Adoption of internet-enabled supply chain management systems

Differences between buyer and supplier perspectives

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Abstract

Purpose – Based on the factors derived from the structural embeddedness theory, the purpose of this paper is to investigate the antecedents to the adoption intention for eSCM from two perspectives: buyer and supplier. The six factors examined in this study are product complexity, product specificity, the number of partners, relationship duration, dependence disadvantage and dependence advantage.
Design/methodology/approach – A questionnaire was designed to collect data from Mainland China with 206 valid data received. Regression analysis was employed to test the hypotheses proposed.
Findings – The differences in the results show that product specificity and dependence disadvantage are significant determinants of eSCM adoption for buyers' perspective, but not from that of suppliers. In addition, product complexity and dependence advantage (although negatively associated with eSCM adoption) are significant for suppliers, but not for buyers. Number of partners and relationship duration are significant determinants from both perspectives.
Originality/value – This research contributes to understanding on how the factors embedded in an exchange structure influence the adoption of eSCM from the angles of both the buyers and suppliers. We fill the research gap in the existing literature by recognizing the differences in the roles of the buyer and supplier regarding the antecedents to eSCM adoption.

Keywords Supply chain management, Buyer-seller relationship, Internet-enabled systems, Product characteristics, Structural embeddedness

Paper type Research paper

1. Introduction

Inter-organizational systems (IOS), through facilitating information sharing, integrating business processes and coordinating work flows among supply chain partners, are suggested to be an essential part for successful supply chain management (Lancioni *et al.*, 2000; Boyer and Hult, 2005). The recent advance of Extensible Markup Language and web services technology has introduced more powerful IOS solutions to enhance supply chain collaboration (Rai *et al.*, 2006; Liu *et al.*, 2010; Venkatesh and Bala, 2012). Among them, internet-enabled supply chain management systems (eSCM), such as the services provided by SAP, Oracle and IBM e-business, have been gaining greater traction as the technical enablers of efficient SCM (Ke *et al.*, 2009). Compared with the traditional forms of IOS, e.g., Electronic Information Exchange (EDI), eSCM require lower implementation and maintenance costs, have decreased technical complexity and can provide improved information exchange capabilities. Therefore, eSCM are expected to resolve the inherent

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trade-off between costs and efficiency characterizes EDI (Zhu *et al.*, 2006). With eSCM, supply chain partners can exchange rich content information about inventory, product design and technical knowledge, integrate business processes, and perform joint planning and decision making, which can lead to positive synergistic effects in the supply chain (Gosain *et al.*, 2003; Ke *et al.*, 2009; Chang and Shaw, 2009). Despite the promising prospects of eSCM, attaining the purported benefits has been challenging (Yao *et al.*, 2007; Cao *et al.*, 2013). Due to the interdependence and network effects, the benefits of eSCM adoption can be distributed unevenly because more powerful organizations can exploit more benefits at the expense of the less powerful partners (Zhu *et al.*, 2006; Zhao *et al.*, 2007). The resulted high uncertainties make it difficult to predict the outcomes from adoption (Weitzel *et al.*, 2006), which, consequently, has impeded the broader diffusion of eSCM. The insufficient adoption of eSCM represents a significant stumbling block for attaining competitive supply chain network, entailing a better understanding of the determinants of eSCM adoption to provide implications facilitating adoption among firms (Ke *et al.*, 2009; Liu *et al.*, 2010).

IOS adoption has received considerable attention from the past literature. However, discrepancy in the perspectives of supplier and buyer are scantly studied. A large number of studies investigated the phenomenon from either the perspective of buyer (e.g. Chwelos *et al.*, 2001; Zhang and Dhaliwal, 2009; Zhu *et al.*, 2006), or the perspective of supplier (e.g. Hart and Saunders, 1998), or treated buyer and supplier positions as a whole (e.g. Chong *et al.*, 2009; Chan *et al.*, 2012; Zhou *et al.*, 2018). There has been raising awareness in the research community recognizing the importance of comparing both buyer and supplier perspectives (Geiger *et al.*, 2012; Nyaga *et al.*, 2010; Kim *et al.*, 2010). It was found that due to power asymmetry, the determinants of inter-organizational cooperation are different between buyer and supplier. Switching costs and trust, for instance, were identified to be significant antecedents to cooperation for buyer, but insignificant for supplier (Kim *et al.*, 2010). Research also showed that supplier and buyer might benefit differently from collaboration. Corsten and Kumar (2005) indicated that suppliers perceive a greater sense of inequity and may feel they deserve more than what they actually receive from a collaborating relationship. Therefore, the difference between buyer and supplier perspectives may have profound impact on behavioral intentions (Geiger *et al.*, 2012). This study aims at expanding previous IOS adoption studies by incorporating both buyer and supplier perspectives to determine how these two perspectives differ in eSCM adoption.

This study investigates the determinants of eSCM adoption based on the factors derived from the structural embeddedness theory, which suggests firms are embedded in network of various relationships (Uzzi, 1997). The configuration of network can have significant influence on firms' strategic behaviors. Accordingly, network properties, especially network tie structure and exchange structure, are suggested to be important determinants shaping the value created from IOS (Tang *et al.*, 2011), which may, in turn, affect firms' adoption behaviors. The objective of this paper is hence to examine the influence of network ties and exchange structure on eSCM adoption intention from buyer and supplier perspectives. Comparing buyer and supplier perspectives is of both theoretical and practical importance because it contributes to enhanced understanding of how to promote eSCM adoption in industrial practitioners based on their major positions in the supply chain.

2. Theoretical background and research hypotheses

2.1 Structural embeddedness theory

Early research has extensively employed the classical diffusion of innovation theory (DOI) to investigate IOS adoption (Kreuzer *et al.*, 2014; Robey *et al.*, 2008). However, because of DOI's relatively generic typology of technology properties, in prior studies, IOS seems to have no distinctive characteristics that are different from other technologies (Robey *et al.*, 2008). Especially, there lacks an awareness of IOS's peculiarity as networked systems and

the significance of the network structures in which IOS is embedded (Tang *et al.*, 2011; Kreuzer *et al.*, 2014). Although recent studies focusing on network externalities expanded beyond classical model and revealed more complex associations between network properties and IOS adoption (Robey *et al.*, 2008; Zhu *et al.*, 2006; Weitzel *et al.*, 2006), the perspective that a network structure can have significant influence on IOS is still not very evident in the literature (Tang *et al.*, 2011). Therefore, this study aims at addressing the knowledge gap and enhancing the understanding of the relationship between network factors and IOS adoption.

The focus on network structure naturally drives our attention to the embeddedness theory, which explains organizational behaviors and the logic of exchange due to firms' embeddedness in networks of repetitive market and personal relations (Granovetter, 1985; Uzzi, 1997; Dacin *et al.*, 1999). Unlike the traditional theoretical paradigms such as DOI which commonly assume that firms are independent, self-sustaining economic entities that make decisions solely based on a single firm's perspective, the embeddedness theory suggests that firms are embedded in networks of relationships that have significant influence on their organizational behaviors (Tang *et al.*, 2011; Pu *et al.*, 2016). There are majorly two dimensions of embeddedness (Rossignoli and Ricciardi, 2015): relational embeddedness which emphasizes the quality of the personal relationships developed by the people involved in the organization (Uzzi, 1997), and structural embeddedness which concerns the key properties of the network itself, e.g., the number of relationships, the level of network closure and density, and the structure of ties.

This paper focuses on the dimension of structural embeddedness, which, through affecting the influence of inter-organizational relationships on network performance, may promote more networking behaviors (Rossignoli and Ricciardi, 2015). Prior studies have established the relationship between network configurations and firms' strategic conduct (Gulati, 1999; McEvily and Zaheer, 1999). Embedded networks are suggested to have positive influence on cooperative norms that can foster mutually beneficial relationships (Granovetter, 1985; Coleman, 1988). Therefore, the structural embeddedness perspective can be employed as an appropriate theoretical foundation to examine how network characteristics can influence the adoption of eSCM as facilitator of inter-organizational collaboration.

Past studies have identified a wide range of structural attributes to characterize the configurations of inter-organizational network (Löhe and Legner, 2010). Some of widely studied factors are concerned with firm-level network properties, e.g., network centrality and structural autonomy (Devi *et al.*, 2006), or pair-level network properties, e.g., structural equivalence (Wasserman and Faust, 1994). With a focus on the network contexts in which firms are embedded, the present study investigates what are suggested to be the important network-level factors: exchange structure and tie structure (Tang *et al.*, 2011).

2.2 Exchange structure and adoption intention of eSCM

The content of exchange are important factors to consider in exchange structure (Tang *et al.*, 2011), which concerns the properties of the products exchanged in the supply chain. According to Malone *et al.* (1987), there are two critical product attributes – product complexity and product specificity – affecting the content of exchange. Product complexity measures how much information is required to describe the attributes and specifications of a product, while product specificity refers to the extent to which a product is tailored or customized for a specific firm such that it cannot be readily utilized by other firms in the market (Son and Benbasat, 2007). Although a product can be highly complex and specific at the same time, product complexity and specificity are independent attributes that do not necessarily appear in parallel (Malone *et al.*, 1987). Therefore, the two concepts should be investigated separately (Son and Benbasat, 2007).

For products that are highly complex in nature, generally a large amount of information is necessary to describe product specifications, which poses pressures on firms to improve information sharing ability. It is found that due to the limited capability of electronic markets to display detailed product descriptions, companies producing complex products are not likely to adopt electronic markets to manage the exchange of products (Son and Benbasat, 2007). The problem of inadequate information sharing can be addressed by eSCM, which can process complex products information and specifications. Therefore, a firm would be more willing to adopt eSCM when product complexity is high. We thus posit that:

H1. The higher the degree of product complexity, the greater is the intention to adopt eSCM.

When product specificity is high, supply chain partners need to closely coordinate and align the production processes (Chang, 2003). With eSCM, firms are better equipped to coordinate the supply chain. The costs of coordination can also be dramatically reduced through the automation of supply chain activities (Liu *et al.*, 2010). In addition, the relationship-specific assets involved in producing the highly specific products can lead to high degree of interdependency between the trading parties, which may foster a favorable condition for implementing eSCM. Therefore, we expect that high specificity will have positive effect on eSCM adoption, which leads to the following hypothesis:

H2. The higher the degree of product specificity, the greater is the intention to adopt eSCM.

2.3 Tie structure and adoption intention of eSCM

Tie structure describes the overall structure of the relationships among supply chain partners (Tang *et al.*, 2011). It is indicated that the characteristics of supply chain relationships have profound influence on IOS adoption by firms (Shah *et al.*, 2002, Choudhury, 1997). In this study, we examine the influence of tie structure on eSCM adoption by looking at relationship duration, number of partners and dependence structure.

Relationship duration measures the average length of the relationships a company keeps with its partners (Tang and Rai, 2012). The duration of an interfirm relationship can range from short-term, arm's length transaction arrangement to a close long-term partnership (Cannon and Perreault, 1999). The longer a relationship lasts, the stronger the relationship will be, and the more likely a common understanding will be shared by both parties of the relationship (Coleman, 1990). Therefore, relationship duration is an important indicator of the strength and depth of a relationship (Uzzi, 1997). A trading relationship is expected to continue in the future if it has lasted for a long time (Ganesan, 1994). When both trading parties hold the beliefs that the cooperation is going to be extended, there will be high motivation to adopt eSCM to maintain the relationship. In addition, it is easier to adopt eSCM with long-term partners as the business processes, standards and production routines have been well established. Furthermore, the mutual trust flourishes in long-term collaboration can mitigate the concern about leaking vital business secrets, which may encourage information sharing behaviors and enhance the willingness to deploy eSCM to facilitate cross-boundary information sharing. Thus, we posit that:

H3. The longer the duration of the relationships a firm has with its partners, the greater is the firm's intention to adopt eSCM.

Regarding the number of partners, a company can either maintain a large number of transactional relationships or a small group of selected partners (Matthyssens and Van den Bulte, 1994). Because of the high implementation and maintenance costs involved in EDI systems (Saeed *et al.*, 2005), companies pursuing supply chain integration have to forgo the benefits of trading in larger networks, which restricts the number of partners a firm can integrate through EDI (Weitzel *et al.*, 2006; Zhu *et al.*, 2006). Because eSCM requires less

relationship-specific investment, companies with a large number of partners can leverage network externalities with eSCM without letting go of the efficiency of close coordination. The more partners a company has, the greater positive network effects it can achieve from eSCM (Zhu *et al.*, 2006), and the more likely it will adopt eSCM. We therefore make the following hypothesis:

H4. The more partners a firm routinely interacts with, the greater is the firm's intention to adopt eSCM.

It is suggested that the structural patterns of interdependence can explain a firm's motive for relationship enhancement (Murray *et al.*, 1996). Central to dependence structure is the concept of power balance. In imbalanced relationships where one party is dependent on another, the powerful party is granted with dependence advantage due to the existence of net-positive dependence (Emerson, 1962).

When a firm is highly dependent on its trading partners, the relationships with the powerful partners are vital sources of its revenue. Therefore, a weak firm would be highly motivated to enhance the relationships with the powerful partners to sustain its access to important resources (Dwyer *et al.*, 1987). The less powerful firm would also display greater relational commitment and long-term orientation (Murray *et al.*, 1996), which will encourage the adoption of eSCM as relationship facilitator. In addition, collaborative information systems can act as supply chain risk mitigator for trading parties in a disadvantaged position (Lavastre *et al.*, 2014) because through jointly implementing eSCM with the powerful partners, the weak partners can be more assured about the continuance of the relationships with the valuable partners. We therefore posit that:

H5. The more a firm is dependent on its partners (i.e. dependence disadvantage), the greater is the firm's intention to adopt eSCM.

When a firm possesses greater power over its partners, it is endowed with the advantage of appropriating value from the relationships (Ghadge *et al.*, 2017). The powerful party can take actions that are adversarial to the weak partners, and there is low chance of retaliation. Therefore, the dominant party can easily request valuable information or favors from the weak partners, but does not need to return any reciprocal gesture (Lusch and Brown, 1996). As a result, despite the willingness of the weak partners to adopt eSCM as relationship catalyzer, to maximize supply chain flexibility, the powerful firm is not likely to invest in eSCM that may increase its switching costs. In addition, for a powerful company, the weak partners are generally considered to be of low value, which may reduce its willingness to adopt eSCM to enhance the relationships with the weak partners (Buchanan, 1992). We thus make the following hypothesis:

H6. The more a firm's partners are dependent on the firm (i.e. dependence advantage), the less is the firm's intention to adopt eSCM.

3. Methodology

3.1 Data collection

Since a company sources resources or services for production from the suppliers and sells the end products or services to the buyers, a supply chain participant can provide both the buyer and supplier perspectives at the same time. We thus designed the questionnaires into two sections, where the first section asking the respondents to answer from a buyer's angle, and, in the second section, the respondents were asked to answer the same questions again, but from a supplier's position. In this way, the questionnaire can acquire two sets of data representing the buyer and supplier perspectives, respectively.

We collected data in in Mainland China to test the proposed hypotheses. Following Liu *et al.* (2010), firms in the manufacturing and service industries were selected as the target sample. Collecting survey data is difficult in China (Zhu and Sarkis, 2004), especially, in the case of this study, requiring the respondents to think in the roles of a buyer and a supplier respectively. We thus obtained help from the Shenzhen Anti-Counterfeiting Association (SACA), a government-initiated association aiming at combating counterfeiting and improving product quality, to distribute the questionnaire among its member firms. As a government-founded organization, SACA consists of firms with various backgrounds, which can ensure the representativeness of the sample regarding firm size, industry and ownership.

A key informant who served an important position in SACA offered help to distribute the questionnaire to the executives or senior managers of 1,100 companies and asked them to forward the questionnaire to the sourcing experts or purchasing managers to complete the first section from the angle of a buyer. Next, the account managers of the company were invited to fill the second section of the questionnaire from a supplier's position. A cover letter from the key informant was attached with the questionnaire to ensure the response rate. The key informant sent a reminder two weeks after the first e-mail to facilitate response. In total, we received 397 responses (36 percent response rate) and 206 of them (52.6 percent completion rate) were valid for analysis. The demographic information of the data is demonstrated in Table I.

3.2 Construct measurement

The dependent variable adoption intention is measured by estimating whether a firm would actually adopt eSCM. We adapted all the independent variables from the previous literature. Product complexity, product specificity, dependence disadvantage, dependence advantage are specified as multi-item reflective constructs and are measured by a seven-point Likert scale, with 1 representing strongly disagree and 7 representing strongly agree. Relationship duration and number of partners are single item constructs by asking the respondents to provide appropriate numbers. The questionnaire items used to measure these constructs and the studies from which they were adapted from are shown in the Appendix.

Several control variables are included in the analysis. Based on whether a firm manufactures physical products or offers intangible services, industry type is coded as a dummy variable with 1 indicating the manufacturing industry and 0 indicating the service industry. The retail/wholesale, bank/insurance, transport/distribution and other services are relegated to the service industry (Mitra and Singhal, 2008). Organization type is measured by creating dummy variables to indicate whether a firm is state-owned, privately owned or foreign-controlled. The number of years of operation are also controlled because firms with older history are more likely to have legacy information systems. Firm size is measure by the number of employees and the yearly turnover.

4. Data analysis

4.1 Measurement validation

We performed confirmatory factor analysis to examine the construct validity and the unidimensionality of the multi-item measurements. Analysis of the buyer side and the supplier side models was conducted with LISREL 8.7 to test the fit indexes including the ratio of χ^2 to degree of freedom, root mean square error of approximation (RMSEA), the comparative fit index (CFI), the normed fit index (NFI), the non-normed fit index (NNFI) and the incremental fit index (IFI). Both the buyer side model ($\chi^2/df = 2.041$, RMSEA = 0.074, CFI = 0.95, NFI = 0.91, NNFI = 0.93, IFI = 0.95) and the supplier side model ($\chi^2/df = 2.33$, RMSEA = 0.079, CFI = 0.95, NFI = 0.92, NNFI = 0.94, IFI = 0.95) demonstrate reasonable model fit. All the constructs show adequate levels of reliability with the values of composite reliability and Cronbach's α exceeding the critical value of 0.70 (Table II).

	Count	Percentage
Turnover (RMB)		
Less than 1m	7	3.30
1–5m	27	12.74
5–10m	29	13.68
10–50m	49	23.11
50–100m	22	10.38
100m–1bn	55	25.94
Larger than 1bn	17	8.02
Number of employees		
Less than 100	113	53.30
100–300	46	21.70
300–500	16	7.55
500–1,000	9	4.25
1,000–5,000	15	7.08
Larger than 5,000	7	3.30
Years of operation		
1–5 years	12	5.66
6–10 years	39	18.40
11–15 years	54	25.47
Greater than 15 years	101	47.64
Industry		
Architecture/Engineering	7	3.30
Business services	3	1.42
Chemicals	11	5.19
Retail/trading	32	15.09
Computer/IT related	7	3.30
Manufacturing	125	58.96
Others	21	9.91
Organization type		
Multi-national	67	31.60
State-owned (fully/partly owned)	13	6.13
Local private owned	115	54.25
Local company with foreign ownership (JV)	11	5.19

Note: $N = 206$

Table I.
Data demographics

The results further reveal that, as shown in Table II, the factor loadings vary from 0.611 to 0.952, all exceeding the recommended threshold of 0.60. The values of the average variance extracted (AVE) range from 0.638 to 0.832, which are all above the critical value of 0.50 (Fornell and Larcker, 1981), suggesting that the variances explained by the items of each construct were greater than the unexplained variances. Both factor loadings and AVEs provide strong evidence for the convergent validity of the measurement model.

The discriminant validity of the model was analyzed by comparing the relationship between shared variances among constructs and the AVEs (Paulraj *et al.*, 2008). As suggested in Table III, for both the buyer and supplier side models, none of the correlations (off-diagonal values) are higher than the square roots of AVEs shown on the diagonal of the table, thus supporting the discriminant validity (Koufteros, 1999).

4.2 Hypothesis testing

Regression analysis was conducted for the buyer and the supplier model, respectively, to test the proposed hypotheses and the results are presented in Table IV. Product complexity

		Factor loadings		AVE		Composite reliability		Cronbach's α	
		Buyer side	Supplier side	Buyer side	Supplier side	Buyer side	Supplier side	Buyer side	Supplier side
Dependence disadvantage	DOP1	0.927	0.844	0.723	0.765	0.8862	0.7668	0.840	0.847
	DOP2	0.874	0.874						
	DOP3	0.740	0.904						
Dependence advantage	ADV1	0.855	0.952	0.803	0.832	0.924	0.937	0.878	0.912
	ADV2	0.935	0.960						
	ADV3	0.896	0.819						
Product complexity	PC1	0.961	0.894	0.750	0.821	0.904	0.932	0.872	0.893
	PC2	0.798	0.923						
	PC3	0.830	0.900						
Product specificity	PS1	0.832	0.854	0.638	0.648	0.840	0.845	0.711	0.72
	PS2	0.866	0.864						
	PS3	0.687	0.683						
Adoption intention	AI1	0.922		0.692		0.849		0.781	
	AI2	0.926							
	AI3	0.611							

Table II. Confirmatory factor analysis

($\beta = 1.78$, $p < 0.01$) was found to have a significant positive effect on adoption intention from the perspective of buyer. The complexity of the products a firm purchases, i.e. product complexity from buyer's position, however, did not show significant effect ($\beta = -0.020$, ns) on the intention to adopt eSCM. *H1*, therefore, is only supported by the perspective of supplier. In terms of product specificity, it was found to be positively related to adoption intention only for the buyer ($\beta = 0.152$, $p < 0.05$) but not for the supplier ($\beta = 0.049$, ns). In this connection, the support for *H2* is only found from the buyer's perspective.

For the characteristics of tie structure, a positive effect of the number of partners was found from both the perspectives of buyer ($\beta = 0.00029$, $p < 0.01$) and supplier ($\beta = 0.0003$, $p < 0.01$), rendering support for *H3*. The same findings applied for relationship duration as both the buyer ($\beta = 0.0306$, $p < 0.05$) and the supplier ($\beta = 0.0215$, $p < 0.05$) models showed significant positive influence.

In terms of dependence disadvantage, only buyer's perspective showed significant positive influence on adoption intention ($\beta = 0.164$, $p < 0.05$), supporting *H3*. The same evidence for *H3* was however not found from the perspective of supplier in that the dependence of suppliers on the buyers did not show significant influence on the intention to adopt eSCM ($\beta = 0.059$, ns). With regard to dependence advantage, no support was found from the perspective of buyer ($\beta = 0.055$, ns) while supplier's dependence advantage showed significant negative influence on adoption intention ($\beta = -0.165$, $p < 0.05$). Therefore, support for *H4* was found from the perspective of supplier.

The differences in the results show that product specificity and dependence disadvantage are significant determinants of eSCM adoption for buyers' perspective, but not from that of suppliers. In addition, product complexity and dependence advantage (although negatively associated with eSCM adoption) are significant for suppliers, but not for buyers. Number of partners and relationship duration are significant determinants from both perspectives.

5. Discussion and implications

The examination of exchange structure characteristics shows the difference between supplier and buyer toward product complexity and specificity. Product complexity is found to have significant positive influence on eSCM adoption from supplier's perspective, which is in line with the findings of Chong and Ooi (2008) and Chang (2003). Yet, product complexity is not

Table III. Discriminant validity test

		Buyer side										
		1	2	3	4	5	6	7	8	9	10	11
1	Adoption intention	*0.832*										
2	Product complexity	0.084	*0.866*									
3	Product specificity	0.188**	0.538**	*0.799*								
4	Dependence disadvantage	0.170*	0.167*	0.068	*0.850*							
5	Dependence advantage	0.144*	0.130	0.151*	0.461**	*0.896*						
6	No. of partners	0.142*	−0.151*	0.057	−0.143*	0.056	—					
7	Relationship duration	0.125	0.098	0.011	0.0703	0.097	0.011	—				
8	Industry	0.036	−0.029	0.123	0.100	0.138*	0.039	−0.014	—			
9	Organization type	−0.009	−0.019	−0.163*	−0.017	−0.168*	−0.121	−0.003	−0.187**	—		
10	Turnover	−0.006	0.007	0.015	−0.036	0.148*	0.0593	0.155*	0.160*	−0.398**	—	
11	No. of employee	0.066	0.063	0.076	−0.063	0.0695	−0.026	0.103	0.166*	−0.374**	0.636**	—
12	Years of operation	−0.044	0.113	0.010	0.087	0.168*	0.0160	0.364**	0.051	−0.200**	0.420**	0.443**
		Supplier side										
		1	2	3	4	5	6	7	8	9	10	11
1	Adoption intention	*0.831*										
2	Product complexity	0.148*	*0.906*									
3	Product specificity	0.137	0.543**	*0.805*								
4	Dependence disadvantage	−0.022	0.335**	0.193**	*0.875*							
5	Dependence advantage	−0.088	0.309**	0.207**	0.567**	*0.912*						
6	No. of partners	0.138*	−0.084	0.117	−0.201**	0.044	—					
7	Relationship duration	0.121	−0.058	−0.027	−0.030	−0.007	0.047	—				
8	Industry	0.034	−0.124	0.045	0.003	0.0191	0.0052	0.055	—			
9	Organization type	−0.009	0.029	−0.003	0.082	−0.071	−0.171*	−0.097	−0.187**	—		
10	Turnover	−0.006	−0.016	−0.083	−0.137*	0.140*	0.105	0.182**	0.160*	−0.398**	—	
11	No. of employee	0.066	−0.049	−0.112	−0.081	0.054	−0.011	0.116	0.166*	−0.374**	0.636**	—
12	Years of operation	−0.043	0.066	−0.060	0.011	0.189**	0.031	0.221**	0.0505	−0.200**	0.420**	0.443**

	Adoption intention	
	Buyer perspective	Supplier perspective
Constant	3.608*** (5.72)	4.337*** (7.39)
Control variables		
Industry (manufacturing)	0.139 (0.75)	0.145 (0.78)
Organization type	−0.341* (−1.72)	−0.391* (−1.86)
Organization type	0.0484 (0.14)	−0.0410 (−0.13)
Turnover	−0.0383 (−0.53)	−0.0321 (−0.39)
Number of employees	0.168* (1.87)	0.171* (1.77)
Years of operation	−0.203** (−2.05)	−0.115 (−1.14)
Exchange structure		
Product complexity	−0.020 (−0.27)	*0.178*** (2.67)
Product specificity	*0.152*** (2.08)	0.040 (0.59)
Tie structure		
Number of partners	*0.00029*** (6.23)	*0.00030*** (5.74)
Relationship duration	*0.0306*** (2.12)	*0.0215*** (2.54)
Dependence disadvantage	*0.164*** (2.031)	0.059 (0.71)
Dependence advantage	0.055 (0.82)	*−0.165*** (−2.12)
R^2	0.145	0.126
Adj. R^2	0.092	0.072

Table IV.
Hypothesis testing

Notes: *t*-statistics in parentheses. *$p < 0.1$; **$p < 0.05$; ***$p < 0.01$

significant from buyer's perspective. The differences in results reflect the importance for suppliers to provide product information. Therefore, when the products suppliers sell involve complex information, they will be more willing to adopt eSCM to attract customers. The results show that product specificity is significant from the perspective of buyer, but not from that of supplier. It generally takes a large amount of resources and time for a buyer to develop qualified suppliers to deliver products specifically tailored to the buyer's needs. Because it is difficult to find readily available suppliers in the market, the buyer would prefer to adopt eSCM to enhance collaboration to ensure continuous access to the specific products provided by the suppliers. Because of eSCM's decreased asset specificity, implementing eSCM may be no different for suppliers whose asset specificity is already very high. This may explain why product specificity is insignificant from supplier's perspective. The results generally support the theory of Malone *et al.* (1987) and extend their study by comparing buyer and supplier. Previous studies investigating product characteristics either did not differentiate between the buying position and the selling position (e.g. Chong *et al.*, 2009), or only examined the products suppliers sell (e.g. Chang, 2003), which failed to take account for the difference between products as inputs and products as outputs.

In terms of tie structure, the number of partners and relationship duration are significant from both the perspectives of buyer and supplier. The significant impact of the number of partners supports the positive network externalities generated by eSCM. With lower relationship-specific investments and enhanced integration capabilities, eSCM can resolve the trade-off between market mechanisms and rationalization of partners. With eSCM, firms can attain deep integration without reducing the number of relationships (White *et al.*, 2005), which will motivate firms with more partners to adopt eSCM due to greater network externalities. The significance of relationship duration confirms that for both buyer and suppliers, eSCM is valued as a powerful tool to further enhance collaboration in long-term relationships.

Dependence disadvantage is found to be positively associated with eSCM adoption for buyers, which is in line with Chong and Ooi (2008), Chong *et al.* (2009) and Zhang and

Dhaliwal (2009), who found that partners' power (mainly the suppliers') has significant positive effect IOS adoption of buyers. When buyers have less power, eSCM can be used as a tool to gain control over the suppliers by aligning business processes and increasing information visibility. With eSCM, buyers can monitor product design and production process more closely, which can reduce the risks of suppliers' opportunism.

Surprisingly, no evidence is found to support the significance of dependence disadvantage from supplier's perspective, which is not consistent with many studies based on the institutional theory, suggesting significant coercive pressures from powerful partners (Teo *et al.*, 2003; Venkatesh and Bala, 2007; Liu *et al.*, 2010). However, these studies did not differentiate between the roles of buyer and supplier. Our results thus extend prior studies by identifying that coercive pressures of suppliers are the significant factors forcing buyers to adopt IOS, whereas the pressures from dominant buyers are not significant affecting suppliers. This finding reflects the difficulty of many large companies in convincing their suppliers to adopt IOS together (Adebanjo and Laosirihongthong, 2014). One possible explanation could be that compared with buyers who have the initiative to start or continue a trading relationship, suppliers are less certain about whether their buyers will continue to source products from them. As a result, suppliers are not affected by the power of buyers in due to the fear that the investment will be for naught if the buyers suddenly terminate their relationships.

The results regarding dependence advantage show that suppliers are less likely to adopt eSCM when buyers are dependent on them. Because powerful suppliers normally produce products that are in short supply, or sell scarce resources that are not available elsewhere, there are always abundant customers approaching them. Thus, they are not likely to adopt eSCM to procure or retain customers. Surprisingly, dependence advantage was not significant from buyer's perspective. It could be because suppliers may still behave opportunistically even when even when they are dependent on buyers. Therefore, to reduce the risk of possible partner opportunism, buyers tend to adopt eSCM to monitor suppliers and ensure production cycles regardless of their advantaged position.

Although the concept of power in supply chain has been extensively examined (Chong and Ooi, 2008; Chong *et al.*, 2009; Zhang and Dhaliwal, 2009), most studies were conducted with the assumption that supply chain partners are more powerful. To the best of our knowledge, it is not yet known how companies will respond to the IOS adoption when they have more dependence advantage over supply chain partners. Our study thus fills the knowledge gap by identifying dependence advantage's significant negative influence from the perspective of suppliers, but not for buyers.

Furthermore, this study can provide practical implications to promote eSCM adoption in industrial practitioners. Our findings suggest that the determinants of eSCM adoption are different for firms in different strategic positions. Therefore, when convincing a firm to adopt eSCM, their major roles in the supply chain should be primarily concerned. For example, if a firm tries to promote eSCM diffusion in suppliers, it should emphasize the capability of eSCM to exchange complex, rich content information. In addition, practitioners should avoid promoting eSCM among powerful suppliers as they are not likely to adopt eSCM. When persuading buyers to adopt eSCM, the success rate will be greater among buyers purchasing highly specific products and those who are dependent on their suppliers.

6. Conclusions and limitations

The contribution of this study to the existing literature is two-folded. First, our results demonstrate important differences between the perspectives of buyer and seller regarding the determinants of eSCM adoption intention. Second, based on the structural embeddedness perspective, we expand the understanding of how network-level properties, specifically, exchange structure and tie structure, affect eSCM adoption. Through revealing the different

impacts that these factors have on adoption intention in the buyer side and the supplier side models, this study identifies the importance of differentiating the roles of buyer and supplier when investigating the IOS adoption. Previous studies only focused on one side of a trading relationship and ignored the fact that an organization can be a buyer and a supplier at the same time. This research therefore fills the knowledge gap and explores a promising direction for future studies investigating the adoption of IOS.

We acknowledge the narrowness of focusing on the adoption intention instead of the actual adoption level. Although it is suggested the estimation measure employed in the research can provide prediction of better performance (Sheppard *et al.*, 1988), adoption intention may fail to reflect the nomological net for actual adoption (Liu *et al.*, 2010). Future research can be conducted investigating the actual adoption level of eSCM. We also acknowledge that this research may be subject to limitations pertaining to cross-sectional data collected at a single point in time. The generalizability of the results may also be constrained by the research context, although the research has been conducted rigorously to ensure internal validity.

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Appendix. Questionnaire items

Adoption intention (adapted from Son and Benbasat, 2007; Liu *et al.*, 2010)
AI1: we are contemplating to adopt eSCM.
AI2: it is likely that our firm will take some steps to adopt eSCM in the future.
AI3: how soon do you think that your firm will adopt eSCM?

(1) Less than 6 months
(2) 6–12 months
(3) 12–18 months
(4) 18–24 months
(5) More than 24 months
(6) No plan

Product complexity (PC) (adapted from Malone *et al.*, 1987; Son and Benbasat, 2007)
PC1: a large amount of information is required to describe the products we buy (we sell).
PC2: many attributes are required to describe the products we buy (we sell).
PC3: the specifications of the products are relatively longer than other products we buy (we sell).

Product specificity (PS) (adapted from Malone *et al.*, 1987; Son and Benbasat, 2007)
PS1: the products we buy (we sell) need to be designed specifically to needs.
PS2: the products we buy (we sell) need to be customized (or tailored) specifically to needs.
PS3: the products we buy (we sell) are of value to only a small number of transaction partners.

Dependence disadvantage (adapted from Lusch and Brown, 1996)
DIS1: we are dependent on our major suppliers (buyers).
DIS2: our major suppliers (buyers) would be difficult to switch away.
DIS3: our major suppliers (buyers) would be costly to lose.

Dependence advantage (adapted from Lusch and Brown, 1996)
AD1: our major suppliers (buyers) are dependent on us.
AD2: our major suppliers (buyers) would find it difficult to switch away from us.
AD3: our major suppliers (buyers) would find it costly to lose us.

Average relationship duration (adapted from Rai *et al.*, 2012)
RD: please indicate the average duration of relationship with your core suppliers (buyers) (in years) ____.

Number of partners
NP: please indicate the number of suppliers (buyers) your firm routinely interacts with_____.

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