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# EFFECTS OF IT CAPABILITY AND EXTERNAL INTEGRATION ON ORGANIZATIONAL RESPONSIVENESS: AN ORGANIZATIONAL LEARNING PERSPECTIVE

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# EFFECTS OF IT CAPABILITY AND EXTERNAL INTEGRATION ON ORGANIZATIONAL RESPONSIVENESS: AN ORGANIZATIONAL LEARNING PERSPECTIVE

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## Abstract

*Drawing upon the organizational learning perspective, this study focuses on the relationship between external integration and organizational responsiveness, and how such relationship is moderated by three kinds of information technology (IT) capability (i.e. inside-out, outside-in, spanning). The results of 197 firms in China reveal the positive relationship between external integration and organizational responsiveness. In addition, three kinds of IT capability play different roles in the relationship between external integration and organizational responsiveness. Specifically, outside-in IT capability and spanning IT capability positively moderate this relationship. In contrast, inside-out IT capability provides a negative moderating effect. Implications and suggestions for future research are provided.*

*Keywords: External integration, Organizational responsiveness, Information technology capability, Organizational learning perspective.*

# 1 INTRODUCTION

There are an increasing number of firms involved in the integration with their partners with the assistance of information technology (IT) (Prajogo & Olhager 2012). Basically, firms pursuing external integration have a common concern about whether it is conducive to their performance improvement. In this regard, scholars have conducted a plenty of research about the value of integration (e.g. Homburg & Kuehnl 2013; Jayaram & Xu 2013; Wiengarten et al. 2014). Unfortunately, mixed findings exist in this stream of research, especially for its impact on organizational responsiveness (Das et al. 2006; Wong et al. 2011). Specifically, some scholars claim that external integration contributes to a more accurate and quicker response to market changes (Flynn et al. 2010; Swink et al. 2007). In contrast, this positive relationship is questioned by the viewpoint that integration may foster interdependencies which create rigidity (Das et al. 2006). To investigate this problem, it is necessary to consider the role of IT in this relationship due to its supportive features (Liu et al. 2013; Sambamurthy et al. 2003). Although IT has a significant impact on external integration (Gunasekaran & Ngai 2004; Rai et al. 2006), scholars have sparsely taken IT into account when discussing the value creation of external integration.

Organizational responsiveness reflects the extent to which a firm responds rapidly to market changes (Wei & Wang 2011). With the need to constantly improve products, services, or business processes for current market trend, the support of intellectual capital is essential for responsiveness (Hoyt et al. 2007; Hult et al. 2005). As no firms are self-sufficient in terms of intellectual capital they possess (Cassiman & Veugelers 2006), external integration provides an approach to firms to learn from others through interactions (Kim 2013). Consequently, the range of their potential behavior is expanded, which leads to better responses when market turbulence occurs (Huber 1991). In this sense, we suppose that developing organizational responsiveness through external integration is essentially a process of learning.

It is widely approved that IT capability is an enabler of organizational learning (Real et al. 2006; Scott 2000; Tippins & Sohi 2003). Specifically, IT capability allows firms to obtain external information by facilitating communication between partners with less obstacles of time and spatial distance (Frohlich & Westbrook 2001; Prajogo & Olhager 2012). Also, IT capability is conducive to the processes of learning which contain dissemination, interpretation, and storage of acquired information (Tippins & Sohi 2003). As mentioned above, leveraging external integration to improve responsiveness can be considered as a process of learning. Meanwhile, organizational learning can be improved by IT capability. Therefore, we assume IT capability positively moderates the relationship between external integration and responsiveness.

In the current research, we try to investigate the relationship between external integration and organizational responsiveness through the lens of organizational learning theory. Specifically, external integration provides an opportunity for firms to acquire external knowledge, which constitutes the foundation for learning. Facilitated by IT capability, organizational learning can be more effectively conducted in firms to absorb knowledge and enlarge their intellectual capital. Consequently, firms are able to make better responses. We identify three kinds of IT capability, namely, inside-out, outside-in, and spanning IT capability. As these three kinds of IT capability have different influencing mechanisms on organizational learning, we suppose that they may have different impact on the relationship between external integration and organizational responsiveness. The conceptual model of our research is depicted in Figure 1.

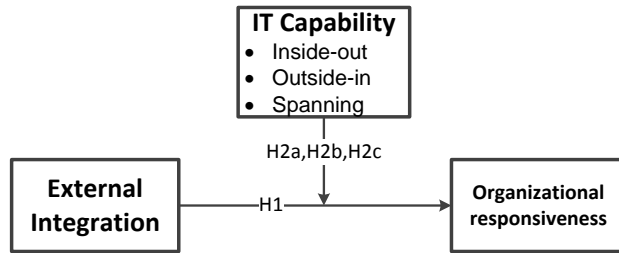


Figure 1. Conceptual model with hypotheses.

## 2 THEORETICAL BACKGROUND AND HYPOTHESES

### 2.1 Organizational learning theory

Organizational learning refers to “the process of improving actions through better knowledge and understanding” (Fiol & Lyles 1985, p.803). Different from related fields of knowledge management and intellectual capital, organizational learning links cognition and action (Crossan et al. 1999). In this sense, organizational learning can be considered as a process to make organizations acquire new knowledge to broaden their range of potential actions, eventually impacting their future behavior (Huber 1991).

Scholars contend that organizational learning consists of four components (i.e. information acquisition, information dissemination, shared interpretation, and development of organizational memory) (Huber 1991; Tippins & Sohi 2003). Information acquisition is the process of gathering useable information from both internal and external sources (Tippins & Sohi 2003). On the one hand, firms can acquire information from the direct experience embedded in their routines and their own memory mechanisms (Huber 1991). On the other hand, firms get external information, such as indirect experience of others, through the interaction of others (Gold et al. 2001; Li et al. 2011; Yli-Renko et al. 2001). Also, it is necessary to disseminate acquired information throughout firms to ensure the occurrence and breadth of learning (Huber 1991). Employees in different units of firms are able to learn only when they receive the information through communication, training, and observation (Chua & Pan 2008).

Moreover, shared interpretation refers to the degree of consensus among employees on the meaning of acquired information (Brockman & Morgan 2003; Daft & Weick 1984). Facing the increasingly severe problem of information overload, shared interpretation helps firms’ covert information to useful knowledge (Brockman & Morgan 2003). Employees can act in a concerted manner based on the consensus of information (Tippins & Sohi 2003). At last, organizational memory refers to “the amount of stored information or experience an organization has about a particular phenomenon” (Moorman & Miner 1997, p.103). It provides a foundation of the range of potential behaviors of firms (Huber 1991). Besides traditional repositories such as books, documents, and manuals, knowledge that cannot be codified are mostly stored in other reservoirs such as members, routines, and transactive memory systems (Argote & Miron-Spektor 2011).

One of the most important goals of organizational learning is to adapt to changes in business environment (Dodgson 1993; Fiol & Lyles 1985). Firms need to make strategic choices immediately to respond to external changes based on current knowledge storage (Miller 1996). As organizational learning brings new knowledge to firms and expand their potential behavior, we consider organizational responsiveness as the outcome of learning. Moreover, external integration reflects the cooperation among partners, which facilitates the exchange of resources and knowledge in the supply chain (Das et al. 2006; Kim 2013). Thus, organizational learning is triggered by external integration which provides partners’ knowledge (Yu et al. 2013). After a series of processes to assimilate external knowledge into their own memory, firms have an improved insight to strategic issue and a wider range of reactions to changes (Fiol & Lyles 1985; Huber 1991). Following this notion, we choose

organizational learning perspective to interpret the impact of external integration on organizational responsiveness.

## **2.2 Organizational responsiveness**

Organizational responsiveness refers to the extent to which a firm rapidly reacts to the changes of business environment in order to seize potential opportunities (Bernardes & Hanna 2009; Wei et al. 2013). It reflects “the efficiency and effectiveness with which firms sense, interpret, and act on market stimuli” (Garrett et al. 2009, p.783). Considered as a firm-level strategic action, responsiveness highlights the firm’s ability to meet the customers’ needs or react to the competitors’ decisions by utilizing various resources (Wei et al. 2013; Wei & Wang 2011). Scholars claim that enhancing a firms’ responsiveness to environmental changes becomes a vital success factor (Homburg et al. 2007). Specifically, it enables companies to quickly detect market changes and reconfigure their processes to provide products and services to satisfy the demand of customers, eventually expanding market share and enhancing profit (Hoyt et al. 2007).

As indicated in previous literature, responsiveness is based on the knowledge firms possess (Bernardes & Hanna 2009; Hult et al. 2005). Organizational learning, as a process to enlarge knowledge storage of firms, plays a critical role in developing responsiveness. In particular, it is important for firms to learn quickly about the changes which are fast-paced and difficult to foresee (Bernardes & Hanna 2009). Firms also need to learn from various sources, both internally and externally, in order to identify overall trends and possible organizational responses (Baird & Griffin 2006). Thus, Ketchen Jr & Hult (2007) claimed that “responsiveness is dependent on the ability of an organization to learn about changes in its market environment” (p. 284).

As the fundamental element of organizational learning, information processing is also important in developing responsiveness. It is suggested that improving the flow of information in a correct manner will improve organizational responsiveness (Douglas 1999). Moreover, Homburg et al. (2007) identified cognitive organizational system, which focuses on improving firms’ information processing (e.g. the generation, dissemination, analysis, and storage of information) as activities for influencing responsiveness. Thus, developing a capability which enables information processing is conducive to developing responsiveness.

## **2.3 External integration**

External integration is defined as “the degree to which a manufacturer partners with its external partners to structure inter-organizational strategies, practices and processes into collaborative, synchronized processes” (Flynn et al. 2010, p.59). It includes a variety of practices which need partners to participate collectively, such as joint goal setting, developing cross-functional teams, as well as new product and process design (Das et al. 2006; Wong et al. 2013). According to knowledge-based view, external integration is a process to acquire consolidate strategic knowledge, including valuable and inimitable knowledge-generating practices (Kim 2013; Swink et al. 2007). External integration is a vehicle for communication, facilitating the transfer and exchange of both explicit and tacit knowledge (Das et al. 2006; Koufteros et al. 2005). In this regard, firms get access to partners’ expertise and proprietary knowledge through collaboration, which provides the source for learning from external entities (Droge et al. 2004; Homburg & Kuehnl 2013; Wong et al. 2013).

A success external integration provides multi-facet benefits for firms by reducing transaction costs, achieving economies of scale, and combining competencies (Das et al. 2006; Peng et al. 2012). However, there exist inconsistent arguments about whether external integration can improve organizational responsiveness (Das et al. 2006; Swink et al. 2007). As external integration includes the underlying flow of knowledge which leads to learning (Das et al. 2006; Yu et al. 2013), we try to clarify this relationship from the lens of organizational learning.

We assume that there underlies a learning mechanism when firms leverage external integration for improving responsiveness. Through integrating with partners, firms can promote their capability of

sensing and responding to market changes. Specifically, in the process of integration, market information is shared along the supply chain, after which an organizational learning mechanism begins (Yu et al. 2013). On the one hand, they make use of this information to know the current demand in marketplace, thereby improving their products or services to be more responsive to customer needs (Flynn et al. 2010). On the other hand, firms try to leverage information to explore the unrevealing rules, in order to have a deeper understanding of market expectations and opportunities, through which firms are able to detect market changes proactively and identify opportunities rapidly (Schoenherr & Swink 2012; Wong et al. 2011). Besides market information, firms can also gain operational skills or specialties which are hard to codify in an explicit way (Homburg & Kuehnl 2013). After combining acquiring knowledge with what they already know, firms can generate innovations on both product and process design (Koufteros et al. 2005; Peng et al. 2012). In this sense, firms are able to conduct a larger range of behavior to make responses when turbulence occurs in market. Based on the discussion above, we propose that:

H1: External integration is positively associated with organizational responsiveness.

## **2.4 The moderating effect of IT capability**

IT capability is defined as “a firm’s ability to acquire, deploy, combine, and reconfigure IT resources in support and enhancement of business strategies and work processes” (Lu & Ramamurthy 2011, p.932). It is asserted that IT capability improves the learning in a firm (Tippins & Sohi 2003). Specifically, IT capability enables firms to get access to proper information from a large scope of sources in a speedy and costless manner (Lu & Ramamurthy 2011; Sambamurthy et al. 2003). By promoting knowledge management initiatives, IT capability can facilitate the dissemination, shared interpretation and storage of information within a firm, thereby enhancing the ability to respond to potential changes (Bharadwaj 2000; Tippins & Sohi 2003; Yoon 2011). Therefore, we assume that IT capability facilitates the relationship between external integration and organizational responsiveness.

Following the typology of Wade & Hulland (2004), we identify three kinds of IT capability (i.e. inside-out, outside-in, and spanning). Particularly, inside-out IT capability is deployed from inside the firm, referring to its ability to leverage shareable platforms (Lu & Ramamurthy 2011). In contrast, outside-in IT capability is externally oriented, emphasizing on maintaining durable relationship with partners, detecting market requirements, and communicating with buyers and suppliers (Bharadwaj et al. 1999; Wade & Hulland 2004). Finally, spanning IT capability involves both internally and externally factors, focusing on the integration of inside-out and outside-in IT capability (Wade & Hulland 2004).

Inside-out IT capability reflects the extent to which a firm deploys data, network, and processing architectures for enterprise applications and services (Bharadwaj et al. 1999). This capability is conducive to organizational learning by improving the reach and range of information (Bharadwaj 2000; Tippins & Sohi 2003). Specifically, inside-out IT capability provides a globally integrated platform that enforces standardization and integration of data and processes (Kim et al. 2011; Lu & Ramamurthy 2011), which enables firms to get access to the information owned by a large range of partners regardless of geographical distance. In the process of external integration, the integrated platform ensures information can be exchanged among partners smoothly through a unified interface, and thus firms are able to gain external information effectively (Lu & Ramamurthy 2011). Moreover, this capability facilitates the dissemination of information within the boundary of firms (Bhatt & Grover 2005). Employees from different business functionalities can reach information through integrated platform (Bharadwaj 2000). Also, inside-out IT capability builds a fine-grained memory system in order to reserve the useful information and knowledge. When there is a need to respond to market changes, firms are able to reach relevant information and knowledge by an effective mechanism of retrieve (Tippins & Sohi 2003). In this sense, inside-out IT capability positively affects the reach and range of information, thereby improving organizational learning. As a consequence, external integration is more conducive to responding to market changes when firms possess a high inside-out IT capability.

H2a: Inside-out IT capability positively moderates the influence of external integration on organizational responsiveness.

Outside-in IT capability represents technology based linkages between the firm and its key business partners, which focuses on the interaction with partners (Bharadwaj et al. 1999). This capability mainly facilitates the acquisition of external information in the process of integration. Specifically, in the process of external integration, formal or informal interaction routines are promoted by IT initiatives, hence improving the information flow between partners (Patnayakuni et al. 2006). In this sense, outside-in IT capability provides firms the channel to obtain information constantly from integration. Besides, a long-term relationship with mutual trust can be developed through interactions, which reduces the perception of opportunistic behaviours in integration (Lawson et al. 2008; Petersen et al. 2008). Thus, partners are willing to share sensitive information with firms with the confidence of their good intent (Prajogo & Olhager 2012; Yeung et al. 2009). Therefore, firms are able to acquire more useful information based on outside-in IT capability in the process of external integration, which constitute the base for learning and further enhance responsiveness.

H2b: Outside-in IT capability positively moderates the influence of external integration on organizational responsiveness.

Spanning IT capability concentrates on the ability to envision and exploit IT resources to support and enhance business objectives of a firm (Lu & Ramamurthy 2011). This capability reflects the extent to which a firm develops favourable IT business partnerships, a clear strategic vision to IT and business, an effective integration between IT and business process, and management ability of IT (Wade & Hulland 2004; Zhang et al. 2008). We suppose that spanning IT capability enables learning process underlying external integration by improving information dissemination, interpretation, and organizational memory, eventually leveraging the information to better respond to market changes. Particularly, although information can be transferred through the integrated IT platform, there still exists tacit information which is hard to codify to transfer (Argote et al. 2003). With the partnership facilitated by spanning IT capability, tacit information can be shared through the interactions across different units, which finally improves information dissemination (Alavi & Leidner 2001; Cavusgil et al. 2003). Furthermore, spanning IT capability involves the synergy between IT and business department, which generates the experience in the field of each other. The shared knowledge base among employees can promote shared interpretation to acquired information (Reich & Benbasat 2000; Tippins & Sohi 2003). In addition, organizational memory mechanism is facilitated by this capability. Apart from the traditional retrieve system of codified documents, employees are able to find the information they need from the person who already acquires it (Sue Young et al. 2010). By understanding the specialty of each other, a knowledge map can be developed to facilitate the retrieval of tacit information (Huang et al. 2013). Based on above, spanning IT capability can strengthen the relationship between external integration and responsiveness by promoting relevant processes of learning.

H2c: Spanning IT capability positively moderates the influence of external integration on organizational responsiveness.

## **3 RESEARCH METHOD**

### **3.1 Sample and data collection**

We try to test our hypotheses using a questionnaire survey. We chose to conduct this survey in China, because China has become an emerging market economy and Chinese firms have an increasingly impact on the global marketplace. We selected a Chinese educational institution to collaborate with in order to make our survey feasible. This institution is well known for its executive training programs, providing a series high quality training on the topic of information systems, supply chain management, and other managerial fields. With the assistance of the institution, we obtained a sampling pool that included 300 firms which had involved external integration in the supply chain. Then, for each firm,

we identified one senior executive who had attended the institution's training programs to serve as a key informant.

After sending out questionnaires, we made follow-up phone calls and sent reminder emails to encourage response. Out of a total of 300 questionnaires, 197 useful questionnaires were returned to us with a response rate of 65.67%. Table 1 showed the demographic data of these respondents, such as the information about industry, ownership, number of employees, and history of their firms.

	N	Percentage
<b>INDUSTRY</b>		
Manufacturing	120	60.91
Service	77	39.09
<b>OWNERSHIP</b>		
State-owned	95	48.22
Privately Owned	87	44.16
Foreign-controlled	15	7.61
<b>NUMBER OF EMPLOYEES</b>		
Less than 100	49	24.87
100-299	49	24.87
300-499	16	8.12
500-999	22	11.17
1000-1999	18	9.14
More than 2000	43	21.83
<b>FIRM HISTORY</b>		
1-5 Years	32	16.24
6-10 Years	45	22.84
11-25 Years	76	38.58
26-50 Years	23	11.68
More than 51 Years	21	10.66

Table 1. Sample demographic.

### 3.2 Measures

We measured external integration by adapting four items from the work of Chiang et al. (2012) and Wong et al. (2013). Organizational responsiveness is measured by four-item scale adapted from the work of Homburg et al. (2007) and Hult et al. (2005). Following the research of Bharadwaj et al. (1999), we identified six categories of IT capability, namely, IT infrastructure, external IT linkages, IT business partnerships, business IT strategic thinking, IT business process integration, and IT management. Based on the study of Wade & Hulland (2004), we categorized these types of IT capability into inside-out IT capability (i.e. IT infrastructure), outside-in IT capability (i.e. external IT linkages), and spanning IT capability (i.e. IT business partnerships, business IT strategic thinking, IT business process integration, and IT management). The scale developed by Zhang et al. (2008) is adapted in order to measure IT capability in our research.

We included three control variables that might affect organizational responsiveness in current research, namely, the industry (IND), the ownership (OWN), and firm size (SIZE). Specifically, we used a dummy variable for the industry, with IND = 1 and IND = 0 for the manufacturing and service industries, respectively. We placed retail/wholesale, bank/insurance, transport/distribution, and other services in the category of service industry based on whether a firm manufactured physical products



or provided services (Liu et al. 2010; Mitra & Singhal 2008). Moreover, we used dummy variables for the firm ownership: state-owned, privately owned, and foreign-controlled. In addition, we measured firm size by the number of full-time employees in the focal firm.

At first, we developed an English questionnaire based on the scales of relevant research. Then we translated it into Chinese version. We hired a professional translator who knew nothing about our research to translate this Chinese questionnaire back to English. By comparing the translated English version to the original English questionnaire, no semantic discrepancies were found, which manifested that the Chinese questionnaire was equivalent to the English one. Meanwhile, a clear description of relevant concepts was included in the questionnaire to ensure participants had the same understanding of these concepts as the authors. In the questionnaire, all items were measured with 5-point Likert scales, ranging from “strongly disagree” to “strongly agree.”

## 4 ANALYSIS AND RESULTS

As all data were perceptual and collected from a single source at one point in time, we adopted Harman's one-factor test to check the possible common method bias. It was shown that the test categorizes the items into seven constructs with eigenvalues greater than 1.0, thus accounting for 71.08% of the variance. Meanwhile, the first construct did not account for the majority of the variance (17.94%). Based on the result, the common method bias was not a serious concern in this study.

### 4.1 Measure validation

We conducted Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA) to assess the construct validity and unidimensionality of the resulting multi-item measurement scales. The individual item loading and the Average Variance Extracted (AVE) were used to test the convergent validity. As shown in Table 2, the results indicated that all measurement items had high enough convergent validity. The loadings varied from 0.74 to 0.93 at a significance level of 0.001. The AVE scores for constructs ranged from 0.64 to 0.83, which were above the recommended benchmark of 0.50 (Fornell & Larcker 1981), implying that most variances in the constructs were captured by the indicators rather than denoting measurement errors.

Items	Loading	Cronbach's alpha	Composite reliability	AVE
External integration	0.80-0.89	0.87	0.91	0.72
Organizational responsiveness	0.74-0.84	0.81	0.88	0.64
Inside-out ITC	0.91-0.92	0.90	0.94	0.83
Outside-in ITC	0.87-0.92	0.87	0.92	0.79
<i>Second-order spanning ITC</i>	<i>0.84-0.89</i>	0.88	0.92	0.74
IT business partnership	0.77-0.86	0.73	0.85	0.65
Business IT strategic thinking	0.85-0.90	0.84	0.91	0.76
IT business process integration	0.86-0.93	0.89	0.93	0.82
IT management	0.87-0.93	0.93	0.95	0.83
Industry	Single item			
Ownership	Single item			
Firm Size	Single item			

Table 2. Results of Confirmatory Factor Analysis (CFA).

Furthermore, we tested discriminant validity by comparing shared variances among constructs and the values of AVEs in the light of previous research (e.g. Liu et al. 2013; Paulraj et al. 2008). The results shown in Table 3 manifested that none of the squares of correlations between constructs was higher

than the value of the related AVE, which supported the discriminant validity. It should be noticed that the correlation between inside-out IT capability and spanning IT capability, outside-in IT capability and spanning IT capability were higher than 0.60. Thus, we conducted a multicollinearity test and found that the highest variance inflation factor (VIF) was 3.20 and the lowest tolerance value was 0.31. As it was suggested that multicollinearity exists when VIF was higher than 10 and tolerance value was lower than 0.10 (Kutner et al. 2004), we proved that multicollinearity did not appear to be a significant problem in our research. In addition, we assessed the reliability of each construct using Cronbach's Alpha and composite reliability (Fornell & Larcker 1981). As shown in Table 2, they were all higher than the suggested threshold of 0.70. Based on above, we concluded that the measurement model possessed adequate convergent validity, discriminant validity, and reliability.

	Mean	SD	1	2	3	4	5	6	7	8	9
1. External integration	3.48	0.84	<b>0.85</b>								
2. Responsiveness	3.59	0.75	0.51	<b>0.80</b>							
3. Inside-out ITC	3.06	1.08	0.45	0.37	<b>0.91</b>						
4. Outside-in ITC	3.18	1.06	0.42	0.34	0.50	<b>0.89</b>					
5. Spanning ITC	3.05	0.86	0.50	0.42	0.77	0.63	<b>0.86</b>				
6. Industry_Dum	NA	NA	0.08	0.01	-0.15	-0.17	-0.20	<b>NA</b>			
7. Ownership_Dum1	NA	NA	-0.12	-0.14	0.13	-0.01	0.10	-0.04	<b>NA</b>		
8. Ownership_Dum2	NA	NA	0.11	0.13	-0.20	-0.03	-0.16	-0.04	0.35	<b>NA</b>	
9. Firm Size	NA	NA	0.03	0.07	0.19	0.08	0.12	0.16	-0.86	-0.36	<b>NA</b>

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

Table 3. Assessment of discriminant validity.

In this study, spanning IT capability was treated as a second-order reflective construct. We employed LISREL to conduct a second-order CFA by using the first-order dimensions to assess whether all first-order dimensions reflected the second-order construct. The results indicated that the higher-order measurement model had an acceptable fit ( $\chi^2 = 141.83$  on 61 d.f., RMSEA = 0.082, CFI = 0.98, IFI = 0.98, NFI = 0.97, NNFI = 0.98). Although the RMSEA value was slightly above the suggested benchmark of 0.080, this value could be accepted according to the criterion of RMSEA < 0.100 proposed by Hair & Anderson (2010).

## 4.2 Hypotheses testing

We conducted hierarchical regression analysis to test these hypotheses (Kutner et al. 2004). To minimize the possibility for multicollinearity, we mean-centered the independent variables and moderator variables (Aiken & Stephen 1991). We examined two models separately according to the approach provided by Perrone et al. (2003). Model 1 included the control variables and all independent variables. The results showed that all control variables had no significant impact on organizational responsiveness. The explained variance of Model 1 was significant ( $R^2 = 0.275$ ; F change = 14.473,  $p < 0.01$ ). Model 2 was a full model with all variables and hypothesized interaction effects as independent variables. The explained variance of Model 2 was also significant ( $R^2 = 0.375$ ; F change = 4.968,  $p < 0.01$ ).

Table 4 revealed the results of the regression analysis. For the impact of external integration on organizational responsiveness, we found support for H1 which proposed external integration was positively related to organizational responsiveness ( $\beta = 0.367$ ,  $p < 0.01$ ). On the other hand, it was shown by the result that outside-in IT capability positively moderated the relationship between external integration and organizational responsiveness ( $\beta = 0.150$ ,  $p < 0.05$ ), which provided a support to H2b. Similarly, a positive moderating effect of spanning IT capability was proved ( $\beta = 0.214$ ,  $p <$

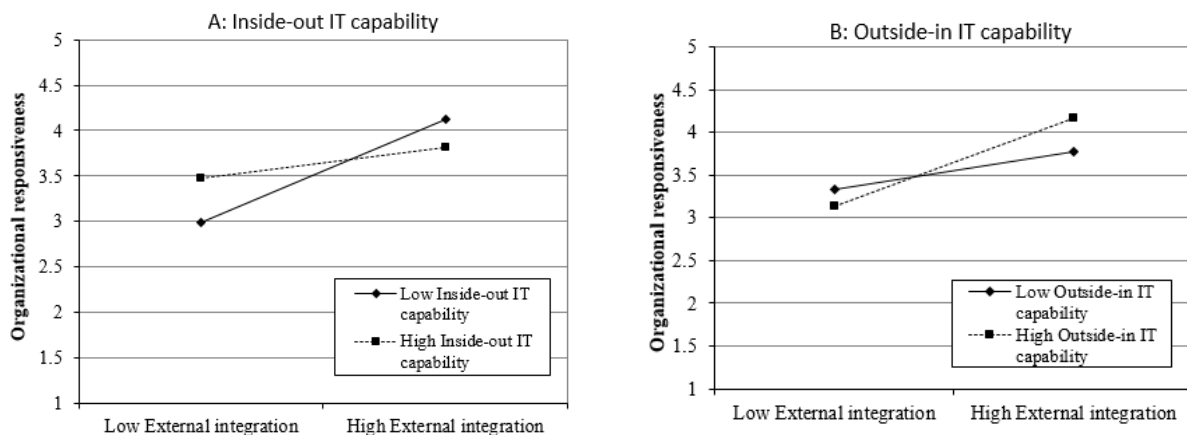
0.05). H2c was supported by this result. However, in contrast to H2a, a significantly negative moderating effect of inside-out IT capability was found ( $\beta = -0.202$ ,  $p < 0.05$ ).

	Organizational responsiveness	
	Model1	Model2
Industry (Dummy)	-0.045	0.040
Ownership (Dummy1)	-0.064	-0.074
Ownership (Dummy2)	0.048	0.101
Firm size	0.098	0.087
External integration	0.509**	0.367**
Inside-out ITC		0.046
Outside-in ITC		0.047
Spanning ITC		0.167
EI*InITC		-0.202*
EI*OutITC		0.150*
EI*SpanITC		0.214*
R <sup>2</sup>	0.275	0.375
Adjusted R <sup>2</sup>	0.256	0.338
F change	14.473**	4.968**

Note: \* $p < 0.05$ . \*\* $p < 0.01$ .

Table 4. Results for hierarchical regression analysis.

In order to further analyze the moderating effects, we followed the graphical procedure suggested by Aiken & Stephen (1991) to draw Figure 2. We assigned to inside-out IT capability, outside-in IT capability, and spanning IT capability the values of one standard deviation above and below their means to plot their moderating effects. It was shown in Figure 2A that the sloped regression line for the relationship between external integration and organizational responsiveness was positive and significant for low inside-out IT capability ( $\beta = 0.552$ ,  $p < 0.01$ ), and it was positive and non-significant for high inside-out IT capability ( $\beta = 0.160$ ,  $p = 0.127$ ). Figure 2B presented the sloped regression line was positive and insignificant for low outside-in IT capability ( $\beta = 0.210$ ,  $p = 0.053$ ), and it was positive and significant for high outside-in IT capability ( $\beta = 0.502$ ,  $p < 0.01$ ). Similarly, the sloped regression line in Figure 2C indicated the positive and insignificant relationship between external integration and organizational responsiveness when spanning IT capability was low ( $\beta = 0.148$ ,  $p = 0.180$ ). This relationship became positive and significant when spanning IT capability was high ( $\beta = 0.564$ ,  $p < 0.01$ ).



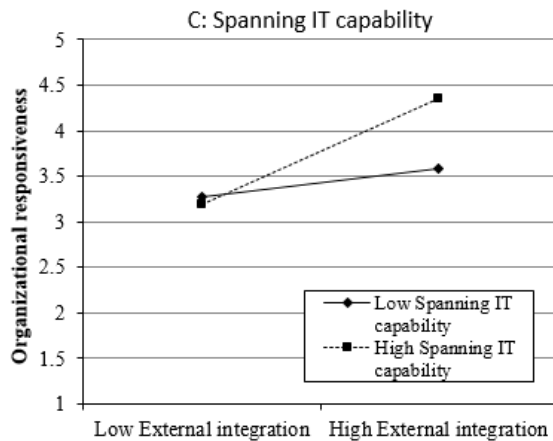


Figure 2. *Moderating effects of IT capability on the relationships between external integration and organizational responsiveness.*

## 5 DISCUSSION, LIMITATIONS AND IMPLICATIONS

Due to the contradictory findings about the relationship between external integration and organizational responsiveness, the current research aims to clarify this relationship in consideration of IT capability through the lens of organizational learning. We suppose that there exists a learning mechanism when firms leverage external integration to improve their responsiveness. In this process, IT capability serves as a moderator in the relationship by promoting organizational learning. Our findings on the effects of external integration and IT capability are not only consistent with prior studies, but also provide new insights towards this research stream.

By analyzing the direct effect of external integration on organizational responsiveness, we provide empirical evidence on the value generated by external integration. Consistent with organizational learning perspective, external integration provides a source for firms to learn from others. After a series of learning processes, firms expand their range of potential behavior in order to make better responses when facing market turbulence.

Moreover, we identified three kinds of IT capability (i.e. inside-out, outside-in, and spanning) and tested the moderating effects of them. We find both outside-in IT capability and spanning IT capability positively moderate the influence of external integration on organizational responsiveness. It accords with our assumption that IT capability facilitates learning processes when developing responsiveness through external integration.

However, to our surprise, it is manifested that inside-out IT capability negatively moderates this relationship. A possible explanation is that a high level of inside-out IT capability could impede information flow because of fixed physical and technological artifacts of information systems (Lu & Ramamurthy 2011; Ray et al. 2005). Also, advanced information systems may get in the way of routines, hindering face to face communication. Employees tend to adopt electronic instruments rather than traditional ways, which is detrimental to learning processes.

Furthermore, we analyzed the moderating effects by plotting the regression line for the relationship between external integration and organizational responsiveness. According to the results presented by graphs, external integration cannot significantly improve organizational responsiveness when outside-in IT capability or spanning IT capability is low, or inside-out IT capability is high. These graphs can explain the mixed claims about the effectiveness of leveraging external integration to improve responsiveness.

Nevertheless, it is necessary to point out limitations of this research before evaluating the contributions. First, external integration may provide various benefits to firms, such as innovation

capabilities (Peng et al. 2012; Wong et al. 2013), customer satisfaction (Yu et al. 2013), and product quality (Jayaram & Xu 2013), but we only investigate its relationship with organizational responsiveness. Future research can focus on other benefits generated by external integration to figure out their relationship. Second, due to the limited demography of our sample, the results cannot be generalized to every field. Specifically, the survey is conducted in the context of China. The respondents are all from a sampling pool of an educational institution. Although it is good for the internal validity of this study due to the common knowledge base possessed by all respondents, the external validity is constrained as a consequence. Scholars and practitioners could put effort to generalize these findings to firms located in a variety of countries with different cultures, values, and business environments. Third, our research conducted the survey in the approach of key informant. As the constructs are perceptual, it is easy to generate bias by only using single respondent to represent the situation of a firm. In this sense, we urge further researchers to use objective data or collect data from multiple informants as suggested by Lu & Ramamurthy (2011).

The study mainly makes two theoretical contributions. On the one hand, it clarifies the mixed current research findings about the relationship between external integration and organizational responsiveness. Through the lens of organizational learning perspective, our research provides a new insight to explain this relationship. We consider external integration as a source to provide materials for firms to learn. Organizational responsiveness is treated as an outcome of organizational learning which provides a wider range of potential behavior of firms. Our study is an effort to provide new ideas and evidence to the relatively limited supply chain integration research using the lens of organizational learning perspective (e.g. Yu et al. 2013).

On the other hand, this research investigates the moderating role of IT capability. IT capability is widely acknowledged as an important enabler when developing supply chain integration (Prajogo & Olhager 2012). However, little research has discussed its role in the process of value generation of integration. We follow the typology of Wade & Hulland (2004), demonstrating different moderating mechanism of inside-out, outside-in, spanning IT capability on the relationship between external integration and responsiveness. According to the results, we find that three kinds of IT capability play different roles in this relationship. We also testify that the positive impact of external integration on organizational responsiveness is contingent on the IT capability firms possess.

Our research also has major practical implications. As an increasing number of firms participating in integration along the supply chain, managers become to care more about the benefit provided by integration. This study tries to investigate the influence of external integration on organizational responsiveness – a vital strategic factor for success. We reveal that the positive effect of external integration is contingent on IT capability of firms. Following this notion, we provide a suggestion to managers that firms should have a favorable level of IT capability. Specifically, in order to achieve high responsiveness through external integration, managers should focus on the development of outside-in and spanning IT capability rather than inside-out IT capability. Also, it is important to promote organizational learning to make employees absorb and share knowledge in order to obtain benefits during the integration with partners.

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