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Abstract

Organizations have increasingly invested money on information technology (IT) in order to improve firms' agility. It is generally believed that companies with greater IT investment tend to be more agile to respond to environmental changes. Yet, the issue of whether IT is an enabler or impeder of organizational agility still remain unresolved. Drawing upon the resource-based view theory, the information systems (IS) and supply chain management literature, we develop and test a hypothesized model that integrates IT capability, supply chain capability and organizational agility. We propose that IT capability enables the development of a higher level of IT-based supply chain capability which is embedded within inter-firm processes and in turn enhances organizational agility. Structural equation modeling is employed to test our theoretical conceptualization of 310 Australian fast-growth small-to-medium enterprises across different industrial sectors. The results show that IT capability does contribute to firm agility through enhancing inter-firm supply chain processes such as integration, information sharing and coordination. This research highlights the role of IT-enabled intermediated processes and the ways in which IT is used by firms to enhance core business processes.

Keywords: IT Resources, IT Capability, Supply Chain Capability, Supply Chain Integration, Supply Chain Information Sharing, Supply Chain Coordination, Organizational Agility, Resource-based View of Firms.

1 INTRODUCTION

In the current context of intensive competition, globalization and time-to-market pressure, firms are making significant investments in information technology (IT) to develop agility and pursue fast and innovative initiatives so as to respond to environmental challenges. Agile firms are able to deal with rapidly evolving situations, survive unexpected threats and thrive in competitive environments through capitalizing on emerging business opportunities (Lu and Ramamurthy 2011). Therefore, agility is regarded as an imperative for business success, helping firms to achieve competitive performance in dynamic business environments (Fink and Neumann 2007; Sambamurthy et al. 2003).

Research that investigates the relationship between IT and organizational agility is increasingly encountered in the information systems (IS) field. Some researchers (e.g., Sambamurthy et al. 2003) assert that IT can enhance organizational agility by building digital options, helping firms to speed up decision making, facilitate communication, and respond quickly to changing conditions. Others (e.g., Van Oosterhout et al. 2006; Weill et al. 2002) argue that IT may hinder and even impede organizational agility because of inflexible legacy IT systems and rigid IT architectures. Ironically, high level of IT investments may result in unintended technology traps over time (Grover and Malhotra 1999). In the digital business environment, although the increasing use of IT creates strong electronic linkages in supply chains, it may also have unintended adverse effects on supply chain flexibility and can severely constrain supply chain performance (Gosain et al. 2004). For example, studies show that the integrated enterprise systems used to automate and support business processes have positive impacts on both business agility (Goodhue et al. 2009) and rigidity (Rettig 2007). These mixed observations suggest that IT can be either an enabler or an impeder of organizational agility. However, the current literature demonstrates a poor understanding of the underlying inherent, but largely ignored, contradictions between IT and organizational agility.

The use of IT in business value creation has also gained intensive attention in the supply chain context. While supply chains involve "the flows of material, information and finance among customers, suppliers, manufactures, and distributors" (Lee 2000, p. 31), supply chain management is regarded as a digitally enabled inter-firm process capability (Rai et al. 2006). As IT provides new opportunities for firms to manage supply chain relationships, it is imperative that we understand how IT resources and capabilities relate to superior supply chain performance (Dong et al. 2009). IT capability demonstrates a firm's ability to acquire, deploy, combine and configure IT resources in order to support and enhance business strategies and processes (Sambamurthy and Zmud 1997). By leveraging IT capability, firms can achieve and sustain competitive advantage (Bharadwaj 2000; Mata et al. 1995). Although research has examined the performance benefits of IT capability (Bhatt and Grover 2005; Stoel and Muhanna 2009), there is still limited understanding of the links between IT capability and agility in the supply chain context (Kohli and Grover 2008). Thus, further rigorous empirical examination is needed to understand how and why IT capability shapes firm agility.

The present research attempts to address the above gaps in the literature. Drawing upon the resource-based view of the firm (RBV) theory and the IS and supply chain literature, we synthesize and theorize the commonly observed but understudied contradiction that relates to IT's potential both to enable and to impede organizational agility. We argue that IT capability can help firms to achieve business value by gaining agility through the development of a higher level of IT-enabled supply chain capability which is embedded within inter-firm supply chain processes. For the purpose of the present study, IT capability is defined as a latent construct reflected in three dimensions: IT infrastructure, back-end integration, and IT human resources. We propose supply chain capability include three interrelated processes: supply chain integration, supply chain information sharing, and supply chain coordination, and conceptualizes market responsive agility as one type of organizational agility. We examine the hypothesized linkages empirically based on data drawn from a survey of 310 fast growth small-to-medium enterprises in Australia.

This paper is structured as follows. The theoretical background section introduces the tenets of RBV which forms the backbone of our conceptual model for hypothesis formulation. The research method section outlines the procedures used for data collection, validation of the measurement properties of the constructs, and the test of the proposed research model. Next we present our findings and finally conclude with a discussion of findings, implications for research and practice, limitations and potential avenues for future research.

2 THEORETICAL BACKGROUND AND HYPOTHESES

The RBV posits that the improvements of firm performance depend on availability of, or access to, valuable, rare, inimitable, non-substitutable and relatively immobile resources or resource bundles (Barney 1991). According to the RBV, organizations succeed and achieve sustainable competitive advantage through treatment of resources/capabilities as central considerations in strategy formulation and as primary sources of competitive advantage. In the IS literature, the RBV has been used to explain how firms create business value from IT capability and organizational skills to leverage IT complementary resources (Bharadwaj 2000; Wade and Hulland 2004). Although IT resources (e.g., hardware and software) are rarely drawn upon for the purpose of creating and sustaining competitive advantage (Clemons and Row 1991), IT capability helps organizations not only to create value but also to gain sustainable competitive advantage (Bharadwaj 2000; Mata et al. 1995; Santhanam and Hartono 2003).

According to Bharadwaj (2000), the combination of IT infrastructure, IT human resources, and firms' ability to leverage IT for intangible benefits serve as firm-specific resources that lead to the creation of a firm-wide IT capability. Although competitors can easily mimic a firm's IT resources, the way companies effectively combine IT resources within an organizational strategy so as to develop an overall IT capability is hard to acquire and difficult to imitate, thus providing firms with a source of competitive advantage. Predicated on this logic, this research defines IT capability as a firm's ability to acquire, deploy, combine, and configure IT resources in order to support and enhance business strategies and processes (Wade and Hulland 2004). As mentioned earlier, IT capability is conceptualized as a latent variable reflected in three dimensions: IT infrastructure, back-end integration, and IT human resources which are critical resources for firms to utilize in conducting their supply chain operations. While IT infrastructure refers to physical IT assets including computers, communication facilities, shareable technical platforms and database (Zhu 2004), in the supply chain context, back-end integration is regarded as a valuable IT resource for the digitally enabled supply chain which links web applications with back-office databases and facilitates supply chain operations between firms and their downstream and upstream partners (Zhu and Kraemer 2005). IT human resources are skills and knowledge of a firm's IT personnel (Wade and Hulland 2004).

Researchers (e.g., Wade and Hulland 2004, pp. 129-130) suggest that examining IT value creation should take into account "an indirect role for IT in firm performance. The basic logic is that IT affects other resources or processes which, in turn, lead to competitive advantage […] Therefore, researchers may find it particularly beneficial to use intermediate-level dependent variables at the business process, department, or project level". In line with this view, the present research posits that IT capability can help firms to create value through the improvement of inter-firm processes in digitally enabled supply chains. Particularly, in the supply chain context, IT value can be manifested in organizational agility, which helps firms to achieve cost reduction, operational efficiency, and sustainable competitive advantage (Lu and Ramamurthy 2011). Organizational agility is a firm-wide capability to deal with and respond to unexpected environmental changes and respond to these changes by exploiting them as opportunities to grow and prosper (Overby et al. 2006).

The strategic management literature suggests that a high-level organizational capability that integrates and reconfigures resources, and fits with firm social, structural and cultural contexts can be regarded as a source of performance (Grant 1996). Because ex ante IS research on the supply chain management field focuses on specific technologies and innovations such as electronic data interchange (EDI), vendor-managed inventory (VMI), and cellular manufacturing, researchers advocate that more investigations are needed to explore how IT capability helps firms to develop an inter-firm capability which links firms with their supply chain partners to create business value (Dong et al. 2009; Kohli and Grover 2008; Rai et al. 2006). Heeding this call, this research defines supply chain capability as a high-order IT-enabled organizational capability which refers to a firm’s ability to identify, utilize, and assimilate internal and external resources in order to enhance the entire supply chain activities (Wu et al. 2006). This study conceptualizes supply chain capability encompassing three dimensions: supply chain integration, supply chain information sharing, and supply chain coordination, the perspective of which represents typical but important activities in the supply chain process (Lee 2004). Each of these three aspects reflects a firm’s ability to perform internal cross-functional as well as inter-firm business activities within supply chains.

Developing this kind of inter-firm capability is a long-term process which requires firms to make a series of integrated strategic decisions and moves related to IT resources so as to blend them with organizational processes and knowledge resources (Barua et al. 2004) and thus can be regarded as a valuable source of sustained competitive advantage (Barney 1991). Firms able to employ IT capability to develop a high-level of IT-enabled supply chain capability which involves supply chain activity integration, real-time information sharing, and inter-firm coordination processes among supply chain partners are likely to develop organizational agility (Lee 2004). For example, Cisco uses e-hub to build strong digital connection with its manufacturers and partners. Such IT capability not only enables Cisco to take advantage of agile, adaptable and aligned supply chain processes but also helps the company to enhance its ability to deal with market demands, leading to new product development, market expansion and revenue growth.

Based on the above discussion, the RBV offers a theoretical perspective explaining how and why firms having IT capability can achieve organizational agility through development of supply chain capability embedded with inter-firm processes in supply chains. Viewed through the lens of the RBV and from the perspective of organizational capability, firms achieve competitive advantage not solely from commonly available IT resources but also from integrating these IT resources to form a valuable IT capability which can be leveraged to develop a higher-order IT-enabled organizational capability residing in organizational skills and processes rather than in IT assets (Bharadwaj 2000; Rai et al. 2006). Figure 1 depicts a hypothesized model of IT capability, supply chain capability and organizational agility, and is followed by a discussion and formulation of testable hypotheses.

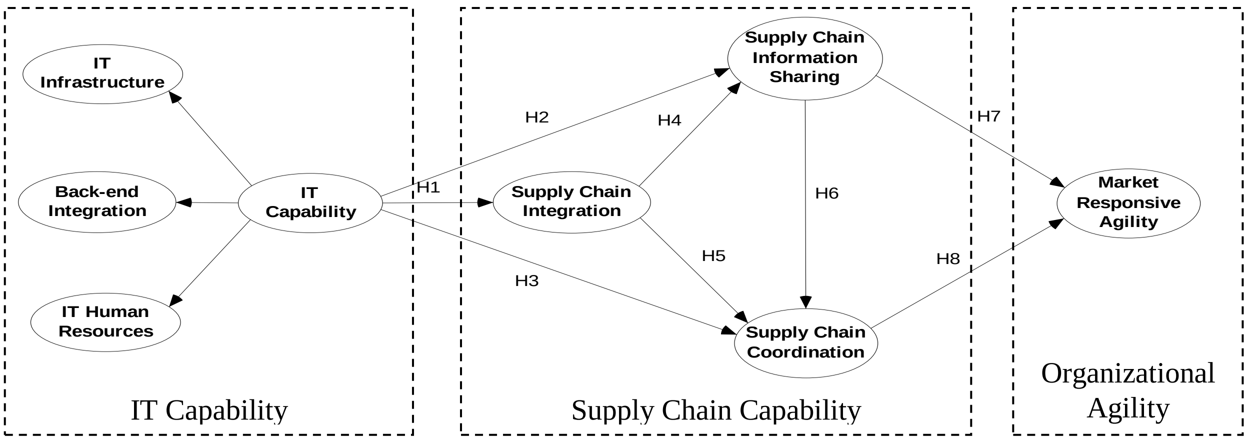

Figure 1. Hypothesized Model

As noted before, IT capability consists of three dimensions: IT infrastructure, back-end integration, and IT human resources. These three components complement each other to enable firms to develop a higher level of organizational capability: supply chain capability which includes supply chain integration, supply chain information sharing, and supply chain coordination. IT infrastructure refers to physical IT assets such as computers, communication facilities, shareable technical platforms and databases, which provide a solid platform upon which firms can leverage technologies not only to conduct business activities but also develop a flexible technology structure (e.g., integrated database) in order to respond to customer demands and market changes for business development (Zhu 2004). A solid IT infrastructure can foster strong links between firms and their supply chain partners, leading to high levels of integration, information sharing, and coordination in supply chains (Bi et al. 2010; Zhu and Kraemer 2005). In addition, back-end integration, as an intangible IT resource, drives collaborative connections among supply chain partners and enhances the flow of information among supply chain partners (Zhu and Kramer 2005), adding value to integration (Rai et al. 2006), collaborative planning, forecasting, and replenishment (Bi et al. 2011) and transactions among supply chain partners (Dong et al. 2009). Finally, IT human resources complement IT physical assets, provide knowledge and skills to develop appropriate IT applications so as to support business strategies and improve inter-firm supply chain processes, helping firms to conduct supply chain activities effectively and efficiently (Bi et al. 2010; Fink and Neumann 2007). Therefore, a firm with superior IT capability involving IT infrastructure, back-end integration and IT human resources are able to enhance the overall supply chain capability through closer integration of decisions and operations, timely information sharing and effective supply chain coordination activities (Rai et al. 2006). Thus, we hypothesize that:

H1: IT capability is related positively to supply chain integration.
H2: IT capability is related positively to supply chain information sharing.
H3: IT capability is related positively to supply chain coordination.

Supply chain integration is the extent to which firms collaborate on strategic planning and forecasting activities with their supply chain partners (Wu et al. 2006). In the context of supply chain operations, a firm's ability to effectively integrate strategic supply chain activities with partners is a prerequisite to achieving high level of supply chain information sharing and coordination efficiency (Cao and Zhang 2011). Supply chain integration not only facilitates joint production planning and sales forecasting (Rai et al. 2006), joint resource planning and work scheduling (Kim et al. 2006), but also enhances joint process integration among members (Johnson et al. 2007). Studies show that firms employing strategic integration with supply chain partners are likely to improve inter-firm coordination and information exchange activities (Stank et al. 2001), and to increase the overall efficiency of production or exchange through closer integration of decisions and operations (Dong et al. 2009). Thus, we hypothesize that:

H4: Supply chain integration is related positively to supply chain information sharing.
H5: Supply chain integration is related positively to supply chain coordination.

While supply chain information sharing refers to the effective and efficient exchange of knowledge between firms and supply chain partners, supply chain coordination refers to firms' ability to coordinate transactional related activities with their partners (Wu et al. 2006). A typical supply chain network involves collecting, interpreting, storing, and sharing data through effective information exchange between members in order to improve efficiency in coordination activities (Lee et al. 2000). Effective information sharing among supply chain members leads to supply chain capability by increasing coordination, flexibility, and responsiveness (Lee 2004). Kim et al. (2006) suggest that supply chain partners exchanging information with each other in a frequent and time manner can contribute to inter-firm coordination. Thus, we hypothesize that:

H6: Supply chain information sharing is related positively to supply chain coordination.

Market responsive agility, as one type of organizational agility, concerns knowledge management to find appropriate responses to environmental changes or new market development (Kim et al. 2006). Market responsive agility includes the scanning and processing of a variety and extensive amounts of information to identify and anticipate external changes, and also involves continuously monitoring and quickly improving product/service offerings in response to market and customer needs (Lu and Ramamurthy 2011). In contemporary volatile marketplaces, it is imperative for firms to develop a responsive agility so as to constantly collect, monitor and process changing environmental signals, make innovative decisions, and quickly adjust processes to capitalize on market opportunities, thus facilitating the achievement of sustainable competitive advantage (Sambamurthy et al. 2003). Kim et al. (2006) argue that effective and efficient inter-firm processes in supply chains can help firms to accommodate market changes or customer requests in a timely manner through efficient information exchange and coordination activities. Thus, we hypothesize that:

H7: Supply chain information sharing is related positively to market responsive agility.
H8: Supply chain coordination is related positively to market responsive agility.

3 RESEARCH METHODOLOGY

3.1 Target Population and Survey Sample

The data used for testing our hypothesized model was collected through an online survey of 1,335 Australian fast-growth small-to-medium enterprises (SMEs) compiled by Business Review Weekly (BRW). The BRW Fast Growth enterprises are similar to Fortune's FSB 100 annual list of North America's fastest growing small companies. Key inclusion criteria for SMEs to enter the BRW fast-growth project are that their previous year's turnover must exceed AUD$500,000; they must have fewer than 200 full-time employees; they cannot be a subsidiary of an Australian or overseas corporation; and they must not receive more than 50% of their revenue from a single client. Except for the turnover criterion, which is subject to indexing, the other criteria have remained constant. Fast-growth companies from this sample fall within Ghobadian and O'Regan's (2000) definition of SMEs.

We have chosen to test our proposed model using fast-growth SMEs because SMEs are a dominant part of and significant contributor of employment of the Australian economy (OECD 2007). IS Research on SMEs is still thin on the ground and the benefits SMEs derive from IT investments is far from conclusive (Bi et al. 2010). Fast-growth SMEs are more entrepreneurial and risk taking in their business orientation. Focusing on fast growth SMEs provides insightful understanding how this cohort of firms leverages IT capability to develop their organizational capability in order to achieve market responsive agility.

3.2 Data Collection Procedures

A personalized email highlighting the academic nature of the study was sent to either the founder or CEO of all 1,335 fast-growth SMEs. In our emails, we emphasized the importance of having respondents with a good understanding and overview of their firm's e-business activities to participate in our survey, urging the founder or CEO to personally complete the online questionnaire, where possible. A follow-up email was sent three weeks after the initial one, and a second reminder email another two weeks later. Respondents were assured of confidentiality. A total of 310 responses were obtained, which gave a gross response rate of 28.1%, after discounting 195 incorrect email addresses and 32 SMEs which declined to participate. All responses were filled by either the company founder or its CEO.

We first tested the sample for non-response bias, using the approach suggested by Armstrong and Overton (1977). Differences in responses to all the constructs between early respondents (i.e., those that completed the survey upon the first invitation) and late respondents (i.e., those who replied to follow-up emails) were compared. Independent sample *t*-tests on each construct failed to reveal significant differences between early and late respondents (all *p*-values>.05), suggesting that non-response bias was not an issue.

The profile of the responding firms in our study (Table 1) shows that they represent all major industry sectors. There is also equal distribution of companies in terms of their age (or years of establishment). All responding firms had achieved a growth rate in excess of 20%.

3.3 Common Methods Bias

As our study used a self-administered questionnaire and respondents were in a senior management position qualified to assess firm performance, measurement was subject to cognitive biases due to participants "seeking to present themselves in a favorable manner" (Thompson and Phua 2005, p. 541). Anticipating such a possibility, we incorporated Marlowe and Crowne's (1961) Social Desirability Scale in our online questionnaire, inviting participants to complete this section as part of the survey. The incorporation of Marlowe and Crowne's (1961) Social Desirability Scale enabled us to assess all study items for social desirability response bias in order to address internal validity and psychometric aspects of instruments. Marlowe and Crowne's (1961) Social Desirability Scale has been used widely for checking cognitive biases (Ballard 1992). In this study, we tested common method bias using structural equation modeling (SEM) procedures recommended by Podsakoff et al. (2003) to examine the influence of social desirability on the research constructs. We found no significant relationships between the social desirability construct and the research constructs (all *p*-values >.05). Accordingly, social desirability does not contribute significantly to the model, suggesting that there is no common method bias.

Demographic	% (*n*=310)
Industry	
Information Technology	18.8
Property & Business Services	18.1
Personal & Other Services	9.6
Finance & Insurance	8.9
Communications	6.6
Other [a]	38
Company Age	
Less than 5 years	49
More than 5 years	51
Previous Year Growth Rate	21.9-759.5
CEO/Founder's Education Level	
Tertiary	53.9
MBA	16.6
Year 12	13.7
PhD or Doctorate	1.8
Other	14.0

Note. [a] Other industry sectors include Construction, Retail Trade, Manufacturing, Health & Community services, Wholesale Trade, Education, Transport & Storage, Accommodation, café, restaurants, Mining, Cultural & recreational services.

Table 1. Profile of Responding Firms

3.4 Constructs

Measurement items were developed based on a comprehensive review of the literature (Table 2). Development of respective measurement models incorporate successive stages of theoretical modeling, statistical testing, and refinement (Straub 1989).

Constructs	Indicators
1. IT Infrastructure (ITIF) *Adapted from Zhu (2004)*	Our company has a good telecommunication infrastructure. Our company’s IT systems infrastructure is very flexible in relation to company’s future needs. Our company’s IT systems enable us to effectively cooperate electronically with suppliers/partners and customers.
2. Back-end Integration (BI) *Adapted from Zhu and Kraemer (2005)*	There are well-integrated multiple web applications encompassing different areas in our company. Our company shares common databases for various applications, rather than having a separate database for each application. Our company’s databases are electronically integrated with our supply chain partners.
3. IT Human Resources (ITHR) *Adapted from Bharadwaj (2000)*	Our company hires highly specialized or knowledgeable people for e-business. IT people working for our company are generally aware of functions of e-business. IT people working for our company are adequately trained in e-business.
4. Supply Chain Integration (SCIT) *Adapted from Kim et al. (2006)*	Our supply chain has built-in functions to collaborate on forecasting and planning with our supply chain partners. Our company projects and plans future demand collaboratively with our business partners through supply chain. Our supply chain allows us to project and plan future demand collaboratively with our business partners. Collaboration in demand forecasting and planning with our business partners is something we always do through our supply chain.
5. Supply Chain Information Sharing (SCIS) *Adapted from Kim et al. (2006) and Wu et al. (2006)*	Our company exchange more information with our supply chain partners than our competitors do with theirs. Information flows more freely between our company and supply chain partners than between our competitors and theirs. Our information sharing with supply chain partners is superior to the information shared by our competitors from theirs.
6. Supply Chain Coordination (SCCD) *Adapted from Kim et al. (2006) and Wu et al. (2006)*	Our company conducts transaction follow-up activities more efficiently with our supply chain partners than do our competitors with theirs. Our company spends less time on supply chain coordination transactions with our supply chain partners than our competitors with theirs. Our company conducts supply chain coordination transactions at less cost than do our competitors with theirs.
7. Market Responsive Agility (MRPA) *Adapted from Kim et al. (2006) and Wu et al. (2006)*	Compared with our competitors, our company responds more quickly and effectively to changing customer and supplier needs. Compared with our competitors, our company responds faster and more effectively to changing competitor strategies. Compared with our competitors, our company develops and markets new products more quickly and effectively. Compared with our competitors, our company is competing effectively in most markets.

Table 2. Constructs and Indicators

3.5 Instrument Validation

Data were analyzed with AMOS 17.0, using confirmatory factor analysis (CFA) procedures with the maximum likelihood (ML) estimation method. Prior to conducting the CFA, we ran an exploratory factor analysis (EFA) on all indicators. Principal axis factoring with direct oblimin rotation yielded consistent groupings with our hypothesized measurement models. All constructs were tested for reliability, validity, and fit. Based on an assessment of CFA fit statistics, measurement models were further refined to obtain sound fit. Respectively, Tables 3 and 4 show correlations and descriptive statistics and measurement properties of constructs. As reported below, instrument validation proceeded through four steps: calculation of construct reliability; variance extracted estimates; and evaluation of convergent and discriminant validity.

	Mean	SD	1	2	3	4	5	6	7
1. ITIF	5.53	1.08	.81						
2. BI	4.12	1.63	.39**	.71					
3. ITHR	4.95	1.69	.48**	.52**	.83				
4. SCIT	4.30	1.60	.27**	.35**	.30**	.91			
5. SCIS	4.36	1.36	.35**	.35**	.31**	.44**	.92		
6. SCCD	4.40	1.24	.38**	.34**	.31**	.47**	.71**	.88	
7. MRPA	5.35	1.07	.29**	.32**	.34**	.38**	.41**	.51**	.75

Note. (1) *p<.05. **p<.01.
(2) The diagonal elements are the square root of the AVE.

Table 3. Correlation Matrix, Mean Scores and Standardized Deviations

3.5.1 Construct Reliability

Construct reliability, a measure of consistency, assesses the degree to which items are free from random error. Indictor and composite reliability are two measures of construct reliability (Fornell and Larcker 1981). While indicator reliability represents the proportion of variation that is explained by a construct it purports to measures, composite reliability reflects the internal consistency of indicators (Werts et al. 1974). In the present study, indicator reliability values range between .43 and .95, and composite reliability values exceed the recommended value of .70 (Nunnally and Bernstein 1994).

3.5.2 Variance Extracted Estimate

Variance extracted estimate reflects the overall amount of variance in indicators accounted for by a latent construct (Fornell and Larcker 1981). In this study, all estimates exceed the recommended value of .50 (Hair et al. 2006).

Constructs	**Cronbach's α**	**Construct Reliability**	**Variance Extraction**	**Range of Standardized Loadings**	**Range of Indicator Reliability**
1. ITIF	.83	.89	.66	.74 - .88	.55 - .78
2. BI	.75	.75	.50	.66 - .79	.43 - .62
3. ITHR	.86	.87	.69	.75 - .95	.56 - .91
4. SCIT	.95	.95	.83	.85 - .95	.71 - .89
5. SCIS	.94	.95	.85	.89 - .91	.79 - .95
6. SCCD	.91	.91	.77	.85 - .91	.72 - .83
7. MRPA	.83	.84	.56	.67 - .80	. 45 - .64

Note. All factor loadings are significant at p<.001 level

Table 4. Confirmatory Factor Analysis: Standardized Loadings and Reliability

3.5.3 Construct Validity

Construct validity was established by measuring convergent and discriminant validity of measurement items (Phillips and Bagozzi 1986). Convergent validity assesses the consistency across multiple operationalizations. Values for t-statistics for all factor loadings were found to be significant (all p-values<.001), indicating that measures satisfy convergent validity criteria (Gefen et al. 2000). According to Fornell and Larcker (1981), average variance extracted for each construct should be greater than the squared correlation between constructs when assessing discriminant validity, the extent to which different constructs diverge from one another. In this case, results suggest that items share more common variance with related than non-related constructs, with all constructs meeting this criterion.

3.6 Data Analysis

Confirmatory and full structural model fit were assessed using multiple indices (Hair et al. 2006), including the normed chi-square (χ^2/df), comparative fit index (CFI), Tucker-Lewis Index (TLI), root mean-square error of approximation (RMSEA), and standardized root mean-square residual (SRMR). All seven measurement models tested were found to meet the criteria set for these indices (Hair et al. 2006): χ^2/df ratio < 3; CFI and TLI > .90; RMSEA < .05; and SRMR < .06.

IT capability was modeled as a reflective second-order construct comprised of three first-order dimensions: IT infrastructure, back-end integration and IT human resources. According to Jarvis et al. (2003), the first-order factors are complementary (i.e., they interact and co-vary with each other, the covariance of these three first-order factors ranges between .49 and .62). A reflective second-order construct is appropriate for capturing complementarities (Tanriverdi and Venkatraman 2005). The alternative approach of using a formative second-order modeling is not appropriate because it does not assume any interactions or covariance among the first order dimensions of a higher-order construct (Chin 1998).

Data fit the measurement model for IT capability well: χ^2(24)=43.802, χ^2/df=1.825, CFI=.984, TLI=.977, SRMR=.05, RMSEA=.04. Respectively, Cronbach's α, construct reliability, and variance extraction for IT capability are α=.85, CR=.79, and VE=.57. As theorized in the Theoretical Background and Hypotheses section, IT capability is a reflective higher-order construct comprising multiple dimensions with significant loadings (all *p*-values<.001). Paths from second-order constructs to first-order factors are of high magnitude, either nearing or exceeding a suggested cutoff value of .7 (Chin 1998). Marsh and Hocevar (1985) suggested that the efficacy of second-order models should be assessed by the target coefficient (*T* ratio) with an upper bound of 1. Our models display very high *T* ratios approximating 1, implying that relationships among first-order constructs are sufficiently captured by their respective second-order construct (Stewart and Segars 2002). Given solid theoretical and empirical grounds, and the parsimonious nature of the second-order factors (Hull et al. 1991), the conceptualization of IT capability as a reflective, high-order, multidimensional construct is considered justified.

4 RESULTS

Given the acceptable measurement models, we estimated a full latent variable structural model (Anderson and Gerbing 1988) using same goodness of fit criteria to test our structural model and respective hypotheses. Table 5 summarizes the results of hypotheses testing, revealing a reliable and robust fit between our theoretical model and sample covariances: χ^2(220)=404.617, χ^2/df=1.839, CFI=.964, TLI=.959, SRMR=.058, RMSEA=.052. These indices suggest a good model fit. The squared multiple correlation (SMC) values, which are similar to R^2 in regression analysis, show that this model accounts for 19% of the variance in supply chain integration, 30% of the variance in supply chain information sharing, 61% of the variance in supply chain coordination, and 35% of the variance in market responsive agility. Table 5 shows that all hypothesized relationships, except H_7, are supported.

We adopted the three-step method suggested by Baron and Kenney (1986) to test the mediating effects of supply chain capability. As Table 6 shows, the direct links between IT capability and market responsive agility is partially mediated by the supply chain capability, which includes supply chain integration, supply chain information sharing and supply chain coordination.

Hypothesis	Standardized Path Estimates	Conclusion
H_1. IT Capability → Supply Chain Integration	.44***	Supported
H_2. IT Capability → Supply Chain Information Sharing	.37***	Supported
H_3: IT Capability → Supply Chain Coordination	.27**	Supported
H_4. Supply Chain Integration → Supply Chain Information Sharing	.27***	Supported
H_5. Supply Chain Integration → Supply Chain Coordination	.16**	Supported
H_6. Supply Chain information Sharing → Supply Chain Coordination	.59***	Supported
H_7. Supply Chain Information Sharing → Market Responsive Agility	.05	Not Supported
H_8. Supply Chain Coordination → Market Responsive Agility	.55***	Supported
Model Fit Indices		
χ^2(219)=404.271		
χ^2/df=1.846		
CFI=.964, TLI=.959		
SRMR=.057		
RMSEA=.052		

Note. **p*<.05. ***p*<.01. ****p*<.001.

Table 5. Proposed Hypotheses and Test Results

Standardized Path Estimates							
IV	M	DV	IV→DV	IV→M	IV+M→DV		Mediating
					IV→DV	M→DV	
ITCP	SCCD	MRPA	.50***	.52***	.30***	.42***	Partial
ITCP	SCCD + SCIS	MRPA	.50***	.37***	.27***	.41***	Partial
ITCP	SCCD+ SCIS+ SCIT	MRPA	.50***	.16***	.30***	.42***	Partial

Note. **p*<.05. ***p*<.01. ****p*<.001.

Table 6. Results of Mediating Tests

5 DISCUSSION AND CONCLUSION

Aiming to address the controversial and understudied issues about IT and organizational agility, this research develops and empirically tests a hypothesized model integrating IT resources/capability, supply chain capability and organizational agility. This study conceptualizes IT capability as a reflective latent variable comprising three elements: IT infrastructure, back-end integration, and IT human resources. This study explores the role of IT resources/capability in developing a higher level of IT-enabled supply chain capability embedded with inter-firm supply chain processes and how this supply chain capability helps firms to enhance market responsive agility. The RBV theory underpins the present research.

Results show that seven of eight hypothesized relationships are supported, the exception of which is that between supply chain information sharing and market responsive agility. Findings suggest that a firm's IT capability has a substantial effect on development of a higher level of IT-enabled supply chain capability. This IT-enabled capability is deeply embedded into the inter-firm supply chain processes such as supply chain integration, supply chain information sharing, and supply chain coordination among members in the supply chains. The development of such process integration, collaboration and coordination capability that leverages IT resources/capability requires significant time and fits with firm social, structural, and cultural contexts, rendering it hard to be imitated by competitors and thus can be regarded as a source of performance. The results also highlight that such effective and efficient inter-firm supply chain processes can help firms to respond to market changes or customer requests in a timely manner through efficient information exchange and coordination activities, thus contributing to organizational agility which is critical to effective competition in rapidly fast changing environments. Regarding the link between supply chain information sharing and market responsive agility, a possible explanation is the direct effects of supply chain information sharing on market responsive agility is mediated through the supply chain coordination because of positive sequential links between supply chain information, supply chain coordination, and market responsive agility. This means that the impact of supply chain capability on agility is a causally complex inter-firm process that moves from supply chain integration to information sharing and finally to coordination which is related positively to market responsive agility.

This research contributes to extant knowledge in four salient ways. First, this study provides initial empirical evidence from an investigation of essential IT capability and its relationship with organizational agility. Antithetical findings concerning IT-agility are not only uncommon but research in this area is also relatively understudied (Lu and Ramamurthy 2011). Therefore, understanding whether IT enables or impedes agility still remains unclear. The present research addresses this issue, suggesting that IT capability can help firms to enhance organizational agility by developing an integrated IT-enabled supply chain capability, providing a rigorous examination of the interrelationships between IT capability, IT-enabled supply chain capability, and organizational agility.

Second, this research informs an ongoing debate about the business value of IT. We suggest that IT capability is critical to value creation and agility. Particularly, IT does not only have a direct effect on organizational agility, but also being mediated through development of a higher order of organizational capability.

Third, this study also bridges insights from the IS and supply chain management literature to examine the role of IT in building supply chain capability and its consequence on firm agility. Understanding how IT impacts supply chain management is important for firms to achieve business advantage in dynamic business environments. This investigation highlights IT as a critical enabler in building agile and adaptable supply chain capability which involves strategic integration, timely information sharing, and effective coordination processes among members. Because this kind of IT-based organizational capability is firm specific and hard for competitors to imitate, it is regarded as a source of competitive advantage.

Finally, this research contributes to IS research by refining the conceptualization and measurement of IT capability, supply chain capability and organizational agility and advances both theory and measurement about essential IT capability and its relationship with organizational agility.

This study has four important implications for management. First, we offer a framework for managers to understand the way in which IT investments helps firms to achieve organizational agility through using lower level of IT capability to enable higher-order inter-firm supply chain process capability. This study highlights that resources/capabilities become sources of competitive advantage only when they are exploited through business processes. For managers, identifying resource competencies that have high potential for developing specific organizational capabilities and focusing on proper business processes where these capabilities are deployed should be a priority.

Second, we conceptualize IT capability as a multidimensional construct which captures the commonality among three elements: IT infrastructure, back-end integration, and IT human resources. This conceptualization emphasizes the complementary among the three dimensions together enhance inter-firm supply chain process capability. Managers should understand the complementary role of IT resources in forming IT capability and therefore need to develop these three dimensions simultaneously at an adequate level in order to successfully manage IT and thus facilitate the inter-firm supply chain processes.

Third, we show that inter-firm supply chain processes exert a significant impact on organizational agility, which firms must achieve if they are to sustain business success in dynamic and volatile environments. Due to the interconnectivity enabled by digital technology on a global scale, firms are no longer working alone and thus the competition will not only be between companies, but also between supply chains. Firms like Dell, Cisco and Wal-Mart gain substantial benefits from establishment of integrated inter-firm processes in their supply chains. Managers should bear in mind that building strategic integration, collaboration, and coordination with supply chain partners is critical when doing business, particularly in dynamic environments.

Finally, our empirical findings from this study are generalizable so long as firms are ambidextrous in their ability to respond to both technological advancements and changing market conditions. Ambidextrous organizations are not constrained to fast growth SMEs even though the latter is typically symbolic of firms possessing such capabilities.

6 LIMITATIONS AND FUTURE RESEARCH

This study has a number of methodological and conceptual limitations. First, IT capability- and IT-enabled supply chain capability-building processes and realization of agility have dynamic features that evolve over a period of time. The present research adopts a static cross-sectional research design with data collected at a single point in time. This approach is limited in addressing processes-oriented issues or causal relationships. Future research might consider using longitudinal designs to address themes relating to the causal dynamics of capability-building processes and the on-going processes between capability and agility.

Second, utilizing a single-informant (CEO and/or founder) data collection technique presents problems of data credibility. Single informant studies are well-known for their susceptibility to reporting bias. Future research might consider obtaining data from managers across the IT, production and operations functions.

A third limitation relates to sample characteristics upon which the present hypotheses are tested. The current investigation is drawn from a relatively small proportion of self-selected fast-growth SMEs in a specific geographic region. While the present hypothesized model might be applicable to larger firms as well as firms in other geographic locales, further research is needed to extend generalizability of the findings.

Finally, the present study only explores the utilization of IT capability in enhancing organizational agility. Technology is only one piece of the puzzle in achieving agility from a socio-technical perspective (Bostrom and Heinen 1977). Future research should extend the current investigation and explore other elements such as how culture, structure and leadership interact with IT in enabling agility. Including these variables could offer significant improvements over the current model, providing a more comprehensive understanding of the value of IT complementary resources and IT capability.

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