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ANTECEDENTS AND CONSEQUENCES OF TRUST IN SUPPLY CHAIN: THE ROLE OF INFORMATION TECHNOLOGY

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Abstract

Trust has been a central construct in studies of inter-firm relationships. Many operational, organizational, social, and cultural factors have been identified to have significant impact on inter-firm trust. In this study, we investigate the role of information technology in generating inter-firm trust and the consequences of this trust in the context of supply networks. Using structural equation modeling techniques, our data show that the level of information systems integration among the partner firms in a supply network significantly impacts the trust among the firms which, together with the integrated information systems, explains more than half of the variances in information sharing and business process coupling in the network. Given the substantial evidence in the literature on the impact of information sharing and process coupling on supply chain performance, we conclude that information systems integration among the partners is critical to supply network performance. We also confirm that information systems flexibility and use of standards in information systems significantly contribute to the level of systems integration among the partners in supply networks as suggested in prior studies. Our findings extend the current literature on inter-firm trust by considering the role of information technology in addition to other important factors already identified.

Keywords*: supply chain, supply network, trust, information sharing, process coupling, firm performance*

1. Introduction

Trust between business partners has been a central issue of research and considered as a critical factor to the operational success in a supply network (Gulati and Nickerson, 2008; Handfield and Bechtel, 2002; Kwon and Suh, 2004; Morgan and Hunt, 1994; Sahay, 2003; Welty and Becerra-Fernandez, 2001; Zaheer and Venkatraman, 1995). Research suggests that trust between partners increases the level of commitment and reduces the chance of opportunistic behavior from both parties, increases supply chain responsiveness, and improves market performance of the partners (Aulakh et al., 1996; Handfield and Bechtel, 2002). However, there are still significant debates about the nature of inter-firm trust and the role of such trust in inter-firm relationships and supply network performance (Sahay, 2003). Some scholars treated trust as a variable exogenous to an inter-firm relationship and investigated its impact on transaction cost, governance forms, and performance (Barney and Hansen, 1994; Krishnan et al., 2006; Zaheer and Venkatraman, 1995), while others conceptualized trust as a mediating variable between firm

level factors and inter-firm relationship and investigated its impact on outcomes such as commitment and conflicts (Kwon and Suh, 2004; Morgan and Hunt, 1994), supply chain responsiveness (Handfield and Bechtel, 2002), and partnership performance (Aulakh et al., 1996).

Despite these differences in the literature, inter-firm governance and supply chain management studies have clearly established the significant role of trust in inter-firm relationships and supply chain performance. What is not so clear in the literature is how trust is developed, nourished, strengthened, or weakened by the stakeholders of a supply chain or supply network, especially in the context of IT enabled integrated supply chain networks. The globalization of the economy and the rapid changing information technology have forced firms to increasingly rely on digitally enabled integrated supply chains as strategic resources to improve their competitive capabilities (Rai et al., 2006). Yet there is little discussion in the literature on the conceptualization and empirical validation of the role of IT, or more specifically the characteristics of corporate IT systems, in the development, sustainment, and improvement of trust between or among partners of a supply chain or supply network, leaving a major gap in supply chain and inter-firm relationship research. In addition, Klein and Rai (2007) argued that while the options available to share information in supply chain relationships have expanded, the relational and technological contexts that promote information sharing in the supply chains still require further examination.

In this study, we focus on the central questions of how the characteristics of information systems in the partner firms influence the trust among the partners and how this trust contributes to the critical success factors of supply networks such as process coupling and information sharing. The rest of the paper is arranged as follows. We first present a theoretical model based on literature review to articulate our central hypotheses that address the research questions. We then discuss the data collection and research methods. This is followed by the presentation of the structural equation modeling results with the data collected from actual supply networks. Finally the theoretical and practical implications of the findings as well as future research directions are discussed.

2. Theoretical Development

Based on a literature review on inter-firm relationship, supply chain performance, and IT enabled business processes and capabilities, we argue that one of the primary antecedents of inter-firm trust is information systems integration between the partners. Higher level of system and application integrations between the partners will increase the visibility of data in the supply chain, promote timely exchange of critical information, and facilitate tighter business process coupling or integration. These exchanges and integrations bind the partners closer together and create mutual expectations about the value, longevity and integrity of the relationship, which then leads the higher level of trust between the partners. In addition, while system and application level integrations certainly facilitate information sharing and business process coupling, they alone cannot predict how much information the partners are willing to share and how closely the partners want to tie their business processes. High level of trust, on the other hand, could lead to increased degree of information sharing and process integration enabled by the integrated IT infrastructure by reducing or eliminating concerns over opportunistic behaviors of the parties. We further argue that system and application level integration cannot be completed or effective without flexible IT systems in the partners that follow a common set of IT standards for inter-system operations. This set of conjectures is depicted in the research model as shown in Figure 1. The definitions for the constructs shown in the model are presented in Table 1.

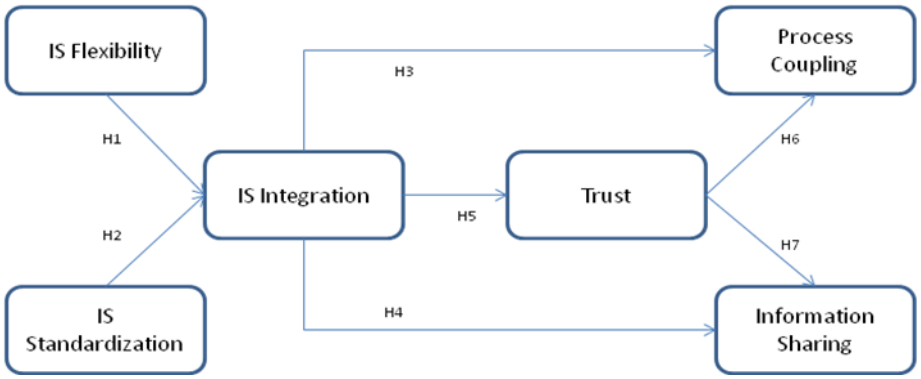

Figure 1: Research Model

Construct	Symbol	Definition	Sources for Measurement
Information System Flexibility	(ISF)	The degree of easiness that the IT systems in the partner firms can be reconfigured to support new applications and to accommodate for changes in business processes.	Gebauer and Schober (2006); Hanseth et al. (1996)
Information Systems Standardization	ISS	The degree of use of standard protocols, architecture, languages, and interfaces in communications, systems, and applications in the partner firms.	Hanseth et al. (1996); Malhotra et al. (2007)
Information Systems Integration	ISI	The extent to which the partner firms integrate their IT systems to provide visibility of data and to allow online information sharing and transaction execution across the supply chain.	Rai et al. (2006); Barua et al. (2004)
Inter-firm Trust	TST	The expectation by one firm that the other would not exploit its vulnerabilities when the opportunity to do so presents itself in an inter-firm relationship.	Krishnan et al. (2006)
Process Coupling	PRC	The degree to which the partner firms have integrated their business processes related to operations.	Rai et al. (2006); Saraf et al. (2007)
Information Sharing	IFS	The extent to which the partner firms share information about operations, tactics, and strategies in the supply network.	Rai et al. (2006); Saraf et al. (2007)

Table 1: Constructs and Definitions

IS flexibility becomes a critical antecednet to IS integration because of the proliferation of information technology platforms, services, and products in the recent decades, which has created significant challenges to firms that attempt to create integrated IT infrastructure and systems with their business partners. The incompatibility among data format, communication standards, functional interfaces, and other technical issues are further exacerbated by incompatible business rules, procedures, and processes in partner firms. Fortunately, a number of IT innovations have emerged, such as component-based and service-oriented software architectures, Web services, autonomous computing concepts, and mobile applications, that promise to offer greater flexibility in IT systems (Gebauer and Schober, 2006), significantly alleviated the difficulties. The standardization of inter-firm communications protocols on the Internet based platforms has significantly simplified interconnectivity issues among partnering firms in supply networks (Xiao et al., 2010). In a study of 41 supply chain partnerships, Malhotra et al. (2007) found that the use of standard electronic business interfaces (SEBI) in partner firms promotes bounding and bridging across supply chain partners yet without binding them inflexibly to specific partners, thus helps mutual adaption and collaborative information exchange. Saraf et al. (2007) found that IS flexibility strongly impact the degree of system integration with both customers and channel partners of a focal firm. Thus, other factors being equal, we propose that:

Hypothesis 1: In a supply network, higher level of IS flexibility in partner firms will lead to higher degree of IS integration among the partner firms.

Hypothesis 2: In a supply network, higher level of IS standardization in partner firms will lead to higher degree of IS integration among the partner firms.

IS integration in the supply chain has been recognized as a major factor in transforming IT capabilities in partner firms into supply chain performance (Barua et al., 2004; Rai et al., 2006). Integrated IT systems facilitate information flow among partners, which in turn contributes to supply chain process integration (Rai et al., 2006). High levels IS integration among partners indicate timely or immediate accessibility of data to other partners once captured by one partner, which requires not only syntactic level integration between databases and application but also semantic level integration including joint forecasting, buffering inventories, and managing logistics (Saraf et al., 2007). While higher level of system integration alone will not assure higher level of information sharing and business process coupling, lower level of system integration will certainly adversely affect these two critical supply chain activities. Thus, other factors being equal, we can reasonably argue that:

Hypothesis 3: In a supply network, higher degree of IS integration among partner firms will lead to higher degree of business process coupling among the partner firms.

Hypothesis 4: In a supply network, higher degree of IS integration among partner firms will lead to higher degree of information sharing among the partner firms.

Inter-firm trust has been a major construct in inter-organizational governance research (Aulakh et al., 1996; Gulati and Nickerson, 2008; Möllering, 2002; Ratnasingam, 2005; Zaheer and Venkatraman, 1995). Research suggests that this trust has at least three interrelated roles in inter-firm relationships: as an important deterrent to opportunistic behavior of the partners in the relationship; as a substitute for hierarchical governance when ownership-control is not strategically viable or economically feasible; and as a contributor to market performance and efficiency of the firms in the relationship (Aulakh et al., 1996). However, these are primarily high level organizational outcomes that are usually complicated by many other organizational, operational, social, and cultural variables in inter-organizational context, as studies have shown (Dyer and Singh, 1998; Poppo and Zenger, 2002). Following the approach of Rai et al. (2006), we seek to understand how information systems-related capabilities engender inter-firm trust and in turn how inter-firm trust strengthens critical relational dimensions of business process coupling and information sharing. Though these two relational dimensions are our eventual dependent variables, a central premise of our model is that they are also important drivers of organizational performance.

Aulakh et al. (1996) argued that two major categories of organizational and operational factors contribute to inter-firm trust: relational norms and monitoring mechanisms. For relational norms, they identified continuity expectations, flexibility in bilateral relationship, and information exchange. We argue that system integration contributes to at least two of the three components of relational norms. Higher levels of systems integration are indications of commitment by the partners that they are in the relationship for the long term by investing in relationship specific hardware and software. In addition, as discussed above, higher levels of system integration facilitate timely or real time sharing of data (Saraf et al., 2007), thus enhance information exchange among the partners. For monitoring mechanism, Aulakh et al. (1996) identified output control, process control, and social control as the primary constituents. Although the empirical results on the monitoring mechanisms are mixed (Aulakh et al., 1996), we argue that systems integration enables and improves all three mechanisms. Without high levels of system integration, real-time or near real-time output control and process control would not be effective or even possible. On the other hand, with accurate and timely operational data, the social control mechanism could be more informed and effective. Thus, other factors being equal, we argue that:

Hypothesis 5: In a supply network, higher degree of IS integration among partner firms will lead to higher degree of trust among the partners firms.

While integrations at system and application level facilitate and in some cases promote the exchange of information and coupling of business processes among the partners in a supply network, the degree of such exchange and coupling may be constrained by the level of trust among the partners. Klein and Rai (2009) argued that sharing of strategic information between partners may bring unintended consequences such as misuse of the shared information that may cause harm to the sharing partner and opportunities for parties to "free-ride" information acquired by other partners. They found that trusting beliefs in buyer or seller in the dyadic relationship significantly enhances information flow to the buyer or the seller from the other partner. In a similar vein, Cai et al. (2010) argued that inter-firm trust mitigates the inherent information asymmetry between trading partners and reduces the perceived vulnerability of the providing party. They found that trust has a positive relationship to both information sharing and collaborative planning between the partners. Handfield and Bechtel (2002) found that higher level of trust of buyers in sellers has a significant impact on the responsiveness of the sellers, characterised by shorter lead time, outstanding on-time delivery record, and ability to modify products to meet buyer requirement. None of these higher level performance indicators would be possible without excellence in lower level processes such as information sharing and process coupling. Thus, other factors being equal, we propose that:

Hypothesis 6: In a supply network, higher level of trust among partner firms will lead to higher degree of business process coupling among the partner firms.

Hypothesis 7: In a supply network, higher level of trust among partner firms will lead to higher degree of information sharing among the partner firms.

However, we caution that there are inconsistencies in the literature about the nature of the trust-information sharing and trust-process coupling relationships. Doney and Cannon (1997) argued that confidential information sharing and willingness to invest in relationship specific assets are building blocks toward inter-firm trust because these actions signal "good faith" and provide tangible evidence of one party is willing to make itself vulnerable, thus demonstrating the party's benevolent motives and intentions. Ratnasingam (2005) found that technical capabilities such as timely and accurate information sharing with strong security and privacy functionality fostered technological trust and eventually led to economical and organizational level trust in trading partners of an electronic commerce exchange. Thus, two-way feedbacks between trust and information sharing and trust and process coupling are possible. In this study, we focus on the forward causal relationship from trust to information sharing and process coupling as argued above, and leave the possible feedback loops for future research.

3. Data and Method

Data collection for this research was carried out in the Southeast region of China, the locus of Chinese manufacturing with heavy concentration of export oriented firms. The significant domestic and foreign investments as well as the influx of advanced manufacturing technologies and management systems and concepts that came with the investments over the last three decades have made the firms in this region the most productive and competitive in China, and many of which are world-class enterprises. Some of the cutting-edge manufacturing concepts and practices, such as JIT inventory, lean manufacturing, ERP systems, and integrated supply chain, are frequently found in the central firms of the manufacturing networks. The supply networks of the central firms often cluster around in close geographic areas, forming specific manufacturing capabilities for certain types of products, such as consumer electronics, non-durable goods, apparel, and automobile. These characteristics of the region make it an ideal ground for studying contemporary supply chain related issues.

The initial survey instrument was created in English by the research team, and then translated into Chinese by the authors who are fluent in both languages. The Chinese version was then verified by the other authors for accuracy. Numerous changes were made in the two versions to make sure that they match each other in meaning as well as terminology in the two languages. The survey instrument was then subjected to a pilot test using CIOs and supply chain managers from 10 different firms in the target

region. Two members of the research team visited each of the firms between July and August in 2009 and went over the survey with these managers to identify and correct ambiguous terms and questionable items. The face validity of the key constructs was also evaluated with the participating managers. Multiple changes were made to the initial instrument before it was finalized by the research team based on the feedbacks.

The final version of the Chinese survey instrument was then distributed to selected companies in the target region. The initial list of target firms were created based on the CIO and EMBA networks of the research team members who were located in China. From this list, a total of 200 central firms were selected primarily based on industry, size, and, most importantly, the estimated size of the supply network of the central firms. The survey instruments were then distributed to the contract person in the selected central firms with a request that the survey be completed by a manager who have intimate knowledge of his/her firm's supply network. In the end, after eliminating the ones with incomplete responses, 128 usable surveys were included in the final data set, resulting in a 64% effective rate of response. The high response rate is primarily attributable to the diligent work of the contacts. While this is not a truly random sample, it can be considered as pseudo-random because there are tens of thousands of companies in the target region. Table 2 shows the characteristics of the respondents, Tables 3 and 4 show the profiles of the central firms, and Table 5 shows the characteristics of the supply networks in the data set.

Characteristics	**Percentage of Respondents (%)**	**Characteristics**	**Percentage of Respondents (%)**
Position		*Education*	
CEO	9.38	Undergraduate	47.66
CFO	2.34	Graduate	41.41
VP/SVP	7.81	Doctoral	8.59
CIO	30.47	Other	2.34
IT Manager	*35.16*	*Sex*	
Manager (Purchasing, Supply Chain, Business)	14.06	Male	92.97
Other	0.78	Female	7.03

Table 2: Profile of the Respondents (N=128)

Industry	**Percentage of Respondents (%)**	**Annual Sales** (million RMB)	**Percentage of Respondents (%)**
Manufacturing	50.00	< 1,000	17.19
Retail/Wholesale	12.50	1,000-5,000	34.38
Information Technology	7.81	5,000-10,000	13.28
Non-Durable Consumer Goods	10.94	10,000-30,000	14.84
Services	10.94	30,000-50,000	8.59
Other	7.81	>50,000	11.72

Table 3: Profile of the Companies (N=128)

Type of Firms	**Percentage of Respondents (%)**	**Number of Employees**	**Percentage of Respondents (%)**
Private	25.00	<100	0.78
State-owned	21.88	100-500	9.38
Foreign-owned	26.56	501-1000	8.59
Public	24.22	1001-5000	30.47
Other	2.34	>5000	50.78

Table 4: Profile of the Companies (N=128)

Number of Main Suppliers	Percentage of Respondents (%)	Business Transactions with Main Suppliers as Percentage of Total	Percentage of Respondents (%)
		<15%	3.13
<10	1.56	15%-30%	7.81
10-30	11.72	30%-50%	17.97
30-100	30.47	50%-70%	34.38
100-500	35.16	70%-90%	29.69
>500	21.09	>90%	7.03

Table 5: Characteristics of the Supply Networks (N=128)

4. Results and Analyses

4.1 Quality of the Measurement

Following the widely adopted two-step approach to structural equation modeling (Anderson and Gerbing, 1988; Hulland, 1999), we first assessed the quality of the measurement model to ensure the validity and reliability of the instrument. This was followed by structural modeling to test the research hypotheses. SmartPLS (Ringle et al., 2005) was used as the primary statistical tool to analyze the quality of the measurement as well as the path models for hypothesis testing. SPSS was used generate statistics not available in the SmartPLS package.

Assessment of measurement quality is the critical first step toward structural equation modeling. Ideally, the quality of the measurement model should be assessed using model fit indices such as χ^2 provided via CFA analysis. However, due to the differences in underlying assumptions about data characteristics, component based SEM techniques such SmartPLS do not provide the fit indices. On the other hand, SmartPLS does provide a rich set of indicators about reliability, convergent and discriminant validities, and other quality indicators. Tables 6 through 8 show some of the quality indicators of our measurement model, all of which are measured at supply chain network level as reported by the informant at central firms.

Construct	Item	Mean	Std. Dev.	*t*-stat (*)	AVE	Composite Reliability	Cronbach's Alpha
ISF	ISF1	0.832	0.037	22.719	0.745	0.921	0.885
	ISF2	0.858	0.027	32.459			
	ISF3	0.849	0.026	32.236			
	ISF4	0.902	0.017	53.997			
ISS	ISS1	0.818	0.033	25.358	0.638	0.875	0.810
	ISS2	0.769	0.042	18.314			
	ISS3	0.816	0.035	23.711			
	ISS4	0.839	0.025	34.047			
ISI	ISI1	0.783	0.037	21.184	0.673	0.892	0.837
	ISI2	0.865	0.019	44.825			
	ISI3	0.845	0.030	27.998			
	ISI4	0.773	0.043	18.155			
TST	TST1	0.872	0.023	38.757	0.691	0.899	0.851
	TST2	0.796	0.054	14.790			
	TST3	0.803	0.032	25.302			

	TST4	0.846	0.032	26.488			
PRC	PRC1	0.854	0.025	34.941	0.774	0.932	0.903
	PRC2	0.865	0.026	33.535			
	PRC3	0.907	0.017	53.775			
	PRC4	0.889	0.017	52.813			
IFS	IFS1	0.814	0.031	26.189	0.667	0.889	0.834
	IFS2	0.841	0.023	36.404			
	IFS3	0.827	0.035	24.053			
	IFS4	0.689	0.066	10.584			

Table 6: Item Outer Loading and Measurement Quality Indicators (all are significant at p <0.01)*

The reliability of measurement addresses the concern of how well the items for one construct correlate or move together (Straub et al. 2004). Reliability is usually assessed by two indicators–Cronbach's apha and composite reliability. Cronbach's alpha is a measure of internal consistency among all items used for one construct. Composite reliability addresses similar concept but is considered as a more rigorous reliability measure in the context of structural equation modeling (Chin, 1998; Raykov, 1998). The reliability indicators of the constructs in this study are shown in Table 6. The lowest composite reliability is 0.875 and the lowest Cronbach's alpha is 0.810, all are higher than the recommended minimum value of 0.7 (Fornell and Larcker, 1981; Gefen, 2000), indicating good reliability of the measurement for each construct.

Construct validity can be assessed using convergent validity and discriminant validity. Convergent validity is defined as the degree to which the measurement items are related to the construct they are theoretically predicted to be related. Convergent validity is shown when the t-values of the outer model item loadings are statistically significant. As it can be seen from Table 6, all item loadings for each construct are significant at $p < 0.01$ ($t > 2.576$), indicating good convergent validity. Hulland (1999) recommends that items with loading below 0.5 be dropped. All item loadings in our measurement model are greater than this threshold. All these indicators suggest an acceptable convergent validity in the measurement model.

Discriminant validity refers to the extent to which measures of the different model constructs are unique. There are a number of techniques that have been used to for testing discriminant validity in the literature (Straub et al., 2004). In this study we assessed the discriminant validity by comparing the correlations between constructs and the square root of AVE of each construct. This is a widely used technique in IS literature when component based SEM methods are used. Discriminant validity is supported if the square root of a construct's AVE is greater than the correlations of the construct with all other constructs (Hulland, 1999). In our case, the diagonal values in Table 7 are the square root of AVEs of constructs. When compared with the correlation coefficients, good discriminant validity for all constructs in the measurement model is confirmed.

	Mean	**Std. Dev.**	**ISF**	**ISS**	**ISI**	**TST**	**PRC**	**IFS**
ISF	3.431	.790	**.863**					
ISS	3.070	.845	.556	**.817**				
ISI	3.047	.910	.610	.758	**.820**			
TST	3.400	.785	.439	.568	.477	**.831**		
PRC	3.205	.825	.505	.599	.596	.662	**.880**	
IFS	2.881	.788	.533	.642	.576	.634	.665	**.798**

Table 7: Correlations of Latent Constructs and Square Root of Extracted Variances

4.2 Structural Analysis

Unlike the covariance based SEM tools such as LISREL, component based PLS techniques do not provide overall model fit indices. The primary indicators for the quality of the structural model are the R^2 values of the endogenous constructs (Hulland, 1999), which measure how much of the variances in the endogenous constructs are explained by the exogenous constructs specified in the model. Figure 2 presents the results of the structural analysis using SmartPLS. These results are summarized in Table 7.

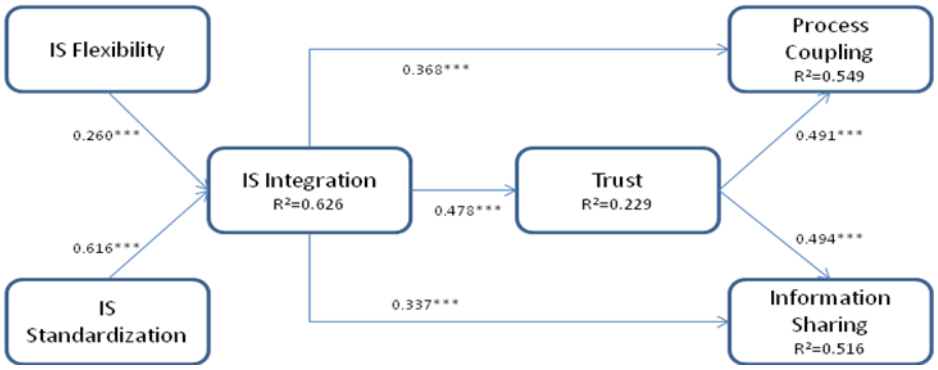

Figure 2: Results of Structural Analysis (*** p<0.01, ** p<0.05, * p<0.1 significant levels)

There are several interesting results in the structural model as shown in Figure 2. First is the confirmation of our core thesis for this research that higher level of IS integration (ISI) among the partners in the supply network leads to stronger trust (TST) among these partners (H5: $\beta = 0.478$, $p<0.01$). IS integration in the supply network alone explains 23% of the variances in the trust construct. This result is remarkable because in the complex system of inter-firm relationship it is rare that one construct alone could explain the variance of trust to this degree, given the number of organizational, operational, social, and cultural antecedents to inter-firm trust that have been identified in the literature (Aulakh et al., 1996; Cai et al., 2010; Doney and Cannon, 1997; Handfield and Bechtel, 2002; Kwon and Suh, 2005).

The second is about the consequences of information systems integration and trust. The paths between IS integration (ISI) and process coupling (PRC) (H3: $\beta = 0.368$, $p<0.01$) and information sharing (IFS) (H4: $\beta = 0.337$, $p<0.01$), and between trust and processing coupling (PRC) (H6: $\beta = 0.491$, $p<0.01$) and information sharing (IFS) (H7: $\beta = 0.494$, $p<0.01$), are not only significant but also high in magnitude, indicating strong influences by IS integration and trust. The data show that higher degrees of systems integration and trust among partners explain over 50% of the variances in processing coupling and information sharing, two significant outcomes that have strong impact on the performance of supply networks (Rai et al., 2006; Saraf et al., 2007).

Last but not the least is the confirmation of the critical role of the characteristics of information systems of the partner firms in the performance of a supply network. The results suggest multiple areas where IT could have a significant impact on a supply network. Flexibility of information systems (ISF) significantly impacts the level of information systems integration in the network (H1: $\beta = 0.260$, $p<0.01$), while not surprising, it is a strong reminder for IT and business managers. In addition, the critical role of standardization of IT systems (ISS) (H2: $\beta = 0.616$, $p<0.01$) is confirmed. Notably, the magnitude of the impact by ISS is more than double of that by ISF on IS integration (ISI) in the supply network, highlighting a critical challenge for IT managers in supply networks.

Hypothesis	Relationship	Path Coefficient	Std. Dev.	t- stat	p-value	Conclusion
H1	ISF->ISI	0.260	0.061	4.294	p<0.01 (***)	Supported
H2	ISS->ISI	0.616	0.053	11.539	p<0.01 (***)	Supported
H3	ISI->PRC	0.368	0.062	5.978	p<0.01 (***)	Supported
H4	ISI->IFS	0.337	0.095	3.546	p<0.01 (***)	Supported
H5	ISI->TST	0.478	0.066	7.264	p<0.01 (***)	Supported
H6	TST->PRC	0.491	0.062	7.881	p<0.01 (***)	Supported
H7	TST->IFS	0.494	0.090	5.483	p<0.01 (***)	Supported

Table 8: Results of the Structural Analysis and Hypothesis Testing

Overall the model is strongly supported by the data, as summarized in Table 8. All of the hypothesized relationships were found to be significant at $p<0.01$ level, and the R^2 values for the endogenous constructs are reasonable high and very high, especially for the two dependent constructs: process coupling (PRC) and information sharing (IFS), indicating the constructs in the model have captured the main variances in the phenomenon of interest: what makes a supply network to link their business processes and sharing information.

5. Discussion

The findings of this study contribute to theories and practices of supply chain management and information systems in a number of aspects. Although trust has been a core construct in inter-firm relationship and supply chain research, few studies have explicitly articulated and tested the role of information technology in the formation of inter-firm trust. While Ratnasingam (2005) investigated how IT contributes to inter-firm trust through a case study of a B2B exchange, trading via electronic exchanges poses much different challenges than transacting with partners in an integrated supply network. Our primary contribution lies in the finding that the systems integration does have a strong positive impact on trust among the partners and this trust, together with the integrated systems, leads to higher levels of information sharing and process coupling, two crucial drivers to supply chain performance and partner performance. Our secondary contribution is in the confirmation of the contributions of two characteristics of information systems – flexibility and standardization – to the core construct of IS integration. Although not completely novel, they are nonetheless part of an integral thesis: in order for the partners in a supply network to have higher level of systems integration and develop stronger trust, each partner must strive to design and build their information systems with flexibility and standardization in mind.

Due to constraints in data collection and research design, this study has a number of limitations that also create as many opportunities for future research. First, our data were collected only from the center firms of supply networks, though significant effort was applied to ensure the informants to report objectively, the data may still be biased due to differences in individual perception and availability of information. Future research could significantly enrich the findings by collecting data from matched dyads or triads or split samples from central firms and their suppliers. Second, due to our focus on the characteristics of IT in the partner firms we did not collect data related to organizational factors such as contracts, relationship, and asset specific investments that have been shown to impact trust and process integration. Future research could examine the interactive effects between IT factors and organizational factors on trust, information sharing, and process coupling. Finally, the issue related to the feedback loop between trust and information sharing and process coupling needs to be further investigated. The current structural equation modeling techniques are not capable of testing such effect. More sophisticated techniques with longitudinal data may be required to determine which direction is more prominent than the other.

6. Conclusion

In this study, we investigated the role of IT in building inter-firm trust and the consequences of this trust in the context of supply networks. Our data show that IS integration among partner firms in a supply network significantly impacts trust among the firms which, together with the integrated information systems, explains more than half of the variances in information sharing and business process coupling in the network. Given the strong evidence in the literature on the impact of these two activities on supply chain performance, we can infer that IS integration among the partners is a critical factor in determining supply network performance. We also confirmed that IS flexibility and use of standards in IS significantly contribute to the level of IS integration among the partners in supply networks, as suggested in the prior studies. This study provides a foundation for future research that further explores the potentials of information technology in inter-firm relationships and its impact on the performance of supply networks.

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