

A Resource-Based View on Enablers of Supplier Integration: Evidence from China

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Abstract: Supplier integration has been a hot topic for both academicians and practitioners since the booming of supply chain management and popularity of Japanese supplier management practices. Previous studies have contributed a lot to the performance impacts of supplier integration. However, not much has been done in investigating the enablers, and little attention has been paid from the resource-based view (RBV) perspective. The organizational resources and capabilities are ignored in empirical studies investigating enablers of supplier integration, although theoretical arguments are strongly supported by RBV. In this study, we identify two organizational resources and two organizational capabilities as enablers of supplier integration based on RBV. Two organizational resources are human resource and information technology (IT) resource while two organizational capabilities are integrative capability and adaptive capability. These resources and capabilities are posited to affect the implementation of supplier integration. With data collected from 604 Chinese manufacturers, we empirically test the impacts of these organizational resources and capabilities on supplier integration. The results show that human resource has direct impact on supplier integration and indirect impact on supplier integration through enhancing two organizational capabilities. IT resource only has indirect impact on supplier integration through enhancing two organizational capabilities. Both of the two organizational capabilities have significant impacts on supplier integration. Relative to IT resource, human resource has higher impacts on the two organizational capabilities. Totally, human resource is much more important in improving supplier integration than IT resource.

Keywords: Supplier integration, RBV, enabler, China

I. Introduction

Over the past decades, companies have inclined to integrate their operations externally with key customers and suppliers (Chen et al., 2009). A number of companies (e.g. Wal-Mart,

Zara, Dell, and Toyota) have managed their supply chains successfully and have achieved superior business performance (Lumms and Vokurka, 1999). The core values of these companies are not products or services they provide but the management style they use to manage their supply chains. Their highly integrated supply chains could response to customers efficiently and effectively, which is a powerful weapon to gain competitive advantages because that requirements of customers change frequently and the product life cycle is becoming shorter and shorter. Though benefits of supply chain integration (SCI) are attractive, it is not easy to implement SCI, especially in a developing country like China, due to infrastructure and cultural issues (Han et al., 2002; Li, 2007, p. 24). Even in the U.S., which has the well developed economy, the inadequate integration among supply chain partners led to \$9 billion additional costs in automobile and electronic industries (2004 report on Economic Impact of Inadequate infrastructure for Supply Chain Integration for National Institutes of Standards & Technology, U.S. A.).

Chinese manufacturers play a more and more important role in the global supply chain. More and more companies from developed countries source from China or outsource their manufacturing to China. Therefore, SCI research in China is desirable as Chinese manufactures are indispensable parts of the global supply chain. When western companies relocate their plants in China, one key issue is how to manage the supply chain well under the localization of human resource and technology. Because of the difference in culture, transportation infrastructure, and technology usage, Chinese manufacturers may implement and configure its resources for the implementation of SCI in a different way. As important part of SCI, supplier integration is focused in this study. It is more interesting to investigate supplier integration in China context because China still plays the sourcing role in the global supply chain. Moreover, recent discovered quality issues in toy and milk powder products strengthened the backbone role of supply management in the Chinese supply chain management.

Though extensive studies investigated the tactics in coordinating processes seamlessly with suppliers and their

performance impacts since the booming of supply chain management philosophy and Japanese supplier management practices (Frohlich and Westbrook, 2001; Stank et al., 2001b; Germain and Iyer, 2006; Das, Narasimhan, and Talluri, 2006; Devaraj et al., 2007; Swink et al., 2007), there are still questions about how to improve its implementation. Our knowledge concerning the enablers of supplier integration is limited. Based on the marketing and strategy literature, organization structure, relationship management, and environmental factors are identified as key enablers of supplier integration by some researchers (Wu et al., 2004; Pagell, 2004; Koufteros et al., 2007; Paulraj and Chen, 2007; Zhao et al., 2008). However, little attention has been paid to treating organization resources and capabilities as enablers of supplier integration. In a recent conceptual work, Shub and Stonebraker (2009) proposed organizational resources and structures as antecedents of SCI. As a key element of SCI, supplier integration can leverage the internal resources and capabilities to achieve competitive advantage. Therefore, it is interesting to know the impacts of internal resources and capabilities on supplier integration.

This study is attempted to cover the gap in investigating enablers of supplier integration. Therefore, the first objective is to identify organizational resources and capabilities, such as human resource, IT resource, integrative capability, and adaptive capability that are related with supplier integration based on past literature and RBV. Subsequently, the second objective is to empirically test the links among organizational resources, organizational capabilities, and supplier integration in a holistic model using data collected from Chinese manufacturers.

The paper is organized as follows. First, we identify organizational resources and capabilities from relevant literature and discuss their relationships with supplier integration. The research hypotheses are then presented. These are followed by research methodology and statistical analyses. Next, the analytical results and managerial implications are discussed. Finally, the research limitations and future research is presented.

II. Theoretical Foundation and Hypotheses

2.1. Supplier integration and RBV

There is no consistent understanding of supplier integration in previous literature (Ho et al., 2002). Some studies focused on logistics (Daugherty et al., 1996; Kahn and Mentzer, 1996), product development (Brown and Eisenhardt, 1995; Handfield et al., 1999; Stump et al., 2002; Tracey, 2004; Koufteros et al., 2005), information technology (Jhingran et al., 2002; Roth et al., 2002; Kulp et al., 2004), or strategic planning processes (Johnson, 1999; Fuchs et al., 2000; Burgelman and Doz, 2001). Others took a general perspective on inter-organizational relationships (Bowersox et al., 1999; Stank et al., 2001a). In this study, supplier integration can be defined as the degree to which a manufacturer cooperates with its key external suppliers to

structure inter-organizational strategies, practices, and processes into collaborative, synchronized processes in order to fulfill its customers' requirements (Stank et al., 2001b).

Previous studies mainly focused on the benefits of supplier integration and what kinds of mechanisms are helpful to achieve that. Therefore, there is lack of studies that examined factors influencing supplier integration (Zhao et al., 2008). Although it is not as important as the investigation of performance impacts of supplier integration, in the recent decade, some efforts have been put on the antecedents of supplier integration by looking at the environmental and relationship factors (Frohlich and Westbrook, 2002; Vickery et al., 2003; Pagell, 2004; Wu et al., 2004; Devaraj et al., 2007; Paulraj and Chen, 2007; Zhao et al., 2008). From the perspective of organization design, environmental factors have been seen as key enablers of supplier integration (Bensaou and Venkatraman, 1995; Thompson, 2003). However, it is believed that the environment influence supplier integration through change of the strategy and the structure (Pagell, 2004). Relationship management factors are also another set of enablers of supplier integration (Morgan and Hunt, 1994; Brown et al., 1995; Sheu et al., 2006; Zhao et al., 2008).

RBV provides a new perspective on how a company competes. It focused on the internal strength and weakness analysis of the company. According to RBV, a firm is composed of resources and capabilities (Wernerfelt, 1984), a firm's resource endowment and capabilities to use these resources are a source of the firm's competitive advantage. It is believed that capabilities are distributed heterogeneously among firms and are difficult to imitate and transfer, which sustain the competitive advantage of them firm (Peteraf, 1993). Thus, the RBV of the firm explains that the differences between different firms' performances are owing to their differences in resources and capabilities. Although a good understanding of the RBV has been attained in strategic management literature, operations management scholars have seldom applied it in their research, except for several studies (Schroeder et al., 2002; Peng et al., 2008; Mishra and Shah, 2009). Though some studies have found the links between certain resource and supplier integration (e.g. Devaraj, et al., 2007), few of them have a holistic view on the relationships between organizational resources, organizational capability and supplier integration. In this study, RBV is used as the theoretical lens to build the relationships between organizational resources, organizational capabilities, and supplier integration.

Usually, firm resources are classified as physical capital resources, human capital resources, and organizational capital resources (Barney, 1991). Physical capital resources are a collection of physical technology, equipment, plant location, etc. (Williamson, 1975). Human capital resources refer to the employee training, expertise, working relationships, knowledge of the employee, etc. (Becker, 1964). Organizational capital resources include organizational structure, management system, relationships

among different functional groups, relations between the company and the environment, etc. (Tomer, 1987). However, not all aspects of a firm's physical capital, human capital, and organizational capital are relevant resources for supply chain management. Only those that do enable a firm to construct and implement supplier integration that improves its efficiency and effectiveness are recognized as firm resources in this study. Other theories also provide support for resource identification in this study. The sociotechnical system theory proposes that organizations are composed by both social and technical subsystems (Parsmore, 1988). The former consists of peoples that work with each other, while the later includes the equipment and technology. Combining RBV and sociotechnical system, we identified two organizational resources: human resource and IT resource. Meanwhile, organizational capabilities are seen as the ability that firm integrate and reconfiguration firm resources. Capabilities are embedded in organizational processes or routines focused on coordination, learning, and transformation (Harreld et al., 2007). Arising from RBV, dynamic capability view was often suggested as a higher level capability that secures the firm's competitive advantage. One of these attempts was Eisenhardt and Martin's (2000) re-conceptualization of dynamic capabilities. They identified dynamic capabilities as "specific organizational and strategic processes (e.g. product development, strategic decision making, alliancing) by which managers alter their resource base". In their view, dynamic capabilities consist of "identifiable and specific routines that often have been the subject of extensive empirical research in their own right outside the resource-based view of the firm" (Eisenhardt and Martin, 2000). In this study, we defined integrative capability as firm's ability to combine their resources that exist among different functions to achieve unity of efforts. Adaptive capability refers to firm's ability to arrange their resources configuration by the demands of the environment. In this study, we use integrative capability to capture firm's resource integration and adaptive capability to capture firm's resource reconfiguration.

2.2 Relationships between organizational resources and capabilities

Based on RBV, organization resources should have the attributes of VRIN, which are valuable, rare, imperfectly imitable, and non-substitutable. Human resource is classified as people dependent intangible resources (Fernández et al., 2000). The human resources management practices could help the firm acquire human capital in terms of knowledge and personal relations. These knowledge and personal relations are nurtured by years of effort and are not easy to imitate. For example, the knowledge of an individual on particular suppliers' product is named as "knowhow" that may be more tacit. Such knowhow may not be easy to explain to others. Only when there is trust and empowerment among the employees, will this kind of knowledge exchange

be encouraged. Furthermore, the personal relations built in contact with the suppliers' employees are also difficult to transfer to others. Purposely and systematically managing the human resources maybe more efficient in transferring the knowhow than learning by doing.

Organizational capital ranges from norms and guidelines, organizational routines and corporate culture to strategic alliances. It seems to make the firms run in order and stably. Under the dynamic environment, the valuable organizational capability can deal with the changes in the market and workplace. Not all the firms can work in this way because it is more risky to be dynamic and flexible. Therefore, adaptive capability is valuable and rare resources in the age that "strategy as commitment" fades and "strategy as strategic flexibility" increases (Sanchez, 1997). In addition, this capability is not easy to form because it needs continuous adjustment of internal structure according to the environment and maturity of learning culture (Sanchez, 1995; Lau, 1996; Young-Ybarra and Wiersema, 1999; Shimizu and Hitt, 2004). Human resource can be a strong support for this flexible organization because human factor itself is flexible and movable. This intangible resource is valuable in maintaining a flexible organizational structure.

H1a: Human resource has a positive impact on integrative capability.

H1b: Human resource has a positive impact on adaptive capability.

As one of physical capital resources, IT software or systems are easier to be purchased in markets. There are plenty of failing cases of IT system applications, such as Enterprise resource planning (ERP) systems. It indicates that IT implementation is difficult to imitate, especially for complex system integrating the business processes. In addition, IT applications are helpful in reducing coordinating costs, overhead costs and operations complexities, which saves time, money, and human capital of the firm (Sethi and King, 1994; Bharadwaj, 2000; Subramani, 2004; Heim and Peng, 2009). These IT resources are becoming proprietary or complex if they are well integrated into the business processes, which is hard to imitate. IT applications can help in information sharing and activity coordination. The resources from different functional silos can be connected together by sharing the information and coordinating the activities first. On the other hand, the facilitated information flow among different functions can also support the resource re-organization. IT can help firms to be flexible without sacrificing the coordinating cost.

H2a: IT resource has a positive impact on integrative capability.

H2b: IT resource has a positive impact on adaptive capability.

2.3 Relationships between organizational resources and supplier integration

Human resources play an important role in implementing supplier integration. Human resource management activities,

such as trusting and empowering employees, career planning and development, and extensive employee involvement and training, are often helpful in enhancing the retention of quality employees, which is useful for building long-term relationship with suppliers. Furthermore, multi-skilled employees are needed if the company wants to have a good collaboration with suppliers. The training for this kind of multi-skilled employees will make the employees have good understanding of the work in other departments. For example, product development personnel can help in building supplier relationship if they are familiar with the production process and material cost. They may also invite suppliers in their product development process when they understand the importance of the supplied material to the product design.

H3: Human resource has a positive impact on supplier integration.

Investment in IT is one of the major concerns in developing supplier integration. It has been accepted that IT is a kind of mechanism that enhances information flows (Flynn and Flynn, 1999). Therefore, IT, as a quick-connect electronic interface, helps the firm to facilitate the information sharing and processing. IT is widely applied in different processes such as manufacturing, planning, and product development, etc. In manufacturing process, IT is mostly used to synchronize and automate production process in shop floor (Banker et al., 2006). Through the connection with other systems, the manufacturing data could be easily shared with its suppliers. Suppliers may know how parts they supply are used in the production process. ERP systems are also widely deployed in the planning process. It could build seamless information sharing and efficient resource deployment of the firm internally. In addition, the well established ERP system in the company could also facilitate the supply chain activities externally. In the product development process, the application of computer aided design (CAD), computer aided manufacturing (CAM), computer aided process planning (CAPP) could help the product and process design by building a common language (Liker et al., 1998), making redesign easily, and reusing past data promptly. Through these IT systems, information could be transferred to suppliers easily. The channel of communication and information sharing will be greatly improved by the application of IT systems.

H4: IT resource has a positive impact on supplier integration.

2.4 Relationships between organizational capability and supplier integration

Appropriate organizational capabilities are needed for establishing, maintaining, and monitoring portfolios or networks of business relationships (Wagner and Boutellier, 2002). Integrative capability can be helpful in organizing the internal resource for external collaboration. Firm's integrative capability is reflected in its integrative organizational structure, synchronized processes, collaborative routines and values. A high level of internal

communication and coordination among different functions will facilitate the achievement of a high level of supplier integration. For example, real-time information sharing and data integration among different functions make it easier for purchasing function to work with suppliers.

H5: Integrative capability has a positive impact on supplier integration.

Adaptive capability plays a significant role in the implementation of supplier integration. Adaptive capability can help the manufacturers build the capabilities of forming a flexible organizational structure and focusing on core competence. In order to outsource non-core activities and maintain the quality of these activities outsourced, the focal firm needs to build long-term relationships with suppliers and to communicate with them to smooth the processes. Furthermore, this concentration of business will make it easier for internal functions to understand the common goals and work in an integrated way. The flexible organizational structure of the firm may help the firm to modify or change its operations according to the requirements of suppliers flexibly and efficiently.

H6: Adaptive capability has a positive impact on supplier integration.

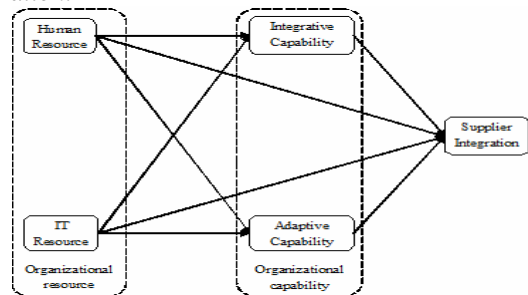


Figure 1: Conceptual model

III. Methodologies

3.1. Questionnaire design

The constructs and measurements of this study are shown in Appendix A. For the organizational resources and capability, we measured them in a routine-based perspective that is built on RBV (Peng et al., 2008). The measurement items for human resource are adapted from existing literature (Sohal and Egglestone 1994; Kosonen and Buharist, 1995; Karlsson and Åhlström, 1996; Cua et al., 2001; Shah and Ward, 2003). IT resource is measured by the implementation of IT in manufacturing process, planning process and new product development process (Boyer et al., 1997; McDermott and Stock, 1999; Kotha and Swamidass, 2000; Gunasekaran and Yusuf, 2002; Diaz et al., 2003). Integrative capability is measured by the items that reflect the integration of the resources among different functions (Narasimhan and Kim, 2002). Adaptive capability is measured by three items commonly used in previous studies (Goldman et al., 1995; Katayama and Bennett, 1999; Gunasekaran and Yusuf, 2002; Yusuf et al., 2004), which

reflect the structural change for operational flexibility. These resources and capabilities are measured from the perspective of the related practices companies used (Peng et al., 2008). The measures for supplier integration are mainly adapted from existing literature (Stank et al., 2001; Narasimhan and Kim, 2002; Chen and Paulraj, 2004). The questions were asked to indicate the level of the supplier integration implementation.

To ensure the reliability of the questionnaire, the English version of the questionnaire was first developed, reviewed, and then was translated into the Chinese version by knowledgeable professors of operations management. After which, the Chinese version was translated back into English by different professors. The back-translated English version was then checked against the original English version. Some questions in Chinese were reworded to better reflect the original meaning of the questions in English. The Chinese version of the questionnaire was pilot-tested in more than 40 manufacturing companies from Tianjin, Guangzhou, and Hong Kong in China. The data collected from the pilot tests were also used to check the face validity of the measures.

3.2. Data collection

In this study, mail survey was used to collect data needed. The research unit is the manufacturing company and its major supply chains. The supply chain managers, operations managers, or general managers who are knowledgeable to answer the questions on operations management of the company and its major supply chains were selected as the key respondents. As China is a very large country, we chose three representative rapidly developing cities as the target sampling areas. These three cities were Shanghai, Guangzhou, and Beijing. The database provided by Ebuywww Company that is providing professional business research service in China was used to form our sample pool. We excluded the companies with less than 100 employees because they are seldom involved in sophisticated supply chain management activities. There were 9,764 companies that met such a criterion.

Table 1: Industry distribution of respondents

Industries	Respondents
Food and beverage	10.10%
Electronic and communication equipment	8.79%
Transportation equipment	8.63%
Textile and garment	33.22%
Electrical equipment	8.38%
Machinery	16.12%
Chemicals and petroleum	7.17%
Plastic and latex	5.37%
Total	100%

We followed the approach suggested by Frohlich (2002) to

improve the response rate. First, the companies were called to solicit their participation, and the best informants were identified. Research assistants made telephone calls to the selected companies to introduce this study and to identify the key informant within the company who was able to answer the questionnaire. A total of 3,187 manufacturing companies were randomly selected from the database and were contacted by the research assistants. However, only 2,724 companies that were reached had correct contact information. In the end, 614 completed questionnaires were received, representing a response rate of about 22.5 percent. After screening, we determined that ten of the 614 questionnaires had not been completed properly and were thus removed from further analysis. In the end, 604 responses were used in our subsequent analysis. Table 1 showed the industry distribution of respondents.

3.3. Psychometric Test

Exploratory factor analysis for each construct was conducted to ensure the unidimensionality of the scales. A principal component factor analysis with varimax rotation was used to detect the underlying dimensions (Appendix 1). The tables show that all items are loaded on the factor that they are intended to measure. The internal consistency or reliability of the scale was assessed by Cronbach's alpha. Tables 2 indicates that all Cronbach's alpha values were above 0.70 and acceptable except adaptive capability. Because adaptive capability is over 0.60, it is believed to be acceptable for this new construct.

Table 2: Reliability analysis

Construct	Number of questions	Cronbach's alpha
Human resource	4	0.814
IT resource	3	0.937
Integrative capability	4	0.851
Adaptive capability	3	0.605
Supplier integration	5	0.803

Next, the construct validity of the measurement instruments was tested. Convergent and discriminant validity were assessed using confirmatory factor analysis. To check the convergent validity, each item was linked to its corresponding construct, and the covariances among the constructs were freely estimated. The model fit indices were $\chi^2(142) = 434.82$, RMSEA=0.061, CFI=0.98, and NNFI=0.97, which were better than the threshold values recommended by Hu and Bentler (1999). In addition, all the loadings were greater than 0.5 with all t values were greater than 2.0. The results indicate that convergent validity was ensured. Discriminant validity was assessed by building a constrained CFA model for every possible pair of latent

constructs, in which the correlations between the paired constructs were fixed to 1.0. This was compared with the original unconstrained model, in which the correlations among constructs were freely estimated. A significant difference of the chi-square statistics between the constrained and unconstrained models indicated high discriminant validity. In this study, all ten differences of χ^2 were significant at the 0.001 level, indicating that discriminant validity was ensured.

IV. Analysis and Results

The hypothesized model in Figure 1 was tested by structural equation modeling with the maximum likelihood estimation method using the LISREL 8.54 software. The corresponding fit indices were $\chi^2(143) = 435.67$, RMSEA=0.061, CFI=0.98, and NNFI=0.97, which were acceptable (Hu and Bentler, 1999). Out of the eight proposed hypotheses, seven were supported at the 0.05 significance level (Figure 2). The major findings will be discussed in the next section.

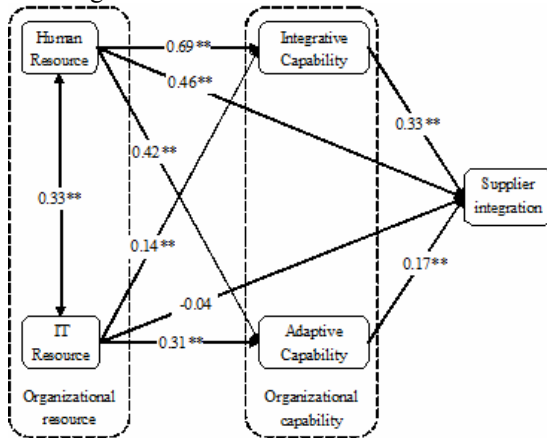


Figure 2: Structural equation model of hypothesized research model

The results of the structural equation modeling are presented in Figure 2. The results generally support the conceptual ideas of this study, that organizational resources and capabilities are key enablers of supplier integration. In detail, human resource has both direct and indirect impacts on supplier integration. IT resource is shown to only have indirect impact on supplier integration. Organizational capability, as intermediates, connects organizational resources and supplier integration.

V. Discussions

The results showed that human resource has much greater impact on supplier integration than IT resource. It is apparent that human resource management takes significant roles in China's supply chain context. In Chinese culture, human factor is the first priority (Cai et al., 2009). Managing human resource well may have influential impacts on the

mechanisms Chinese firms adopt in competition. Chinese people believed that they can deal with any difficulties if there is teamwork as stated in the proverb by Chinese philosopher Mencius "The timing and climate conducive to less favorable terrain, and the favorable terrain of people work together better". Therefore, the important role of impact of human resource in supplier integration implementation is strongly supported. It indicated that human resource may be the basic requirement for supplier integration. In Chinese companies, human resource is very important to the implementation of supplier integration strategies. The human factor is a key factor in deploying other internal and external resources and activities. For example, project managers can facilitate the internal and external R&D collaboration. They could manage the internal and external resources well in case that they have multiple function knowledge.

Other resources may work by building on better human resources management. Such situation may apply to the relationship between IT resource and supplier integration. IT resource has no direct impact on supplier integration. Much more is required for supplier integration because long-term relationships and information sharing with external supply chain partners may be realized and conducted by capable employees. Some Chinese companies have built good IT infrastructure to connect internal silos, however, it is only sufficient condition but not necessary condition for external integration. This kind of intra-firm IT system provide good information exchange standard. A lot of work is needed before the inter-firm IT system is built. Due to the lag in infrastructure development in China, the intra-firm IT investment is easier to be rewarded.

Both resources have indirect impacts on supplier integration through organizational capability, which validate the dynamic view of internal resource, internal capability, and external relationship in supply chain management. External relationship is a result of internal capability. Internal capability is improved through accumulation of internal resources. IT resource is showed to have indirect impact on supplier integration through organizational capability. It seems to be an internally focused mechanism in supply chain management. With the help of IT systems, different functions can communicate and work together easily. IT facilitates information sharing among functions directly, through which, all internal functions are integrated together closely. This means that companies should pay more attention to the applications of IT systems, especially for ERP and cross-functional IT systems.

VI. Conclusions

This study extends the existing literature on supplier integration from several perspectives. First and the most important one, this study empirically tested the impacts of organizational resources and capabilities on supplier integration based on RBV. Based on our knowledge, few

studies focused on the comprehensive analysis of internal organizational resources and capabilities, and investigated their impacts on supplier integration in a large sample test. Second, the study extends the supplier integration research in Chinese context. Most previous supplier integration literature focused on the companies from developed economy. Along with the increasing importance of Chinese firms in global supply chains, our findings would have more practical meanings for the operations managers in western customers or multinational companies. This study steps into how internal organization resources and capabilities influence the mechanisms of integrating external suppliers. In China context, it seems that multi-skilled human resource is required to have good integration with suppliers. IT resource is mostly used to facilitate internal operations in Chinese firms. Therefore, the China's competition environment may ask for different implementation of internal organization resources and capabilities to achieve supplier integration.

Several limitations in our study suggest potential directions for future research. First, though some aspects of IT resource are across the supply chain, such as ERP and CAD, we mainly measure it for intra-firm management other than for inter-firm management. We believed that intra-firm IT is better understood and implemented in China. Future study can investigate different impacts of intra- and inter-firm IT on supplier integration. Second, the reliability of adaptive capability is relatively low. Future study may identify more items to capture it from more perspectives in reliable way. This construct may also mean differently in different context. Third, we only measure supplier integration from the manufacturers' standpoint. Future research could strengthen supplier integration measurement by including both suppliers and buyers' perspectives. Fourth, we use cross-sectional data to test the resource-capability-supplier integration model, future research can collect longitudinal data to examine the evolution of resources, capabilities and supplier integration. Finally, the replication of our proposed model in other countries may be also interesting. The differences in results may be useful in analyzing the impacts of national culture on the resource/capability implementation and configuration.

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