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A CONTINGENT VIEW OF THE INTERNET-ENABLED SUPPLY CHAIN INTEGRATION AND FIRM PERFORMANCE

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Abstract

Building on multiple theoretical perspectives, we examined how organizational culture moderates the association of different dimensions of Internet-enabled Supply Chain Integration (i.e., online information integration and operational coordination) and firm performance (i.e., customer service and financial performance). We tested hypotheses using survey data from senior executives in China. Our findings reveal that an internally focused culture weakens the effects of online information integration on customer service performance, whereas it strengthens the influences of online operational coordination. Further, an externally focused culture weakens the effects of online operational coordination on customer service performance too. In addition, the results indicate that customer service can directly improve financial performance, and partially mediate the relationship between online information integration and financial performance. Theoretical contributions and managerial implications of the study are discussed.

Key words: Internet-enabled supply chain integration, organizational culture, customer service

1 INTRODUCTION

The current digitalized, interconnected, and globalized markets are promoting firms to foster Supply Chain Integration (SCI) via the Internet to improve performance (Boyer et al. 2005; Frohlich 2002; Ke et al. 2009; Lee et al. 2004; Liu et al. 2010; Rosenzweig 2009). Specifically, the Internet-enabled SCI (IeSCI) facilitates creation of values for customers and improves a firm's profitability with an open, worldwide, and real-time format (Frohlich 2002). It enables firms to integrate the flow of information, materials, and finances across the supply chain efficiently (Lee et al. 2004; Porter 2001), and eventually encourages open markets and value-added service, which cannot be achieved by firms individually (Frohlich 2002; Karimi et al. 2001; Lee et al. 2004; Liu et al. 2010). As such, it is suggested that IeSCI could engender superior performance.

A growing literature has indicated that the greater the supply chain integration, the better the firm performs (e.g., Frohlich 2002; Frohlich et al. 2001; Rai et al. 2006). While the prior research findings provide some empirical supports for the SCI-performance link, some scholars highlight that these findings are mixed (Flynn et al. 2010). Indeed, most studies did not examine the specific form of the link (Vickery et al. 2003). For example, some studies conceptualized SCI as a single concept and examined the effects of SCI on the mean levels of performance (Frohlich et al. 2001; Rai et al. 2006), and most ignore the fact that the effects of SCI might be conditional upon other factors. As such, it would be critical and necessary to explore how a firm's IeSCI impacts its performance in a multi-dimensional ways, and to identify the specific construct that could differentiate the contexts in which IeSCI impact firm performance.

In this study, we intend to assess the relationships among IeSCI, customer service, and financial performance based on dynamic capabilities view, and further to investigate organizational culture to differentiate the contexts via the competing values perspective. Specifically, following Frohlich and Westbrook (2001), we identify online information integration and operational coordination as the dimensions of IeSCI. Given customer service is widely touted as an immediate outcome of SCI (Vickery et al. 2003), we first test the direct impacts of these two dimensions of IeSCI on customer service. Further, it is widely proposed that a 1-point rise in firms' customer satisfaction index would incur an average \$240 million increase in their market value (Karimi et al. 2001). Thus, we examine the potential mediating effects of customer service on the relationship between IeSCI and financial performance to explore the nuances of the SCI-performance relationship.

In addition, we hypothesize that the effects of IeSCI on customer service will be contingent on the firm's organizational culture (Hewett et al. 2002; Hult et al. 2007). Organizational culture refers to a collection of assumptions, values, and beliefs that are embedded in an organization and reinforced by organizational practices and goals (Deshpandé et al. 1993; Liu et al. 2010; Quinn et al. 1983). Scholars indicate that organizational culture could impact firm performance indirectly through moderating the effects of supply chain management (Hewett et al. 2002; Hult et al. 2007).

In the next section, we describe the conceptualization of IeSCI and develop hypotheses on the relationships among IeSCI, organizational culture, and firm performance. Section three describes the research methodology employed and our data analysis and results; and section four is the discussion, which include theoretical and practical implications and limitations.

2 THEORETICAL BACKGROUND AND HYPOTHESES

Internet-enabled Supply Chain Integration (IeSCI) refers to the degree to which a firm collaboratively manages intra- and inter-organization processes with customers, suppliers, and other channel partners based on applications of the Internet (Frohlich et al. 2001; Frohlich et al. 2002; Lee 2000; Lee et al. 2004). As an innovation, IeSCI leads to the new era of supply chain management (Frohlich 2002). It could overcome the tradeoffs between low cost, rich content, real-time data, and broad deployment across the supply chain, which are faced by traditional marketplace-based competition (Frohlich 2002; Frohlich et al. 2002). According to Frohlich and Westbrook (2001), integrating information and coordinating operations are the two basic tactics of SCI. Further, Sahin and Robinson (2002; 2005)

suggest that the degree of information sharing and workflow coordination are the two critical dimensions of SCI. Following this notion, we conceptualize IeSCI as a construct with two dimensions, namely online information integration and operational coordination. According to dynamic capabilities view, a firm's supply chain coordination could play as critical dynamic capabilities (Eisenhardt et al. 2000; Zahra et al. 2006), which refer to "the ability to integrate, build, and reconfigure internal and external competencies to address rapidly changing environments" (Teece et al. 1997 p. 517), and eventually impact firm performance.

1.1 Online Information Integration

Online information integration is defined as the extent to which channel members exchange information across the supply chain via the Internet (Lee et al. 2004; Rai et al. 2006). It reflects the direct, automatic, global, and real-time information accessibility and sharing. Specifically, the Internet integrates firms' information systems electronically, and creates an open, global, and real time information hub (Lee et al. 2004). This information hub allows firms to conduct online information integration with appropriate technological interface between systems (Ba et al. 2008; Lee et al. 2004; Porter 2001). Such integration would allow integrated firms to exchange and access information automatically anywhere, any time (Lee et al. 2004; Zhu et al. 2006).

The existing literature argues that online information integration enables firms to collect timely information about customer demands, which is critical for customer service quality (Frohlich et al. 2001; Lee et al. 2004; Porter 2001). For example, through exchanging real-time and rich content information with customers, firms can detect and handle customer complaints quickly, and sense customer demands or demands change extensively and timely (Ba et al. 2008; Lee et al. 2004). On the other hand, customers always want to receive information directed toward their special needs and interests at any time and place. Through the online information hub, customers can easily access rich information on products, troubleshooting techniques, and services without the constraints of time and place (Ba et al. 2008).

H1: Online information integration is positively related to the firm's customer service performance.

1.2 Online Operational Coordination

Online operational coordination refers to the extent to which firms have highly coordinated and streamlined supply chain operations with channel members via the Internet (Lee et al. 2004; Sanders 2007; Sanders 2008). This coordination can take IeSCI one step further than online information integration. It defines not only "what" information firms can share, but also "how" firms can use the shared information (Lee 2000). With open system, real time information exchange and low cost, the Internet facilitates communication and coordination, and thus allows firms to jointly conduct complex processes efficiently (Garcia-Dastugue et al. 2003).

Online operational coordination would offer opportunities for the improving of customer service. In particular, online operational coordination allows customers to place orders, access services, and file complaints practically anywhere, any time (Ba et al. 2008; Rosenzweig 2009). Further, high coordination could allow a firm to shift from routine, low value service to high value, personal consultancy on special customer demands (Lepak et al. 2002; Lepak et al. 2003). Through interaction between boundary spanning, the firm can proactively adjust actions or strategies according to the update of their joint plans with customers. Therefore, online operational coordination may help the firm increase mutual understanding with customers, decrease potential conflicts, and thus enhance the quality of customer service (Keeny 1999).

H2: Online operational coordination is positively related to the firm's customer service performance.

Scholars have noticed that the impact of SCI on financial performance would be indirect (Chen et al. 2004; Vaart et al. 2008; Vickery et al. 2003). For example, Vickery (2003) showed that the relationship between SCI and financial performance was mediated by customer service, and Chen et al. (2004) argued the significant impacts of customer service on financial performance. Indeed, a firm with superior customer service could quickly respond to customer demands with superior order scheduling

and provide effective solutions for customer complaints. This could accelerate a firm's business process and then promote continual business relationships, which could improve the firm's cash flow and profitability. As such, a growing stream of research has suggested that superior customer service should help firms to generate greater revenue and yield greater profitability.

H3. A firm's customer service is positively related to its financial performance.

1.3 Organizational Culture

Organizational culture reflects a collection of assumptions, values, and beliefs that are embedded in an organization and reinforced by organizational practices and goals (Deshpandé et al. 1993; Liu et al. 2010; Quinn et al. 1983). In the existing literature, the Competing Values Model (CVM) has been treated as the efficient perspective to empirically investigate organizational culture, since it reveals the complexity of value orientations and allows the comparison of value orientations within and between firms (Deshpandé et al. 1993; Liu et al. 2010; Quinn et al. 1983).

The CVM is characterized by two dimensions (Quinn et al. 1983). The first dimension measures the firm's desire for a focus on flexibility or control. The flexibility orientation values empowerment, flexibility, and spontaneity, and the control orientation emphasizes order, efficiency, and achievement. The second dimension refers to activities occurring within or outside firms. An internal focus emphasizes the development of people and systems within the firm, while an external focus stresses external positioning and interaction with the external environment.

As argued by contingency theorists, to be effective, a firm's managerial practices must be consistent with other aspects of the firm, especially factors that are human-related (Delery et al. 1996; Greening et al. 1994). In the existing literature, scholars indicate that organizational culture could impact firm performance through moderating the effects of supply chain management (Hewett et al. 2002; Hult et al. 2007). Some research further finds that inter-firm linkages enhance firm effectiveness only when the relationship is consistent with corporate culture (e.g., Hewett et al. 2002). In the existing literature, scholars propose the different role of externally and internally focused cultures in affecting firm performance (Deshpandé et al. 1993). As Hewett et al. (2002) contend, dividing organizational culture into the internally/ externally focused culture is particularly appropriate to investigate supply chain relationships. Compared to an internally focused firm, an externally focused firm might act differently in a specific supply chain relationship, and such differences would affect how firms benefit from the supply chain relationship (Deshpandé et al. 1993; Hewett et al. 2002). In the same vein, we contend that the effects of IeSCI on customer service may be conditional and affected by organizational culture, namely internally focused and externally focused culture, as depicted in Figure 1.

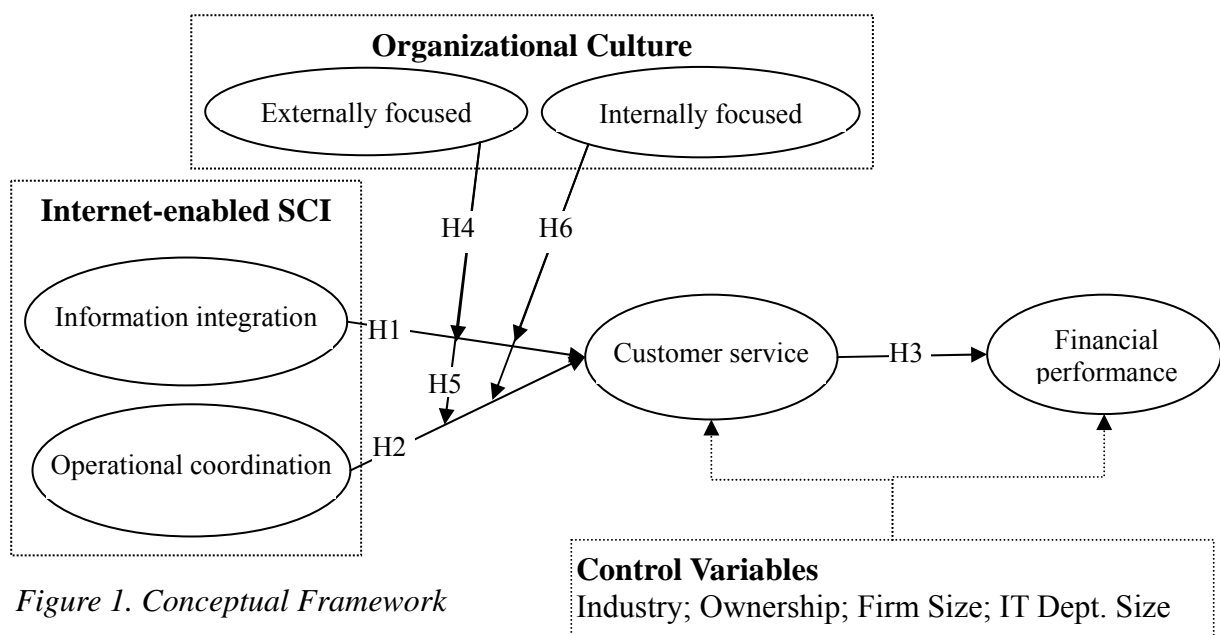


Figure 1. Conceptual Framework

According to the CVM, an internally focused firm would emphasize internal improvement, and favor expending resources to optimize existing operational equipment and practices (Ralston et al. 2006). This indicates that an internally focused culture does not value the support afforded by online information integration. Specifically, online information integration may have positive effects on customer service as it allows firms to access proprietary information across the supply chain and therefore to be responsive to customer demands changes. However, an internally focused culture places a great emphasis on the development of internal processes, values internally generated information, and prefers managing documents within the confine of the firm (Berthon et al. 2001; McDermott et al. 1999). As such, the impacts of online information integration on the firm may be limited in the supply chain. However, an internally focused culture might enhance the relationship between online operational coordination and customer service, because of its emphasis on optimizing existing operational equipment and practices (McDermott et al. 1999). Further, this culture values human relationships and favors empowerment, participation, and coordination (Khazanachi et al. 2007). Such a focus would help the firm to improve customer service through online operational coordination.

H4. An internally focused culture negatively moderates the relationship between online information integration and customer service.

H5. An internally focused culture positively moderates the relationship between online operational coordination and customer service.

An externally focused culture emphasizes firm linkages to the external environment (Buenger et al. 1996; Cooper et al. 1993). It takes the environment as complex, turbulent, and politicized, and a significant factor that affects firm survival (Detert et al. 2000). As such, an externally focused culture, which encourages firms to adapt quickly to market conditions (Hewett et al. 2002), may facilitate IeSCI to improve customer service. Specifically, this culture would lead a firm to actively scan the external environment to assess its strengths and weaknesses, and strive to meet customer demands (McDermott et al. 1999). The firm would actively apply the timely information provided by online information integration across the supply chain (Buenger et al. 1996). Thus, an externally focused culture may enhance the impact of online information integration on customer service. In addition, to ensure flexibility (Zammuto et al. 1992), a firm with an externally focused culture would encourage the coordination of operations across the supply chain. Therefore, an externally focused culture would facilitate online operational coordination to enhance the firm's agility and responsiveness to customer demands, and then increase its customer service performance (Devaraj et al. 2007).

H6. An externally focused culture positively moderates the relationship between IeSCI (i.e., online information integration and operational coordination) and customer service.

3 METHODOLOGY

3.1 Data Collection

The study collected the data through a questionnaire survey of executives in China. Senior executives, such as CEOs, senior vice presidents of operations, or chief technology officers, were chosen as the key informants. We randomly chose 1,000 firms from a list provided by a Chamber of Commerce located in the east of China and sent them invitations to participate in our survey. Questionnaires were sent to 600 firms that agreed to participate in the survey. To improve the response rate, we made follow-up phone calls and sent reminder emails. A total of 251 usable completed questionnaires were received, which allowed us to achieve a response rate of approximately 25.1%.

3.2 Development of Measures

The instrument was developed based on previously validated measures in the extant literature. All items were assessed with 5-point Likert scales, ranging from "strongly disagree" to "strongly agree." To ensure the face and content validity of the questionnaire, we first invited three researchers from the areas of information systems and operations management to review it. Some revisions were made

based on their comments and suggestions. Further, given this research was to be conducted in China, we translated the instrument into Chinese after completing the original English version. The translation followed the translation committee approach suggested by previous research (van de Vijver et al. 1997). Specifically, the original English questionnaire was first translated into Chinese by a committee and then back-translated to English. This method ensures the equivalence of meaning between the English and Chinese versions.

The major constructs employed in this study included IeSCI, organizational culture, and firm performance. Five items used to measure online information integration were adapted from Devaraj et al. (2007), based on Lee and Whang's (2004) definition. The 5-item measures for online operational coordination were developed based on the work of Kandemir et al. (2006), Narasimhan and Das (2001), and Lee and Whang (2004). We measured the organizational culture using eight items adapted from the works of Deshpandé et al. (1993) and Khazanch et al. (2007), with four items for internally and externally focused culture, respectively. The items for customer service performance were adapted from Chen et al. (2004) and Rai et al. (2006). They assessed the focal firm's speed of filling customer orders, time taken to handle customer complaints, and the establishment of a strong and continuous bond with customers. Finally, the items for financial performance were adapted from Carr and Pearson (1999) including return on investment, profits as a percent of sales, and net income before tax. Since the performance may be affected by the firm's individual characters, the study included four control variables, i.e., industry (IND), the ownership (OWS), firm size (SIZE), and the size of the firm's IT department (ITQ).

3.3 Data Analysis and Results

3.3.1 Measurement Validity

To assess the construct reliability and validity of our subjective measurement instruments, we used the Confirmatory Factor Analysis (CFA). As shown in Table 1, the composite reliability of each construct ranged from 0.83 to 0.91, which indicated a good reliability of the measured constructs. Further, we tested the construct validity by focusing on convergent validity, and discriminant validity. The results showed that the loadings of all items were higher than 0.50 and t-values were significant at the $p < 0.01$ level. In addition, the values of Cronbach Alpha ranged from 0.70 to 0.86; and the values of the Average Variance Extracted (AVE) ranged from 0.56 to 0.78. These results indicated that our measurement model has good convergent validity.

To assess the discriminant validity, we compared the relationship between correlations among constructs and the square roots of AVEs as recommended by Fornell and Larcker (1981). As shown in Table 2, the square roots of AVE for all constructs were greater than the correlations between constructs, which confirmed the discriminant validity.

Construct	Cronbach Alpha	Composite Reliability	AVE
Online information integration	0.84	0.89	0.62
Online operational coordination	0.83	0.88	0.59
Externally focused culture	0.74	0.84	0.57
Internally focused culture	0.70	0.83	0.56
Customer service performance	0.85	0.91	0.77
Financial Performance	0.86	0.91	0.78

Table 1. Results of Confirmatory Factor Analysis

	Mean	S.D.	1	2	3	4	5	6	7	8	9	10
1 information integration	3.47	0.93	0.79									
2 operational coordination	3.25	0.89	0.66	0.77								
3 Internally focused	3.56	0.66	0.50	0.42	0.75							
4 Externally focused	3.66	0.67	0.50	0.41	0.69	0.75						

5 Customer service	3.91	0.78	0.48	0.38	0.39	0.42	0.88					
6 Financial Performance	3.63	0.76	0.36	0.31	0.40	0.41	0.51	0.88				
7 Ownership	n.a	n.a	0.12	0.10	-0.01	0.01	0.10	0.04	n.a			
8 Industry	n.a	n.a	-0.01	-0.11	-0.03	-0.05	-0.21	-0.10	-0.13	n.a		
9 Firm size	n.a	n.a	0.04	0.13	0.03	0.03	0.03	0.08	-0.06	-0.02	n.a	
10 IT dep. size	n.a	n.a	0.11	0.22	0.16	0.13	0.06	0.14	-0.06	-0.09	0.69	n.a

Note: The diagonal elements are the square roots of AVEs.

Table 2. Mean, Standard Deviation, and Correlation

3.3.2 Hypotheses Testing

In this study, we assessed all hypotheses through a hierarchical regression analysis (Kutner et al. 2004). We mean-centered the independent variables to minimize the potential multicollinearity issue. Table 3 reports the results. As shown in Model 1, the impacts of online information integration ($\beta = 0.26$, $p < 0.01$) on customer service were significant, and therefore H1 was supported. However, the relationship between online operational coordination and customer service was not significant ($\beta = 0.07$). Thus, H2 was not supported. In addition, we tested the moderating effects of organizational culture on the relationships between IeSCI and customer service performance. Specifically, the interaction term of internally focused culture and online information integration was negatively and significantly associated with customer service ($\beta = -0.27$, $p < 0.05$), and the interaction term of internally focused culture and online operational coordination was positively and significantly associated with customer service ($\beta = 0.45$, $p < 0.01$), which supported H4 and H5. Yet, the interaction term of externally focused culture and online operational coordination had negative and significant effects on customer service ($\beta = -0.32$, $p < 0.05$). Thus, H6 was not supported. On the other hand, as shown in Model 3, the relationship between customer service and financial performance was significant and positive, which supported H3. Further, the results shown in Model 2 indicate that customer service could partially mediate the influences of online information integration on financial performance, but cannot mediate the impact of operational coordination.

	Customer service		Financial Performance	
	Model 0	Model 1	Model 2	Model 3
Control Variables				
Ownership	0.02	0.03	-0.01	-0.00
Industry	-0.15**	-0.14**	-0.06	0.01
Firm Size	0.02	0.04	0.00	-0.01
IT Dept. Size	-0.03	-0.08	0.06	0.09
Independent Variable				
Online information integration (IFI)	0.35**	0.26**	0.23**	
Online operational coordination (OPC)	0.08	0.07	0.08	
Internally focused culture (INF)		0.12		
Externally focused culture (EXF)		0.18*		
IFI*INF		-0.27*		
OPC*INF		0.45**		
IFI*EXF		0.17		
OPC*EXF		-0.32*		
Customer service				0.49
Model F				
Model F	15.32**	10.83**	7.23**	18.18**
R ²	0.27	0.35	0.15	0.27
Adjusted R ²	0.26	0.32	0.13	0.26

Note: * $p < 0.05$; ** $p < 0.01$ (two-tail test)

Table 3. Results for Hierarchical Regression Analysis

4 DISCUSSION

The current study makes notable theoretical contributions to the developing literature on the business values of SCI and the impact of organizational culture on firm performance. First, we conceptualize IeSCI as a construct with two dimensions, namely online information integration and online operational coordination. Different from previous empirical studies that treat SCI as a single-dimensional construct (e.g., Cousins et al. 2006; Lyer et al. 2009; Rai et al. 2006; Vickery et al. 2003), this study explores the varying effects of the two dimensions of IeSCI on firm performance.

We found that online information integration has a positive effect on customer service performance, while online operational coordination does not significantly affect customer service performance. This finding shows the varying relationships between dimensions of SCI and firm performance in the online environment. It indicates that integrating supply chain via the open interface can result in extensive benefits, such as better customer service. In contrast, it may be difficult to ensure customer service quality by coordinating operations in the online context. This finding is consistent with what is proposed by previous research (e.g., Miller, Craighead, & Karwan, 2000). It is suggested that, compared to the technological interface, a high level of coordination might complicate the online service delivery processes (Miller et al. 2000).

Another finding of this study is that customer service could partially mediate the influence of online information integration on financial performance. Yet, online operational coordination cannot directly improve both customer service and financial performance. These findings further indicate the importance of exploring the multi-dimensional relationships between IeSCI and firm performance. On the other hand, the findings also highlight the necessity to consider the contextual factors in the value creating process of complicated integration, namely operational coordination.

Most importantly, this study examines the moderating effects of organizational culture in the value realizing process of IeSCI. This investigation makes the current study distinct from previous research that assumes unconditional effects of SCI on firm performance (e.g., Fynes et al. 2005; Kaufmann et al. 2006). It helps to explain why the existing findings on the SCI-performance relationship are mixed, in the view that we found the differential moderating effects of the internally and externally focused culture on the relationships between IeSCI and firm performance, in addition to the differential relationships between dimensions of IeSCI and performance. In particular, our results show that an internally focused culture strengthens the relationships between online operational coordination and firm performance, while it weakens the association of online information integration and firm performance. Such findings reveal that an internally focused culture helps to enhance the performance benefits of online operational coordination, while online operational coordination does not directly affect firm performance. In addition, we found that an externally focused culture weakens the association of online operational coordination and firm performance, while it does not moderate the relationship between online information integration and firm performance. This finding is not consistent with what we hypothesized. A possible explanation is that employees do not get sufficient training on how to apply IeSCI efficiently and effectively because an externally focused culture does not place enough emphasis on internal human resource development (Batt 2002; Becker et al. 1996).

4.1 Practical Implications

This research has important practical implications for managers. First, our findings on the differential relationships between dimensions of IeSCI and firm performance provide managers with guidance on which integration type to work on to improve their favored performance benefits. For example, managers should be aware that conducting online operational coordination might not help to achieve superior customer service. Also, managers should understand that a higher degree of SCI may not necessarily lead to better performance, although the notion of “the more the better” is prevalent in the field (Fabbe-Costes et al. 2007). Second, it is important for managers to realize that the effects of IeSCI are not unconditional. Rather, the value realizing process of IeSCI is affected by organizational culture. As such, to reap the well-touted benefits of IeSCI, the firm should make sure that what is required by IeSCI is aligned with its organizational culture. For example, an internally focused culture

is conducive for reaping benefits of online operational coordination, while it hampers the positive influence of online information integration. Finally, this study highlights the direct relationship between customer service and financial performance. Thus, managers should understand that customer service is critical for their profitability in the online supply chain context.

4.2 Limitations of the Study

It is important to evaluate the results and contributions of this study in light of its limitations. Our study has the following limitations that can be addressed by future research. First, this study applied a focal firm, rather than a supply chain, as the unit of analysis. Although this approach has been applied widely in existing research, it has shortfalls. Scholars have suggested that matching information from both sides of an inter-firm relationship is more appropriate than collecting only one-sided information for research conducted in the context of a supply chain. Second, the demography of the respondents of this study may limit the generalizability of our findings. This study was conducted in China. As such, caution should be exercised in generalizing the research findings to firms located in different economic, political and cultural environments. Third, this study has the limitation common to all cross-sectional studies. A longitudinal study may enrich our understanding by offering information on the causal relationships between independent and dependent variables. Another limitation of this study is using perceptual measures of firm performance. Although the subjective perceptual measures have been found to strongly correlate with objective measures (Sheehan et al. 2007), collecting objective data on firm performance would be more appropriate in future research.

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