and Gelderman, 2007).

Third, SCI positively influences both customer service performance and innovation performance for all firms, suggesting that all managers should combine both supplier integration and customer integration to satisfy current customers and retain current customers and attract new customers as early as possible. In practice, managers should facilitate integration efforts, such as information sharing, synchronized replenishment, and collaborative product design and development (Kulp *et al.*, 2004). For instance, Seven-Eleven Japan (SEJ), a successful convenience store chain, has integrated with its key supply chain

partners to quickly respond to changes in supply and demand. Well before the internet era, SEJ used satellite connections and other techniques to link all its stores with distribution centers, suppliers, and logistics service providers. Such integration allows its supply chain to detect fluctuations in supply and demand, alerting suppliers to potential shifts in requirements and ensuring that the company restocks at the right time (Lee, 2004).

#### 5.4 Limitations and future research

The findings of this study must be viewed in light of its limitations. First, our survey took the standpoint of focal firms. It is difficult to include performance of other members of the supply chain in one survey because it is always biased to ask a manager from the focal firm to assess the whole supply chain performance (van der Vaart and van Donk, 2008). We encourage future researchers to develop parallel surveys to overcome this drawback. Second, our sample is based on Chinese enterprises. Especially considering that China has a high power distance that ensures an acceptance of power inequalities (Hofstede, 1980), whether our results can be applied internationally needs to be investigated in the future. Third, our responses were all from young executives who had four years' work experience on average. Their average four years of experience leads us to believe that they are experienced enough to respond to our questions. However, a sample of top-level executives may provide additional input for similar future research. Fourth, most of our data were declarative and perceptual. For our respondents, their perception on SCI and inter-organizational learning may be reasonable and reliable, but their evaluation on performance may be subject to improvement. Therefore, future research is recommended to include objective data (e.g. accounting data), especially for performance evaluation. Finally, analogous to similar research in SCI, our study utilized cross-sectional data. It would be interesting for future researchers to examine longitudinal data, including the evolution of SCI.

#### References

- Akkermans, H., Bogerd, P. and van Doremalen, J. (2004), "Travail, transparency and trust: a case study of computer-supported collaborative supply chain planning in high-tech electronics", *European Journal of Operational Research*, Vol. 153 No. 2, pp. 445-456.
- Autry, C.W., Rose, W.J. and Bell, J.E. (2014), "Reconsidering the supply chain integration-performance relationship: in search of theoretical consistency and clarity", *Journal of Business Logistics*, Vol. 35 No. 3, pp. 275-276.
- Bagozzi, R.P. and Youjae, Y. (1988), "On the evaluation of structural equation models", *Journal of the Academy of Marketing Science*, Vol. 16 No. 1, pp. 74-94.
- Baron, R.M. and Kenny, D.A. (1986), "The moderator-mediator variable distinction in social psychological research: conceptual, strategic, and statistical considerations", *Journal of Personality and Social Psychology*, Vol. 51 No. 6, pp. 1173-1182.
- Bessant, J., Kaplinsky, R. and Lamming, R. (2003), "Putting supply chain learning into practice", *International Journal of Operations & Production Management*, Vol. 23 No. 2, pp. 167-184.
- Caniëls, M.C.J. and Gelderman, C.J. (2007), "Power and interdependence in buyer supplier relationships: a purchasing portfolio approach", *Industrial Marketing Management*, Vol. 36 No. 2, pp. 219-229.
- Cao, M. and Zhang, Q. (2011), "Supply chain collaboration: impact on collaborative advantage and firm performance", *Journal of Operations Management*, Vol. 29 No. 3, pp. 163-180.
- Cassel, M.C., Hackl, P. and Westlund, A.H. (2000), "On measurement of intangible assets: a study of robustness of partial least squares", *Total Quality Management*, Vol. 11 No. 7, pp. 897-907.
- Chang, W., Ellinger, A.E., Kim, K.K. and Franke, G.R. (2016), "Supply chain integration and firm financial performance: a meta-analysis of positional advantage mediation and moderating factors", *European Management Journal*, Vol. 34 No. 3, pp. 282-295.



- Chavez, R., Yu, W., Gimenez, C., Fynes, B. and Wiengarten, F. (2015), "Customer integration and operational performance: the mediating role of information quality", *Decision Support Systems*, Vol. 80, pp. 83-95.
- Chin, W.W. (1998), "The partial least squares approach to structural equation modeling", in Marcoulides, G.A. (Ed.), *Modern Methods for Business Research*, Lawrence Erlbaum Associates, Mahwah, NJ, pp. 295-336.
- Cox, A., Watson, G., Lonsdale, C. and Sanderson, J. (2004), "Managing appropriately in power regimes: relationship and performance management in 12 supply chain cases", *Supply Chain Management: An International Journal*, Vol. 9 No. 5, pp. 357-371.
- Coyte, R., Ricceri, F. and Guthrie, J. (2012), "The management of knowledge resources in SMEs: an Australian case study", *Journal of Knowledge Management*, Vol. 16 No. 5, pp. 789-807.
- Derfus, P.J., Maggitti, P.G., Grimm, C.M. and Smith, K.G. (2008), "The red queen effect: competitive actions and firm performance", *Academy of Management Journal*, Vol. 51 No. 1, pp. 61-80.
- Dunn, S.C., Seaker, R.F. and Waller, M.A. (1994), "Latent variables in business logistics research: scale development and validation", *Journal of Business Logistics*, Vol. 15 No. 2, pp. 145-172.
- Dyer, J.H. and Singh, H. (1998), "The relational view: cooperative strategy and sources of interorganizational competitive advantages", *Academy of Management Review*, Vol. 23 No. 4, pp. 660-679.
- Esper, T.L., Ellinger, A.E., Stank, T.P., Flint, D.J. and Moon, M. (2009), "Demand and supply integration: a conceptual framework of value creation through knowledge management", *Journal of the Academy of Marketing Science*, Vol. 38 No. 1, pp. 5-18.
- Fabbe-Costes, N. and Jahre, M. (2008), "Supply chain integration and performance: a review of the evidence", *The International Journal of Logistics Management*, Vol. 19 No. 2, pp. 130-154.
- Farahani, R.Z., Rezapour, S., Drezner, T. and Fallah, S. (2014), "Competitive supply chain network design: an overview of classifications, models, solution techniques and applications", *Omega*, Vol. 45, pp. 92-118.
- Flint, D.J., Larsson, E. and Gammelgaard, B. (2008), "Exploring processes for customer value insights, supply chain learning and innovation: an international study", *Journal of Business Logistics*, Vol. 29 No. 1, pp. 257-281.
- Flynn, B.B., Huo, B. and Zhao, X. (2010), "The impact of supply chain integration on performance: a contingency and configuration approach", *Journal of Operations Management*, Vol. 28 No. 1, pp. 58-71.
- Fornell, C. and Larcker, D.F. (1981), "Evaluating structural equation models with unobservable variables and measurement error", *Journal of Marketing Research*, Vol. 18 No. 1, pp. 39-50.
- Gimenez, C. and Ventura, E. (2005), "Logistics-production, logistics-marketing and external integration: their impact on performance", *International Journal of Operations & Production Management*, Vol. 25 No. 1, pp. 20-38.
- Grant, R.M. (1996), "Prospering as in dynamically-competitive environments: organizational capability as knowledge integration", *Organization Science*, Vol. 7 No. 4, pp. 375-387.
- Hair, J.F., Ringle, C.M. and Sarstedt, M. (2011), "PLS-SEM: indeed a silver bullet", *The Journal of Marketing Theory and Practice*, Vol. 19 No. 2, pp. 139-152.
- Hofstede, G. (1980), *Culture's Consequences: International Differences in Work-related Values*, Sage Publications, Beverly Hills, CA.
- Homburg, C. and Stock, R.M. (2004), "The link between salespeople's job satisfaction and customer satisfaction in a business-to-business context: a dyadic analysis", *Journal of the Academy of Marketing Science*, Vol. 32 No. 2, pp. 144-158.
- Jansen, J.J.P., van den Bosch, F.A.J. and Volberda, H.W. (2005), "Managing potential and realised absorptive capacity: how do organisational antecedents matter?", *Academy of Management Journal*, Vol. 44 No. 6, pp. 999-1015.

- Jean, R.J.B., Kim, D. and Sinkovics, R.R. (2012), "Drivers and performance outcomes of supplier innovation generation in customer-supplier relationships: the role of power-dependence", *Decision Sciences*, Vol. 43 No. 6, pp. 1003-1038.
- Ketchen, D.J. and Hult, G.T.M. (2007), "Toward greater integration of insights from organization theory and supply chain management", *Journal of Operations Management*, Vol. 25 No. 2, pp. 455-458.
- Kim, S.W. (2006), "Effects of supply chain management practices, integration and competition capability on performance", *Supply Chain Management: An International Journal*, Vol. 11 No. 3, pp. 241-248.
- Kobashi, T. and Fujikawa, N. (2009), "A research on development of inter-organizational learning: through the case of an international strategic alliance", *Journal of International Business Research*, Vol. 8 No. 2, pp. 29-41.
- Kogut, B. and Zander, U. (1992), "Knowledge of the firm, combinative capabilities, and the replication of technology", *Organization Science*, Vol. 3 No. 3, pp. 383-397.
- Koufteros, X., Vonderembse, M. and Jayaram, J. (2005), "Internal and external integration for product development: the contingency effects of uncertainty, equivocality, and platform strategy", *Decision Sciences*, Vol. 36 No. 1, pp. 97-133.
- Koufteros, X.A., Cheng, T.C.E. and Lai, K.-H. (2007), "'Black-box' and 'gray-box' supplier integration in product development: antecedents, consequences and the moderating role of firm size", *Journal of Operations Management*, Vol. 25 No. 4, pp. 847-870.
- Kulp, S.C., Lee, H.L. and Ofek, E. (2004), "Manufacturer benefits from information integration with retail customers", *Management Science*, Vol. 50 No. 4, pp. 431-444.
- Lane, P.J., Koka, B. and Pathak, S. (2006), "The reification of absorptive capacity: a critical review and rejuvenation of the construct", *Academy of Management Review*, Vol. 31 No. 4, pp. 833-863.
- Lau, A.K.W., Yam, R.C.M. and Tang, E.P.Y. (2010), "Supply chain integration and product modularity: an empirical study of product performance for selected Hong Kong manufacturing industries", *International Journal of Operations & Production Management*, Vol. 30 No. 1, pp. 20-56.
- Lawson, B. and Potter, A. (2012), "Determinants of knowledge transfer in inter-firm new product development projects", *International Journal of Operations & Production Management*, Vol. 32 No. 10, pp. 1228-1247.
- Lee, H.L. (2004), "The triple-a supply chain", *Harvard Business Review*, Vol. 82 No. 10, pp. 102-112, 157.
- Lee, C.W., Kwon, I.-W.G. and Severance, D. (2007), "Relationship between supply chain performance and degree of linkage among supplier, internal integration, and customer", *Supply Chain Management: An International Journal*, Vol. 12 No. 6, pp. 444-452.
- Lee, H., Smith, K.G., Grimm, C.M. and Schomburg, A. (2000), "Timing, order and durability of new product advantages with imitation", *Strategic Management Journal*, Vol. 21 No. 1, pp. 23-30.
- Leuschner, R., Rogers, D.S. and Charvet, F. (2013), "A meta-analysis of supply chain integration and firm performance", *Journal of Supply Chain Management*, Vol. 49 No. 2, pp. 34-57.
- Li, S., Ragu-Nathan, B., Ragu-Nathan, T.S. and Rao, S.S. (2006), "The impact of supply chain management practices on competitive advantage and organizational performance", *Omega*, Vol. 34 No. 2, pp. 107-124.
- Mackelprang, A.W., Robinson, J.L., Bernardes, E. and Webb, G.S. (2014), "The relationship between strategic supply chain integration and performance: a meta-analytic evaluation and implications for supply chain management", *Journal of Business Logistics*, Vol. 35 No. 1, pp. 71-96.
- Maloni, M. and Benton, W.C. (2000), "Power influence in the supply chain", *Journal of Business Logistics*, Vol. 21 No. 1, pp. 49-74.
- Manuj, I., Omar, A. and Yazdanparast, A. (2013), "The quest for competitive advantage in global supply chains: the role of interorganizational learning", *Transportation Journal*, Vol. 52 No. 4, pp. 463-492.
- Modi, S.B. and Mabert, V.A. (2007), "Supplier development: improving supplier performance through knowledge transfer", *Journal of Operations Management*, Vol. 25 No. 1, pp. 42-64.

- Mohr, J.J. and Sengupta, S. (2002), "Managing the paradox of inter-firm learning: the role of governance mechanisms", *Journal of Business & Industrial Marketing*, Vol. 17 No. 4, pp. 282-301.
- Mohr, J.J. and Spekman, R. (1994), "Characteristics of partnership success: characteristics of partnership, partnership communication and conflict resolution techniques", *Strategic Management Journal*, Vol. 15 No. 2, pp. 135-152.
- Mowery, D.C., Oxley, J.E. and Silverman, B. (1996), "Strategic alliances and interfirm knowledge transfer", *Strategic Management Journal*, Vol. 17 No. S2, pp. 77-91.
- Nonaka, I. (1994), "A dynamic theory knowledge of organizational creation", *Organization Science*, Vol. 5 No. 1, pp. 14-37.
- Nunnally, J.C. (1978), *Psychometric Theory*, McGraw-Hill, New York, NY.
- Pagell, M. (2004), "Understanding the factors that enable and inhibit the integration of operations, purchasing and logistics", *Journal of Operations Management*, Vol. 22 No. 5, pp. 459-487.
- Pil, F.K. and Cohen, S.K. (2006), "Modularity: implications for imitation, innovation, and sustained advantage", *Academy of Management Review*, Vol. 31 No. 4, pp. 995-1011.
- Podsakoff, P.M., MacKenzie, S.B., Lee, J.-Y. and Podsakoff, N.P. (2003), "Common method biases in behavioral research: a critical review of the literature and recommended remedies", *Journal of Applied Psychology*, Vol. 88 No. 5, pp. 879-903.
- Preacher, K.J. and Leonardelli, G.J. (2003), "Calculation for the Sobel test", available at: [http://people.hofstra.edu/Jeffrey\\_J\\_Froh/Website\\_Fall\\_08/Interactive%20Mediation%20Tests.htm](http://people.hofstra.edu/Jeffrey_J_Froh/Website_Fall_08/Interactive%20Mediation%20Tests.htm) (accessed April 4, 2017).
- Ringle, C.M., Wende, S. and Will, S. (2005), *SmartPLS 2.0 (M3) Beta*, Hamburg, available at: [www.smartpls.de](http://www.smartpls.de) (accessed September 27, 2013).
- Seabright, M., Levinthal, D. and Fichman, M. (1992), "The role of individual relationships in interorganizational attachments", *Academy of Management Journal*, Vol. 35 No. 1, pp. 122-160.
- Shao, X.-F. (2013), "Supply chain characteristics and disruption mitigation capability: an empirical investigation in China", *International Journal of Logistics: Research and Applications*, Vol. 16 No. 4, pp. 277-295.
- Simonin, B.L. (2004), "An empirical investigation of the process of knowledge transfer in international strategic alliances", *Journal of International Business Studies*, Vol. 35 No. 5, pp. 407-427.
- Sobel, M.E. (1982), "Asymptotic confidence intervals for indirect effects in structural equation models", *Sociological Methodology*, Vol. 13, pp. 290-312.
- Spekman, R.E., Spear, J. and Kamauff, J. (2002), "Supply chain competency: learning as a key component", *Supply Chain Management: An International Journal*, Vol. 7 No. 1, pp. 41-55.
- Swink, M., Narasimhan, R. and Wang, C. (2007), "Managing beyond the factory walls: effects of four types of strategic integration on manufacturing plant performance", *Journal of Operations Management*, Vol. 25 No. 1, pp. 148-164.
- Tenenhaus, M., Vinzi, V.E., Chatelin, Y.M. and Lauro, C. (2005), "PLS path modeling", *Computational Statistics and Data Analysis*, Vol. 48 No. 1, pp. 159-205.
- Tsinopoulos, C. and Mena, C. (2015), "Supply chain integration configurations: process structure and product newness", *International Journal of Operations & Production Management*, Vol. 53 No. 10, pp. 1437-1459.
- Van der Vaart, T. and van Donk, D.P. (2008), "A critical review of survey-based research in supply chain integration", *International Journal of Production Economics*, Vol. 111 No. 1, pp. 42-55.
- Van Wijk, R., Jansen, J.J.P. and Lyles, M.A. (2008), "Inter- and intra-organizational knowledge transfer: a meta-analytic review and assessment of its antecedents and consequences", *Journal of Management Studies*, Vol. 45 No. 4, pp. 830-853.
- Vickery, S.K., Jayaram, J., Droge, C. and Calantone, R. (2003), "The effects of an integrative supply chain strategy on customer service and financial performance: an analysis of direct versus indirect relationships", *Journal of Operations Management*, Vol. 21 No. 5, pp. 523-539.

- 
- Webster, J. (1995), "Networks of collaboration or conflict? Electronic data interchange and power in the supply chain", *Journal of Strategic Information Systems*, Vol. 4 No. 1, pp. 31-42.
- Williamson, O.E. (1975), *Markets and Hierarchies*, The Free Press, New York, NY.
- Wu, G.-C. (2013), "The influence of green supply chain integration and environmental uncertainty on green innovation in Taiwan's IT industry", *International Journal of Operations & Production Management*, Vol. 18 No. 8, pp. 539-552.
- Young, G., Smith, K.G. and Grimm, C.M. (1996), "Austrian' and industrial organization perspectives on firm-level competitive activity and performance", *Organization Science*, Vol. 7 No. 3, pp. 243-254.
- Zack, M., McKeen, J. and Singh, S. (2009), "Knowledge management and organizational performance: an exploratory analysis", *Journal of Knowledge Management*, Vol. 13 No. 6, pp. 392-409.
- Zander, U. and Kogut, B. (1995), "Knowledge and the speed of the transfer and imitation of organizational capabilities: an empirical test", *Organization Science*, Vol. 6 No. 1, pp. 76-92.
- Zhao, X., Huo, B., Flynn, B. and Yeung, J. (2008), "The impact of power and relationship commitment on the integration between manufacturers and customers in a supply chain", *Journal of Operations Management*, Vol. 26 No. 3, pp. 368-388.
- Zhu, Q. and Sarkis, J. (2004), "Relationships between operational practices and performance among early adopters of green supply chain management practices in Chinese manufacturing enterprises", *Journal of Operations Management*, Vol. 22 No. 3, pp. 265-289.

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