HOW THE EFFECTS OF IT CAPABILITY AND KNOWLEDGE CAPABILITY ON ORGANIZATIONAL AGILITY ARE CONTINGENT ON ENVIRONMENTAL UNCERTAINTY AND INFORMATION INTENSITY

Completed Research Paper

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Abstract

Although the relationship of information technology (IT) capability and knowledge capability with organizational agility has been documented, limited information is available on the extent to which these two capabilities affect organizational agility. Attempts to understand the effect of IT and knowledge capability on organizational agility in the presence of contextual factors have also been few. Based on data collected from 123 organizations in China, we examine the moderating effects of two contextual factors (environmental uncertainty and information intensity) on the relationship of IT and knowledge capability with organizational agility. We contribute to current knowledge by showing that environmental uncertainty positively moderates the effects of IT capability and knowledge capability on organizational agility and that information intensity positively moderates the effects of knowledge capability on organizational agility. While we find that both IT and knowledge capabilities have positive effects on organizational agility, knowledge capability is more effective than IT capability.

Keywords: Information technology capability, knowledge capability, organizational agility, environmental uncertainty, information intensity

Introduction

The significance of agility is widely accepted because agile organizations operate successfully in changing and competitive environments (Van Oosterhout et al. 2006). The pulse of the profession organizational agility report by the Project Management Institute (PMI) has shown that the success rate of projects in more agile organizations are over 70%, which is considerably higher than that in organizations with low agility. In the past several years, at least two streams of research have documented the process of improving organizational agility by developing capabilities. One stream is the resource-based view (RBV) from the technical perspective (Barney 1991; Wade and Hulland 2004; Wernerfelt 1984), which posits that information technology (IT) capability (i.e., the ability to manage IT resources) is necessary to enhance organizational agility (e.g., Chen et al. 2013; Lu and Ramamurthy 2011; Sambamurthy et al. 2003). The other stream is the knowledge-based view (KBV), which argues that the organizational ability to obtain economic value by collecting knowledge assets is a critical factor for organizational agility (e.g., Ashrafi et al. 2006; Becker 2001; Dove 2002). However, these two streams have rarely been integrated.

Three gaps in previous research on these two streams have emerged. First, the findings on the relationship between IT capability and organizational agility are contradictory. Although advocates of the RBV theory claim that IT capability can improve organizational agility, a finding that appears to be intuitively appealing (e.g., Chen et al. 2013; Goodhue et al. 2009; Lu and Ramamurthy 2011; Sambamurthy et al. 2003; Overby et al. 2006), other researchers argue that IT capability can also be negatively associated with agility. For example, Rettig (2007) claimed that enterprise software often produced rigidity and unexpected barriers that hindered change. IT capability could also play a mixed role in constructing agile organizations (Seo and La Paz 2008; Van Oosterhout et al. 2006). On the one hand, IT capability enables rapid and flexible operation of business processes. On the other hand, IT is characterized by overwhelming collection of data, technology dependence, and a great propensity for error. Understanding this problem is essential because organizations employ different strategies to develop agility. Therefore, further empirical evidence on the relationship between IT capability and organizational agility is necessary.

Second, adherents of KBV, such as Dove (2002), propose that knowledge capability has a positive impact on agility. However, this proposition has never been tested empirically. Chen et al. (2010) argue that knowledge capability can boost agility in the long run; however, this desired agility cannot be achieved if the organization aims to gain maximum profit in the short run. As knowledge-based resources are socially complex (Grant 1996; Kogut and Zander 1992), that is, that they could be either valuable assets or improper elements, knowledge capability may also exert a mixed influence on organizational agility. Therefore, empirically examining the effects of knowledge capability on organizational agility is required. Moreover, limited empirical evidence exists on the relationship between knowledge capability and agility. Thus, the relative effectiveness of IT capability and knowledge capability is also unknown. Understanding the relative importance of these two capabilities can help managers make appropriate decisions and formulate approaches and strategies to improve organizational agility. In addition, IT capability represents technical perspective, whereas knowledge capability represents knowledge-based perspective. Hence, managers must understand which between technology and knowledge is more important to agility.

Third, traditional RBV and KBV researchers tend to focus on internal organizational mechanisms to improve agility. They ignore the external mechanisms of organizations. A number of researchers suggest that an integrated analysis of the effects of contextual variables (external factors) on the internal mechanism of an organization is necessary (Barney et al. 2001; Chen et al. 2013; Wade and Hulland 2004). We know from contingency theory that successful organizations can establish a fit between the environment and their structural and technological characteristics to take advantage of potential opportunities (Lawrence et al. 1967; Umanath 2003). Indeed, in the relationship between IT capability and organizational performance (but not agility), certain contextual factors such as industry type, level of competition, and dynamism of the environment have been found to be the potential moderators (Bhatt 2000; Teo and King 1997; Wade and Hulland 2004). Inconsistent arguments in prior studies on the effectiveness of IT capability suggest that moderators may exist in the changing environment on the relationship between capabilities and organizational agility (Fink and Neumann 2007; Rettig 2007). To close this gap, in this study we combine the RBV and KBV theories, which focus on internal resources, with contingency theory, including external contextual factors, and examine how the effects of IT

capability and knowledge capability on organizational agility are moderated by two contextual factors: environmental uncertainty and information intensity.

We attempt to bridge the aforementioned gaps by answering the following three research questions:

(1) How do IT capability and knowledge capability influence organizational agility?

(2) What is the relative impact of IT capability and knowledge capability on organizational agility?

(3) How do environmental uncertainty and information intensity moderate the relationship between IT and knowledge capabilities and organizational agility?

The rest of this paper is structured as follows. First, we present the theoretical background, research model, and hypotheses. Next, we state the research methodology based on survey data from 123 organizations in China to test our hypotheses. Then, we provide the results and findings through hierarchical regression analysis. Finally, we discuss both the theoretical and managerial implications of our findings.

Theoretical Background

IT Capability

Organizations have long considered developing IT capability as a key approach to create strategic value to gain sustainable competitive advantages (Bharadwaj 2000; Wade and Hulland 2004). Consistent with Sambamurthy and Zmud (1994), IT capability is defined as the ability of an organization to acquire, deploy, combine, and reconfigure IT resources to support and enhance business strategies and work processes. Various dimensions of IT capability have been proposed (e.g., Bharadwaj 2000; Ross et al. 1996; Wade and Hulland 2004). Among these dimensions, Lu and Ramamurthy (2011) have presented an aggregate multidimensional framework by categorizing IT capability as IT infrastructure capability, IT business spanning capability, and IT proactive stance. They also tested the impact of IT capability as a second-order construct. Our dimensions in this study are consistent with the ideas of Lu and Ramamurthy (2011) because these three dimensions are broadly viewed as representative of actual practice. These dimensions cover not only the quality of IT resources but also the ability to manage resources.

In these dimensions, IT infrastructure capability is defined as the capability to arrange technical facilities (hardware systems and networks), applications (platforms, databases, operating systems, and core software), and IT management services (Lu and Ramamurthy 2011; Weill et al. 2002). IT business spanning capability is defined as the capability of organizations to integrate IT, business processes, and strategy (Bharadwaj et al. 1999; Lu and Ramamurthy 2011; Wade and Hulland 2004). Spanning capability enables organizations to have a clear vision of IT value. IT proactive stance is defined as the ability to proactively explore new IT innovations or exploit available IT resources to create and use business opportunities for competitive advantages (Fichman 2004; Lu and Ramamurthy 2011; Weill et al. 2002). The proactive stance capability measures the attitudes of organizations toward IT innovations and new IT values. Given that our focus is on IT capability, consistent with Lu and Ramamurthy (2011), we consider IT capability as a second-order construct and examine the impact of IT capability at an aggregated level.

Knowledge Capability

Based on prior literature, we define knowledge capability as the ability of organizations to mobilize and deploy knowledge-based resources combined with other capabilities to obtain business value and gain competitive advantages from a knowledge-based view (Chuang 2004; Grant 1996; Kearns and Lederer 2003). Knowledge capability can be measured from two perspectives: knowledge infrastructure (the technical, structural, and cultural aspects) and knowledge processes (from knowledge creation to knowledge use) (Gold et al. 2001; Zaim et al. 2007). In this study, we view knowledge capability from the process perspective, which has also been documented by most studies in the information systems (IS) field (Alavi and Leidner 2001; Tanriverdi 2005). The process perspective was chosen for three reasons. First, in IS literature, knowledge capability tends to be regarded as a process-related construct, an idea

that is widely used in previous studies (Alavi and Leidner 2001; Tanriverdi 2005). However, the knowledge infrastructure perspective is rarely applied. Second, given that IT infrastructure capability is one dimension of IT capability and technology infrastructure is a sub-dimension of knowledge infrastructure (Gold et al. 2001), measuring knowledge capability from the infrastructure perspective is not appropriate for the measurement model and will cause these two variables to interact. Third, agility refers to a process of making changes (first by sensing and then by responding). Thus, measuring knowledge capability from the process perspective rather than from the infrastructure perspective is more likely to explain a significant amount of variance.

Three major processes are included in knowledge capability: knowledge capture, transfer, and use (Gold et al. 2001; Pérez-López and Alegre 2012). Knowledge capture capability refers to the ability of organizations to accumulate knowledge whether from outside or within the organization or to generate new knowledge from existing information. Knowledge transfer capability refers to the ability of organizations to share knowledge throughout the organization to make this knowledge useful. Knowledge use capability refers to the ability to apply knowledge efficiently within the organization. Higher knowledge capability can increase the efficiency of organizations, create new products or services, and reduce costs so that the organization can gain competitive advantages.

Organizational Agility

Distinct from flexibility, organizational agility is the ability of organizations to sense changes in the environment and respond quickly, efficiently, and cost-effectively to improve competitive advantages (Amos 1998; Chen 2012). Agility extends the concept of flexibility and is associated with speedily sensing and responding to opportunities and threats in the business environment. Agility is regarded as the ability of organizations to thrive in a continuously changing and unpredictable business environment (Dove 2002). In this study, consistent with the literature (Chung et al. 2010; Lu and Ramamurthy 2011; Sambamurthy et al. 2003), agility is considered as the ability of organizations to respond quickly to changing environments to increase product or service quality and meet market needs by using the external and internal processes of the organization.

The Relationship between IT Capability, Knowledge Capability, and Organizational Agility

Previous studies on IT capability, knowledge capability, and organizational agility demonstrate that IT capability can be viewed as either an enabler or a disabler of organizational agility, but few studies have quantitatively examined the relationship between knowledge capability and agility. Few studies have integrated IT capability and knowledge capability. Moreover, past researchers failed to compare the relative significance of these two types of capabilities.

The role of IT capability has been examined both qualitatively and quantitatively in terms of the relationship between IT capability and organizational agility. Information technology is commonly considered as an enabler of organizational agility because information technology can help create operational and strategic benefits (Fink and Neumann 2007). The strategic value of IT has also been emphasized (Sambamurthy et al. 2003; Van Oosterhout et al. 2006). Studies have shown that IT capability positively influences different forms of agility: business process agility, entrepreneurial agility, adaptive agility, market capitalizing agility, and operational adjustment agility (Chen et al. 2013; Lee et al. 2008; Lu and Ramamurthy 2011). However, several researchers have argued that the integration and process automation brought by information technology can make change difficult for the organization because of the rigidity of processes and unexpected barriers (Rettig 2007). Allen and Boynton (1991) also argued that information systems are disablers of flexibility for many organizations. Van Oosterhout et al. (2006) further pointed out the mixed role of IT capability in building agile organizations. Some points (e.g., information inaccuracy, information overload for decision makers, technology dependence) are deemed as the dark side of IT that affects agility negatively (Seo and La Paz 2008). Thus, more empirical evidence is required to verify the relationship between IT capability and organizational agility.

Although knowledge management is necessary in delivering organization values (Dove 2002), only a few studies have discussed the relationship between knowledge management and organizational agility based

on qualitative descriptions (Becker 2001; Dove 2002; Du Plessis 2005; Nazir and Pinsonneault 2012). For instance, some researchers contend that developing knowledge management is an efficient way to improve organizational agility by accessing real-time knowledge on markets and products (Khalifa et al. 2008; Tseng 2010). However, little empirical evidence has been provided. Most prior studies have linked agility to only one of the many aspects of knowledge capability, including knowledge infrastructure (Becker 2001), knowledge creation and integration (Chung et al. 2010; Nazir and Pinsonneault 2012), and knowledge use (Khalifa et al. 2008). Thus, the present study aims to provide a comprehensive understanding of the overall effectiveness of knowledge capability and to advance the research field by empirically comparing the relative importance of knowledge capability and IT capability in organizational agility.

Contextual Factors and the Relationship between Capabilities and Organizational Agility

Traditional RBV and KBV theories tend to focus on the internal mechanism of organizations. However, limited information is available on the joint effect of the internal and external mechanisms of organizations. To address this issue, we introduce two contextual factors derived from contingency theory: information intensity and environmental uncertainty.

The strategic role of information intensity is often emphasized in the information age where it is used to obtain competitive advantages, which help organizations to identify the priority of business units in terms of IT investment (Porter and Millar 1985). According to prior literature, information intensity is the amount of information that must be acquired and processed by its value chain and customers (Chandra and Calderon 2009; Porter and Millar 1985). High information intensity in one industry means that its products or services require more efforts from customers. Moreover, certain industries have a relatively high frequency of using and updating information. For example, producing complex products such as satellites requires considerably more information than producing simple items such as pencils. The information on the former type of product must be updated frequently and used to a large extent.

Environmental uncertainty is also a potential moderator of IT capability effectiveness because the nature of the environment is linked to strategy making (Chen et al. 2013; Wade and Hulland 2004). Environmental uncertainty refers to the uncertainty around an organization. Dynamism, heterogeneity, and hostility are three dimensions of environmental uncertainty (Newkirk and Lederer 2006; Teo and King 1997). Dynamism refers to unpredictable changes in the environment. These changes come from the unpredictability of demand for products or services, the unpredictable behavior of competitors, and the rate of technological change. Heterogeneity refers to the complexity that results from the diversity of products or services and customer behavior. Hostility refers to the degree of competition and the availability of resources in such competitive environment. The three dimensions of environmental uncertainty indicate that the higher the environmental uncertainty is, the higher is the information processing ability required by organizations (Galbraith 1974).

From the contingency perspective, the optimal performance of organizations is contingent on both internal and external constraints (Fiedler 1964), which implies that internal capabilities must fit into the external environment (Umanath 2003). In this study, we select information intensity and environmental uncertainty as contingent variables, which is consistent with the work of Kearns and Lederer (2004). We select these two variables as moderators for the following reasons. First, although environmental uncertainty may change rapidly, information intensity depends on the industry to which the organization belongs and changes more slowly. In addition, environmental uncertainty is a short-term factor whereas information intensity is a long-term element. These two characteristics provide more insights into changes in organizational agility. Second, while environmental uncertainty reflects the instability of the environment, information intensity shows a relatively predictable feature of the environment, which is an ideal supplement for the environment. Third, environmental uncertainty has been documented as the primary aspect of the external environment (Jaworski 1988). In our study, environmental uncertainty also includes three dimensions that constitute a relatively comprehensive picture of the environment. Fourth, these two factors have been tested as moderators in other relationships (Bhatt 2000; Chen et al. 2013).

Although environmental uncertainty and information intensity are two major variables in contingency theory, attempts to test their moderating effects in the capability–agility relationship are limited. In a

theoretical framework, Aragon-Correa and Sharma (2003) proposed that environmental factors moderated the deployment of organizational capabilities. Lu (2006) examined the moderating effects of partial environmental uncertainty dimensions but failed to provide comprehensive insights into environmental uncertainty. Stoel and Muhanna (2009) discovered empirically that environmental conditions moderated the relationship between IT capability and organizational performance. Chen et al. (2013) empirically examined the moderating role of environmental factors in the link between IT capability and business process agility. Based on these studies, the two exogenous contextual factors (environmental uncertainty and information intensity, which is also an environment-related factor) can reasonably be expected to moderate the relationship between IT capability and organizational agility.

Based on the literature, we posit that information intensity and environmental uncertainty moderate the effect of IT and knowledge capability on organizational agility. High information intensity highlights the significance of the capability to enhance competitive advantage (i.e., agility). Furthermore, more dynamic, hostile or complex environments call for additional information-processing capabilities (IT and knowledge capabilities) to improve agility (Chen et al. 2013). When the environment is uncertain, organizations tend to develop capabilities with the aim of using information to a greater extent so that they can respond to changes in a faster and more flexible manner. In the following section, we present our research model and hypotheses to demonstrate the relationships specifically.

Research Model and Hypotheses

We present our research model in Figure 1, which shows the positive impact of IT and knowledge capabilities on organizational agility and the moderating roles of environmental uncertainty and information intensity.

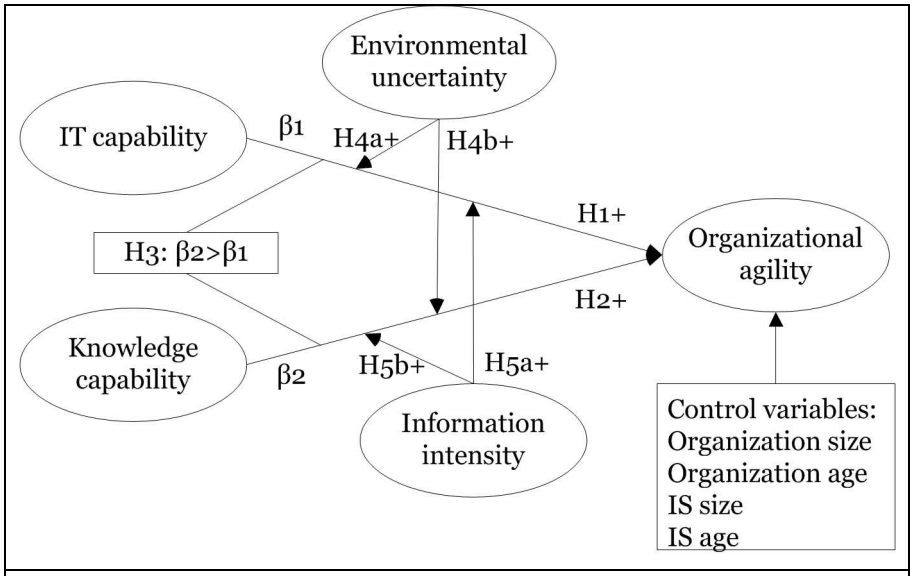

Figure 1. Research Model

Note: IT infrastructure capability, IT business spanning capability and IT proactive stance are first-order constructs, and IT capability is a second-order construct.

The effect of IT Capability and Knowledge Capability on Organizational Agility

Agility is a type of competitive advantage to improve organizational performance (Huang et al. 2012; Lee et al. 2011; Sherehiy et al. 2007) and is recognized as a critical organizational goal (Sambamurthy et al. 2003; Tallon and Pinsonneault 2011). Coincidently, IT capability is able to create competitive advantages to achieve operational and strategic benefits (Fichman 2004). Establishing virtual communities and technical facilities can also improve the ability of the organization to achieve fast, accurate, and economical targets to exploit innovative opportunities (Sambamurthy et al. 2003). In addition, IT

capability allows organizations to respond quickly and efficiently to market and customer changes by adjusting internal business processes (Chen et al. 2013; Tallon 2008). IT infrastructure capability provides a well-qualified platform by managing standardized and integrated data. The accurate, real-time, and comprehensive information in this platform is useful for making decisions efficiently and improving strategic agility in organizations (Weill et al. 2002). Moreover, High-quality IT applications and services will increase the demand for IT and in turn speed up communication, facilitate the monitoring of changes, and offer customized products or services. IT business spanning capability emphasizes the integration of strategy and IT planning as well as a synergy between IT and business processes (Lu and Ramamurthy 2011; Wade and Hulland 2004). Thus, a well-designed information system for target business processes can make the organization flexible. Such system enables the information flow for business processes to reach each business unit of an organization quickly and increases the efficiency of communication and decision making. Integrating a flexible IT planning process and strategy with business strategic planning also enables organizations to achieve agility. A comprehensive understanding of IT and business value can greatly reduce the resistance to change for the organization in the competitive environment. In such a case, organizational agility can be strengthened. Additionally, a proactive stance on IT enables organizations to continue learning about its own behavior and increases the value of IT businesses (Lu and Ramamurthy 2011). Seeking IT innovation will provide many options for organizations to respond to market changes. Thus, we propose the following hypotheses:

H1: IT capability has a positive effect on organizational agility.

Organizations often benefit from acquiring external knowledge and distributing internal knowledge at both strategic and operational levels (Ashrafi et al. 2005). Dove (2002) argued that managing knowledge appropriately will enable organizations to respond quicker because it enables organizations to solve problems and seize opportunities. Knowledge capability can assist organizations in capturing the correct information at the right time. Sharing specialized knowledge within the organization or with its partners can facilitate internal and external communications (Im and Rai 2008). The richness of the knowledge possessed by organizations and its processes also improve the organizational ability to respond to changes (Overby et al. 2006). The knowledge management processes ensure the availability and accessibility of strategic knowledge on markets and products for decision making; organizations can thereby react to changes quickly or act ahead of their competitors (Du Plessis 2005). Thus,

H2: Knowledge capability has a positive effect on organizational agility.

While IT capability emphasizes capability based on technical platforms, knowledge capability tends to focus on "soft" ability (i.e., knowledge perspective) in organizations. However, given that knowledge is regarded as the most strategic and significant resource of organizations (Grant 1996), we posit that the effect of knowledge capability on organizational agility is greater than that of IT capability. While knowledge capability promotes the two components of agility (sense and response) similar to IT capability, knowledge capability appears to be more direct and effective in terms of determining what to sense and how to respond. In terms of what to sense, both explicit and tacit knowledge are required to maintain agility in the organization (Saint-Onge 1996). Organizations with strong knowledge capability can effectively capture and deal with both explicit and tacit knowledge to enhance agility. Although organizations with strong IT capability can sense and deal with explicit knowledge or information effectively, they will find it difficult to identify and handle tacit knowledge (Clark et al. 2007), because these organizations rely highly on the formal IT platforms and services in such a case. In terms of how to respond, agility is regarded as the ability to continually sense opportunities and to manage the knowledge and assets for seizing those opportunities (Sambamurthy et al. 2003). Dove (2002) also states that agility is the ability to manage and apply knowledge effectively. As knowledge capability directly refers to knowledge management and describes how to generate, transfer, and exploit knowledge, knowledge capability is closely associated with agility. In addition, prior empirical evidence has shown that knowledge capability is supported by IT (Alavi and Leidner 2001) and mediates the relationship between IT relatedness and organizational performance (Tanriverdi 2005). This finding also suggests that knowledge capability affects performance more than IT relatedness (which can be seen as a sort of IT capability). Therefore,

H3: The relationship between knowledge capability and organizational agility is stronger than the relationship between IT capability and organizational agility.

Moderating Role of Environmental Uncertainty and Information Intensity

In prior studies, certain contextual factors were examined and were found to have indirect effects on organizational performance (e.g., Choe 2003; Lu 2006; Newkirk and Lederer 2006; Ray et al. 2009; Yayla and Hu 2012), which suggested the potential moderating effects of information intensity and environmental uncertainty. Organizations are often challenged by environmental uncertainty (dynamism, heterogeneity, and hostility) as a result of unpredictable events, product diversity, and the competition (Newkirk and Lederer 2006). According to the information processing theory (Galbraith 1974) and the concept of fit (Venkatraman 1989), when the environment is uncertain, organizations require more information and a higher information processing ability to be more agile by sensing effectively and responding efficiently. IT capability and knowledge capability are more effective when they can use resources in the organization and process information in a more uncertain environment. The investment of time, money, and effort to construct capabilities to achieve agility also requires a payoff (Tallon 2008). When the environment is relatively stable, the large investment involved in developing IT and knowledge capability results in fewer returns. IT capability and knowledge capability also make the organization more adaptive and agile in the uncertain environment. Thus, we posit the following hypotheses:

H4a: The positive effect of IT capability and organizational agility is moderated by environmental uncertainty such that the positive effect is greater when environmental uncertainty is higher.

H4b: The positive effect of knowledge capability and organizational agility is moderated by environmental uncertainty such that the positive effect is greater when environmental uncertainty is higher.

Information intensity of the products or services and the value chain reflects the content and extent of information use (Porter and Millar 1985; Teo and King 1997). When high levels of information intensity are present, organizations have more information to capture, process, and transform into knowledge through IT-based and knowledge-based platforms and channels. Both IT and knowledge capabilities become more effective on organizational agility, which allows organizations to function and behave appropriately in the environment characterized by intensive information. In addition, if the products or services are more information intensive, organizations are more likely to build higher levels of IT or knowledge capability to fit the intensive information so that organizations can provide rapid response to the market and customers (Bhatt 2000). Thus:

H5a: The positive effect of IT capability and organizational agility is moderated by information intensity such that the positive effect is greater when information intensity is higher.

H5b: The positive effect of knowledge capability and organizational agility is moderated by information intensity such that the positive effect is greater when information intensity is higher.

Control Variables

Organizational agility is likely to be affected by four control variables: organization size, organization age, IS size (the ratio between the number of full-time employees that use information systems for daily work and the number of full-time employees in the entire organization) and IS age (the number of years employees have used information systems). Large organizations have difficulties changing their business processes and activities because stable and large investments have been made to construct their infrastructures. Older organizations tend to be more agile because they have accumulated well-designed solutions, processes, and useful experiences. IS size and age are two common variables for controlling the expected effects, as documented in prior IS studies (Lu and Ramamurthy 2011). However, IS size and age may have both positive and negative effects on organizational agility. Therefore, we introduced four control variables in our model.

Research Methodology

Data Collection

We developed a survey instrument to collect data for our hypothesis testing. With the assistance of an information management research center, we obtained a list of 261 organizations across different industries in China. Senior executives in these organizations were asked to participate in our survey. All of these executives possessed IT experience, and some of them had managed IS departments. After receiving confirmations from these senior managers, we mailed 261 paper-based questionnaires to them and asked if they encountered problems in responding to the survey. They were likewise required to provide corresponding information on their own organizations and on the current state of IT and knowledge management. Out of the 261 questionnaires, 123 usable questionnaires were received in December 2012, yielding a response rate of 47%. The respondents had 1 to 26 years (mean=5.27, sd=3.83) of work experience in their current organizations. The characteristics of the organizations are presented in Table 1.

Table 1. Sample Characteristics

	Range	Number	Percentage (%)
Industry Sector	Energy	15	12.2
	Information technology	14	11.4
	Manufacturing	43	35.0
	Banking/Finance	25	20.3
	Education	11	8.9
	Public sector	9	7.3
	Others	6	4.9
Organization Size (The number of employees)	≤50	9	7.3
	51-100	7	5.7
	101-200	21	17.0
	201-500	14	11.4
	501-1000	14	11.4
	>1000	58	47.2
Organization Type	State owned	51	41.5
	Private	43	35.0
	Joint venture	16	13.0
	Foreign	13	10.5
Organization Age	≤5 years	16	13.0
	6-10 years	33	26.8
	11-20 years	34	27.6
	21-50 years	25	20.3
	>50 years	15	12.3

To check for the existence of non-response bias, we compared early responses with late responses that were supposed to be similar to those from non-respondents. T-tests on the means of IT infrastructure capability (p=0.10), IT business spanning capability (p=0.64), IT proactive stance (p=0.16), knowledge management capability (p=0.32), organizational agility (p=0.56), environmental uncertainty (p=0.83), and information intensity (p=0.19) indicated that no significant difference existed between the early and late responses. Thus, our sample does not appear to be threatened by non-response bias.

To avoid the threat of common method bias in our study, we conducted marker variable analysis as suggested by Lindell and Whitney (2001) and Malhotra et al. (2006). We identified the lowest and second lowest correlation marker variables as R_{M1} and R_{M2} during the survey administration. We also calculated the average correlations between R_{M1} and the study variables (R_{M1avg}) as well as between R_{M2} and the study variables (R_{M2avg}). Only small decreases in the correlations occurred and their significance levels did not change. Therefore, our study had no common method bias. As the space is limited to 16 pages, we have not provided the table of both corrected and uncorrected correlations of marker variables and study constructs.

Construct Measurement

The measured items for all constructs were adapted from prior studies and had been tested previously. A seven-point Likert-type scale with items that ranged from "strongly disagree" to "strongly agree" was used to measure the items. Three or more measurement items were used for each construct in the model. A pre-testing process for the questionnaire was conducted with 11 senior executives to ensure that the instrument would be understandable and reliable. Modifications were made based on their feedback. The final constructs and measures are presented in Table 2.

Table 2. Constructs and Measures

Construct		Item	Measurement Item	References
IT capability (ITC)	IT infrastructure capability (ITI)	ITI1	The data-management services and architectures are sufficient in my organization	(Lu and Ramamurthy 2011; Ross et al. 1996; Weill et al. 2002)
		ITI2	The network communication is sufficient with good connectivity, reliability and availability	
		ITI3	The quality of IT application and services (e.g., ERP, ASP) can meet the organization needs	
		ITI4	IT management services can coordinate the physical infrastructure and manage the relationship with business units effectively and efficiently	
	IT business spanning capability (ITB)	ITB1	My organization has a clear understanding on how IT contributes to the competitive advantages	(Bharadwaj et al. 1999; Lu and Ramamurthy 2011)
		ITB2	My organization integrates business strategic planning with IT planning	
		ITB3	My organization enables functional area and general management ability to understand the value of IT investment	
		ITB4	My organization has an effective and flexible IT planning process	
	IT proactive stance (ITP)	ITP1	My organization constantly keeps up with new IT innovations	(Lu and Ramamurthy 2011; Weill et al. 2002)
		ITP2	My organization supports new ways of using IT	
		ITP3	My organization constantly seeks new ways to enhance the effectiveness of IT use	
Knowledge capability (KC)		KC1	My organization has processes to gain knowledge on our suppliers, customers and partners	(Gold et al. 2001; Pérez-López and Alegre 2012; Zaim et al. 2007)
		KC2	My organization can generate new knowledge from existing knowledge	
		KC3	My organization has processes to distribute knowledge throughout the organization	

Table 2. Constructs and Measures			
Construct	Item	Measurement Item	References
	KC4	My organization periodically holds meetings to inform employees of the latest innovations	
	KC5	My organization has formal processes to share the best practice among the different fields of activities	
	KC6	In my organization, knowledge is accessible to those who need it	
	KC7	My organization has processes for using knowledge to develop new products or services	
Environment uncertainty (EU)	EU1	In our industry, the technology of products or services changes very quickly	(Kearns and Lederer 2004; Teo and King 1997)
	EU2	Our industry has tough competition in the quality or price of products or services	
	EU3	Our industry has considerable diversity with regard to competition	
Information intensity (II)	II1	In our industry, potential customers require a lot of product or service information before buying	(Kearns and Lederer 2004; Teo and King 1997)
	II2	In our industry, frequent use of information is required in our production or service operations	
	II3	Information is used to a great extent in the operation (e.g. R&D processes) of the product or services	
Organizational agility (OA)	OA1	My organization can make rapid response to fulfill demands	(Goldman et al. 1995; Lu and Ramamurthy 2011; Tsourveloudis et al. 1999)
	OA2	My organization can quickly adjust production or service levels to support fluctuations based on market demands	
	OA3	My organization can quickly create and implement appropriate decisions in the face of demand changes	
	OA4	My organization constantly attempts to reinvent or reengineer itself to better meet market needs	
	OA5	My organization considers market-related changes and apparent chaos as opportunities to capitalize quickly	

Results

Measurement Model

Partial least squares (PLS) method was employed to assess the measurement model because PLS maximizes the variance explained in the dependent variable but requires only a small sample size to obtain considerable statistical power (Chin 1998). We used SmartPLS 2.0 for data analysis and hypothesis testing in our model. Formative measurement is not appropriate for the constructs in our model because each construct cannot meet the four major criteria simultaneously as specified by Petter et al. (2007) and Jarvis et al. (2003). Therefore, all constructs were measured to be reflective, and each first-order construct was modeled to be reflective of the second-order construct.

Internal consistency and convergent validity of all first-order and second-order constructs were first assessed (Jarvis et al. 2003). The minimal item-to-construct loading for either first-order or second-order construct was 0.72, which was higher than 0.707. This result indicated that the shared variance between

each item and its principal construct was higher than the error variance (Chin 1998). The loadings between each item and its principal construct were greater than the loadings between the item and other constructs, and the differences were over the 0.1 threshold (Gefen and Straub 2005). We then presented the descriptive statistics, correlations, Cronbach's alpha, composite reliabilities, and average variance extracted (AVE)s of all constructs. The values of Cronbach's alpha and composite reliabilities were higher than 0.7 (Nunnally and Bernstein 1994). Further examination of the AVEs showed that the AVE for each construct was above 0.5 (Fornell and Larcker 1981; Hair et al. 1998). We examined the discriminant validity by evaluating if the square roots of AVEs associated with each construct were greater than the correlations between a pair of latent variables. The results suggested that our measures passed this test, thereby providing strong evidence of discriminant validity. As the space is limited to 16 pages, we have not provided the table of the item to construct loadings, descriptive statistics, correlations and reliability.

Given that IT capability was modeled as a second-order construct, we examined whether relationships between the first-order and second-order constructs were significant or not (Lu and Ramamurthy 2011). All loadings of the first-order construct on the second-order construct (ITC) were above 0.75 (IT infrastructure capability=0.78, IT business spanning capability=0.85, and IT proactive stance=0.76) and significant. Moreover, all values of variance inflation factors were less than 2.60. Therefore, multicollinearity was not a threat to the constructs. These testing results provided reliable evidence that our model had good measurement properties.

Hypotheses Testing

Hierarchical regression analysis was conducted to test the research hypotheses, as suggested by Sharma et al. (1981). PLS was similarly used to test the interaction effects in numerous IS studies (Im and Rai 2008). We ran several models in PLS following the hierarchical procedure. The model began with control variables, and then the main effects model was introduced. The moderation effect model was tested by integrating independent variables, moderators, and their interactions. The incremental variance explanation was obtained by comparing each model. We evaluated each two-way interaction to minimize multicollinearity and formed three models. The effects of control variables were evaluated in Model 1. In Model 2a, the main effects were evaluated (H1 and H2), and the results could be used as inputs to compare the relative effects of different types of capabilities (H3). The moderation effects were then evaluated in Models 3a, 3b, 3c, and 3d (H4a, H4b, H5a, and H5b).

We conducted bootstrap analysis and bootstrap sample size was set to 123, which was equal to the sample size. Table 3 shows the results of hierarchical regression analysis, which includes unstandardized path coefficients, explained construct variances (R^2), incremental changes in R^2, and effect sizes between hierarchical models.

Table 3. Results of Hierarchical Analysis							
	Model1	Model2a	Mode2b	Model3a	Model3b	Model3c	Model3d
Block 1:control variables							
IS age	0.04 (0.17)	0.01 (0.08)	0.01 (0.08)	-0.01 (0.08)	-0.01 (0.09)	0.01 (0.09)	0.01 (0.09)
IS size	0.03 (0.13)	-0.03 (0.07)	-0.03 (0.07)	-0.03 (0.07)	-0.04 (0.07)	-0.03 (0.07)	-0.03 (0.07)
Organization age	0.04 (0.15)	-0.001 (0.03)	0.02 (0.08)	0.02 (0.09)	0.02 (0.09)	0.001 (0.09)	0.002 (0.10)
Organization size	0.01 (0.12)	-0.03 (0.08)	-0.05 (0.07)	-0.04 (0.08)	-0.04 (0.08)	-0.03 (0.08)	-0.03 (0.07)
Block 2:main effects							
ITC		**0.15*** (0.09)	**0.14*** (0.09)	**0.12*** (0.08)	0.10 (0.09)	**0.15*** (0.10)	**0.14*** (0.10)
KC		**0.56**** (0.09)	**0.50**** (0.10)	**0.49**** (0.10)	**0.61**** (0.10)	**0.52**** (0.10)	**0.53**** (0.01)
EU			**0.21**** (0.09)	**0.15**** (0.08)	**0.16*** (0.09)		
II			-0.09 (0.08)			0.03 (0.09)	0.01 (0.08)
Block3: moderation							
ITC×EU				**0.14*** (0.07)			
KC×EU					**0.14*** (0.06)		
ITC×II						**0.13*** (0.07)	
KC×II							**0.20*** (0.07)
ΔR^2		0.496	0.040	0.043	0.035	0.008	0.018
f^2 (Effect size)		1.044	0.092	0.100	0.080	0.017	0.039
R^2(OA)	0.029	0.525	0.565	0.568	0.560	0.533	0.543
F hierarchical		**121.128**	**10.483**	**11.347**	**9.068**	1.953	**4.490**

Notes: * p<.05; ** p<.01. One-tailed t-test was performed as the direction of differences was hypothesized. All path coefficients are unstandardized coefficients, which are calculated following the formula: $b_u=b_s\times S_Y/S_i$, b_u is unstandardized coefficient, b_s is standardized coefficient, S_i is standard deviation of the independent variable, and S_Y is standard deviation of the dependent variable. f^2 is the effect size. A pseudo F-test for the change in R^2 with 1 and (n-k) degrees of freedom is calculated (n=sample size; k=the number of independent variables).

The results (Table 3, Model 1) indicate that the control variables did not have a significant effect on organizational agility. The size and age of an organization did not affect organizational agility, and neither did the size and age of the IS department. Thus, managers in either large or small organizations should pay attention to organizational agility.

Model 2a in Table 3 shows that both IT capability and knowledge capability have significant positive effects on organizational agility. The explained variances reached 0.525; thus, H1 and H2 are supported. The effect of knowledge capability on organizational agility (β=0.56) appeared to be greater than that of IT capability (β=0.15). We conducted an appropriate t-test proposed by Cohen et al. (2003) to compare the two path coefficients statistically. The result of t-test (t=5.21) suggested that the effect of knowledge capability on organizational agility was significantly greater than that of IT capability. Thus, H3 is supported.

Model 3a-d tested the interaction effect between different organizational capabilities and industry contextual factors on organizational agility. In Models 3a and 3b, the interaction terms with positive and significant coefficients between environmental uncertainty and IT capability (β=0.14) and between environmental uncertainty and knowledge capability (β=0.14) indicated significant impacts on organizational agility. The two interaction terms increased by 4.3% and 3.5% of the explained variance in organizational agility, respectively. The value of F hierarchical likewise indicated that changes in explained variance were significant. Thus, H4a and H4b are supported. In Models 3c and 3d, the interaction terms with positive and significant coefficients between information intensity and IT capability (β=0.13) and between information intensity and knowledge capability (β=0.20) indicated significant effects on organizational agility. The two interaction terms increased by 0.8% and 1.8% of the explained variance in organizational agility. However, further examinations of the F hierarchical value showed that whereas the change in explained variance between Model 3d and Model 2a was significant (F=4.490), that between Model 3c and Model 2a was not significant (F=1.953). Thus, H5b is supported, but H5a is not supported.

The results of hypothesis testing are summarized in Table 4. Except for H5a, all other hypotheses (H1, H2, H3, H4a, H4b, and H5b) are supported.

Table 4. Results of Hypothesis Testing

Hypothesis	Results
H1: IT capability→Organizational agility	Supported
H2: Knowledge capability→Organizational agility	Supported
H3: Knowledge capability→Organizational agility>IT capability→Organizational agility	Supported
H4a: IT capability × Environment uncertainty→Organizational agility	Supported
H4b: Knowledge capability × Environment uncertainty →Organizational agility	Supported
H5a: IT capability × Information intensity→Organizational agility	Not Supported
H5b: Knowledge capability × Information intensity→Organizational agility	Supported

Discussions and Implications

Implications for Theory

Prior studies tend to examine the relationship between IT capability and organizational agility, but the limited empirical evidence proves the effect of knowledge capability on agility. Thus, to address the gap in the business values of IT and knowledge capabilities, we examined the relationship between these capabilities and organizational agility. We likewise investigated the moderating effects of environment uncertainty and information intensity to determine how IT and knowledge capabilities contribute to organizational agility in different contexts (Chen et al. 2013; Lu 2006). This study has a threefold theoretical contribution.

First, we extend the research on agility by introducing the KBV theory and providing empirical evidence. Both IT and knowledge capabilities have positive effects on organizational agility. The abilities of processing information and managing knowledge are significant regardless of organization size and age. Our results are consistent with prior studies that illustrated the positive relationship between IT capability and organizational agility (e.g., Lee et al. 2008; Lu 2006; Lu and Ramamurthy 2011). Our findings also demonstrate that the advantages of IT capability outweigh its disadvantages, which provides additional evidence in addressing the debate on whether IT capability enables or disables agility (Lu and Ramamurthy 2011; Rettig 2007). IT capability enhances organizational agility by reducing internal transaction costs, external transaction costs, and time spent on internal and external communications.

Similarly, our results highlight a strong linkage between knowledge capability and agility. This finding addresses the proposal of Lu and Ramamurthy (2011) that more studies should examine how other

elements connect with IT in enabling agility. Prior studies limit their focus on technology itself and its value. However, when IT capability is imitated by other organizations or becomes a tradable product such as in the case of IT outsourcing, the competitive advantage in promoting IT would be reduced. In such a case, the agility strategy requires more support from other abilities such as knowledge capability to enhance business agility (Overby et al. 2006; Sambamurthy et al. 2003). The capability to acquire, transfer, and use knowledge is difficult for other competitors to obtain and imitate (Grant 1996). Our findings reveal that knowledge capability should likewise be distributed resources to construct organizational agility. Therefore, different types of capabilities should be integrated to improve organizational agility.

Second, in this study, we extend the RBV and KBV theories by comparing the effectiveness of IT and knowledge capabilities. Empirical evidence has been found on how to leverage capabilities within organizations. Although IT capability is necessary for organizational agility, knowledge capability has a more significant function. Higher organizational agility depends on knowledge rather than on technology. Agility requires both explicit and tacit knowledge. Compared with IT capability, knowledge capability can provide tacit knowledge, which is difficult to achieve with IT capability. Therefore, organizations should focus on establishing, standardizing, and optimizing knowledge management processes while investing in constructing IT capability to improve agility.

Third, our study contributes to the current theory by integrating the RBV, KBV, and contingent theories. The empirical results indicated that environmental uncertainty positively moderated the effects of both IT and knowledge capabilities on organizational agility, whereas information intensity positively moderated the effects of knowledge capability only on organizational agility. Several potential moderators are suggested in the IS literature to explain the mechanism of organizational capability value creation (Wade and Hulland 2004). In this study, this gap is bridged by combining internal mechanisms with external mechanisms to achieve high organizational agility. In addition, although certain sub-dimensional factors of environmental uncertainty such as environmental complexity are found to moderate the effect of IT capability and agility positively in prior studies (Lu 2006), environmental hostility has the opposite moderating effect (Chen et al. 2013). We provide an overview of environmental uncertainty to show that the overall moderating effect on the relationship between IT capability and agility is positive. The overall results suggest that the development of capabilities should fit with contextual factors to maintain high levels of organizational agility. Therefore, more contextual factors should be introduced in future research to investigate their joint effects, as suggested by Lu and Ramamurthy (2011).

Implications for Practice

The findings of this study have a number of implications for management practice. First, the results of our study affirm that both IT and knowledge capabilities can enhance agility in an organization. These results indicate the significance of investments in developing both IT and knowledge capabilities. Moreover, the results provide knowledge for managers on how to leverage IT or knowledge capabilities to develop an agile organization to achieve competitive advantages in a changing environment. According to our research, the best way to develop agility is to strengthen IT and knowledge capabilities that can help to form decisions on what to sense and how to respond efficiently. In addition to IT infrastructure, organizations have to integrate their IT construction and organizational processes with a proactive stance on IT value. A combination of IT and knowledge capabilities is likewise recommended to maximize the value. Organizations can implement IT and knowledge projects jointly to develop capabilities between functional and IT departments. This strategy can achieve an effective configuration of resources.

Second, given that knowledge capability is effective for agility, managers should not only formalize and upgrade the knowledge management process within the organization, but also obtain, transfer, and use knowledge outside the organization. Knowledge from suppliers, customers, and partners is a valuable resource that is necessary to become an agile organization. In addition, managers should encourage employees to share their knowledge within the organization and make organizational knowledge accessible to employees who require it. By doing so, the entire organization can respond appropriately and quickly to the changes in the market and customer demands.

Third, managers should focus on the role of contextual factors such as information intensity and environmental uncertainty in enabling the effectiveness of IT and knowledge capabilities. Managers

would do well to consider evaluation on contextual factors that the organization is involved in. Low levels of environmental uncertainty and information intensity would not require organizations to develop strong IT and knowledge capabilities to meet customer requirements and respond quickly to the market. Managers can distribute resources to develop other aspects of capabilities to improve organizational competitive advantages. However, to obtain sustainable competitive advantage, strong IT and knowledge capabilities are necessary to enable organizations to adapt to different environments.

Limitations and Directions for Future Research

Our study has several limitations. First, our sample size of 123 is relatively small. A larger sample size would provide higher statistical power. Second, our findings are not based on a matched-pair survey. We required our respondents to have IT experience and an overview of the organization to respond to the questionnaires appropriately. However, this requirement could exaggerate the effectiveness of IT and knowledge capabilities on organizational agility. A future pair design between IT-related executives and non-IT-related executives would be desirable. Third, the perceptions of respondents from different cultures would be differentiated toward contextual factors. For example, people from a risk-seeking culture would have a lower perception of environmental uncertainty than people from a risk-averse culture. Further examinations are necessary to determine whether our model can be applied to different cultures. Fourth, capabilities and agility are formed after a long-term process. Organizational agility enabled by IT and knowledge capabilities may in turn enhance the development of IT or knowledge capability. A longitudinal study is desirable to design causality between these variables.

Our study leads to a few directions for future research. First, the moderating effects of other contextual factors (e.g., strategic orientation) on the relationship between capabilities and organizational agility can be examined. Second, improvement of IT and knowledge capabilities is a major area for further investigation. Third, examining the relationship between IT and knowledge capabilities at a more granular level would be desirable. Finally, the complementary effects of IT capability and knowledge capability are also worth exploring.

Conclusions

The key contribution of this study is integrating the RBV and KBV theories with the contingent perspective. Our findings suggest that environmental uncertainty positively moderates the effects of IT and knowledge capabilities on organizational agility, and that information intensity positively moderates the effects of knowledge capability on organizational agility. In sum, IT and knowledge capabilities are more effective in the presence of high environmental uncertainty and information intensity. Another significant contribution is that although we find that both IT and knowledge capabilities have positive effects on organizational agility, knowledge capability is more effective than IT capability, which raises the critical implication that different capability types should be integrated to improve organizational agility. While organizations use IT capability to achieve agility, they should exert effort in establishing, standardizing, and optimizing knowledge management processes.

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References

Alavi, M., and Leidner, D. E. 2001. "Review: Knowledge Management and Knowledge Management Systems: Conceptual Foundations and Research Issues," *MIS Quarterly* (25:1), pp. 107-136.

Allen, B. R., and Boynton, A. C. 1991. "Information Architecture: in Search of Efficient Flexibility," *MIS Quarterly* (15:4), pp. 435-445.

Amos, J. 1998. *Transformation to Agility: Manufacturing in the Market Place of Unanticipated Change,* London, UK: Routledge.

Aragon-Correa, J. A., and Sharma, S. 2003. "A Contingent Resource-Based View of Proactive Corporate Environmental Strategy," *The Academy of Management Review* (28:1), pp. 71-88.

Ashrafi, N., Xu, P., Kuilboer, J., and Koehler, W. 2006. "Boosting Enterprise Agility via IT Knowledge Management Capabilities," in *Proceedings of the 39th Annual Hawaii International Conference on System Sciences*, Kauai, HI, USA.

Ashrafi, N., Xu, P., Mathiyalakan, S., Kuilboer, J. P., Koelher, W., Heimann, D., and Waage, F. 2005. "A Framework for Implementing Business Agility through Knowledge Management Systems," in *Seventh IEEE International Conference on E-Commerce Technology Workshops*, Munich, Germany, pp. 116-121.

Barney, J. 1991. "Firm Resources and Sustained Competitive Advantage," *Journal of Management* (17:1), pp. 99-120.

Barney, J., Wright, M., and Ketchen, D. J. 2001. "The Resource-Based View of the Firm: Ten Years after 1991," *Journal of Management* (27:6), pp. 625-641.

Becker, F. 2001. "Organisational Agility and the Knowledge Infrastructure," *Journal of Corporate Real Estate* (3:1), pp. 28-37.

Bharadwaj, A. S. 2000. "A Resource-Based Perspective on Information Technology Capability and Firm Performance: An Empirical Investigation," *MIS Quarterly* (24:1), pp. 169-196.

Bharadwaj, A. S., Sambamurthy, V., and Zmud, R. W. 1999. "IT Capabilities: Theoretical Perspectives and Empirical Operationalization," in *Proceedings of the 20th International Conference on Information Systems*, J. I. Degross, R. Hirschheim and M. Newman (eds.), Helsinki, Finland, pp. 378-385.

Bhatt, G. D. 2000. "Exploring the Relationship between Information Technology, Infrastructure and Business Process Re-Engineering," *Business Process Management Journal* (6:2), pp. 139-163.

Chandra, A., and Calderon, T. G. 2009. "Information Intensity, Control Deficiency Risk, and Materiality," *Managerial Auditing Journal* (24:3), pp. 220-232.

Chen, A. N., Hwang, Y., and Raghu, T. S. 2010. "Knowledge Life Cycle, Knowledge Inventory, and Knowledge Acquisition Strategies," *Decision Sciences* (41:1), pp. 21-47.

Chen, X. 2012. *Impact of Business Intelligence and IT Infrastructure Flexibility on Competitive Advantage: An Organizational Agility Perspective*, Nebraska, USA: The University of Nebraska - Lincoln.

Chen, Y., Wang, Y., Nevo, S., Jin, J., Wang, L., and Chow, W. S. 2013. "IT Capability and Organizational Performance: The Roles of Business Process Agility and Environmental Factors," *European Journal of Information Systems Advance Online Publication 26 March*, doi:10.1057/ejis.2013.4.

Chin, W. W. 1998. "The Partial Least Squares Approach for Structural Equation Modeling," in *Modern Methods for Business Research,* G. A. Marcoulides (ed.), Mahwah, NJ: Lawrence Erlbaum Associates, Inc., pp. 150-170.

Choe, J. M. 2003. "The Effect of Environmental Uncertainty and Strategic Applications of IS on a Firm's Performance," *Information & Management* (40:4), pp. 257-268.

Chuang, S. H. 2004. "A Resource-Based Perspective on Knowledge Management Capability and Competitive Advantage: An Empirical Investigation," *Expert Systems with Applications* (27:3), pp. 459-465.

Chung, T. T. R., Liang, T. P., Peng, C. H., and Chen, D. N. 2010. "Knowledge Creation and Firm Performance: Mediating Processes from an Organizational Agility Perspective," in *Proceedings of the 16th Americas Conference on Information Systems*, Lima, Peru.

Clark, T. D., Jones, M. C., and Armstrong, C. P. 2007. "The Dynamic Structure of Management Support Systems: Theory Development, Research Focus, and Direction," *MIS Quarterly* (31:3), pp. 579-615.

Cohen, J., Cohen, P., West, S. G., and Aiken, L. S. 2003. *Applied Multiple Regression/Correlation Analysis for Behavioral Sciences (3rd edn)*, Mahwah, NJ: Lawrence Erlbaum Associates.

Dove, R. 2002. "Knowledge Management and Agility: Relationships and Roles," in *Handbook on Knowledge Management,* C. W. Holsapple (ed.), Heidelberg, Berlin: Springer, pp. 309-330.

Du Plessis, M. 2005. "Drivers of Knowledge Management in the Corporate Environment," *International Journal of Information Management* (25:3), pp. 193-202.

Fichman, R. G. 2004. "Real Options and IT Platform Adoption: Implications for Theory and Practice," *Information Systems Research* (15:2), pp. 132-154.

Fiedler, F. E. 1964. "A Contingency Model of Leadership Effectiveness," in *Advances in Experimental Social Psychology*, L. Berkowitz (ed.), New York, USA: Academic Press, pp. 149-190.

Fink, L., and Neumann, S. 2007. "Gaining Agility through IT Personnel Capabilities: The Mediating Role of IT Infrastructure Capabilities," *Journal of the Association for Information Systems* (8:8), pp. 440-

462.
Fornell, C., and Larcker, D. F. 1981. "Evaluating Structural Equation Models with Unobservable Variables and Measurement Error," *Journal of Marketing Research* (18:1), pp. 39-50.
Galbraith, J. R. 1974. "Organization Design: An Information Processing View," *Interfaces* (4:3), pp. 28-36.
Gefen, D., and Straub, D. 2005. "A Practical Guide to Factorial Validity Using PLS-Graph: Tutorial and Annotated Example," *Communications of the Association for Information Systems* (16:1), pp. 91-109.
Gold, A. H., Malhotra, A., and Segars, A. H. 2001. "Knowledge Management: An Organizational Capabilities Perspective," *Journal of Management Information Systems* (18:1), pp. 185-214.
Goldman, S. L., Nagel, R. N., and Preiss, K. 1995. *Agile Competitors and Virtual Organizations Measuring Agility and Infrastructure for Agility*. London, UK: Van Nostrand Reinhold, International Thomas Publishing.
Goodhue, D. L., Chen, D. Q., Boudreau, M. C., Davis, A., and Cochran, J. D. 2009. "Addressing Business Agility Challenges with Enterprise Systems," *MIS Quarterly Executive* (8:2), pp. 73-87.
Grant, R. M. 1996. "Toward a Knowledge-Based Theory of the Firm," *Strategic Management Journal* (17: SI), pp. 109-122.
Hair, J. F., Anderson, R. E., Tatham, R. L., and William, C. 1998. *Multivariate Data Analysis*. Upper Saddle River, NJ: Prentice Hall.
Huang, P., Ouyang, T. H., Pan, S. L., and Chou, T. 2012. "The Role of IT in Achieving Operational Agility: A Case Study of Haier, China," *International Journal of Information Management* (32:3), pp. 294-298.
Im, G., and Rai, A. 2008. "Knowledge Sharing Ambidexterity in Long-Term Interorganizational Relationships," *Management Science* (54:7), pp. 1281-1296.
Jarvis, C. B., Mackenzie, S. B., and Podsakoff, P. M. 2003. "A Critical Review of Construct Indicators and Measurement Model Misspecification in Marketing and Consumer Research," *Journal of Consumer Research* (30:2), pp. 199-218.
Jaworski, B. J. 1988. "Toward a Theory of Marketing Control: Environmental Context, Control Types, and Consequences," *The Journal of Marketing* (52:3), pp. 23-39.
Kearns, G. S., and Lederer, A. L. 2003. "A Resource-Based View of Strategic IT Alignment: How Knowledge Sharing Creates Competitive Advantage," *Decision Sciences* (34:1), pp. 1-29.
Kearns, G. S., and Lederer, A. L. 2004. "The Impact of Industry Contextual Factors on IT Focus and the Use of IT for Competitive Advantage," *Information & Management* (41:7), pp. 899-919.
Khalifa, M., Yu, A. Y., and Shen, K. N. 2008. "Knowledge Management Systems Success: A Contingency Perspective," *Journal of Knowledge Management* (12:1), pp. 119-132.
Kogut, B., and Zander, U. 1992. "Knowledge of the Firm, Combinative Capabilities, and the Replication of Technology," *Organization Science* (3:3), pp. 383-397.
Lawrence, P. R., Lorsh, J. W., and Garrison, J. S. 1967. *Organization and Environment: Managing Differentiation and Integration*. Boston, MA: Harvard University Press.
Lee, O. D., Sambamurthy, V., Lim, K., and Wei, K. K. 2008. *IT-Enabled Organizational Agility and Sustainable Competitive Advantage (August 23, 2008),* Available at SSRN: http://ssrn.com/abstract=1249301.
Lee, O. K., Xu, P., Kuilboer, J. P., and Ashrafi, N. 2011. "IT-Enabled Strategic-Level Agility and Firm Performance: Service versus Manufacturing Industry," in *Proceedings of the 19th European Conference on Information Systems*, Helsinki, Finland.
Lindell, M. K., and Whitney, D. J. 2001. "Accounting for Common Method Variance in Cross-Sectional Research Designs," *Journal of Applied Psychology* (86:1), pp. 114-121.
Lu, Y. 2006. *IT Capability, Uncertainty and Organizational Performance: Development of Measures and Empirical Examination*. Milwaukee, WI, USA: The University of Wisconsin - Milwaukee.
Lu, Y., and Ramamurthy, K. 2011. "Understanding the Link between Information Technology Capability and Organizational Agility: An Empirical Examination," *MIS Quarterly* (35:4), pp. 931-954.
Malhotra, N. K., Kim, S. S., and Patil, A. 2006. "Common Method Variance in IS Research: A Comparison of Alternative Approaches and a Reanalysis of Past Research," *Management Science* (52:12), pp. 1865-1883.
Nazir, S., and Pinsonneault, A. 2012. "IT and Firm Agility: An Electronic Integration Perspective," *Journal of the Association for Information Systems* (13:3), pp. 150-171.
Newkirk, H. E., and Lederer, A. L. 2006. "The Effectiveness of Strategic Information Systems Planning Under Environmental Uncertainty," *Information & Management* (43:4), pp. 481-501.

Nunnally, J. C., and Bernstein, I. H. 1994. *Psychometric Theory*. New York, USA: McGraw-Hill.
Overby, E., Bharadwaj, A., and Sambamurthy, V. 2006. "Enterprise Agility and the Enabling Role of Information Technology," *European Journal of Information Systems* (15:2), pp. 120-131.
Pérez-López, S., and Alegre, J. 2012. "Information Technology Competency, Knowledge Processes and Firm Performance," *Industrial Management & Data Systems* (112:4), pp. 644-662.
Petter, S., Straub, D., and Rai, A. 2007. "Specifying Formative Constructs in Information Systems Research," *MIS Quarterly* (31:4), pp. 623-656.
Porter, M. E., and Millar, V. E. 1985. "How Information Gives You Competitive Advantage," *Harvard Business Review* (63:4), pp. 149-174.
Ray, G., Wu, D. Z., and Konana, P. 2009. "Competitive Environment and the Relationship between IT and Vertical Integration," *Information Systems Research* (20:4), pp. 585-603.
Rettig, C. 2007. "The Trouble with Enterprise Software," *Sloan Management Review* (49:1), pp. 21-27.
Ross, J. W., Beath, C. M., and Goodhue, D. L. 1996. "Develop Long-Term Competitiveness through IT Assets," *Sloan Management Review* (38:1), pp. 31-42.
Saint-Onge, H. 1996. "Tacit Knowledge the Key to the Strategic Alignment of Intellectual Capital," *Strategy & Leadership* (24:2), pp. 10-16.
Sambamurthy, V., Bharadwaj, A., and Grover, V. 2003. "Shaping Agility through Digital Options: Reconceptualizing the Role of Information Technology in Contemporary Firms," *MIS Quarterly* (27:2), pp. 237-263.
Sambamurthy, V., and Zmud, R. W. 1994. *IT Management Competency Assessment: A Tool for Creating Business Value through IT*. Morristown, NJ, USA: Financial Executives Research Foundation.
Seo, D. B., and La Paz, A. I. 2008. "Exploring the Dark Side of IS in Achieving Organizational Agility," *Communications of the ACM* (51:11), pp. 136-139.
Sharma, S., Durand, R. M., and Gur-Arie, O. 1981. "Identification and Analysis of Moderator Variables," *Journal of Marketing Research* (18:3), pp. 291-300.
Sherehiy, B., Karwowski, W., and Layer, J. K. 2007. "A Review of Enterprise Agility: Concepts, Frameworks, and Attributes," *International Journal of Industrial Ergonomics* (37:5), pp. 445-460.
Stoel, M. D., and Muhanna, W. A. 2009. "IT Capabilities and Firm Performance: A Contingency Analysis of the Role of Industry and IT Capability Type," *Information & Management* (46:3), pp. 181-189.
Tallon, P. 2008. "Inside the Adaptive Enterprise: An Information Technology Capabilities Perspective on Business Process Agility," *Information Technology & Management* (9:1), pp. 21-36.
Tallon, P. P., and Pinsonneault, A. 2011. "Competing Perspectives on the Link between Strategic Information Technology Alignment and Organizational Agility: Insights from A Mediation Model," *MIS Quarterly* (35:2), pp. 463-486.
Tanriverdi, H. 2005. "Information Technology Relatedness, Knowledge Management Capability, and Performance of Multibusiness Firms," *MIS Quarterly* (29:2), pp. 311-334.
Teo, T. S., and King, W. R. 1997. "Integration between Business Planning and Information Systems Planning: An Evolutionary-Contingency Perspective," *Journal of Management Information Systems* (14:1), pp. 185-214.
Tseng, S. 2010. "The Correlation between Organizational Culture and Knowledge Conversion on Corporate Performance," *Journal of Knowledge Management* (14:2), pp. 269-284.
Tsourveloudis, N., Valavanis, K., Gracanin, D., and Matijasevic, M. 1999. "On the Measurement of Agility in Manufacturing Systems," in *Proceedings of the 2nd European Symposium on Intelligent Techniques*, Chania, Greece.
Umanath, N. S. 2003. "The Concept of Contingency Beyond "It Depends": Illustrations from IS Research Stream," *Information & Management* (40:6), pp. 551-562.
Van Oosterhout, M., Waarts, E., and Van Hillegersberg, J. 2006. "Change Factors Requiring Agility and Implications for IT," *European Journal of Information Systems* (15:2), pp. 132-145.
Venkatraman, N. 1989. "The Concept of Fit in Strategy Research: Toward Verbal and Statistical Correspondence," *Academy of Management Review* (14:3), pp. 423-444.
Wade, M., and Hulland, J. 2004. "Review: The Resource-Based View and Information Systems Research: Review, Extension, and Suggestions for Future Research," *MIS Quarterly* (28:1), pp. 107-142.
Weill, P., Subramani, M., and Broadbent, M. 2002. "Building IT Infrastructure for Strategic Agility," *Sloan Management Review* (44:1), pp. 57-65.
Wernerfelt, B. 1984. "A Resource-Based View of the Firm," *Strategic Management Journal* (5:2), pp. 171-180.
Yayla, A. A., and Hu, Q. 2012. "The Impact of IT-Business Strategic Alignment on Firm Performance in a

Developing Country Setting: Exploring Moderating Roles of Environmental Uncertainty and Strategic Orientation," *European Journal of Information Systems* (21:4SI), pp. 373-387.
Zaim, H., Tatoglu, E., and Zaim, S. 2007. "Performance of Knowledge Management Practices: A Causal Analysis," *Journal of Knowledge Management* (11:6), pp. 54-67.