The impacts of IT capability and marketing capability on supply chain integration: A resource-based perspective

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Abstract

Although previous research has addressed the interface and logical association among marketing, information technology (IT), and supply chain management (SCM) there have been few, if any, attempts to investigate how IT capability and marketing capability influence supply chain integration (SCI). Thus, this study investigates the direct and interactive effects of IT capability and marketing capability on SCI. The hypothesised relationships were tested using survey data gathered from 329 firms in China's manufacturing industry. The results reveal that both IT capability and marketing capability have a significant positive effect on SCI. Interestingly, no significant interaction effect was found, indicating that marketing IT capability and marketing capability influence SCI independently, and not synergistically. However, while IT capability and marketing capability do not interact, IT capability does mediate the impact of marketing capability on SCI.

Keywords: Marketing capability; IT capability; Supply chain integration

1. Introduction

Significant investments are made each year by businesses in information technology (IT) (Powner, 2013). For example, manufacturing firms are increasingly investing in advanced enterprise-level information technologies to improve synchronization and integration across the entire supply chain (Bharadwaj et al., 2007; Childerhouse and Towill, 2011; Yu, 2015). These investments may be a result of the rapid rate of change in the environment (Zhang et al., 2003). Such firms are making these investments to help cope with such environmental changes (Speier at al., 2008); investments in IT, e.g. communications and product development, and investments in marketing, e.g. segmentation and analytics. Unfortunately, little empirical research has been published on the linkage between the resources these investments represent and the ability to operate and an integrated supply chain (Ghobakhloo and Tang, 2014; Wang et al., 2016; Xu et al., 2014). In fact, despite the notion that effective integration can contribute to firm performance, the nature and implications of the integration of marketing and supply chain have not been empirically investigated at great length in the literature (Jüttner and Christopher, 2013;

Kozlenkova et al., 2015; Mentzer and Gundlach, 2010). This is surely why others have called for a greater understanding of the topic (Adams et al., 2014).

While IT often necessitates a substantial investment, it may offer little value without the appropriate resources being in place and available (Adams et al., 2014). Further Adams et al. (2014) suggest these resources may have both direct and interacting effects on outcomes. Marketing capability has been positioned as such a resource that could be leveraged along with information technology (Agan, 2011).

Given the foregoing, the resource-based view of the firm (RBV) holds promise for growing our understanding about the relationship among IT capability, marketing capability, and supply chain integration since it focuses on the roles of organizational resources and capabilities (Barney, 1991; Bharadwaj, 2000; Wernerfelt, 1984); capabilities being broadly defined as "complex bundles of skills and accumulated knowledge that enable firms to coordinate activities and make use of their assets" (Day, 1990, p. 38). This study focuses on two functional capabilities (i.e. IT and marketing) and explores their direct and interacting effects on supply chain integration (SCI). We chose these particular capabilities because they are fundamental building blocks of supply chain capability (Swink et al., 2010). Additionally, managers and researchers understand the criticality of these two functional capabilities (Ho and Tang, 2004; Nath et al., 2010; Yu et al., 2014), but need to understand how these building blocks interrelate to improve SCI (Adams et al., 2014; Ghobakhloo and Tang, 2014).

IT capability has become an essential firm capability (Lin, 2007) because of the importance of managing information and material flows more effectively (Prajogo and Olhager, 2012; Vickery et al., 2003; Yu, 2015). But, IT investments involve costs and risks, and the implementation of IT in the supply chain context does not guarantee stronger financial benefits (Wu et al., 2006; Yu, 2015). Drawing on the RBV, IT researchers argue that firm performance differentials depend on differences in IT capabilities (Mata et al., 1995; Ray et al., 2005); IT capability being defined as "the relative capabilities that help an organization create technical and market knowledge and facilitate intra-organizational communication flow" (Song et al., 2008, p. 16). Furthermore, published research has asserted that firms must effectively integrate IT capability with other capabilities, e.g. marketing, to attain strategic objectives (Bakos and Treacy, 1986). Therefore, in this study we investigate the interaction effect of IT capability and marketing capability on SCI.

As the above discussion attests, the literature acknowledges the association among IT capability, marketing capability, and supply chain integration. However, there is relatively little empirical evidence of the exact nature of the relationship between these functional capabilities and supply chain integration (SCI). The implication is an underdeveloped understanding of why some firms find success while others do not (Helfat, 2000), particularly in the supply chain context. Thus, taking the RBV perspective this study seeks to explicate the direct and interacting effects of IT capability and marketing capability on SCI. This study addresses three main research questions: (1) Is IT capability related to SCI? (2) Is marketing capability related to SCI? and (3) Do IT capability and marketing capability interact with one another to influence SCI? Answering these questions contributes to the literature and practices in several ways. First, to date there has been no clear and cohesive theoretical framework that conceptualizes the relationship between IT and marketing capabilities in a supply chain context from a RBV perspective. Thus, this study contributes to the body of knowledge by empirically testing the relationships between functional capabilities (IT and marketing) on SCI. More specifically, the empirical evidence will demonstrate the relative importance of IT capability and marketing capability to SCI. Second, this study provides guidelines for managers on how to devote their efforts and resources toward IT and marketing capabilities to achieve a higher level of integration.

2. Theoretical background

2.1. Resource-based view (RBV) and functional capabilities

The RBV considers a firm to be a bundle of tangible and intangible resources and organisational capabilities (Wernerfelt, 1984). From this vantage point, the RBV provides an established theoretical framework to analyse how competitive advantage is achieved through resources and capabilities (Corbett and Claridge, 2002). The RBV holds that firms will have different resources and varying levels of capability in regards to resource exploitation (Barney, 1991; Grant, 1991). In general, resources are tangible and intangible firm assets that can be put into productive use (e.g. Amit and Schoemaker, 1993; Grant, 1991). In contrast to resources, capabilities are embedded in the dynamic interactions of multiple knowledge sources and are more firm-specific and less transferable, which leads to competitive advantage (Peng et al., 2008). Capabilities can be broadly categorized into those that relate to performing basic

functional activities of the firm and those that guide the improvement and renewal of the existing activities (Collis, 1994). Organisational capabilities relate to the ability of the firm to use its resource "to affect a desired end" (Amit and Schoemaker, 1993, p. 35). Firm survival depends on the ability to create new resources, build upon existing capabilities, and make the capabilities more inimitable (Day and Wensley, 1988; Peteraf, 1993).

To create economic value and sustain competitive advantage, an organization requires a wide range of capabilities (Day, 1994; Estampe et al., 2013; Song et al., 2008). Although it is impractical to list them all since every business develops its own configuration of capabilities rooted in the realities of the markets in which it competes, past commitments and anticipated requirements along with categories of capabilities common to many organizations have been identified and used in previous research (Day 1994; DeSarbo et al., 2006). In this study, we focus on two important functional capabilities: IT and marketing (Day, 1994; Grant, 1991; Song et al., 2007, 2008), and investigate their impacts on SCI. IT capabilities are proficiencies in various activities and tasks that enable the organization to diffuse information effectively across all relevant functional areas, so that it can manage functional areas and facilitate intra- and inter-organizational communication and information flows more effectively (Song et al., 2007, 2008). Marketing capabilities are proficiencies in activities such as segmentation, targeting, pricing, and advertising that enable firms to exploit its market-sensing and technological resources and implement effective marketing programs (Song and Parry, 1997; Song et al., 2008). Not all organizations will have all of these capabilities (Day and Nedungadi, 1994; Day and Wensley, 1988). Miles and Snow (1978) argue that companies will solidify and develop their particular capabilities over time according to their strategic type. For example, prospectors tend to compete by anticipating new product or marketplace opportunities and by implementing technological innovation; continued, successful prospecting will have the effect of strengthening inside-out and IT capabilities (Song et al., 2008).

Functional capabilities are important for competitive advantage (DeSarbo et al., 2006; Song et al., 2007; Yu et al., 2014) but exist at very different levels of development in each organization. The RBV suggests that the mere possession of capabilities is a necessary but not sufficient condition for superior business performance (Teece et al., 1997). Rather, the firm that has exploitable resources and invests in capabilities that complement the existing capability base will be best able to exploit its distinctive competencies (Song et al., 2007; Teece et al., 1997).

The firm that does this will be rewarded with a sustainable competitive advantage and improved long-term performance (Song et al., 2007). In the interest of learning how capabilities are built and relate to each other we consider a limited set that are foundational to firm and supply chain success.

2.2. Supply chain integration (SCI)

In today's highly dynamic marketplace, the nature of competition has been shifted from company-based to supply-chain-based competition. Supply chains should be integrated and aligned with the external operations of customers, suppliers, and other channel members (Kim, 2009; Lee, 2004). SCM is based on the integration of all activities that add value to customers, from the product design stage to delivery (Gunasekaran and Ngai, 2004). Researchers and managers have long articulated the need for a close and strategic integrated relationship between a firm and its supply chain partners (Bowersox et al., 1999; Flynn et al., 2010; Vickery et al., 2003; Yu et al., 2013). There is a growing recognition that firms need strategic resources that lie beyond their boundaries to gain competitive advantages (Das and Teng, 2000). Therefore, in the present study, we focus on integration across supply chain partners (Bowersox et al., 1999; Wu et al., 2006). Following the work of Wu et al. (2006), we define SCI as the extent to which a firm coordinates its strategic supply chain activities (such as planning and forecasting) with its channel members (such as customers and suppliers). SCI entails building strategic relationships with supply chain partners (Wu et al., 2006; Yu et al., 2013). Specifically, it involves strategic collaboration between a focal firm and its customers and suppliers in managing boundary spanning business activities, including collaboration in purchasing, planning and forecasting, and joint product development (Flynn et al., 2010; Wong et al., 2011; Yu et al., 2013). Although SCI has received considerable attention from both academicians and practitioners because of its strategic importance to firm performance, how functional capabilities influence SCI has not been empirically explored.

2.3. IT capability

From a RBV perspective, Bharadwaj (2000, p. 171) defines IT capability as "a firm's ability to mobilize and deploy IT-based resources in combination or co-present with other resources and capabilities". Stoel and Muhanna (2009, p. 182) also state that IT capabilities are

"complex bundles of IT-related resources, skills and knowledge, exercised through business processes that enable firms to coordinate activities and make use of the IT assets to provide desired results". These capabilities can be marshalled to coordinate activities such as advertising programs or product development. To the extent that these activities are unique with respect to competitors, superior performance can result (Bharadwaj, 2000). Greater levels of IT capability are associated with greater strategic flexibility and, ultimately, with better firm performance and greater organizational success (Bharadwaj et al., 1999; Santhanam and Hartono, 2003). For example, greater information transmission across functional areas leads to more successful new products (e.g. Griffin and Hauser, 1992; Song and Montoya-Weiss, 2001). Even if IT resources between firms are similar, Day (1994) suggests that greater creativity in their deployment will lead to better firm performance. Santhanam and Hartono (2003) confirm that firms with IT capability indeed exhibit superior current and sustained performance when compared to average industry performance, even after adjusting for effects of prior firm performance. Although there has been a considerable amount of research evaluating the effect of IT capability on firm performance, relatively little rigorous empirical research has been conducted to examine how IT capabilities influence SCI.

2.4. Marketing capability

Marketing capability is an integrative process whereby a firm uses tangible and intangible resources to understand customer needs, achieve product differentiation relative to competition, and create high levels of brand equity (Day, 1994; Song et al., 2005, 2007; Yu et al., 2014). Marketing capabilities include knowledge of the competition and of customers, as well as skill in segmenting and targeting markets, advertising and pricing, and integrating marketing activities (Song et al., 2007). Development of marketing capabilities occurs when employee skill and knowledge combines with other resources (Vorhies and Morgan, 2005). For example, resources supporting customer interaction can cultivate a market sensing capability (Narasimhan et al., 2006). Such capabilities, once built are very difficult to imitate for competing firms (Day, 1994) and can be an important source of competitive advantage to firms possessing them. Song et al. (2007) suggest that marketing capabilities enable firms to create and retain strong bonds with customers and a strong brand image. These marketing capabilities drive superior business performance (Ortega and Villaverde, 2008) through effective transformation of inputs into

outputs such as portfolio complexion (Vorhies and Morgan, 2003). While it is known that marketing capabilities are associated with performance improvement (Karray and Amin, 2015), to date there is a lack of empirical research in a supply chain network context that investigates the direct effect of marketing capability on SCI.

3. Conceptual framework and hypotheses

3.1. Conceptual framework

Using the RBV as a theoretical lens, we develop a theoretical framework that investigates the effects of marketing capability, IT capability, and their interaction on SCI. The research model is presented in Figure 1.

---------- Insert Figure 1 ----------

3.2. IT capability and SCI

Previous research has identified the importance of IT in enhancing SCM and stated that successful application of IT is often viewed as an enabler of SCI (Chae et al., 2005; Vickery et al., 2003; Yu, 2015). Richey et al. (2010) suggest that IT capability facilitates relationships with trading partners. There are several potential reasons for this. One is that advances in IT have enhanced the ability of firms to share information (Agan, 2011) and the timely exchange of information, e.g. via EDI, allows multiple firms to act as a single entity in regards to managing inventory levels and material flows (Hill, 2000). There is evidence that implementing IT in supply chains can improve the accuracy of information and in turn increase the information processing capabilities embedded within a relationship, which consequently leads to greater inter-organizational collaboration (Chae et al., 2005; Gunasekaran and Ngai, 2004; Subramani, 2004). This information exchange is vital to relationship building processes (Handfield, 2015). Although the relationship between IT capability and SCI is an important research topic, conclusive evidence about whether IT capability contributes directly to a firm's SCI is not available and the exact nature of the relationship between IT capability and SCI is still ambiguous.

Drawing on the RBV, some researchers contend that competitive advantage depends upon differences in IT capability (Powell and Dent-Micallef, 1997; Ray et al., 2005); IT capability referring to a firm's ability to mobilize IT-based resources to gain completive advantage

(Bharadwaj, 2000). IT capabilities enable organizations to diffuse useful information effectively across all relevant functional areas (Song et al., 2007, 2008). As such, IT capabilities facilitate internal communication and cross-functional integration (Bharadwaj et al., 1999; Santhanam and Hartono, 2003), which will help the firms manage information flow and share information with their supply chain partners effectively (Zhao et al., 2011). Bharadwaj (2000) proposes that a unique IT capability can result in competitive advantage. In a supply chain context, the IT capability is exploited to engender cooperative forecasting, scheduling, and the like among the firm and its supply chain partners (Prajogo and Olhager, 2012; Yu, 2015). Thus drawing upon the RBV and logical arguments put forward in the literature, we propose the following hypothesis.

H1: IT capability is positively related to SCI.

3.3. Marketing capability and SCI

Marketing capability spans processes that are established within organizations to decipher the trajectory of customer needs through effective information acquisition, management, and use (Day, 1994; Krasnikov and Jayachandran, 2008). Min and Mentzer (2000) discuss some of the key theoretical constructs in both marketing and supply chain disciplines and conclude that a market orientation is linked with SCI. Others (Speier et al., 2008) suggest that marketing capabilities such as knowledge of customers, segmentation skills, and evaluation of marketing activities can help cope with changes in the environment forming a basis from which to build relationships. In fact, a marketing orientation may provide an environment that encourages a firm to build and maintain relationships with trading partners (Min and Mentzer, 2000). Since marketing guides firms to seek satisfied customers at a profit (Agan, 2011), marketing capabilities will likely motivate the firm to obtain information from supply chain partners (Min et al., 2007). Jüttner et al. (2010) develop a conceptual framework wherein they suggest that integrating marketing and supply chain strategies involves the management of four integration levels: corporate integration, strategic customer integration, strategic supplier integration, and marketing and supply pipeline strategy integration. Thus it seems that marketing capability can improve SCI by enabling the strategic collection of valuable information on supply chain partners (Kozlenkova et al., 2015; Min and Mentzer, 2000). Despite the logical association between marketing and supply chain concepts (Jüttner et al., 2010; Jüttner and Christopher,

2013; Min et al., 2007), to the best of our knowledge there have been no empirical studies published examining the effect of marketing capability on SCI. To fill this gap in the literature, we propose the following hypothesis.

H2: Marketing capability is positively related to SCI.

3.4. Interactive effect of marketing IT capability and marketing capability on SCI

In addition to the direct effects IT and marketing capabilities on SCI proposed in H1 and H2, IT capability and marketing capability may interact to influence SCI. Specifically, it has been suggested that IT facilitates relationships (Adams et al., 2014). Given that marketing includes building relationships with customers, there is a complimentary role played by IT and marketing capabilities. For example, the marketing function is responsible for communicating about the firm's products and services so as to generate customer demand. The IT function enables the marketing function by providing information about demand patterns, customer preferences via CRM, and can employ analytics to identify latent needs. Thus the resources associated with IT and marketing capabilities may have an interacting effect (Constantin and Lusch, 1994). As such this may be evidence of the strategic use and inimitable combination of resources that the RBV suggests leads to competitive advantage (Barney, 1991) In a supply chain context, ERP retains information about events in sourcing and delivery that might be advantageously used later by marketing (Seethamraju, 2008) to better serve customers. Thus IT and marketing functions may work together to build SCI.

Consistent with the RBV, leveraging IT capability firms may enable taking full advantage of marketing capabilities with the result being a higher level of SCI (Prajogo and Olhager, 2012; Yu, 2015). Vickery et al. (2003) argue that integrated information systems enable all functional departments (e.g. manufacturing, purchasing, marketing, R&D, etc.) within the firm to access and transmit information. In this case, it can be argued that implementing informational technologies such as ERP and EDI in supply chains will enhance the effect of marketing capability on SCI. However, even though the marketing function may have a relationship with customers, poor internal integration attributable to an immature IT capability may hinder integration with customers (Slack et al., 2013; Zhao et al., 2011).

To date, although different types of organisational capabilities have been shown to enhance firm performance, to the best of our knowledge there have been no studies published examining

the interaction effects of IT and marketing capabilities on SCI. Thus in a supply chain context, little is known about the relative effectiveness of the two types of functional capabilities (IT and marketing) and how they interact with one another to influence SCI. Based on the foregoing arguments and theoretical perspective of the RBV, we hypothesize that two-way interaction between IT capability and marketing capability affects SCI.

H3: The interaction of IT capability and marketing capability is positively related to SCI.

4. Research method and data

4.1. Sample and data collection

We collected survey data from manufacturers in China. Five regions that represent different stages of economic development in China were chosen as the sample pool: Pearl River Delta, Yangtze River Delta, Bohai Sea Economic Area, Central China, and Southwest China, which cover all major geographical regions in China (Zhao et al., 2006). The China Enterprises Directory was used as a starting point to identify potential participants. In order to obtain a representative sample, a total of 1500 manufacturers were randomly selected from the Directory in the five regions. We then contacted the key informants by telephone and email before sending out the questionnaires in order to obtain their preliminary agreement to take part in this research. The informants held executive positions such as CEO, president, director, or general manager, and were knowledgeable about the information requested in the survey. We then sent the questionnaires to 1230 manufacturing firms that agreed to participate and provide information for this research. After several reminders via follow-up phone calls and emails, we received 337 questionnaires. A total of eight returned questionnaires were discarded because of significant missing data, which results in 329 valid questionnaires. The effective response rate was 26.75%. A profile of the respondents is reported in Table 1, indicating that they represent a wide range of manufacturing industries and a variety of backgrounds. Most of the respondents had been in their current position for more than five years. Thus, it is reasonable to expect that the respondents were familiar with their firms and had sufficient knowledge to complete the survey.

---------- Insert Table 1 ----------

4.2. Questionnaire design and measures

Following previous empirical studies conducted in the Chinese market (e.g. Flynn et al., 2010; Huo et al., 2014; Zhao et al., 2011), we developed the English version of the questionnaire and then translated it into Chinese, and conducted a back-translation to ensure conceptual equivalence. In addition, to improve the reliability of the questionnaire, the translated English version was then checked against the original English version. A number of questions were modified in minor ways to improve the accuracy of the translation and account for language and cultural differences (Zhao et al., 2006). In order to assess the content validity of the measurement scales, we conducted two preliminary assessments of the questionnaire (Flynn et al., 2010; Huo et al., 2014). First, we sent the questionnaire to three academic experts for their review and feedback. Second, we pre-tested the questionnaire with five randomly selected manufacturing firms via semi-structured interviews. On the basis of the feedback from both academicians and executives, we modified the questionnaire to ensure that the measurement items were understandable and relevant to Chinese cultural and business practices (Zhao et al., 2006).

We conducted an extensive literature review to identify valid measures for theoretical constructs. The measures and their sources are presented in Table 2. The measures for marketing capability were adapted from Song et al. (2008), which focused on knowledge of customers, knowledge of competitors, integration of marketing activities, skills in segmentation and targeting, and effectiveness of pricing and advertising programs. The measures for IT capability were also adapted from Song et al. (2008), which focused on the relative capabilities that help an organization create technical and market knowledge and facilitate intra-organizational communication flow. Following the work of Song et al. (2008), the indicators were measured using a seven-point Likert scale (ranging from 1 "much worse than your major competitors" to 7 "much better than your major competitors"). The measures for SCI were adapted from Wu et al. (2006), which emphasized on coordinating supply chain activities (such as planning and forecasting) with supply chain partners such as customers and suppliers. Consistent with Wu et al. (2006), all the items pertaining to SCI were measured on seven-point Likert scales from 1 (strongly disagree) to 7 (strongly agree).

---------- Insert Table 2 ----------

The four control variables used in our research model (see Figure 1) include firm age, firm size, industry types, and firm ownership. First, firm size was measured as the number of employees. Larger firms may have more resources for managing supply chain activities than

small firms (Huo et al., 2014; Wagner et al., 2012). Second, firm age was measured by the number of years since firm foundation. Older firms are more likely to develop higher levels of SCI than young firms. Third, we used dummy variables for firm ownership, namely state-owned manufacturer, private Chinese manufacturer, wholly foreign-owned manufacturer, and joint venture manufacturer (see Table 1). Firm ownership, as a form of control and governance, may influence the implementation of supply chain activities (Huo et al., 2014; Zhao et al., 2011). Fourth, we also used a dummy variable for industry types (see Table 1). The type of industry was controlled because firms in the different manufacturing industries may develop different levels of SCI (Huo et al., 2014; Wagner et al., 2012).

4.3. Non-response bias and common-method bias

With regard to non-response bias, we compared early and late responses on their demographic characteristics of number of employees, annual sales, and industry type (Lessler and Kalsbeek, 1992). The t-test results reveal that there is no significant statistical difference ($p < 0.05$) among the category means for the demographic characteristics. Furthermore, we assessed non-response bias using a chi-square test (Cao and Zhang, 2011). The results indicate that there is no significant difference between early and late responses on all three demographic categories (i.e. number of employees, annual sales, and industry type) at the significance level of 0.10. In summary, we conclude that non-response bias is not a major concern in this study.

With regard to common method bias, Harman's one-factor test reveals several distinct factors for the variables, indicating that common method bias is not an issue (Huo et al., 2014: Podsakoff et al., 2003). Furthermore, confirmatory factor analysis was applied to Harman's single-factor model (Flynn et al., 2010; Podsakoff et al., 2003). The model fit indices (χ^2/df (3214.185/230) = 13.975, CFI = 0.572, IFI = 0.574, and RMSEA = 0.199) were unacceptable (Hu and Bentler, 1999), which indicates that a single factor is not appropriate. In summary, we conclude that common method bias is not a serious concern in this study.

5. Data analysis results

5.1. Reliability and validity

With regard to the reliability of each theoretical construct, principal component analysis with varimax rotation was first undertaken on the three constructs to examine the underlying

dimensions of the constructs (Hair et al., 2010; Loehlin, 1998). As shown in Table 2, the factor analysis shows all factors with eigenvalues greater than one and all items had strong loadings on the construct that they were intended to measure, which demonstrate construct unidimensionality (Hair et al., 2010). Furthermore, Cronbach's alpha was calculated to assess construct reliability, which is a commonly accepted measure of reliability. Table 3 shows that the Cronbach alpha values of all the constructs are above the widely recognized rule of thumb of 0.70 (Hair et al., 2010; Nunnally, 1978; O'Leary-Kelly and Vokurka, 1998). In addition, we conducted the corrected item-total correlation (CITC) reliability test (Kerlinger, 1986). As shown in Table 3, all CITC values are larger than 0.60, which is higher than the minimum acceptable value of 0.30. In summary, we conclude that our theoretical constructs exhibit adequate reliability.

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Content validity was supported through our extensive literature review, executive interviews, and pilot tests (Flynn et al., 2010; Zhao et al., 2011). Construct validity was established through unidimensionality and discriminant validity (Chavez et al., 2016; O'Leary-Kelly and Vokurka, 1998). As mentioned above, unidimensionality was established through several analyses. Discriminant validity was examined to measures the extent to which individual items, which intend to measure one latent construct, do not, at the same time, measure a different latent variable (DeVellis, 2003). Discriminant validity was assessed through inter-factor correlation (Anderson and Gerbing, 1988). While it is expected a degree of correlation, a very strong correlation between factors indicates that they are measuring the same construct (Anderson et al., 2002). Table 4 indicates that discriminant validity is confirmed (Anderson and Gerbing, 1988).

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5.2. Results

Ordinary least square (OLS) regression was used after mean centring the data to test the effects of marketing capability, IT capability, and their interaction on SCI (Hair et al., 2010). OLS regression has been widely used in the SCM literature for testing interaction effect (e.g. Huo et al., 2014; Zhao et al., 2011). The result of OLS regression are reported in Table 5. The VIF values in all models are lower than 2.0, which indicates that multicollinearity is not an issue (Mason and Perreault, 1991). Although we controlled for firm age, firm size, industry type and

firm ownership, the factors do not have any apparent effect on SCI, except for industry type, which has a negative effect. We hypothesised that marketing capability (H1) and IT capability (H2) is significantly and positively related to SCI. As illustrated in Table 5, marketing capability ($\beta = 0.340$, $p < 0.001$) and IT capability ($\beta = 0.442$, $p < 0.001$) has a significant positive effect on SCI. Thus, H1 and H2 are supported.

To further explore the relationships among marketing capability, IT capability and SCI, we also tested the interactive effect of IT capability and marketing capability on SCI. However, as shown in Table 5, no significant interactive effect was found ($\beta = 0.008$, n.s.), which indicates that IT and marketing capability influence SCI independently, and not interactively. Thus, H3 is rejected.

Since it is prudent to test alternative models (Anderson and Gerbing, 1988), we performed a post hoc analysis to examine the mediating role of IT capability in the marketing capability–SCI relationship. This test was executed using the mediated multiple regression method suggested by Baron and Kenny (1986). The results can be seen in Table 6. As shown in Model 2 of Table 6, marketing capability is positively and significantly related to SCI with a beta of 0.561. The impact of marketing capability on SCI is reduced but still remains significant when the mediator is added, suggesting partial mediation of the relationship between marketing capability and SCI by IT capability. Thus, we conclude that while IT capability and marketing capability do not interact, IT capability does partially mediate the impact of marketing capability on SCI.

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6. Discussion and implications

6.1. Theoretical implications

Employing the RBV as a theoretical lens, this study extends previous research by developing and empirically test a theoretical framework that investigates the direct and interactive effects of IT and marketing capability on SCI. From a theoretical perspective, the conceptual framework makes an important contribution to the existing knowledge on the interplay among marketing, IT and SCM (Day, 1994; Jüttner et al., 2010; Vickery et al., 2003). Our analyses reveal that IT and marketing capability significantly influence SCI independently,

and not interactively. There is a significant implication for the research community of the findings presented in this study. SCM is arguably the amalgam of the disciplines of SCI, information systems, and marketing. A traditional view of SCM is that it tightly integrates supply chain operations and marketing via advanced information technologies. The mediating role of IT capability tends to affirm this perspective. Given the alignment of the disciplines with the capability sets presented herein, this study provides insight into the relationships among the disciplines/capabilities.

First, we found that marketing capability is significantly and positively associated with SCI. This is an important finding since the nature and implications of the interface between marketing and SCM have not been empirically investigated at great length (Jüttner and Christopher, 2013; Kozlenkova et al., 2015; Mentzer and Gundlach, 2010). Although previous research has addressed the importance of the interface and logical association between marketing and SCM, marketing and SCM have typically been studied separately (Karmakar, 1996). The marketing literature traditionally externally focuses on stimulating demand, and how to offer customers a unique value proposition (Jüttner et al., 2007; Vorhies and Morgan, 2005). On the other hand, SCM research tends to focus on the efficient use of resources in implementing marketing decisions (Jüttner et al., 2007). Our findings reveal that in today's dynamic markets building strategic integration with supply chain partners through the interface between marketing and operations can be a source of supply chain success. The finding of the significant positive effect of marketing capability on SCI is consistent with the expectations of the RBV. This study also raises the need for further building and testing of marketing concepts in SCM theory. Such a differentiated view is essential for further developing the marketing and SCM interface as an inter-disciplinary phenomenon (Jüttner et al., 2010).

Second, another important finding is that IT capability has a significant positive effect on SCI. This finding is important because it shows the values of IT capability in a supply chain context. Although previous studies have demonstrated the importance of IT investments in SCM (Prajogo and Olhager, 2012; Vickery et al., 2003; Yu, 2015), to date there have been limited empirical studies assessing how IT capabilities influence SCI. IT capability can facilitate communication and collaboration among supply chain partners through information sharing (e.g. inventory level, production planning and control and demand forecast) throughout the supply chain (Gunasekaran and Ngai, 2004; Vickery et al., 2003). In today's dynamic and competitive

environment manufacturing firms are forced to make greater investments in information technologies in their supply chains and build IT capability to achieve competitive advantages. Thus, this study reinforces the importance of IT capability in building strategic cooperation with supply chain partners as it not only acts directly but also partially mediates the relationship between marketing capabilities and SCI. Drawing on the RBV, IT researchers argue that firm performance differentials depend on differences in IT capabilities rather than IT investments. This is an important point for firms when they consider investing in information technologies for SCM.

Third, our analyses also indicate that there is no interaction effect of IT capability and marketing capability on SCI. This is another important finding since little remains known about the relative effectiveness of the two functional capabilities (IT and marketing) and how they interact with one another in the supply chain processes to influence integration. Our finding indicates that IT and marketing capability are two different approaches to building strategic cooperation with customers and suppliers. While IT capability cannot directly improve the role of marketing capability in improving SCI, its absence can adversely influence the impact that marketing capability has on SCI. In order to build close and long term with supply chain members, firms can work on either marketing capability or IT capability, but may be advantaged by choosing to invest in IT capability first.

6.2. Managerial implications

Our findings provide significant managerial implications for managers. First, our findings aim at providing managers with guidelines for managing supply chains through an aligned marketing, IT and SCM approach. According to the RBV, it is important for firms to invest in and exploit their capabilities in order to capitalize on them, and achieve sustainable competitive advantage. An integration of functional capabilities is important for supply chain success. Thus, managers are encouraged to strengthen their IT and marketing capabilities in order to build strategic integration with supply chain partners, such as deploying resources to improve their marketing communication and deploying IT-based resources to create efficient planning of material and information flows.

Second, our findings reveal that firms operating in an increasingly dynamic market should place greater emphasis on the development and maintenance of IT and marketing capabilities as

they grow in importance for building strategic integration with supply chain members. By building functional capabilities (IT and marketing), firms can enhance their strategic integration with customers and with suppliers. We believe that this provides managers a new way to improve SCI from a functional capability perspective; namely through more efficient resource utilization driven by understanding complementarities between two functional capabilities investigated in this study.

Third, our findings indicate that IT and marketing capability influence SCI independently rather than interactively. These findings are important to managers for understanding how IT capability and marketing capability are independently related to SCI. Both functional capabilities are effective for managers to pursue a high level of SCI and managers can work on either IT capability or marketing capability when building strategic collaboration with supply chain partners, but they are advised to focus on IT capabilities first as they will be responsible for delivering some of the impact from investments in marketing capabilities to SCI.

7. Conclusions and limitations and future research

Drawing upon the RBV, we have developed and empirically tested a theoretical framework examining the importance of functional capabilities (IT and marketing) in improving SCI. Our analysis has shown that the two functional capability sets are involved in helping manufacturing firms build strategic integration with customers and suppliers. More specifically, our study has revealed that IT and marketing capability influence SCI independently and that IT capability partially mediates the relationship between marketing capability and SCI. From a theoretical perspective, our conceptual framework and empirical findings make a significant contribution to the existing knowledge of the relationships among the disciplines/capabilities (such as marketing, IT, and SCM). From a practical perspective, our empirical findings drive meaningful managerial implications. This study provides managerial guidelines for deciding how to devote efforts toward differing functional capabilities associated with managing supply chains more effectively.

This study has some limitations. The functional capability sets explored in this study included IT and marketing. However, according to the RBV, each organization has a distinctive set of resources and capabilities (Day, 1990; Song et al., 2007) and as such additional functional capability sets likely bear on SCM. Future studies should seek to identify and map the impacts of additional relevant functional capabilities (e.g. human resource management, socially responsible

practices, innovation, finance, and research and development capabilities) and examine their roles in determining SCI. Another limitation is that the study focuses on SCI in aggregate. Future research could seek to explicate these relationships between IT and marketing capability to the narrower facets of supply chain integration such as supplier or customer integration. An additional limitation is that this study presents an analysis of relationships at a single point in time. Since China's market and manufacturers will evolve with social, cultural, and historical change, and the business environment is constantly changing, longitudinal follow-up studies should be designed to identify these changes and re-examine whether and how these relationships are changing. Also, in any model in which causality is suggested, longitudinal studies will provide for stronger inferences. Therefore, the model developed in this study could benefit from being tested in a longitudinal design, so that actual behaviour of respondents can be taken into account.

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Table 1: Demographic characteristics of respondents (n=329)

	Number of firms	Percent (%)
Industries		
Automobile	113	34.3
Chemicals and petrochemicals	50	15.2
Electronics and electrical	26	7.9
Fabricated metal product	8	2.4
Food, beverage and alcohol	9	2.7
Rubber and plastics	13	4.0
Textiles and apparel	110	33.4
Number of employees		
1 – 100	56	17.0
101 – 200	36	10.9
201 – 500	65	19.8
501 – 1000	27	8.2
1001 – 3000	54	16.4
> 3000	91	27.7
Annual sales (in million Yuan)		
Below 10	36	10.9
10 – 50	53	16.1
50 – 100	44	13.4
100 – 500	56	17.0
500 – 1000	26	7.9
Above 1000	114	34.7
Firm age (years)		
≤10	103	31.3
11 – 20	104	31.6
21 – 30	35	10.6
> 30	87	26.4
Firm ownership		
State-owned manufacturer	108	32.8
Private Chinese manufacturer	130	39.5
Wholly foreign-owned manufacturer	36	10.9
Joint venture manufacturer	55	16.7
Respondent location (geographical regions)		
Pearl River Delta*	17	5.2
Yangtze River Delta	33	10.0
Bohai Sea Economic Area	22	6.6
Central China	27	8.2
Southwest China	230	69.9
Years in current position		
≤ 5	136	41.3
6-10	101	30.7
> 10	92	28.0

Note: * It includes one firm in Taiwan and one firm in Hong Kong.

Table 2: EFA of marketing capability, IT capability, and SCI

Measurement items	F1	F2	F3
1. Marketing capability (Song et al., 2008)			
Knowledge of customers	**0.709**	0.184	0.197
Knowledge of competitors	**0.740**	0.229	0.125
Accuracy of profitability and revenue forecasting	**0.718**	0.174	0.015
Awareness of organizational marketing strengths	**0.800**	0.244	0.031
Awareness of organizational marketing weaknesses	**0.766**	0.198	0.125
Marketing planning process	**0.756**	0.134	0.317
Allocation of marketing department resources	**0.791**	0.205	0.245
Integration of marketing activities	**0.801**	0.206	0.188
Skill to segment and target markets	**0.769**	0.115	0.266
Effectiveness of pricing programs	**0.679**	0.113	0.374
Effectiveness of advertising programs	**0.559**	0.167	0.325
Control and evaluation of marketing activities	**0.671**	0.118	0.377
2. IT capability (Song et al., 2008)			
IT systems for new product development projects	0.178	**0.808**	0.218
IT systems for facilitating cross-functional integration	0.248	**0.855**	0.170
IT systems for facilitating technology knowledge creation	0.247	**0.816**	0.284
IT systems for facilitating market knowledge creation	0.217	**0.831**	0.302
IT systems for internal communication (e.g., across different departments, across different levels of the organization, etc.)	0.218	**0.820**	0.210
IT systems for external communication (e.g., suppliers, customers, channel members, etc.)	0.197	**0.783**	0.325
3. Supply chain integration (Wu et al., 2006)			
Our company develops strategic plans in collaboration with our partners	0.302	0.322	**0.776**
Our company collaborates actively in forecasting and planning with our partners	0.298	0.327	**0.794**
Our company projects and plans future demand collaboratively with our partners	0.216	0.295	**0.847**
Collaboration in demand forecasting and planning with our partners is something we always do in our company	0.278	0.249	**0.793**
Our company always forecasts and plans activities collaboratively with our partners	0.188	0.323	**0.797**
Eigenvalues	11.642	2.952	1.690
Total variance explained		70.798%	

Table 3: Reliability analysis

Theoretical constructs	Number of questions	Cronbach's alpha	CITC range of the underlying items
Marketing capability	12	0.941	0.808–0.880
IT capability	6	0.945	0.787–0.873
Supply chain integration	5	0.944	0.613–0.811

Table 4: Correlations, means, and standard deviations

	Mean	S.D.	MC	ITC	SCI
Marketing capability (MC)	4.849	1.009	1		
IT capability (ITC)	4.553	1.376	0.516**	1	
Supply chain integration (SCI)	4.661	1.266	0.581**	0.624**	1

Note: ** **Correlation is significant at the 0.01 level (2-tailed).**

Table 5: Effect of marketing capability, IT capability, and their interaction on SCI: OLS regression results

	Model 1	Model 2	Model 3	Model 4
Control variables				
Firm age	0.061 (0.877[a], 1.639[b])	0.066 (1.159, 1.639)	0.062 (1.229, 1.639)	0.062 (1.225, 1.640)
Firm size	0.029 (0.433, 1.479)	0.007 (0.129, 1.481)	-0.068 (-1.396, 1.522)	-0.068 (-1.393, 1.522)
Industry type	-0.202 (-3.625, 1.063)***	-0.124 (-2.685, 1.083)**	-0.096 (-2.334, 1.088)*	-0.096 (-2.317, 1.091)*
Firm ownership	0.036 (0.598, 1.213)	0.041 (0.834, 1.213)	0.061 (1.401, 1.216)	0.061 (1.390, 1.218)
Independent variables				
Marketing capability (MC)		0.561 (12.469, 1.022)***	0.340 (7.321, 1.380)***	0.340 (7.311, 1.380)***
IT capability (ITC)			0.442 (9.320, 1.440)***	0.442 (9.307, 1.440)***
Interaction effect				
MC × ITC				0.008 (0.207, 1.005)
R^2	0.052	0.360	0.496	0.496
R^2 change	0.052	0.308	0.136	0.000
Adjust R^2	0.041	0.350	0.487	0.485
F-value	4.487**	36.398***	52.874***	45.192***
F change	4.487**	155.487***	86.870***	0.043

*** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$.

Note: The numbers in parentheses are: [a] t values and [b] variance inflation factor (VIF); Dependent variable is supply chain integration.

Table 6: Results of regression analysis for mediation of IT capability

	Dependent variable: SCI			Mediator: IT capability	
	Model 1	**Model 2**	**Model 3**	**Model 4**	**Model 5**
Control variables					
Firm age	0.061 (0.877[a], 1.639[b])	0.066 (1.159, 1.639)	0.062 (1.229, 1.639)	0.004 (0.056, 1.639)	0.009 (0.145, 1.639)
Firm size	0.029 (0.433, 1.479)	0.007 (0.129, 1.481)	-0.068 (-1.396, 1.522)	0.189 (2.887, 1.479)**	0.170 (3.009, 1.481)**
Industry type	-0.202 (-3.625, 1.063)***	-0.124 (-2.685, 1.083)**	-0.096 (-2.334, 1.088)*	-0.133 (-2.389, 1.063)*	-0.063 (-1.132, 1.083)
Firm ownership	0.036 (0.598, 1.213)	0.041 (0.834, 1.213)	0.061 (1.401, 1.216)	-0.050 (-0.850, 1.213)	-0.046 (-0.896, 1.213)
Independent variable					
Marketing capability		0.561 (12.469, 1.022)***	0.340 (7.321, 1.380)***		0.499 (10.646, 1.022)***
Mediator					
IT capability			0.442 (9.320, 1.440)***		
R^2	0.052	0.360	0.496	0.062	0.306
R^2 *change*	0.052	0.308	0.136	0.062	0.244
Adjust R^2	0.041	0.350	0.487	0.050	0.295
F-value	4.487**	36.398***	52.874***	5.346***	28.425***
F change	4.487**	155.487***	86.870***	5.346***	113.328***

*** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$.

Note: The numbers in parentheses are: a t values and b variance inflation factor (VIF)

Figure 1: Conceptual framework