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# Understanding the Link Between Information Technology Capability and Organizational Agility: An Empirical Examination[1]

**Ying Lu**
School of Business, Pfeiffer University,
Misenheimer, NC 28109 U.S.A. {ying.lu@fsmail.pfeiffer.edu}

**K. (Ram) Ramamurthy**
Sheldon B. Lubar School of Business, University of Wisconsin–Milwaukee,
Milwaukee, WI 54302 U.S.A. {ramurthy@uwm.edu}

*Information technology is generally considered an enabler of a firm's agility. A typical premise is that greater IT investment enables a firm to be more agile. However, it is not uncommon that IT can also hinder and sometimes even impede organizational agility. We propose and theorize this frequently observed but understudied IT–agility contradiction by which IT may enable or impede agility. We develop the premise that organizations need to develop superior firm-wide IT capability to successfully manage their IT resources to realize agility. We refine the conceptualization and measurement of IT capability as a latent construct reflected in its three dimensions: IT infrastructure capability, IT business spanning capability, and IT proactive stance. We also conceptualize two types of organizational agility: market capitalizing agility and operational adjustment agility. We then conduct a matched-pair field survey of business and information systems executives in 128 organizations to empirically examine the link between a firm's IT capability and agility. Business executives responded to measurement scales of the two types of agility and organizational context variables, and IS executives responded to measurement scales of IT capabilities and IS context variables. The results show a significant positive relationship between IT capability and the two types of organizational agility. We also find a significant positive joint effect of IT capability and IT spending on operational adjustment agility but not on market capitalizing agility. The findings suggest a possible resolution to the contradictory effect of IT on agility: while more IT spending does not lead to greater agility, spending it in such a way as to enhance and foster IT capabilities does. Our study provides initial empirical evidence to better understand essential IT capabilities and their relationship with organizational agility. Our findings provide a number of useful implications for research and managerial practices.*

**Keywords**: Organizational agility, IT–agility contradiction, information technology capability, second-order latent multidimensional construct, IT spending, theory development

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## Introduction

In today's volatile business environments, firms must be agile and be able to handle extreme changes, survive unprecedented threats, and capitalize on emerging business opportunities (Prahalad 2009). Organizational agility is a firm's ability to cope with rapid, relentless, and uncertain changes and thrive in a competitive environment of continually and unpredictably changing opportunities (Dove 2001; Goldman et al. 1995). Firms invest in information technology to pursue fast, innovative initiatives in response to a constantly unfolding marketplace. This raises an interesting question: How does IT enhance organizational agility?

Past research generally has asserted that IT can enable agility by speeding up decision making, facilitating communication, and responding quickly to changing conditions (Lucas and Olson 1994) by providing the "wiring" for adaptive enterprise (Haeckel 1999) and by building digital options (Sambamurthy et al. 2003). However, researchers have also noted that IT may hinder and sometimes even impede organizational agility (Lucas and Olson 1994; Overby et al. 2006; Weill et al. 2002), partly due to the relatively fixed physical and technological artifacts of information systems (Allen and Boynton 1991; Galliers 2007). Businesses are often constrained by the limitations of inflexible legacy IT systems, rigid IT architectures, or complex nests of disparate technology silos so much so that IT becomes a disabler for agility (van Oosterhout et al. 2006). For instance, the increasing use of IT to create stronger electronic linkages in supply chains may have unintended adverse effects on supply chain flexibility and can severely constrain supply chain performance (Gosain et al. 2005). Furthermore, greater investments in process and IT usually can lead, ironically, to unintended technology traps over time (Grover and Malhotra 1999). For example, enterprise systems that use large integrated, packaged systems to automate and support business processes have been associated with both business agility (Goodhue et al. 2009) and rigidity (Galliers 2007; Rettig 2007). Such mixed observations seem to suggest that IT can often enable as well as impede organizational agility. Yet, there is a lack of understanding of the underlying inherent, but largely ignored, contradictions between IT and agility.

IT capability is a firm's ability to acquire, deploy, combine, and reconfigure IT resources in support and enhancement of business strategies and work processes (Sambamurthy and Zmud 1997). IT capability is critical for a firm to realize business value and sustain competitive advantage. Although research has begun to link firm-wide IT capability to competitive advantage (Bharadwaj 2000; Bhatt and Grover 2005; Mata et al. 1995; Ross et al. 1996), there is still limited understanding of IT capability and how it relates to agility in contemporary business environments (Kohli and Grover 2008). Research to date is primarily conceptual or case study oriented. Thus, there is a need for further rigorous empirical examination of the relationship between IT capability and agility.

Our research attempts to address the above gaps in the literature. We first synthesize and theorize the commonly observed but understudied IT-agility contradiction that IT may *enable* or *impede* organizational agility. We then develop the premise that IT capability is critical in effectively deploying and managing IT resources for greater agility. Specifically, we investigate two primary research questions:

(1) *Does IT capability enhance or impede agility?*

(2) *How does IT capability complement other organizational resources, namely, IT spending, to enhance agility?*

We conceptualize two types of agility—market capitalizing and operational adjustment agility—and refine IT capability as a latent construct reflected in three dimensions: IT infrastructure capability, IT business spanning capability, and IT proactive stance. We then conduct a field survey of business as well as IS executives in 128 organizations to examine the IT capability–agility link. Business executives respond to measurement scales of the two types of agility and organizational context variables, and IS executives respond to measurement scales of IT capabilities and IS context variables. The results show that IT capability positively relates to both types of agility. We also uncover a possible resolution to the conundrum of the contradictory effect of IT on agility: while more IT spending does not lead to greater agility, spending it in such a way as to enhance and foster IT capabilities does. We discuss ways that managers can use to channel their IT spending into developing IT capability to achieve greater agility.

Our study provides initial empirical evidence to better understand how IT can enable organizational agility via building and enhancing essential IT capabilities. We also advance theory and measurement by refining the conceptualization of IT capability and organizational agility and by empirically validating the measures. Further, our research seeks to open up discussion and advance theory for a more holistic, comprehensive understanding about the impact of IT on agility.

We encourage future research to further investigate the contradictions and dynamics inherent in IT management in fast-changing business contexts so that forward thinking explanatory theory can be developed (Grover et al. 2008). In the next few sections, we develop the theoretical background and the research model and hypotheses and describe the research method, sample and data collection, instrument development, and validation. We then present and discuss the findings and implications, limitations, directions for future research, and conclusions.

## Theoretical Background and Hypotheses

### Organizational Agility and the IT–Agility Contradiction

Organizational agility is a firm-wide capability to deal with changes that often arise unexpectedly in business environments via rapid and innovative responses that exploit changes as opportunities to grow and prosper (Goldman et al. 1995; van Oosterhout et al. 2006; Zhang and Sharifi 2000). Agility extends the notion of flexibility that can usually be engineered into an organization's processes and IT systems to address changes that are largely predictable with a predetermined response. Agility also extends the concept of strategic flexibility that handles unstructured changes (Overby et al. 2006; Volberda and Rutges 1999).

We identify two types of organizational agility: market capitalizing agility and operational adjustment agility. *Market capitalizing agility* refers to a firm's ability to quickly respond to and capitalize on changes through continuously monitoring and quickly improving product/service to address customers' needs. This agility emphasizes a dynamic, aggressively change-embracing, and growth-oriented entrepreneurial mind set about strategic direction, decision making, and judgment in uncertain conditions (Sambamurthy et al. 2003; Volberda 1996, 1997). *Operational adjustment agility* refers to a firm's ability in its internal business processes to physically and rapidly cope with market or demand changes (Dove 2001; Sambamurthy et al. 2003). This agility highlights flexible and rapidly responding operations as a critical foundation for enabling fast and fluid translation of innovative initiatives in the face of changes. Both types of agility entail a continual readiness to change, with the former focusing on entrepreneurial mind set and the latter emphasizing speedy execution/implementation.

To achieve both types of agility requires timely processing of a large volume and variety of distributed information that can be enhanced by a number of IT-enabled supporting, monitoring, or learning systems (Goldman et al. 1995; Volberda 1997). IT becomes essential in building the digital platform that shapes agility within an enterprise (Sambamurthy et al. 2003; Weill et al. 2002). However, the systems themselves do not automatically confer or enhance agility and can sometimes actually impede agility. As such, there is a need to better understand the contradiction between IT and agility.

Some of the key aspects, inherent to IT and agility, that trigger the above-noted contradiction are discussed. First, IT–agility contradiction, that is, the enabling or impeding property of IT lies in the paradoxical nature of agility as a metric of organizational effectiveness (Cameron 1986). For instance, agile firms must simultaneously manage the apparently conflicting goals of stability and flexibility to survive and prosper from changes and uncertainty, because flexibility without stability results in chaos (Volberda 1996). Moreover, agile firms not only need to be able to act upon opportunities with speed but the actions that they take should also be simultaneously cost-effective to confer profitable outcomes (Goldman et al. 1995). Second, as posited by the structuration theory, the duality of technology by which technologies may simultaneously constrain and enable human actions is inherent in IT and its use in organizations (Orlikowski 1992; Orlikowski and Robey 1991; Poole and Van de Ven 1989). This duality of technology may result in unintended rigidity when leveraging IT for agility. In addition, the ongoing interactions of humans with technology constantly evolve and change to potentially reshape technology, its use, and impact through improvised use, etc. These effects, in turn, can cause unintended consequences to constrain organizations (Orlikowski 1992, 1996). Furthermore, unanticipated responses from users can cause second-order effects. For example, users may react negatively to new IT or new uses of IT that intend to offer flexibility (Lucas and Olson 1994). Finally, prior research relating IT to agility has also supported the above noted IT–agility contradiction. As illustrated in Table 1, some studies propose an enabling role of IT, while others suggest a disabling or a mixed effect of IT on agility. However, much of the research to date is mostly conceptual or case oriented. Hence, there is a need to further examine the IT–agility link. We next elaborate the research model presented in Figure 1.

### IT Capability

Extending prior research, we conceptualize IT capability as a latent construct reflected in three dimensions: IT infrastructure capability (the technological foundation), IT business spanning capability (business–IT strategic thinking and partnership), and IT proactive stance (opportunity orientation). *IT infrastructure capability* is a firm's ability to deploy shareable platforms—a capability that captures the extent to

**Table 1. Prior Research on IT and Organizational Agility***

| References | Method | IT (capabilities) | Enable | Disable | Mixed | Findings about IT and agility |
|---|---|---|---|---|---|---|
| Allen and Boynton (1991) | Conceptual and Case example | Information systems architecture | | X | | Information systems are inflexible and are disablers of flexibility. The study proposes two IS architectural solutions to address the dual challenge of "speed and flexibility" and "low cost and efficiency": the low-road and high-road approach. |
| Lucas and Olson (1994) | Conceptual and Case example | Information technology | X | | | Information technology can have a significant impact on organizational flexibility by speeding up the processing of information and enabling quick response to changing market conditions. The study also acknowledges that IT may disable flexibility because of technological inflexibility or second-order effects. |
| Clark et al. (1997) | Case study | Change-readiness IT capabilities | X | | | IT groups' business expertise, in combination with IT skills, directly determines the firm's ability to rapidly develop and deploy critical information systems within short development cycle times for long-term competitive advantage. |
| Zaheer and Zaheer (1997) | Empirical | Use of information networks | X | | | Proactive use of information networks enables alertness and responsiveness to rapidly-changing market information in the global currency trading industry. |
| Weill et al. (2002) | Conceptual | IT infrastructure | X | | | IT infrastructure capability enables strategic agility. The study identifies types of IT infrastructure services to support three types of business initiatives: supply-side, internally focused, and demand-side. |
| Sambamurthy et al. (2003) | Theoretical | IT competence | X | | | The study proposes IT as a digital options generator in contemporary firms. IT competence positively impact agility through digital options including process and knowledge options. |
| Gosain et al. (2005) | Survey | Interorganizational systems | | | X | The study found that modular design of interconnected processes and structured data connectivity relates positively to supply chain flexibility whereas sharing a broad range of information is detrimental to supply chain flexibility. |
| Overby et al. (2006) | Conceptual | Information technology | X | | | The study proposes that IT enables enterprise agility by extending the reach and richness of firm knowledge and processes but also acknowledges that IT might hinder agility due to inappropriate deployment or management. |
| van Oosterhout et al. (2006) | Case study | Information technology | | | X | IT can be both an enabler and disabler for business agility. The study found that inflexible legacy IT systems result in rigid IT architectures and disable agility in the face of unpredictable rapid changes whereas an agile process and information system architecture serves as an enabler for agility. |
| Fink and Neumann (2007) | Field survey | IT personnel capabilities, IT infrastructure capabilities | X | | | The study found that technical and behavioral capabilities of IT personnel have a positive effect on infrastructure capabilities, which, in turn, exhibit a direct effect and indirect effect (mediated by IT-dependent system and information agility) on IT-dependent strategic agility. |
| Mathiassen and Vainio (2007) | Case study | Dynamic capabilities | X | | | The study employs the sense-and-respond framework to explore and analyze activity level sense-and-respond behavior and firm-level mechanisms that shape a firm's responsiveness in software development. |
| Rettig (2007) | Conceptual | Enterprise software | | X | | The study posits that enterprise systems that emphasize data integration and process automation may produce rigidity and unexpected barriers to change because changes involving technology are both profoundly complex and uncertain. |
| Zhang and Sharifi (2007) | Survey and case | Information systems | X | | | Information system is considered one of the agility providers to implement manufacturing choices and to achieve agility. Cluster analysis was used to identify agility strategy types in a subset of the sample but did not directly examine the relation between information systems and agility. |
| Goodhue et al. (2009) | Case study | Enterprise systems | X | | | Enterprise systems enable business agility through four options – built-in unused capabilities, globally consistent integrated data, "add-on" systems available on the market, and vendor provided "patches." The study also acknowledges the challenge to change the tightly integrated backbone in an enterprise system. |

*Illustrative; not a comprehensive listing or analysis of prior research (chronologically ordered).

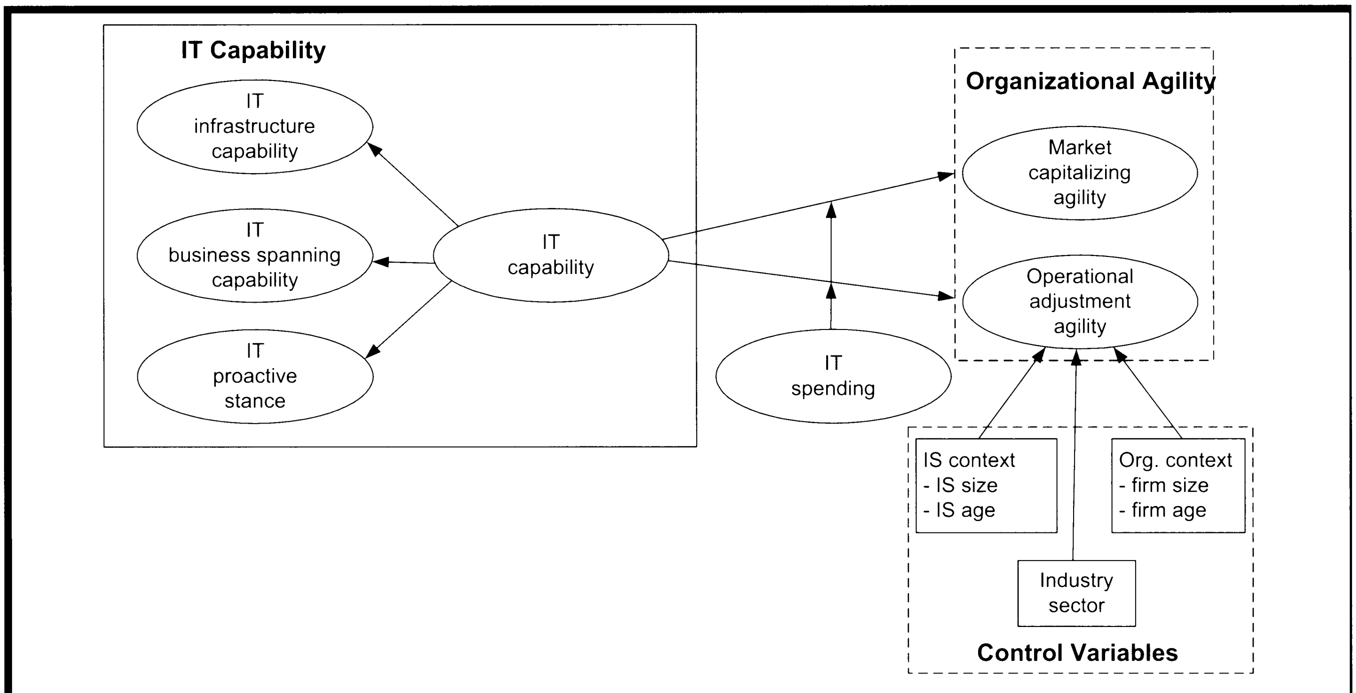


**Figure 1. Research Model**

which the firm is good at managing data management services and architectures, network communication services, and application portfolio and services (e.g., Bharadwaj 2000; Broadbent et al. 1999a; Ross et al. 1996; Weill et al. 2002). *IT business spanning capability* is the ability of a firm's management to envision and exploit IT resources to support and enhance business objectives—a capability that reflects the extent to which the firm develops a clear IT strategic vision, integrates business and IT strategic planning, and enables management's ability to understand the value of IT investments (e.g., Bharadwaj 2000; Mata et al. 1995; Ross et al. 1996; Wade and Hulland 2004). *IT proactive stance* is a firm's ability to proactively search for ways to embrace IT innovations or exploit existing IT resources to create business opportunities—a stance that measures the extent to which the firm strives to be always current with IT innovations, continues to experiment with new IT as necessary, constantly seeks new ways to enhance its effectiveness of IT use, and fosters a climate that is supportive of trying out new ways of using IT (e.g., Agarwal and Sambamurthy 2002; Fichman 2004; Galliers 2007; Weill et al. 2002). Table 2 summarizes the definitions of key constructs.

In this definition, IT capability is the higher-level general construct underlying its three dimensions. It thus reflects the extent to which a firm is good at managing its IT resources to support and enhance business strategies and processes. IT capability captures the commonality shared by all three dimensions. A firm with superior IT capability, for example, should be expected to exhibit to a great extent each of the three IT capability dimensions.

## *The Impact of IT Capability on Organizational Agility*

As noted, two forms of organizational agility are considered in this study. *Market capitalizing agility* emphasizes knowledge management or intellectual ability to find appropriate things to act on (Dove 2001). This agility involves not only collecting and processing extensive amounts and a variety of information to identify and anticipate external changes but also continuously monitoring and quickly improving product/service offerings to address customer needs. On the other hand, *operational adjustment agility* highlights a firm's ability in its internal business processes to physically and rapidly cope with market or demand changes (Sambamurthy et al. 2003). This agility focuses more on routine maneuvering to provide fast response to changes. It is primarily directed at operational activities and is reactive in nature (Volberda 1997).

**Table 2. Research Variables**

| Construct | Operational Definition | Supporting Literature |
|---|---|---|
| IT infrastructure capability | A firm's ability to deploy a set of shareable platforms, capturing the extent to which the firm is good at managing data management services and architectures, network communication services, and application portfolio and services. | Bharadwaj 2000<br>Broadbent et al. 1999a<br>Ross et al. 1996<br>Weill et al. 2002 |
| IT business spanning capability | The ability of management to envision and exploit IT resources to support and enhance business objectives. | Bharadwaj 2000<br>Mata et al. 1995<br>Ross et al. 1996<br>Wade and Hulland 2004 |
| IT proactive stance | A firm's ability to proactively search for ways to embrace new IT innovations or exploit existing IT resources to address and create business opportunities. | Agarwal and Sambamurthy 2002<br>Fichman 2004<br>Galliers 2007<br>Weill et al. 2002 |
| Market capitalizing agility | A firm's ability to quickly respond to/ capitalize on changes through continuously monitoring and quickly improving product/service to address customers' needs. | Sambamurthy et al. 2003<br>Volberda 1996, 1997 |
| Operational adjustment agility | A firm's ability in its internal business processes to physically and rapidly cope with market or demand changes. | Dove 2001<br>Sambamurthy et al. 2003 |

The three IT capability dimensions may enable both forms of agility. The first capability dimension—superior IT *infrastructure*—provides a globally integrated platform that enforces standardization and integration of data and processes. This level of integration makes possible timely and accurate information gathering and sharing. Sharing of real-time, consistent, and comprehensive information enables fast, efficient decision making (Eisenhardt 1989). For example, in the global currency trading industry, information integration allows firms to proactively access and quickly act to obtain private price information in the face of rapid market changes (Zaheer and Zaheer 1997). Real-time access to global information also supports extensive environmental scanning to gather, track, and disseminate information pertaining to changes in customer needs, competitors, and technology or regulatory developments (Kohli and Jaworski 1990; Overby et al. 2006). Enhanced strategic scanning generates market intelligence that provides early warning and an ability to anticipate, sort out, and make sense out of rapidly changing and possibly contradictory market information in a timely manner (El Sawy 1985; Weill and Ross 2004). In addition, a globally integrated infrastructure provides a platform to generate digital options that enhance the reach and richness of the firm's knowledge and its processes and assist the firm in accessing, synthesizing, and exploiting knowledge (Sambamurthy et al. 2003). For instance, firms can simultaneously adopt various IT-enabled approaches for knowledge management, such as codifying and storing knowledge in databases that automate knowledge sharing and reuse, or, alternatively, building networks of people to share knowledge (Hansen et al. 1999).

A globally integrated infrastructure also enables the firm to cope with frequent or unexpected rapid changes by dealing with disruption in supply or fluctuations in demand and making necessary internal adjustments. Boundary-spanning IT infrastructure services such as firm-wide applications, databases, and common systems are essential to quickly implement extensive, innovative, and radical process changes and best support demand-side initiatives (Broadbent et al. 1999b; Weill et al. 2002). An integrated infrastructure allows the firm to quickly implement new IT-enabled offerings or initiatives. The firm can use modular, reusable code to rapidly produce IT-based products and services that will respond to changes, enable supply-chain and production capabilities to accommodate unexpected changes, and allow quick reconfiguration of the platform (Overby et al. 2006). A case in point is Procter & Gamble's shared services platform that delivers reusable business support services to enable brand managers to quickly and efficiently launch new products (Weill et al. 2007).

The second capability dimension—superior *IT business spanning capability*—emphasizes IT-business partnership and synergy. Partnership and synergy between IT and business managers leads to effective IT–business joint decision making, more strategic applications, and greater buy-in and, thus, produces better implementation (Weill and Ross 2004). In addition, close interaction and collaboration between IT and business foster a mutual respect and trust over time that encourages sharing and exchange of knowledge between IT and line managers (Ross et al. 1996). Such shared knowledge plays an important role in influencing an organization's IT use

(Boynton et al. 1994), its assimilation of IT (Armstrong and Sambamurthy 1999), its level of IT–business alignment (Reich and Benbasat 2000), and its more focused and strategic use of IT (Chan et al. 2006). For instance, active and close IT business interaction increases knowledge sharing between IT and business and leads to superior customer service (Ray et al. 2005).

The synergy between IT and business activities also ensures speedy, effective, and efficient translation of innovative responses that usually require radical changes to and reengineering of business processes and information systems. For example, greater collaboration between IT and business executives was found to be fundamental for continuous IT-based innovations in the case study of Marshall Industries (El Sawy et al. 1999). Likewise, tightly coupled IT and strategy was found beneficial for implementing innovative, radical process changes (Mitchell and Zmud 1999). Firms often rely on a patching process to map and remap their business units and create a continually shifting mix of highly focused, tightly aligned businesses that could respond to changing market opportunities (Campbell et al. 1999). IT business partnership supports informal and improvised decision making that is typical in turbulent environments (Brown and Eisenhardt 1997). For example, Zara, a Spanish clothing retailer, has a super-responsive supply chain in the highly volatile fashion garment industry in which customers' tastes change unpredictably and quickly. Zara's production requirements for new and existing garments, its planning and scheduling within each factory, and its process of deciding which stores get garments in deficient supply are highly informal. Their technologists work closely with line managers to understand the business requirements and propose solutions. The close collaboration between IT and business enables its business processes to be responsive and flexible (Ferdows et al. 2004; McAfee 2004).

The third capability dimension—a *proactive IT stance*—characterizes a firm that always searches for ways to explore or exploit its IT resources to create and capitalize on business opportunities. Such a firm is likely to make better sense of a major IT innovation and fully consider its potential fit to the firm and, thus, is able to mindfully identify, select, and pursue IT innovations (Swanson and Ramiller 2004). The firm is capable of comprehending the uncertainty about the benefits of using the innovation and the irreversibility in the costs of deployment, and it prudently avoids a herd-like mentality while examining the potential of a new IT innovation (Fichman 2004). In addition, the firm is able to anticipate and sense relevant changes due to advances in IT and the opportunities created by emerging technologies (Weill and Ross 2004). As such, a proactive IT stance enables the firm to quickly identify and select opportunities with IT innovations to address changing information needs that are in line with changing business strategy (Galliers 2007). For instance, in the volatile global currency trading industry, Zaheer and Zaheer (1997) found that proactive use of information networks enabled the firm to engage in proactive information seeking as well as to regularly obtain superior price information and more accurate perceptions of price trends. This proactive stance allowed the firm to spot market opportunities and quickly capitalize on these opportunities.

A proactive IT stance also enables continual learning and renewal. Augmented learning leads to an ability to quickly reconfigure processes in response to changes (Haeckel 1999). IT becomes a proactive partner in the innovation process and permits dynamic reconfiguring on the fly and continuous morphing in changing environments (Agarwal and Sambamurthy 2002). The firm with a proactive IT stance can mindfully manage the adoption, assimilation, and implementation of a new IT innovation and, thus, avoid falling into lock-in technology rigidity (Swanson and Ramiller 2004). The firm can also identify the appropriate opportunity to reconfigure and reuse its existing IT resources to enable rapid execution of innovative, radical actions.

On the other hand, the three IT capability dimensions may have negative impacts on the two forms of agility. A globally integrated *IT infrastructure*—the first capability dimension—may lead to unintended rigidity in the face of local changes (Goodhue et al. 2009). Localized data management and specialized applications can more quickly and easily support supply-side business initiatives (Weill et al. 2002), and decentralized, dispersed local IS can better support fast innovative solutions (Allen and Boynton 1991). Wider environmental scanning and access to more information may lead to information overload and limit decision makers' ability to take timely actions. In the face of unanticipated fleeting opportunities, an overreliance on technology and formal analysis based on data and reports may paralyze managers' ability to see opportunities and take quick moves to capture these opportunities (Eisenhardt and Sull 2001; Langley 1995). For instance, sharing a broad range of information was found detrimental to supply chain flexibility (Gosain et al. 2005). In addition, IT-based knowledge sharing may potentially reduce deviation and encourage consensus and can inhibit knowing and learning (Newell and Galliers 2006). Robust knowledge storage and retrieval systems such as knowledge repositories and portals were found to reduce knowledge heterogeneity and promote exploitation while crowding out exploration (Kane and Alavi 2007).

An integrated IT infrastructure may also lead to unintended process rigidity when markets evolve, because changes involving technology can be complex, especially when automated processes or the tightly integrated backbone are in need for change (Goodhue et al. 2009; Rettig 2007). IT is increasingly embedded in basic or cross-functional processes (Grover and Malhotra 1999). Over time, most firms get entangled with large, complex information systems with embedded business processes, which frequently limit their actions when innovative changes are necessary (van Oosterhout et al. 2006). For instance, IT was found to be the biggest barrier to rapid and radical changes in business process reengineering initiatives (Attaran 2004). IT infrastructure lacking extensive boundary spanning services was found to constrain business process reengineering implementation (Broadbent et al. 1999b).

An overemphasis of *IT business synergy*—the second capability dimension—may lead to tightly *coupled IT and business.* Tightly coupled IT and business could lead to group thinking and favor a reactive IT orientation to support and enable business initiatives while ignoring new opportunities in the face of disruptive IT innovation. Tightly coupled IT and business could also lead to competency trap and unintended routine rigidity when radical process changes are necessary (Leonard-Barton 1992). Likewise, an excessive emphasis of *a proactive IT stance*—the third capability dimension—may result in directing too much resource to explore new IT-enabled opportunities while ignoring necessary and beneficial exploitation. The over-reliance on exploration activities can potentially harm the firm's agility because agile firms must be able to simultaneously achieve the seemingly conflicting goals of stability and flexibility, and efficiency and profitability (Goldman et al. 1995; March 1991; Volberda 1996). Without adequate refinement and meticulous execution, firms may end up with an unstable foundation and not be able to fully realize and extract the value of their IT innovative initiatives (McAfee and Brynjolfsson 2008). For example, firms that are overly proactive in IT may find themselves constantly allured by emerging technologies but lack the capability to focus and turn these opportunities into profits. These firms may also make misjudgments on the timing of adoption and implementation that result in fragmented silos or bleeding edge technology choices.

On balance, we would expect *IT capability*, the common factor underlying its three dimensions, to have a positive impact on the two forms of agility. The three dimensions together complement each other to enable agility. For instance, a proactive IT stance can help to ensure that the globally integrated IT infrastructure has the necessary flexibility to anticipate and incorporate future and local needs. Firms with a proactive IT stance would build an integrated but flexible IT infrastructure with adequate modularity via selective standardization and integration in data and processes (Ross and Weill 2005). A proactive IT stance also would ensure continuous learning and renewal to avoid competency trap and would enable coevolution that emphasizes a dynamic fluidity of interactions between IT and business (Agarwal and Sambamurthy 2002). Simultaneously, superior IT infrastructure capability would provide adequate internal efficiency and continuity for a proactive IT stance and would make dynamic IT business synergy possible. Finally, superior IT business spanning capability would ensure that proactive IT initiatives are appropriately targeted and disciplined in line with business strategy. As such, a firm with superior IT capability would be able to constantly scan and process changing environmental signals, monitor internal information, make fast innovative decisions, quickly adjust internal processes, and, thus, realize greater market capitalizing agility and operational adjustment agility. Hence, we present the following hypotheses:

*H1: IT capability is positively associated with market capitalizing agility.*

*H2: IT capability is positively associated with operational adjustment agility.*

### The Complementary Effect of IT Capability and IT Spending on Organizational Agility

As illustrated in Figure 1, we conceptualize the complementarity of IT capability and IT spending as a moderation or an interaction effect (Venkatraman 1989). IT spending provides the firm adequate slack resources as a buffer/cushion for new innovations or for faster execution (Bourgeois 1981; Hambrick et al. 1996; Young et al. 1996). Slack is cited as a factor that partially explains an organization's innovative behavior (Damanpour 1987). For instance, prior research has suggested that increased slack stimulates creativity and experimentation (Meyer 1982; Nord and Tucker 1987). One manifestation of such behavior may be developing, for example, new state-of-the-art CRM and business intelligence applications that provide the firm with agility to respond to market and customer changes.

However, huge investment in IT may not necessarily foster agility, particularly when they are not channeled into nurturing and developing IT capability. Imprudent IT investment may, in fact, create unintentional clusters of fragmented technology silos that constrain the organization from effectively executing routine business activities let alone launching new innovative initiatives. Conversely, carefully channeled IT spending that successfully develops and reinforces essential IT capabilities would enhance agility. Analogously, the firm depends on superior IT capability to translate IT spending into enabling agility. For example, firms with superior IT infrastructure capability usually manage IT infrastructure as an asset and balance investment carefully over time. Such firms were found to outperform other firms that took a "big bang" approach to IT infrastructure (Weill and Ross 2004). Moreover, firms with a well-aligned IT–business link can better position themselves to substantially leverage additional IT investment and reap better firm performance (Byrd et al. 2006). In addition, firms with a proactive IT stance are likely to mindfully manage IT innovations and avoid jumping on the bandwagon of "me too" best practices or industry fads (Swanson and Ramiller 2004). Further, the changing business environment requires that core competences be evolving and developing continually to confer competitive advantage. Thus, firms must continue to invest in and upgrade their competences to make their skills and capabilities dynamic and create new strategic growth alternatives (Hitt et al. 1998); otherwise, core competences may become outdated and can limit future strategic alternatives and result in core rigidities (Leonard-Barton 1992). Overall, this suggests that IT capability and IT spending together enable agility.

Hence, we expect IT capability and IT spending to have a positive joint effect on organizational agility. Financial resources offer the firm opportunities to develop and implement more IT-enabled initiatives as well as the luxury to experiment with new IT. The firm with superior IT capability is better positioned to properly direct and leverage its IT investment to build IT-based supporting, monitoring, or learning systems and the digital platform for market capitalizing agility and operational adjustment agility. We propose the following:

*H3: IT capability augments IT spending that the two jointly have a positive impact on market capitalizing agility.*

*H4: IT capability augments IT spending that the two jointly have a positive impact on operational adjustment agility.*

## Research Method

### Sample and Data Collection

Data were collected using a matched-pair field survey of senior business and IS executives in 843 organizations[2] in the upper midwestern states of the United States. This sample targets medium sized firms, while prior research has focused either on large Fortune 1000 firms (e.g., Ravichandran and Lertwongsatien 2005) or manufacturing firms (e.g., Bhatt and Grover 2005). Survey packages were mailed to the business executive in each target firm with a request that the recipient complete Part A relating to organization contexts and agility and distribute Part B to the suitable IS executive to provide information about the firm's IT management practices and IT capabilities.

We received 128 usable responses, resulting in a 15 percent response rate.[3] A test for nonresponse bias showed no significant differences between responding and nonresponding organizations with regard to their firm's age, size, and ownership type (private or public). Table 3 presents the sample profile. The sample firms were distributed across a wide range of industry sectors, with the majority being private firms. On average, the sample firms had been in business for about 61 years and had 3,935 employees enterprise-wide and 653 FTEs at the local sites. Their IS departments were in place for about 20 years and had 84 employees. Their IS budget was on average about 3.5 percent of sales revenue. The IS executives had on average 10 years experiences in their present firm and 18 years in industry. This shows that the sample firms are a good representation of our target population of medium-sized firms. In addition, over 94 percent of the responding business executives and about 86 percent of the IS executives were above the level of director and were of high ranking and, thus, were expected to be knowledgeable about the information sought in our study. This provides us confidence in the fidelity of their responses.

### Instrument Development

The measurement scales for agility and IT capability were adapted from prior literature and validated in a series of procedures to ensure content validity, construct validity, and reliability (Straub 1989). First, the draft scales were pretested using Q-sort method (Moore and Benbasat 1991). Four judges (non-IS business doctoral students) were invited to evaluate items for Part A (business executive survey) while six MIS doctoral students were asked to sort items for Part B (IS executive survey). Results of the Q-sort demonstrated initial construct validity with overall hit ratios of 83 percent (Part A) and 79 percent (Part B). The Kappa scores, aver-

[2]The sample list was compiled across two major sources: HarrisInfoSource 2005 and the Book of Lists 2005 by randomly selecting medium-sized (i.e., more than 200 employees) single-business firms or strategic business units (SBU) of multidivisional companies. We enforced this selection criterion to ensure a meaningful measure of IT capability.

[3]We have taken various strategies and follow-up procedures (e.g., personal phone calls and mail) to ensure a satisfactory response rate. This response rate for a matched-pair survey from senior executives is comparable to other studies (Armstrong and Sambamurthy 1999; Ray et al. 2005).

**Table 3. Sample Profile**

| Industry Sector | Obs. | (%) | Business Executives | | |
|---|---|---|---|---|---|
| Banking/Finance | 10 | 7.8 | **Title** | **Obs.** | **(%)** |
| Computers/Software | 5 | 3.9 | President/Chief Executive | 46 | 35.9 |
| Consulting | 5 | 3.9 | Vice President, General Manager | 59 | 46.1 |
| Insurance | 7 | 5.5 | Director | 16 | 12.5 |
| Manufacturing | 51 | 39.8 | Manager | 7 | 5.5 |
| Medicine/Health | 15 | 11.7 | **IS Executives** | | |
| Publishing/Communications | 4 | 3.1 | **Title** | **Obs** | **(%)** |
| Hotel/Restaurant | 5 | 3.9 | Chief Information Officer | 12 | 9.4 |
| Transportation | 6 | 4.7 | Vice President | 41 | 32.0 |
| Other* | 20 | 15.6 | Director | 57 | 44.5 |
| Total | 128 | 100.0 | Manager/Leader | 18 | 14.1 |

*Other industries include agriculture, oil/petroleum, utilities, wholesale/retail, real estate, construction, travel agency, etc.

aging .82 (Part A) and .68 (Part B), were greater than the suggested threshold of .65 and demonstrated inter-rater reliability of the sorting scheme (Moore and Benbasat 1991). All ambiguous items identified were further examined and modified. Second, the refined questionnaire was further pilot-tested with four local firms to evaluate the phrasing and clarity of the indicators and adequacy of the domain coverage. Two executives (business and IS executives) from each firm were interviewed to assess the indicators, constructs, and comprehensiveness of the instrument. The questionnaires were further refined prior to final administration of the survey.

### Operationalization of Constructs

We operationalized the study variables using multi-item reflective measures (on a seven-point scale). Reflective indicators are caused by the latent construct, are interchangeable, covary, and share a common theme (Jarvis et al. 2003).[4] Appendix A presents the final instrument.

**Organizational agility**: *Market capitalizing agility* was measured with three items that reflected the firm's ability to quickly respond to/capitalize on changes through continuously monitoring and quickly improving products/services to address customers' needs. *Operational adjustment agility* was measured with three items that reflected a firm's ability in its internal business processes to physically and rapidly cope with and respond to market or demand changes.

**IT capability**: Consistent with our theoretical conceptualization, we modeled IT capability as a second-order construct reflected in its three interrelated first-order dimensions.[5] This measurement model specification captures the common variances or covariances shared by all three dimensions, thus representing a covariation model among the dimensions (Venkatraman 1989).

*IT infrastructure capability* was measured with three items that reflect the extent to which a firm deploys a set of shareable platforms. *IT business spanning capability* was measured with three indicators that reflect the ability of a firm's management to envision and exploit its IT resources to support and enhance business objectives. *IT proactive stance* was measured using four items that capture the

[4]Formative measurement is not appropriate for our study variables based on four major criteria: (1) the direction of causality between the construct and its indicators, (2) interchangeability of the indicators, (3) covariation among the indicators, and (4) nomological net of the indicators (Jarvis et al. 2003). Recent research discusses the specification and potential problems of formative constructs in IS research (Kim et al. 2010; Petter et al. 2009).

[5] Law et al. (1998) suggested three alternative approaches to specifying and modeling a multidimensional construct: latent model, aggregate model, and profile model. The latent model is consistent with our theoretical conceptualization of IT capability and the direction of the relationship between IT capability and its three dimensions. For example, a firm with superior IT capability should exhibit a great extent of each and every dimension whereas the opposite may not necessarily be true. The alternative specifications of the measurement model are not appropriate because, in either aggregate model or profile model, the multidimensional construct exists at the same level as their dimensions and the dimensions form the construct.

extent to which the firm proactively searches for ways to explore or exploit IT resources to address and create business opportunities.

**IT contextual variables**: *IT spending* was measured as a ratio of IT budget to sales revenue.

**Control variables**: *Firm size* was measured as the firm-wide number of full-time employees (FTE) and *firm age* as years the company had been in business. *IS size* was measured as the ratio of number of FTEs in the IS department to firm-wide FTEs. *IS age* was the number of years the IS department had been in place. Finally, *industry sector* was a binary variable with 1 for service firms and 0 for manufacturing firms.

# Results

## Measurement Validation

We conducted various tests to assess construct validity and reliability of the instrument. Table 4 presents the results of exploratory factor analysis (EFA). A five-factor structure emerged with all predefined indicators loading on to their respective constructs, which thereby affirmed convergent validity and unidimensionality of the constructs.

We also performed confirmatory factor analysis (CFA) using CALIS procedure of SAS 9.12 to assess convergent validity and reliability. Table 5 presents the results of CFA, and Table 6 presents correlation among all indicators. As shown in Table 5, first, all indicators loaded high (> .73) on their respective constructs. Second, the fit indices of the measurement model were all within the normally specified thresholds. Third, composite reliability for each construct was greater than .7, and the average variance extracted (AVE) for each construct was above .5. The square-roots of all AVEs were greater than the correlations between the respective constructs and other latent constructs (Fornell and Larcker 1981; Hair et al. 1998). Together, these results provide evidence of reliability, convergent validity, and discriminant validity of the measures.

Discriminant validity was further assessed in CFA through chi-square ($\chi^2$) tests between a constrained model that sets the correlation between two constructs to 1 and an unconstrained model that frees the correlation (Segars and Grover 1998). A significant $\chi^2$ difference suggests that the unconstrained model is a better fit than the constrained model. We conducted 10 pair-wise tests among the five constructs. The results in Table 7 show that all $\chi^2$ differences are significant ($p < .001$). These results further affirm discriminant validity between the five constructs.

We also performed comparative analysis of the second-order factor model with alternative first-order models of IT capability (Segars and Grover 1998, pp. 152-156). Specifically, we tested five models: (1) Model 1: a first-order one-factor model that all 10 measurement items load on, and Model 1A, a constrained first-order three-factor model that sets the correlations between the three factors to one, (2) Model 2, uncorrelated first-order three-factor model that sets the correlations between the three factors to zero, (3) Model 3, a freely correlated first-order three-factor model that allows the correlations between the three factors to be freely estimated, and (4) Model 4, a second-order model. Table 8 presents the fit indices of the five models. First, the results show that the two baseline models—Model 1 and Model 1A are comparable with the same $\chi^2$ for the same degrees of freedom and identical fit indices. Second, Model 2 (with lower $\chi^2$ for the same degrees of freedom and better fit indices) fits better than either Model 1 or Model 1A, suggesting a multidimensional model with three uncorrelated factors is superior to either a unidimensional factor model or a constrained three-factor model. Third, Model 3 with three freely correlated first-order factors fits better than Model 2, indicated by the much lower $\chi^2$ and better fit indices while loosing three degrees of freedom. Finally, Model 4 (the second-order model), comparable to Model 3, was adopted in further analyses because of its parsimony and consistency with our theoretical conceptualization of IT capability. As illustrated in Figure 2, the overall model fit indices and the significant second-order factor loadings further support our measurement model specification. Together, these results provide evidence that the second-order model of IT capability is a good fit both conceptually and empirically.

## Tests of Common Method Bias and Survey Data

First, multiple respondents (business and IS executives) were used for data collection to minimize the threat of common method bias. The dependent variables (market capitalizing agility and operational adjustment agility) were measured by asking business executives, and the independent variable (three IT capabilities) was measured by asking IS executives. Second, we conducted Harman's *post hoc* single-factor analysis to examine for method bias in the data. If common method variance is a serious issue, a factor

**Table 4. Results of Exploratory Factor Analysis: Joint Factor Analysis**

| Item | Mean | Std Dev | Minimum | Maximum | Factor1 | Factor2 | Factor3 | Factor4 | Factor5 |
|---|---|---|---|---|---|---|---|---|---|
| IPS3 | 4.44 | 1.49 | 1 | 7 | **0.943** | -0.048 | -0.005 | 0.008 | -0.034 |
| IPS2 | 4.38 | 1.36 | 1 | 7 | **0.786** | 0.113 | 0.180 | -0.046 | -0.048 |
| IPS4 | 4.60 | 1.34 | 1 | 7 | **0.726** | 0.289 | 0.050 | -0.016 | -0.152 |
| IPS1 | 4.48 | 1.47 | 1 | 7 | **0.718** | 0.144 | 0.106 | -0.047 | 0.084 |
| IBC2 | 4.46 | 1.36 | 2 | 7 | 0.097 | **0.884** | -0.054 | 0.070 | -0.057 |
| IBC1 | 4.51 | 1.15 | 2 | 7 | 0.088 | **0.845** | -0.081 | 0.100 | -0.003 |
| IBC3 | 4.44 | 1.16 | 1 | 7 | 0.044 | **0.814** | -0.064 | 0.029 | 0.100 |
| MA3 | 4.71 | 1.26 | 1 | 7 | 0.081 | -0.076 | **0.854** | 0.022 | 0.082 |
| MA2 | 4.28 | 1.32 | 1 | 7 | 0.040 | -0.048 | **0.713** | 0.217 | 0.072 |
| MA1 | 4.16 | 1.49 | 1 | 7 | 0.040 | 0.012 | **0.670** | 0.332 | -0.080 |
| OA2 | 4.12 | 1.51 | 1 | 7 | -0.160 | 0.197 | 0.162 | **0.805** | -0.062 |
| OA3 | 4.13 | 1.48 | 1 | 7 | 0.146 | -0.103 | 0.087 | **0.762** | -0.159 |
| OA1 | 5.09 | 1.27 | 1 | 7 | -0.032 | 0.010 | 0.188 | **0.653** | 0.316 |
| IIC1 | 4.98 | 1.14 | 1 | 7 | -0.152 | 0.037 | 0.155 | -0.074 | **0.897** |
| IIC2 | 5.37 | 1.04 | 1 | 7 | 0.280 | -0.033 | -0.138 | 0.266 | **0.567** |
| IIC3 | 4.57 | 1.36 | 1 | 7 | 0.180 | 0.219 | 0.220 | -0.196 | **0.526** |

Factor 1: IT proactive stance
Factor 2: IT business spanning capability
Factor 3: Market capitalizing agility
Factor 4: Operational adjustment agility
Factor 5: IT infrastructure capabiilty

**Table 5. Results of Confirmatory Factor Analysis: Correlation and Reliability of Latent Constructs**

| Constructs | Respondent | Items | Mean | Std Dev | 1 | 2 | 3 | 4 | 5 | Range of Factor Loadings | Composite Reliability | AVE |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. IT infrastructure capability | IS executive | 3 | 4.97 | 0.92 | *0.82* | | | | | .73-.91 | 0.86 | 0.67 |
| 2. IT business spanning capability | IS executive | 3 | 4.45 | 1.16 | 0.65 | *0.87* | | | | .83-.88 | 0.90 | 0.75 |
| 3. IT proactive stance | IS executive | 4 | 4.47 | 1.25 | 0.61 | 0.69 | *0.85* | | | .83-.88 | 0.91 | 0.73 |
| 4. Market capitalizing agility | Business executive | 3 | 4.38 | 1.17 | 0.28 | 0.33 | 0.46 | *0.85* | | .82-.87 | 0.89 | 0.72 |
| 5. Operational adjustment agility | Business executive | 3 | 4.44 | 1.18 | 0.24 | 0.36 | 0.42 | 0.65 | *0.84* | .74-.90 | 0.88 | 0.71 |

**Notes**: Model fit indices: $\chi^2$ (df) = 126.43 (94), p = 0.0144; root mean square error of approximation (RMSEA) = 0.0521, normed fit index (NFI) = 0.92, goodness-of-fit index (GFI) = 0.90, adjusted goodness-of-fit index (AGFI) = 0.85, comparative fit index (CFI) = .98. Square-root of AVE values along the diagonal

**Table 6. Correlations among Measurement Items**

| Item | Mean | STD | IIC1 | IIC2 | IIC3 | IBC1 | IBC2 | IBC3 | IPS1 | IPS2 | IPS3 | IPS4 | MA1 | MA2 | MA3 | OA1 | OA2 | OA3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| IIC1 | 4.98 | 1.14 | 1.00 | | | | | | | | | | | | | | | |
| IIC2 | 5.37 | 1.04 | 0.58 | 1.00 | | | | | | | | | | | | | | |
| IIC3 | 4.57 | 1.36 | 0.67 | 0.62 | 1.00 | | | | | | | | | | | | | |
| IBC1 | 4.51 | 1.15 | 0.41 | 0.49 | 0.54 | 1.00 | | | | | | | | | | | | |
| IBC2 | 4.46 | 1.36 | 0.37 | 0.50 | 0.57 | 0.78 | 1.00 | | | | | | | | | | | |
| IBC3 | 4.44 | 1.16 | 0.35 | 0.47 | 0.52 | 0.71 | 0.74 | 1.00 | | | | | | | | | | |
| IPS1 | 4.48 | 1.47 | 0.37 | 0.54 | 0.57 | 0.61 | 0.62 | 0.55 | 1.00 | | | | | | | | | |
| IPS2 | 4.38 | 1.36 | 0.32 | 0.44 | 0.54 | 0.59 | 0.60 | 0.56 | 0.74 | 1.00 | | | | | | | | |
| IPS3 | 4.44 | 1.49 | 0.26 | 0.50 | 0.39 | 0.53 | 0.53 | 0.55 | 0.67 | 0.75 | 1.00 | | | | | | | |
| IPS4 | 4.60 | 1.34 | 0.28 | 0.45 | 0.50 | 0.65 | 0.68 | 0.55 | 0.71 | 0.73 | 0.74 | 1.00 | | | | | | |
| MA1 | 4.16 | 1.49 | 0.10 | 0.17 | 0.23 | 0.28 | 0.29 | 0.18 | 0.37 | 0.38 | 0.29 | 0.34 | 1.00 | | | | | |
| MA2 | 4.28 | 1.32 | 0.17 | 0.21 | 0.22 | 0.25 | 0.25 | 0.25 | 0.34 | 0.34 | 0.33 | 0.34 | 0.64 | 1.00 | | | | |
| MA3 | 4.71 | 1.26 | 0.25 | 0.13 | 0.25 | 0.23 | 0.25 | 0.24 | 0.35 | 0.44 | 0.31 | 0.30 | 0.62 | 0.61 | 1.00 | | | |
| OA1 | 5.09 | 1.27 | 0.23 | 0.31 | 0.27 | 0.32 | 0.31 | 0.33 | 0.35 | 0.39 | 0.37 | 0.33 | 0.47 | 0.50 | 0.45 | 1.00 | | |
| OA2 | 4.12 | 1.51 | 0.02 | 0.20 | 0.09 | 0.28 | 0.30 | 0.23 | 0.31 | 0.32 | 0.27 | 0.29 | 0.53 | 0.50 | 0.41 | 0.59 | 1.00 | |
| OA3 | 4.13 | 1.48 | -0.01 | 0.14 | -0.02 | 0.20 | 0.19 | 0.09 | 0.23 | 0.33 | 0.25 | 0.32 | 0.56 | 0.35 | 0.34 | 0.44 | 0.57 | 1.00 |

**Note**: All indicators measured on a 1 to 7 scale (where 1 = poorer than most/strongly disagree/not at all; 7 = superior to most/strongly agree/very true).

**Table 7. Discriminant Validity**

| Model | $\chi^2$ (df) | $D\chi^2$ (df, sig.) |
|---|---|---|
| Unconstrained baseline model with freely correlated latent constructs | 126 (94) | |
| Constrained IT infrastructure capability and IT business spanning capability = 1 | 216 (95) | 90 (1, .001) |
| Constrained IT infrastructure capability and IT proactive stance = 1 | 233 (95) | 107 (1,.001) |
| Constrained IT business spanning capability and IT proactive stance = 1 | 242 (95) | 116 (1,.001) |
| Constrained market capitalizing agility and operational adjustment agility = 1 | 232 (95) | 106 (1,.001) |
| Constrained market capitalizing agility and IT infrastructure capability = 1 | 287 (95) | 161 (1,.001) |
| Constrained market capitalizing agility and IT business spanning capability = 1 | 315 (95) | 189 (1,.001) |
| Constrained market capitalizing agility and IT proactive stance = 1 | 296 (95) | 170 (1,.001) |
| Constrained operational adjustment agility and IT infrastructure capability = 1 | 288 (95) | 162 (1,.001) |
| Constrained operational adjustment agility and IT business spanning capability = 1 | 309 (95) | 183 (1,.001) |
| Constrained operational adjustment agility and IT proactive stance = 1 | 297 (95) | 171(1,.001) |

**Table 8. Second-Order Model of IT Capability**

| Models | $\chi^2$ (df) | NFI | CFI | GFI | AGFI | RMSEA |
|---|---|---|---|---|---|---|
| Model 1: first-order one-factor model | 252.33 (35) | 0.73 | 0.75 | 0.67 | 0.48 | 0.22 |
| Model 1A: constrained first-order three-factor model | 252.33 (35) | 0.73 | 0.75 | 0.67 | 0.48 | 0.22 |
| Model 2: uncorrelated first-order three-factor model | 171.00 (35) | 0.81 | 0.84 | 0.79 | 0.67 | 0.17 |
| Model 3: freely correlated first-order three-factor model | 41.71 (32) | 0.96 | 0.99 | 0.94 | 0.90 | 0.048 |
| Model 4: second-order factor model | 41.71 (32) | 0.96 | 0.99 | 0.94 | 0.90 | 0.048 |

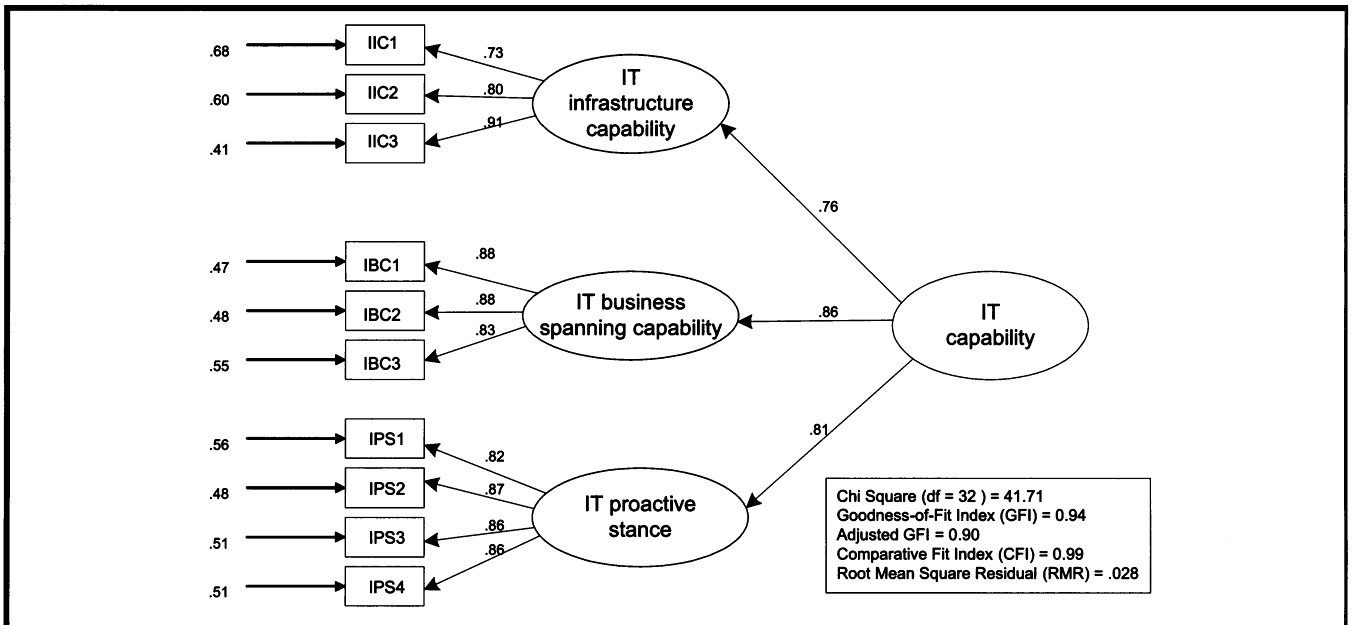


**Figure 2. Second-Order Model of IT Capability**

analysis would generate a single factor accounting for most of the variance (Podsakoff et al. 2003). An EFA of all 16 indicators generated five distinct factors, and the first extracted factor explained about 28 percent of the variance. Third, a CFA was performed to test a single factor model with all 16 indicators (Kearns and Sabherwal 2007). The model exhibited a poor fit with $\chi^2 = 707.5$ (df = 104), RMSEA = .21, CFI = .56, NFI = .53, and GFI = .54. These diagnostic analyses indicate that common method bias is unlikely to be an issue with our data.

We also performed additional cross-validation tests on a subset of the sample for which objective demographics were available in secondary data source. The firm size and age data provided by respondents had correlations of .91 (n = 88) and .88 (n = 93), respectively, with corresponding objective data. This provides further evidence for the validity of our survey data.

## Hypothesis Tests

Regression analysis was used to test the research hypotheses.[6]

The multi-item measures were transformed into summated scales. As per research practice, firm size, firm age, and IS age were log-transformed because of their wide range of values. To reduce any potential problems of multicollinearity,[7] we mean centered study variables prior to forming the multiplicative product term (Cohen et al. 2003). We also mean centered all control variables (except industry sector) to ensure easy interpretation of the coefficients. Table 9 provides summary statistics, and Table 10 presents the results of hierarchical regression analyses.

As shown in Table 10, the results (Model 2) provide strong support for H1 and H2 as indicated by the significant positive coefficients of IT capability on market capitalizing agility (b = .53, p < .01) and operational adjustment agility (b = .46, p < .01) over and above the effect of IT spending and control variables. Interestingly, IT spending is found to have a signi-

[6]Structural equation modeling was not used due to the relatively small sample size limitation and a concern for statistical power in testing moderating relationships (Goodhue et al. 2007). In performing regression analysis, we generated a summated scale to represent each multi-item construct in the study. A summated scale is a good representative of the original set of items when reliability and validity of the construct have been established (Hair et al. 1998). We used the average score of the indicators to represent each construct because it is easily replicable across studies. As a robustness check, we also generated summated scales from factor scores and performed the analyses; they were highly correlated with the mean value scales and generated almost identical results.

[7]Diagnostics such as *variance inflation factors* (VIF), *conditional indices*, and *decomposition of coefficient variance matrix* were checked. These did not indicate any serious multicollinearity issues (Hair et al. 1998) or violate the (informal) guidelines suggested by Neter et al. (1985, p. 390).

**Table 9. Summary Statistics and Correlations**

| | 1 | 2 | 3 | 3A | 3B | 3C | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. Market capitalizing agility | 1.0 | | | | | | | | | | | |
| 2. Operational adjustment agility | 0.64 | 1.0 | | | | | | | | | | |
| 3. IT capability | 0.40 | 0.36 | 1.0 | | | | | | | | | |
| 3A. IT infrastructure capability | 0.28 | 0.20 | 0.83 | 1.0 | | | | | | | | |
| 3B. IT business spanning capability | 0.31 | 0.32 | 0.90 | 0.65 | 1.0 | | | | | | | |
| 3C. IT proactive stance | 0.45 | 0.42 | 0.88 | 0.61 | 0.69 | 1.0 | | | | | | |
| 4. IT spending[a] | -0.05 | -0.11 | 0.19 | 0.19 | 0.19 | 0.11 | 1.0 | | | | | |
| 5. Firm size[b] | 0.02 | 0.01 | 0.14 | 0.13 | 0.16 | 0.08 | 0.04 | 1.0 | | | | |
| 6. Firm age[b] | -0.13 | -0.02 | 0.03 | -0.02 | 0.06 | 0.02 | -0.14 | 0.23 | 1.0 | | | |
| 7. IS size[c] | 0.02 | 0.07 | 0.23 | 0.20 | 0.27 | 0.13 | 0.26 | 0.18 | 0.18 | 1.0 | | |
| 8. IS age[b] | -0.10 | -0.07 | 0.09 | 0.05 | 0.12 | 0.06 | -0.09 | 0.29 | 0.49 | 0.12 | 1.0 | |
| 9. Industry sector[d] | 0.06 | 0.12 | 0.31 | 0.27 | 0.30 | 0.24 | 0.31 | 0.03 | -0.03 | 0.24 | -0.14 | 1.0 |
| **Mean** | 4.38 | 4.44 | 4.63 | 4.97 | 4.45 | 4.47 | 0.03 | 2.64 | 1.71 | 0.07 | 1.25 | |
| **Std Dev** | 1.17 | 1.18 | 0.99 | 0.92 | 1.16 | 1.25 | 0.03 | 0.37 | 0.28 | 0.11 | 0.25 | |
| **Min** | 1.00 | 2.00 | 2.27 | 2.10 | 1.90 | 1.92 | 0.001 | 2.11 | 0.78 | 0.008 | 0.60 | 0 |
| **Max** | 7.00 | 7.00 | 6.53 | 6.72 | 6.43 | 6.48 | 0.10 | 3.76 | 2.20 | 0.22 | 1.78 | 1 |

[a]IT spending as a ratio of IT budget to annual sales revenue.

[b]The logarithm of number of full-time employees, firm age, and IS age. The range values in original scale are firm size (130–5800 full-time employees).

[c]IS size as a ratio of number of employees in IS department to firm-wide.

[d]A binary variable: 1 for service firms and 0 for manufacturing firms.

**Note:** Significance levels for Pearson Correlation $r \geq 0.148$ ($p < 0.10$); $r \geq 0.176$ ($p < 0.05$); $r \geq 0.232$ ($p < 0.01$)

**Table 10. Results of Hierarchical Regression Analyses of Research Hypotheses**

| | Operational Adjustment Agility | | | Market Capitalizing Agility | | |
|---|---|---|---|---|---|---|
| **Variable** | **Model 1 Controls** | **Model 2 Main Effect** | **Model 3 Full Model** | **Model 1 Controls** | **Model 2 Main Effect** | **Model 3 Full Model** |
| Intercept | 4.31** | 4.39** | 4.37** | 4.33** | 4.45** | 4.45** |
| Industry sector | 0.23[+] | 0.089 | 0.092 | 0.09 | -0.13 | -0.13 |
| Firm size[a] | 0.06 | -0.019 | -0.012 | 0.19 | 0.083 | 0.085 |
| Firm age[a] | 0.003 | -0.014 | -0.025 | -0.21[+] | -0.20* | -0.20* |
| IS age[a] | -0.30 | -0.54* | -0.54* | -0.29 | -0.57* | -0.56* |
| IS size[a] | 0.50 | 0.42 | 0.59 | 0.28 | -0.063 | -0.020 |
| IT spending[a] | | -8.11**[b, c] | -9.69**[b, c] | | -5.42**[b, c] | -5.83**[b, c] |
| IT capability[a] | | 0.46** | 0.47** | | 0.53** | 0.54** |
| IT capability × IT spending | | | 3.56*[b] | | | 0.92[b] |
| $R^2$ | 0.02 | 0.18 | 0.21 | 0.03 | 0.21 | 0.22 |
| F | 0.98 | 7.83** | 7.10** | 1.33 | 9.56** | 8.35** |
| $\Delta R^2$ | | 0.16 | 0.03 | | 0.18 | 0.01 |
| F test of $\Delta R^2$ | | | 4.52* | | | 1.52 |

[+]$p < .10$, *$p < .05$, **$p < .01$. One-tailed tests.

[a]All variables are mean centered for moderation analyses.

[b]One should note that IT spending is operationalized as a ratio of IT budget to annual sales revenue when interpreting the coefficients. The unit of change for IT spending is .01, i.e., 1% change in IT spending in terms of annual sales revenue.

[c]Two-tailed tests are performed for the main effect of IT spending on the two types of agility as directionality of effect not known *a priori*.

ficant negative effect on market capitalizing agility (b = -5.42, $p < .01$) and operational adjustment agility (b = -8.11, $p < .01$).[8] We performed additional analysis to further delineate the relationship among IT spending, IT capability, and the two forms of agility. We regressed IT capability on IT spending, controlling for the effects of IS size and IS age. The results show a significant positive effect of IT spending on IT capability (b = 4.74, $p < .05$) over and above the two control variables. This suggests that higher IT spending leads to superior IT capability, which, in turn, enhances agility. Thus, the negative main effect of IT spending on both forms of agility captures the effect of IT spending on pathways other than IT capability building that potentially reduces agility. This may be indicative of an IT group that is off track and somehow not aligned with organizational objectives and interests. Such an IT group is likely to mismanage their IT investment and direct their IT spending on the wrong things such as, for instance, investing in new hardware, software and networks that serve to mimic competitor peer organizations and are not directly need-based, or additional workspace and/or paid vacations for IT staff that are not performance-related, or disparate technology silos that are not channeled into IT infrastructure capability, or rigid, complicated systems that cannot be easily changed resulting in reduced agility; some evidence of this has been reported recently (Goodhue et al. 2009). The results (Model 3) also show support for H4, namely, that IT capability and IT spending have a significant positive joint effect on operational adjustment agility (b = 3.56, $p < .05$; $\Delta R^2 = .03$, $p < .05$). Note that the main effects of IT capability and IT spending on both forms of agility remain significant after entering the interaction terms (Model 3). Interestingly, these effects are of opposite direction. The significant positive interaction indicates that superior IT capability helps to leverage IT spending to achieve greater operational adjustment agility. However, the interaction between IT capability and IT spending was not found to have a significant effect on market capitalizing agility (b = 0.92, n.s.; $\Delta R^2 = .01$, n.s.), and H3 was not supported. We summarize the results of hypotheses testing in Table 11.

Several relations are also apparent from the tests of control variables in Model 3. IS age is found to have a significant negative impact (b = -.54, $p < .05$) on operational adjustment agility. This finding indicates that firms with an older IS department seem to be less agile in adjusting their internal processes and resources to cope with changes. Similarly, firm age (b = -.20, $p < .05$) and IS age (b = -.56, $p < .05$) are found to have negative effects on market capitalizing agility. This finding suggests that older firms and firms with an older IS department appear to be less agile perhaps in even recognizing and then responding to and capitalizing on changing market or customer needs.

## Discussion

Our study posed two research questions:

(1) Does IT capability enhance or impede agility?
(2) How does IT capability complement other organizational resources, namely, IT spending, to enhance agility?

With regard to the first question, we found that IT capability enhances both types of agility: market capitalizing agility and operational adjustment agility. With regard to the second question, we found significant positive joint effect of IT capability and IT spending on operational adjustment agility but not on market capitalizing agility.

Our study provides initial empirical evidence via a rigorous examination of the link between IT capability and agility. We synthesize and theorize the commonly observed but understudied IT–agility contradiction that IT may *enable* and *impede* agility. This helped us to extend the enabling role of IT to better understand the relationship between IT and agility. By refining the conceptualization and measurement of IT capability and organizational agility, we advance both theory and measurement about essential IT capabilities and their relationship with agility. In a broader sense, such knowledge is fundamental to better understand IT business value because IT capability is a central concept in IT-based value creation, and agility is an expanded IT value metric (Kohli and Grover 2008). The advancement in measurement is in line with the recent call for closer attention to auxiliary theory development in IS research that focuses on theoretical conceptualization and measurement model development (Kim et al. 2010). By exploring the complementarity of IT capability with other organizational resources, namely, IT spending, we also gained some insights into the contradictory effect of IT investment on agility and the critical role of IT capability in directing and translating IT investment to enable agility.

Our findings provide several implications. First, we conceptualize the multidimensional construct (IT capability) as a higher level general construct that captures the commonality among the dimensions. This conceptualization emphasizes the complementarity among the dimensions, that is, the three IT capability dimensions together enhance agility. The theme

[8] All tests on the main effects of IT spending on agility were two-sided tests because we do not hypothesize for a particular direction of the relationship. In order to not distract the focus of the study, the additional regression analysis of IT spending and IT capability was not included in Table 10.

**Table 11. Summary of Hypotheses and Results**

| Hyothesis | Relations | Predicted Sign | Results |
|---|---|---|---|
| H1 | Direct effects: IT capability → Market capitalizing agility | + | Supported |
| H2 | Direct effects: IT capability → Operational adjustment agility | + | Supported |
| H3 | Moderating effect: IT capability × IT spending → Market capitalizing agility | + | Not supported |
| H4 | Moderating effect: IT capability × IT spending → Operational adjustment agility | + | Supported |

of IT capability complementarity underscores the fact that firms need to simultaneously develop at least an adequate competency level in these three dimensions to successfully manage IT and thus realize greater agility. An integrated infrastructure provides the firm a robust, stable, and efficient foundation for agility. The firm can use this platform to build and enhance market intelligence to detect market opportunities and to attend to marketplace and customer concerns. Given that no firm is endowed with unlimited resources, an ability to engage in business–IT strategic thinking that integrates IT and business planning and establishes synergy between IT and line business helps the firm to target scarce and limited IT resources to the right business initiatives and thus enhance agility and realize value. Further, our finding highlights the importance of a proactive IT stance by which firms continuously experiment and explore new technologies as well as exploit their existing competencies to address and create new business opportunities. Together, firms that have built a robust and flexible technological foundation, have established IT–business synergy and partnership, and have taken a proactive IT stance are seen to be more attentive, responsive, and adaptive to market changes. These firms constantly look out for competitive opportunities so that they can add profitable features to their products or services as the market unfolds, share timely customer- or market-focused information with decision makers, and cultivate an entrepreneurial mind set to quickly capitalize on market-related changes and apparent chaos. Likewise, these firms can better position themselves to leverage their IT resources to physically and rapidly cope with radical unanticipated changes and fulfill demands for rapid-response, to scale up or scale down production or operational levels, and to make internal adjustments in responding to market fluctuations or supply disruption. Overall, our findings suggest to organizational managers that they need to pay greater attention to developing their IT capability to successfully sense and seize market opportunities.

An interesting and intriguing finding is that IT spending leads to superior IT capability, which, in turn, provides greater agility. However, when IT spending is not properly channeled into IT capability building, greater IT spending has a negative effect on both types of agility. This finding may suggest that IT capability is critical in realizing greater agility, and focused, wise IT spending is a way to develop superior IT capability when it is correctly managed and directed into nurturing and fostering essential IT capabilities. This is in line with the argument that we should rethink the typical sequential view that IT investment leads to capabilities, which, in turn, leads to business value. Instead, we must first understand the capabilities needed and then identify how to build them with IT so as to realize and maximize value, especially as IT is increasingly embedded in business processes (Kohli and Grover 2008). This finding also seems to underscore and clarify the apparent paradox that huge, impudent IT investment is not necessarily beneficial to a firm's agility in responding to market changes (Weill et al. 2002). This may be a result of the wrong infrastructure or incompatible systems, delayed and rushed implementations, or islands of automation meeting local needs without integration across the enterprise. An alternative explanation may be that large IT spending in the face of changes and uncertainty is likely reactive and reinforces the current underlying patterns and logic, which, in turn, results in active inertia and leads to unintended rigidity in managerial and organizational routines (Gilbert 2006). For instance, more IT spending and reliance on business intelligence tools may reinforce environmental scanning in the current domains, yet they may ignore signals in new domains and, thereby, lead to inaccurate perception of market changes and misdirected decision making.

One other plausible line of thinking suggests that firms, under conditions of low IT capability, may be tempted to channel their IT spending primarily in infrastructure technologies and perhaps become prey to a myopic view that mere platform technology investments would somehow enable them to reap business benefits in the form of agility. Under conditions of high IT capability, managers may become more prudent in properly channeling their IT investment decisions and, perhaps, in avoiding large chunks of investment on technologies per se, especially in the wake of rapid changes and newer generations of technologies. This seems to be consistent with anecdotal evidence that IT-savvy organizations often adopt the prudent principles of "less is more" and "penny wise, pound foolish" in actively and carefully managing and directing their IT budget in changing environments (Ferdows et al. 2004; McAfee 2004). Obviously, a direct inference is that IT capability is beneficial and that IT spending on the *right things* is one way to obtain IT capability. On the contrary, IT spending on the wrong things may be indicative of an IT group that is off track, resulting in decreased agility. Overall, the finding may indicate one resolution to the apparent paradox: merely spending more on IT does not necessarily lead to greater agility but spending it in such a way as to nurture and enhance IT capabilities does.

## Limitations and Future Research

The study has a few limitations and can be extended in the following areas. First, the sample size of 128 is relatively small, besides being confined to the midwestern part of the United States, which limits our ability to generalize the results to a wider population of firms. Thus, this study needs to be replicated in and extended to other contexts.

Second, capability building and realizing agility are typically a firm's long-term goal with associated on-going processes (Sambamurthy et al. 2003). The cross-sectional research design in the current study is limited in addressing process-oriented issues or causal relationships. A longitudinal design would be desirable to further delineate the causal dynamics or endogeneity between IT capability and agility. For example, superior IT capability can enable greater agility, and simultaneously, agile firms may tend to direct more attention toward IT capability development.

Future research should further examine antecedents to IT capability to better understand the process of capability development. For example, intensity of organizational learning is found to be an important antecedent to IT capability building, and various mechanisms have been identified to foster IT business coevolution (Agarwal and Sambamurthy 2002; Bhatt and Grover 2005). In addition, firms may not only enforce formal data and process integration embedded in IT infrastructure but also develop informal integration via active IT–business collaboration and partnership. As noted, IT-savvy organizations such as Zara rely heavily on the decision-making abilities of their people and do not replace their judgment with IT-automated processes. Instead, IT is used to help managers deal with the huge amounts of data and to enable constant exchange of hard data and anecdotal information quickly and easily throughout every part of their supply chain (Ferdows et al. 2004; McAfee 2004). Likewise, the search by firms for new ways to use IT or IT research and development services are industry- or enterprise-specific and dependent on their general research capability in tracking technology trends (Weill et al. 2002). Future research should further explore these pathways to and underlying mechanisms for IT capability and agility across firms or business contexts. Further, there is a clear need to identify and analyze the underlying opposing forces at play (Robey and Boudreau 1999) to better understand the dynamics and contradictions of IT and agility. For example, researchers have begun to study the ambidextrous phenomenon of IT exploitation and exploration in knowledge management and IT-enabled agility (Im and Rai 2008; Lee et al. 2008).

Third, our conceptualization of IT capability as a higher level latent construct captures the commonality shared by its three dimensions. Future research should explore alternative approaches to conceptualizing and modeling the multi-dimensional construct, IT capability. For example, future research could examine profiles of IT capability as well as the dynamics relating to how these profiles may vary across firms and industries or shift over time. Future research could examine IT capability profiles across industries with varying volatility or uncertainty. For example, firms in a relatively stable setting may emphasize IT infrastructure capability over the other two dimensions, while firms in a highly dynamic environment may place more emphasis on proactive IT stance and IT business spanning capability. Future research should also study how IT capability profiles may dynamically evolve over time. For example, during times of economic recession, it may be beneficial to emphasize a proactive IT stance and search for new opportunities for business innovation or transformation. Conversely, in times of hypercompetitive growth market, firms may emphasize IT infrastructure capability and IT business spanning capability for incremental improvements and innovations to realize agility.

Fourth, technology is only one piece of the puzzle in achieving agility from a socio-technical perspective (Bostrom and Heinen 1977). Future research should extend our research and examine how other elements such as culture, structure, process, or people interact/couple with IT in enabling agility. For example, Weill et al. (2002) have suggested that customer base, brand, core competence, infrastructure, and employees' agility to change are an integrated group of resources that is critical to agility. Future research needs to study how a firm could and should develop superior IT capability as an interaction and fusion of technologies, people, structure, and processes (Garud et al. 2006; Weill et al. 2002).

Core capabilities can become core rigidities (Leonard-Barton 1992). It is crucial to understand the importance of capability and capability building so that the firm can make sound decisions about how to assess, exploit, and leverage its current capabilities, or whether and how the firm can develop new capabilities in order to succeed. For example, organizational processes or routines can facilitate the ability of employees who have different levels of skills and knowledge to execute a particular task, yet they can also impede their efforts to perform a different task. The firm must pay attention to the management and development of its talents and evolve human policies and corporate culture to support the very best knowledge workers (McAfee and Brynjolfsson 2008). This may start from identifying and recruiting the right people and providing a necessary learning environment to develop their talents because most capabilities come from learning-by-doing experiences. For instance, Infosys Technologies emphasizes learnability or an individual's ability to derive generic lessons from specific situations and to apply those lessons to unstructured problems as key criterion when recruiting candidates (Garud et al. 2006). Firms can leverage their IS personnel agility for superior IT infrastructure capability and greater agility (Fink and Newmann 2007). In addition, future research should also study the mechanisms in developing routines and structures that facilitate learning and experimentation and enhance capability building. For example, IT governance is important in setting formal and informal relationships and defining mechanisms in formalizing the relationships or providing rules and operating procedures (Weill and Ross 2004).

Fifth, future research should explore the various mechanisms for implementing superior IT capability to achieve agility. For example, firms may go through different pathways to build IT infrastructure capability for agility over time (Prahalad and Krishnan 2002). Likewise, firms can adopt different technology architectures such as enterprise systems, SOA, cloud computing, business process and rule management systems, etc., to implement IT infrastructure capability. For instance, firms could use different mechanisms, such as built-in capabilities, globally consistent integrated data, third party add-on systems, or vendor-provided patches in enterprise systems, to enable business agility (Goodhue et al. 2009), or they could use a more flexible architecture, such as SOA (Mooney and Ganley 2007). In addition, agile systems development[9] is a stream of research that emphasizes using agile methods to achieve agility in system development in response to changing requirements and environments (Abrahamsson et al. 2009; Agerfalk et al. 2009). However, research has also shown that agile methods may not be equally applicable or always beneficial (Conboy 2009; Maruping et al. 2009; McAvoy and Butler 2009). Our findings can shed useful light in a future study examining the appropriate use of agile methods in developing IT infrastructure capability.

Finally, given the somewhat coarse grained measurement of the IT spending variable in this study, future research should examine in greater detail the nature of specific IT resource spending and investments (e.g., skill building, agile development approaches, specific knowledge/ business intelligence applications, technology, etc.), portfolio choices, the underlying processes in making these technology choices, and whether a plan exists to align IT investments to the firm's IT capability-enhancing aspects, business strategy, and market forces. Future research should also explore the use of objective measures in conjunction with the nature of IT investment noted above to better clarify the role of IT investment[10] and its contradictory effects on agility and triangulate the results of the study.

## Conclusions

The role of IT in enhancing agility has been appraised in recent years. A few conceptual works have posited the enabling role, while a few others have also proposed the disabling role of IT on agility. We sought to better understand this commonly observed but understudied IT–agility contradiction. We refined the conceptualization and measurement of IT capability as a latent construct reflected in its three dimensions: IT infrastructure capability, IT business spanning capability, and IT proactive stance. Our results suggested that IT capability enables market capitalizing agility and operational adjustment agility. Our findings also revealed that IT capability is essential to achieve agility and that IT capability may offer a possible resolution to the conundrum of contradictory effect of IT on agility: while more IT spending does not lead to greater agility, spending it in such a way as to enhance and foster IT capabilities does. Firms need to continuously nurture and develop superior firm-wide IT capability to successfully manage and leverage their IT resources to build agile organizations. We hope this study opens up further discussion and advances theory to generate a more holistic, comprehensive understanding about the contradictions and dynamics of IT and agility.

[9]We thank one of the anonymous reviewers for this suggestion.

[10]We thank one of the anonymous reviewers for this suggestion of using objective data.

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## About the Authors

**Ying Lu** is a faculty member at the School of Business, Pfeiffer University. She received her Ph.D. in MIS from the University of Wisconsin-Milwaukee. Her research interests include organizational impact of IT, IT business value, IS strategy, and IT innovation. Her current research focuses on understanding how, when, and why IT creates value to enterprises in fast changing volatile business environments. She also consults on IT management, IT capabilities and agility, IT innovation and competitive advantage, IS strategy and alignment, financial IT, and healthcare IT.

**K. Ramamurthy** is a professor and James R. Mueller Distinguished Scholar in Management Information Systems at the Sheldon B. Lubar School of Business, University of Wisconsin-Milwaukee. He received his Ph.D. in business with a concentration in MIS from the University of Pittsburgh. He has 20 years of industry experience, holding several senior technical and executive positions. He served as an associate editor of *MIS Quarterly* for four years. He has published extensively in many top-tier and very high quality journals including *MIS Quarterly, Journal of Management Information Systems, IEEE Transactions on Software Engineering, Decision Sciences*, and *European Journal of Information Systems* among others. His current research interests include electronic commerce with interorganizational systems/EDI and the Internet; adoption, assimilation, and diffusion of modern IT; data resource management and data warehousing; IT business value; IT outsourcing; decision and knowledge systems for individuals and groups; and TQM including software quality. He has published extensively in major scholarly journals and conference proceedings, and is a charter member of the Association for Information Systems.

# Appendix A

## Measurement Scales

| Construct and Indicator Items | Supporting Research |
|---|---|
| 1. ***IT Infrastructure Capability***[a]<br>Relative to other firms in your industry, please evaluate your organization's IT infrastructure capability in the following areas on a 1-7 scale (1=poorer than most, 7= superior to most).<br>IIC1: Data management services & architectures (e.g., databases, data warehousing, data availability, storage, accessibility, sharing etc. )<br>IIC2: Network communication services (e.g., connectivity, reliability, availability, LAN, WAN, etc. )<br>IIC3: Application portfolio & services (e.g., ERP, ASP, reusable software modules/components, emerging technologies, etc. )<br>IIC4: IT facilities' operations/services (e.g., servers, large-scale processors, performance monitors, etc.)[c] | Bharadwaj et al. 1998<br>Ross et al. 1996<br>Weill et al. 2002 |
| 2. ***IT Business Spanning Capability***[a]<br>Relative to other firms in your industry, please evaluate your organization's IT management capability in responding to the following on a 1 to 7 scale (1 = poorer than most, 7 = superior to most).<br>IBC1: Developing a clear vision regarding how IT contributes to business value<br>IBC2: Integrating business strategic planning and IT planning<br>IBC3: Enabling functional area and general management's ability to understand value of IT investments<br>IBC4: Establishing an effective and flexible IT planning process and developing a robust IT plan.[c] | Bharadwaj et al. 1998<br>Mata et al. 1995 |
| 3. ***IT Proactive Stance***[a]<br>Relative to other firms in your industry, please evaluate your capability in acquiring, assimilating, transforming, and exploiting IT knowledge in the following areas on a 1 to 7 scale (1 = strongly disagree, 7 = strongly agree).<br>IPS1: We constantly keep current with new information technology innovations<br>IPS2: We are capable of and continue to experiment with new IT as necessary<br>IPS3: We have a climate that is supportive of trying out new ways of using IT<br>IPS4: We constantly seek new ways to enhance the effectiveness of IT use | Fichman 2004<br>Weill et al. 2002 |
| 4. ***Operational Adjustment Agility***[b]<br>Relative to your competitors, please indicate on a 1 to 7 scale (1 = not at all true; 7 = very true) how well your organization performs or is positioned to perform the following activities.<br>OA1: We fulfill demands for rapid-response, special requests of our customers whenever such demands arise; our customers have confidence in our ability.<br>OA2: We can quickly scale up or scale down our production/service levels to support fluctuations in demand from the market.<br>OA3: Whenever there is a disruption in supply from our suppliers we can quickly make necessary alternative arrangements and internal adjustments. | Goldman et al. 1995<br>Tsourveloudis et al. 1999 |
| 5. ***Market Capitalizing Agility***[b]<br>MA1: We are quick to make and implement appropriate decisions in the face of market/customer-changes.<br>MA2: We constantly look for ways to reinvent/reengineer our organization to better serve our market place.<br>MA3: We treat market-related changes and apparent chaos as opportunities to capitalize quickly. | Goldman et al. 1995<br>Tsourveloudis et al. 1999 |
| 6. ***Other Variables***<br>***Organizational context***:[b]<br>Approximately how many years has your company been in business? _________Years<br>Please indicate the approximate number of Fulltime Equivalent Employees (FTE): ________<br>***IS context and IS decision:***[a]<br>Number of years the IS function in your organization been formally in place: _________Years<br>Please indicate the approximate number of Full-time Equivalent Employees (FTE) in IS function: ________<br>On average, what is the approximate ratio of the IT budget to your firm's annual sales? _______% | |

[a]Marked variables responded by IS executives.
[b]Marked variables responded by business executives.
[c]Marked items were dropped out in various stages of joint factor analyses to purify the measures.