The current unpublished reference for this work is as follows:

> Paul Benjamin Lowry and David W. Wilson (2016). "Creating agile organizations through IT: The influence of internal IT service perceptions on IT service quality and IT agility," ***Journal of Strategic Information Systems*** (***JSIS***) (accepted 15-May-2016).

If you have any questions, would like a copy of the final version of the article, or would like copies of other articles we've published, please contact any of us directly, as follows:

- **Paul Benjamin Lowry:**
  - Email: Paul.Lowry.PhD@gmail.com
  - Website: http://www.cb.cityu.edu.hk/staff/pblowry
  - System to request Paul's articles: https://seanacademic.qualtrics.com/SE/?SID=SV_7WCaP0V7FA0GWWx
- **David W. Wilson**
  - davidwilsonphd@gmail.com
  - Website: https://ou.edu/content/price/mis/people/davidwilson.html

Creating Agile Organizations through IT: The Influence of Internal IT Service Perceptions on IT Service Quality and IT Agility

ABSTRACT

Businesses continue to make large investments in information technology (IT) resources, and it is crucial for them to implement effective management strategies to better leverage these resources. Modern organizations are increasingly dependent on IT to remain agile and competitive in a rapidly changing market, but there remain gaps in understanding how IT resources support IT agility. Recent IT strategy research highlights the role of IT service climate in driving positive IT service quality, and we extend this work in the form of a theoretical model that relates an organization's internal IT service perceptions to IT agility. We hypothesize a partially mediated relationship wherein internal IT service perceptions positively affects IT agility, both directly and indirectly, through facilitating positive IT service quality, highlighting the crucial role of IT personnel and their service orientation in provisioning services to enable IT agility. We test our model with an unmatched survey of 400 full-time IT managers and professionals and find strong support for our hypotheses. Our results have important implications for future research and practice, as the IT community continues to seek to adopt effective strategies for managing and leveraging its expensive resources.

KEYWORDS

IT service climate, internal IT service perceptions, IT service quality, IT agility, construct distinctiveness, IT strategy

INTRODUCTION

Managing the information technology (IT) functional unit in most organizations is a difficult task. Whereas a large amount of research focuses on understanding organizational issues—such as IT strategy and innovation (Arvidsson, Holmström, & Lyytinen, 2014; Chatterjee, Moody, Lowry, Chakraborty, & Hardin, 2015; Chen, Mocker, Preston, & Teubner, 2010; Henfridsson & Lind, 2014), IT outsourcing and offshoring (Abbott, Zheng, Du, & Willcocks, 2013; Mani, Barua, & Whinston, 2010; Mathew & Chen, 2013; Thouin, Hoffman, & Ford, 2009), crowdsourcing (Majchrzak & Malhotra, 2013), IT structure (Silva & Hirschheim, 2007), IT alignment (Baker & Niederman, 2014; Luftman & Ben-Zvi, 2010), and IS portfolio management (Daniel, Ward, & Franken, 2014)—significant gaps remain in understanding how organization can effectively manage and leverage IT resources. Among these gaps is an understanding of how organizational context constructs, such as information systems culture or climate, can influence the effective management of the IT function (Jia & Reich, 2013; Walsh, 2014), as well as other outcome variables that are dependent on IT resources. In this manuscript, our focus is on predicting IT agility.

IT agility is "the ability to respond operationally and strategically to changes in the external environment through IT" (Fink & Neumann, 2007, p. 444). Organizations look to IT departments to provide service for internal and external customers in an increasingly complex environment (Byrd, 2001). Woolley & Hobbs (2008) note that as organizations leverage an IT department's agility rather than investing in strategic IT investments, the IT department more fully determines how effectively the organizations adapt to changing market conditions (Agarwal & Sambamurthy, 2002). As modern organizations' agility increasingly depends on their IT departments (Galliers, 2006; Peppard & Ward, 2004), understanding which key factors related to

how these departments perform their work and a business's general IT climate contribute to IT agility becomes increasingly important. Accordingly, we focus on explaining two promising constructs that will likely be associated with increased organizational IT agility: internal perceptions of an IT department's service climate and its IT service quality.

IT service climate, a relatively new concept in the IT literature, is a promising construct that can be operationalized to better understand the climate of the IT function. It is defined as "IT professionals' shared perceptions of the practices and behaviors in their workplace that support the provision of IT service to business customers" (Jia & Reich, 2013, p. 53). Creating a positive IT service climate within an IT department is a practical and measurable objective for IT executives and dramatically influences the quality of services an IT department provides (Jia & Reich, 2013).

Although a great deal of prior research examines the relationship between an organization's IT resources and its IT agility (e.g. Fink & Neumann, 2007; Kassim & Zain, 2004; Sambamurthy, Anandhi, & Varun, 2003), no studies to date research IT service climate as a predictor of IT agility. Understanding the additional factors that influence IT agility can provide academics and practitioners a larger toolset with which to address agility issues and increase an organization's nimbleness. A positive IT service climate may provide the organizational context necessary to create an effective and aligned IT department and enable more agile, flexible responses to changing market conditions, in part because IT service climate is linked to excellent *IT service quality* (performance of the level of IT customer service provided to an organization) (Jia & Reich, 2008; Jia, Reich, & Pearson, 2008). The possible link between IT service climate and IT agility and the interrelationships among these constructs and IT service quality have not been empirically evaluated using internal IT perceptions, and thus represent a

compelling opportunity for additional insight into this important area of research. We capitalize on this opportunity by addressing the following research question: "How does an organization's internal IT service perceptions influence its IT agility?"

To address this research question, we first review the related literature on IT service climate and IT service quality and we summarize prior work on the relationship between IT resources and IT agility. We then develop a theoretical model that encompasses internal IT service perceptions, IT service quality, and IT agility. We report the results of an empirical study that tests our theoretical model, and we conclude by discussing the implications of our findings for research and practice, along with this study's limitations and suggestions for future research.

CONCEPTUAL BACKGROUND

Before extending the IT service climate literature to incorporate the IT agility construct, we first review the relevant literature. This review serves to both inform the reader about the relatively new IT service climate concept and to distinguish it from the concepts of IT service quality and IT agility. Table 1 summarizes their conceptual differences.

IT Service Climate

Building on extensive climate work in other organizational domains (Schneider, White, & Paul, 1998), Jia & Reich (2013, p. 53) define *IT service climate* as "IT professionals' shared perceptions of the practices and behaviors in their workplace that support the provision of IT service to business customers." An organization's IT service climate is composed of three sub-constructs (Jia & Reich, 2008, 2013; Jia et al., 2008): IT service leadership, IT service evaluation, and IT service vision. *IT service leadership* refers to perceptions of "the extent to which IT managers take actions to guide the delivery of service" (Jia & Reich, 2008, p. 5). IT service leadership employs goal-setting theory, expectancy theory, and the path-goal theory of

Table 1. Conceptual Overview of IT Service Climate, IT Service Quality, and IT Agility

Element	IT service climate	IT service quality	IT agility
Traditional definition	IT employees' shared perceptions of the behaviors that are rewarded with respect to IT customer service	The perceived performance of the level of IT customer service provided to an organization	The ability to respond operationally and strategically to changes in the external environment through IT
Primary IS citations	(Jia & Reich, 2013; Jia et al., 2008)	(van Dyke, Kappelman, & Prybutok, 1997; Van Dyke, Prybutok, & Kappelman, 1999)	(Fink & Neumann, 2007)
Secondary supporting citations	(Schneider, 1990; Schneider & Bowen, 1985; Schneider et al., 1998)	(Babakus & Boller, 1992; Boulding, Kalra, Staelin, & Zeithaml, 1993; Cronin & Taylor, 1992; Lee & Kettinger, 1996; Parasuraman, Zeithaml, & Berry, 1994)	(Eardley, Avison, & Powell, 1997; Sambamurthy et al., 2003; Weill, Subramani, & Broadbent, 2002; Weill & Vitale, 2002)
Sub-constructs	***Leadership*** (the degree to which IT managers take actions to guide the delivery of IT customer service) ***Evaluation*** (the degree to which IT employee rewards and incentives are linked to service performance) ***Vision*** (the degree to which meeting client needs, demonstrating flexibility, and establishing communication are emphasized)	***Tangibles*** (the physical appearance of IT facilities, equipment, personnel, and materials) ***Reliability*** (the ability of IT personnel to perform IT services accurately and dependably) ***Responsiveness*** (IT employee willingness to help customers and provide prompt service) ***Assurance*** (IT employee courtesy and ability to engender trust and confidence) ***Empathy*** (IT employee ability to provide caring and custom attention to customers)	***System agility*** (the ability of IT departments to accommodate change in information systems through system development, implementation, modification, and maintenance) ***Information agility*** (the ability of IT departments to accommodate change in the way organizational users access and use information resources) ***Strategic agility*** (the ability of IT departments to respond efficiently and effectively to emerging market opportunities by taking advantage of existing IT capabilities)
Unit of analysis	Individual and group	Individual and group	Individual, group, and organization
Conceptual point of view	Internal to the organization; heavy focus on IT service conditions	Internal to the organization; heavy focus on performance of IT services to the organization	Internal to the organization; focus on the ability to respond to external operational and strategic conditions that matter to the organization

leadership to explain the influence of effective goal setting, coordination, and planning by IT managers (Abdel-Hamid, Sengupta, & Swett, 1999; Boehm, 1981) and represents managerial efforts to specify IT service-related behaviors and outcomes.

Closely related to service leadership, *IT service evaluation* is employee perception of "the extent to which the evaluation of IT professionals is linked with service performance" (Jia & Reich, 2008, p. 5). This dimension emphasizes the importance of recognizing employee service achievements. Reward systems do not always align with what managers emphasize. For example, IT managers could emphasize client service in their verbal communication while rewarding technical skills (Jia & Reich, 2008; Jia et al., 2008). In other words, if customer service achievements are not rewarded, they might not be a priority for employees; thus, an important factor in promoting a favorable IT service climate to focus on service outcomes in the evaluation structure.

IT service vision refers to employee perception of "the extent to which meeting client needs, demonstrating flexibility, and establishing communication are emphasized" (Jia & Reich, 2008, p. 5). This construct includes not only focusing on the customer but also "becoming strategic partners and providers of value-added service" (Jia et al., 2008, p. 303). Jia et al. (2008) note that an IT department focused on serving business needs will likely emphasize customer service and align its objectives and priorities with those of the organization to which the department belongs. The authors suggest that IT departments with other dominant orientations (e.g., implementing new technologies) are less likely to produce quality service. Jia et al. posit that when IT personnel envision their role as serving the organization's needs, the personnel are more likely to provide quality service, respond adaptively to customer requests, and align their goals with organizational objectives.

In summary, the IT service climate construct, a relatively recent entrant to the IS literature, has strong theoretical roots in the organizational service climate. Climate theories in general prove valuable in better understanding important organizational IT issues. Three sub-constructs—IT service leadership, IT service evaluation, and IT service vision—comprise three key features of the service climate within an IT service group. Because the IT service climate construct was originally derived as a key predictor of IT service quality (Jia & Reich, 2013; Jia et al., 2008), we review this stream of literature next.

IT Service Quality

IT service climate springs from the organizational service climate literature (Schneider et al., 1998) and measures employee perception of the types of behaviors that are rewarded. In contrast, IT service quality builds on the service quality research in the marketing literature (Parasuraman, Zeithaml, & Berry, 1988) and examines how effectively services are rendered. IT service quality is defined as the degree to which the IT department provides service to customers that meets customer expectations (Zeithaml, 1988). Often, the customers of the IT department are the organization's internal users of IT and not its customers. IT service quality is used with substantial predictive validity in a variety of contexts to measure the quality of service IT departments provide to business users (e.g., Benlian, 2013; Gorla & Somers, 2014; Gorla, Somers, & Wong, 2010; Jiang, Klein, & Carr, 2002; Kettinger & Lee, 1994, 2005; Tan, Benbasat, & Cenfetelli, 2013; Watson, Pitt, & Kavan, 1998; Xu, Benbasat, & Cenfetelli, 2013). IT service quality is associated with greater user satisfaction (e.g., Benlian, 2013; Benlian, Koufaris, & Hess, 2012; Chou & Chiang, 2013; Sun, Fang, Lim, & Straub), IT adoption (e.g., Xu et al., 2013), and continued use of IT (e.g., Akter, Ray, & D'Ambra, 2011; Benlian et al.; Petter, DeLone, & McLean, 2008), to name a few.

However, there are two conceptualizations of service quality in the literature that partially diverge from each other, both conceptually and operationally (Cronin & Taylor, 1994; Erdil & Yildiz, 2011; Parasuraman et al., 1988, 1994). A subset of the literature defines service quality in terms of the gap between actual service and customer expectations (Parasuraman et al., 1988, 1994) and measures this gap using an instrument called SERVQUAL. A different subset argues that service quality is simply the perceived performance and that expectations are irrelevant (Cronin & Taylor, 1994; Erdil & Yildiz, 2011). This second set of research uses a measurement instrument called SERVPERF to distinguish this conceptual and measurement difference (Cronin & Taylor, 1992). Notably, Jia & Reich (2013) embrace the idea of gap assessments of expectations and performance from Parasuraman et al. (1988, 1994), thus measuring it using the SERVQUAL instrument from Pitt, Watson, & Kavan (1995). Hence, they define IT service quality as the degree to which the IT department provides service to customers that meets customer expectations (Jia & Reich, 2013; Zeithaml, 1988).

However, following our external review of the service quality literature, we were persuaded to adopt SERVPERF, which conceptualizes service quality by focusing solely on performance. Indeed, many IS and marketing researchers find stronger predictive validity using the SERVPERF instrument, which focuses only on perceived service quality (Babakus & Boller, 1992; Boulding et al., 1993; Cronin & Taylor, 1992; Lee & Kettinger, 1996; Parasuraman et al., 1994; van Dyke et al., 1997; Van Dyke et al., 1999). In fact, even some of the original creators of the SERVQUAL instrument find that only performance perceptions matter in predicting behaviors, not the gap with expectations (Boulding et al., 1993). These findings have also been confirmed more recently (Erdil & Yildiz, 2011). An expansive meta-analysis shows that both approaches have similar predictive validity but the SERVQUAL approach requires more

contextualization and adaptation for successful use than does SERVPERF (François, Fernando, & Jay, 2007).

Considering the overall evidence, we thus chose the more concise performance conceptualization and measurement of IT service quality. Accordingly, we define IT service quality as the perceived performance of the level of IT customer service provided to an organization. We then measure it using the performance dimension of IT service quality from Watson et al. (1998), ignoring the expectations dimension. We also embraced the five most common dimensions of IT service quality: tangibles, reliability, responsiveness, assurance, and empathy. *Tangibles* refer to the appearance of facilities, equipment, personnel, and materials. *Reliability* suggests the ability to perform a service accurately and dependably. *Responsiveness* represents a willingness to help customers and provide prompt service. *Assurance* refers to employee courtesy and their ability to engender trust and confidence. Finally, *empathy* is defined as the ability to provide caring, individualized attention to customers.

IT Agility

IT capabilities have long been seen as important resources that facilitate organizational agility, and a rich literature investigates this relationship. Organizations that wish to remain agile must have information systems that are structured to allow for future, rapid change (Allen & Boynton, 1991). Sambamurthy and colleagues (Chakravarty, Grewal, & Sambamurthy, 2013; Overby, Bharadwaj, & Sambamurthy, 2006; Sambamurthy et al., 2003; Sambamurthy, Wei, Lim, & Lee, 2007) argue that organizational agility and performance are heavily influenced by IT capabilities. The IT strategy literature suggests that IT resources should be designed to support organizational flexibility (Eardley et al., 1997; Weill et al., 2002; Weill & Vitale, 2002), and these flexible IT resources can enhance the effects of business–IT alignment on

organizational agility (Tallon & Pinsonneault, 2011). Although a comprehensive review of the relationship between IT resources and organizational agility is beyond the scope of this paper, we summarize by stating that prior literature repeatedly argues for a relationship between IT resources and organizational agility. Fink & Neumann (2007) define the *IT-dependent organizational agility* construct (which we shorten to *IT agility*) as "the ability to respond operationally and strategically to changes in the external environment through IT" (p. 444). Their model positions IT agility as a second-order construct comprised of three sub-constructs: (1) IT-dependent system agility, (2) IT-dependent information agility, and (3) IT-dependent strategic agility.

IT-dependent system agility refers to "the ability to accommodate change in information systems through activities of system development, implementation, modification, and maintenance" (p. 442). An organization with this kind of IT agility achieves system modifications efficiently, allowing the organization to respond more effectively to changing market opportunities (Fink & Neumann, 2007). IT-dependent information agility is "the ability to accommodate change in the way organizational users access and use information resources" (p. 442). Organizations with high IT agility are able to disseminate information quickly and effectively to where it is most needed. *IT-dependent strategic agility* refers to the "ability to respond efficiently and effectively to emerging market opportunities by taking advantage of existing IT capabilities" (p. 442). A more capable IT function allows an organization to respond more effectively to changing market conditions and opportunities. If IT projects, and changes to those projects, are executed quickly and at a low cost, then an organization can effectively adapt to market demands.

Although much is written about the relationship between IT capabilities and

organizational agility, relatively little can be found on other antecedents to IT-dependent organizational agility. A large majority of prior work frames such antecedents at a high conceptual level (Piccoli & Ives, 2005), theorizing more generally about IT infrastructure (Fink & Neumann, 2007; Weill & Vitale, 2002) or IT competence (Chakravarty et al., 2013; Sambamurthy et al., 2003). Some studies examine capabilities more granularly, examining both IT assets (such as network infrastructure, information repositories, or other computing assets) and the various IT capabilities of IT personnel (including technical skills, management skills, and interpersonal skills) (see Piccoli & Ives, 2005 for a review). Even with these more granular approaches, however, an exclusive focus on these IT infrastructure or capabilities is a consistent theme in the IT agility literature.

However, there are exceptions to this trend. Several studies examine IT assimilation or adoption as an antecedent to organizational agility (Chen & Siau, 2012; Kharabe, Lyytinen, & Grover, 2013; Kharabe & Lyytinen, 2012; Zain, Rose, Adbullah, & Masrom, 2005). Other work explores external integration (i.e., partnerships with external organizations such as suppliers) as a facilitator of organizational agility (Cai, Liu, Huang, Liang, & Shen, 2013; Nazir & Pinsonneault, 2012). Other researchers follow a more strategic view and argue that business–IT alignment drives organizational agility (e.g., Tallon & Pinsonneault, 2011). In addition to IT capabilities, distinct knowledge capabilities are sometimes positioned as antecedents to organizational agility (Cai et al., 2013; Mao, Liu, & Zhang, 2013).

Although the antecedents in all of this prior work are certainly related to IT capabilities, they are studied as distinct concepts in conjunction with IT infrastructure or capabilities. Clearly, with an issue as complex as organizational agility, there is room for additional antecedents to help theorists and businesses to increase the potential for agility in today's turbulent markets. In

this paper, we add IT service climate to this relatively small list of antecedents of IT-dependent organizational agility, given its promise as an alternative frame of reference for understanding organizational IT issues (Jia & Reich, 2008, 2011, 2013; Jia et al., 2008). At least one prior study (Cai et al., 2013) studies organizational agility in the context of organizational climate. This prior work differs from ours, however, because we focus explicitly on IT service climate whereas Cai et al. examine climate more broadly in terms of affiliation, fairness, and innovation. Further, Cai et al. position organizational climate as a moderator that qualifies the relationship between IT capabilities and organizational agility. In contrast, we propose IT service climate as a direct predictor of agility, partially mediated by IT service quality.

To summarize, IT capabilities are shown to enable organizational agility (Sambamurthy et al., 2003). Fink & Neumann (2007) explicitly model three related but distinct sub-constructs of IT agility—IT-dependent system agility, IT-dependent information agility, and IT-dependent strategic agility—and provide empirical support for the influence of IT infrastructure capabilities in enabling these drivers of organizational agility. In the next section, we propose that internal IT service perceptions (a non-matched reconceptualization of IT service climate) is related to IT agility, both as a direct driver and as an indirect influence, mediated by the IT service quality that is supported by a positive service environment.

THEORETICAL MODEL AND HYPOTHESES

In this section, we operationalize the underlying theory and constructs into testable hypotheses. Recent work clearly demonstrates the contribution of IT service climate construct to the IT service quality literature (Jia & Reich, 2013; Jia et al., 2008). Using this prior work as our foundation, we expand these relationships to include a key downstream outcome of internal IT service perceptions and service quality—IT agility. Fig. 1 summarizes our proposed model,

which argues that a favorable IT service environment facilitates a more nimble organization, both directly and indirectly, through its impact on IT service quality.

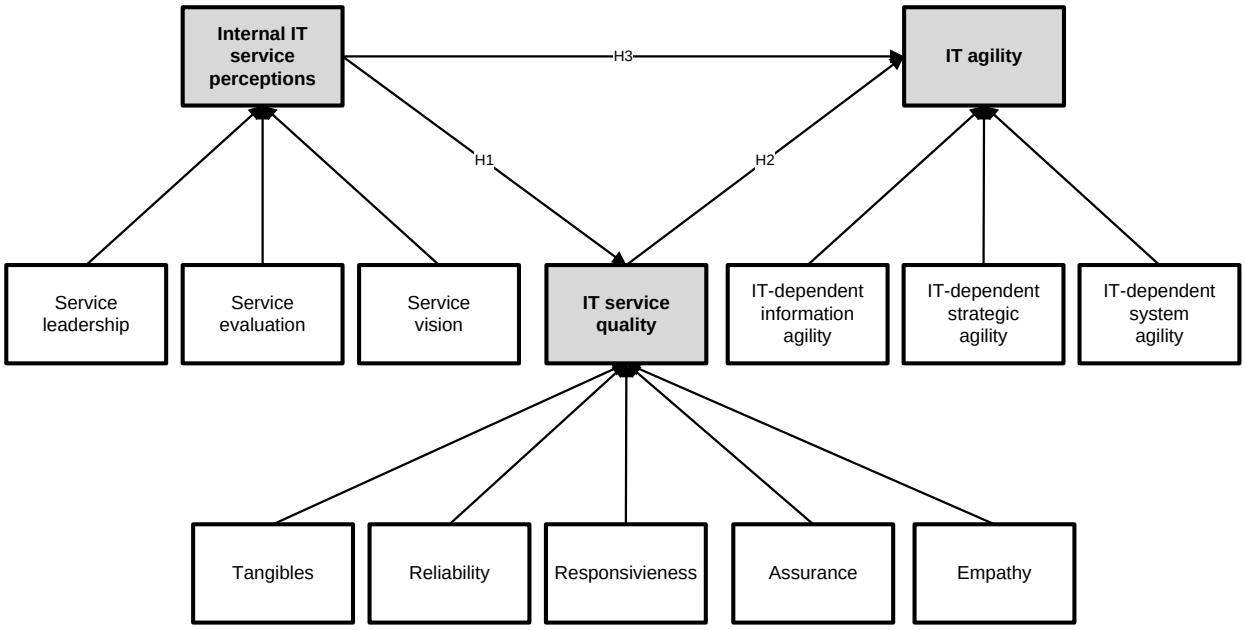

Fig. 1. Our Operationalized Research Model
Note: highlighted constructs are the second-order constructs that are core to our model.

However, in doing so, we explain our important departure from the IT service climate literature, which focuses on using *shared* internal IT perceptions by matching three or more IT employees in the same department to achieve the IT service climate measures. Jia & Reich (2013) do so using four organizations, one of which was a government organization. By contrast, we chose to broaden our data collection to be more generalizable across many for-profit organizations, with anonymous responses of unmatched IT informants from single organizations. We specifically focus on individual perceptions from the IT department. Acknowledging this lack of shared responses and to avoid theoretical and measurement confusion, we name our construct, *internal IT service perceptions*.

Internal IT Service Perceptions and IT Service Quality

The theoretical models proposed by Jia et al. (2008) and Jia & Reich (2013) include both the antecedents and outcomes of IT service climate, whereas we focus exclusively on the downstream effects of a favorable IT service environment (as perceived by individual IT informants), and we add richness to the IT service nomology by investigating IT agility as an outcome of a positive service environment.

The more general service climate literature repeatedly finds that a positive service climate facilitates higher quality service (Schneider, 1990; Schneider, Gunnarson, & Niles-Jolly, 1994; Schneider et al., 1998). An organization's climate, which is largely determined by management policies and behaviors (Schneider & White, 2004), can meaningfully influence work attitudes (Carr, Schmidt, Ford, & DeShon, 2003), employee commitment (Parker et al., 2003), and motivation (Kopelman, Brief, & Guzzo, 1990). By positively influencing these and other employee attitudes and beliefs, a service climate can have a positive impact on job performance (Lawler, Hall, & Oldham, 1974; Parker et al., 2003), which ultimately leads to increased customer satisfaction with the quality of service provided (Schneider, 1990; Schneider et al., 1998).

Within the context of IT services, IT service climate has been validated as an influential predictor of IT service quality (Jia & Reich, 2013). Jia et al. (2008) suggest that "a focus on serving business clients and communication leads to shorter development cycle time, increased ability to accommodate changes in systems projects, and better project outcomes" (p. 312). Positive IT service climate also facilitates IT innovation (Watts & Henderson, 2006), developer–user relations (Ein-Dor & Segev, 1982), and IT employee creativity (Couger, Higgins, & McIntyre, 1993), among other things. This link between IT service climate and IT service quality

may even be stronger than the link between service climate and service quality in other domains, because IT employees' customers are typically internal business units within the same company, providing more frequent and repeated opportunities for the IT service climate to impact service quality (Jia et al., 2008).

As noted, an IT service climate is comprised of IT service leadership, IT service evaluation, and IT service vision (Jia & Reich, 2013; Jia et al., 2008), and this conceptualization has been empirically validated to predict IT service quality (Jia & Reich, 2013). In short, IT service climate represents organizational support for delivering favorable IT customer service, and high levels of IT service quality are expected to exist in an organization with a favorable IT service climate. We essentially replicate this relationship from Jia & Reich (2008, 2013) but use single-company informants as our respondents, focusing on IT's knowledge of their services; thus, we predict the following:

H1. A positive relationship exists between internal IT service perceptions and IT service quality.

To extend the prior IT service quality literature, we also predict a positive relationship between IT service quality and IT agility. IT agility has been studied as an outcome of business–IT alignment (e.g., Duncan, 1995; Eardley et al., 1997; Tallon & Pinsonneault, 2011), enumerated among the benefits of successful IT projects (e.g., Broadbent, Weill, Clair, & Kearney, 1999; Chang & King, 2005; Mirani & Lederer, 1998), and examined in the context of IT as a business resource (e.g., Bharadwaj, 2000; Byrd, 2001). IT agility is a key mediator through which the value of effective IT resources is realized in strategic organizational outcomes (Gallagher & Worrell, 2008; Tiwana & Konsynski, 2010). For example, some prior research highlights IT competence (Sambamurthy et al., 2003), IT capability (Bharadwaj, 2000), and IT

infrastructure (Duncan, 1995; Fink & Neumann, 2007) as antecedents of IT agility. This work clearly shows that the IT resources available within an organization allow the organization to be more nimble and adapt to changes in the competitive market.

Although none of these prior studies directly predict a relationship between IT service quality and IT agility, we argue that this relationship is implicitly supported. Most convincingly, Fink & Neumann (2007) demonstrate that IT personnel capabilities (i.e., business capabilities, behavioral capabilities, and technical capabilities) are required to provide the infrastructure capabilities that facilitate IT agility. Their findings provide evidence that IT employees must develop not only deep IT technical skills but also IT business capabilities, such as an understanding of their customers; horizontal business skills; collaboration skills; continual, attentive interaction with customers; and an understanding of business strategy. Notably, these ideas are embedded throughout the conceptualization and measurement of IT service quality (Watson et al., 1998). Likewise, Gallagher & Worrell (2008) strongly emphasize the need to standardize and refine service offerings before IT agility can achieved. Hence, they argue that traditional, haphazard decentralized approaches to service offerings will suffer from limitations and not lead to IT agility (Gallagher & Worrell, 2008). Consequently, we argue that when an IT organization has high-quality service offerings (i.e., IT service quality), they will be more able to adapt to rapidly changing demands (thus supporting IT agility).

Accordingly, we propose that IT service quality is one facet of an organization's IT resources that also facilitates a more agile organization. This implies a broader view of IT resources, beyond the physical hardware and software components for which IT personnel provision services to meet business needs and support agility (Fink & Neumann, 2007; McKay & Brockway, 1989). That is, IT agility is derived from both employee capabilities and the IT

infrastructure itself, and IT agility cannot be fully realized unless an IT organization provides effective, quality services. Working in conjunction with strategic investments in the IT infrastructure, the IT department can nimbly adapt to customer needs through IT agility. As a measure of the quality of IT-related services provided by IT personnel, we argue that IT service quality perceptions should act as an effective proxy in determining the effectiveness of the IT functions in supporting agile business processes. If an organization has excellent IT personnel who consistently meet or exceed the service expectations of their business partners, these IT employees constitute a major asset to the organization that is reflected in IT service quality. The organization, in turn, is more able to derive IT-agility-related benefits from these IT resources, much in the same way that similar benefits are derived from a properly implemented ERP system (e.g., Gunasekaran, 1999; Mondragon, Lyons, & Kehoe, 2004).

Conversely, if IT service quality is low—indicating that IT personnel are not adequately meeting the needs and expectations of their business partners—the organization's ability to innovate and respond to changing market conditions will be hindered. In short, we propose that IT service quality will have an impact on an organization's ability to innovate and respond to changing market conditions. Excellent service quality should therefore enhance an organization's IT agility.

H2. A positive relationship exists between IT service quality and IT agility.

Internal IT Service Perceptions and IT Agility

We further propose an indirect relationship between internal IT service perceptions and IT agility. Jia et al. (2008) report from qualitative interviews that a favorable IT service climate may promote shorter development cycles and greater ability to accommodate change. The IT agility literature convincingly shows that effective IT resources enable adaptive responses to

changing market conditions (Allen & Boynton, 1991; Eardley et al., 1997; Fink & Neumann, 2007; Sambamurthy et al., 2003). Importantly, many IT-agility-enabling IT capabilities are common among organizations with attributes of a positive IT service climate. Positive, synergistic interactions between the IT department and the broader organization influence the ability to introduce IT innovations (Fink & Neumann, 2007; Lind & Zmud, 1991; Swanson, 1994). IT personnel who communicate well and frequently generate mutual understanding with business units (Bassellier & Benbasat, 2004) and facilitate flexible IT infrastructures (Byrd, 2001). IT units whose leaders emphasize and reinforce customer focus and service provide competitive advantages to organizations trying to respond to change (Rockart, Earl, & Ross, 1996; Ross, Beath, & Goodhue, 1996). When this customer orientation is aligned with the broader organization, the organization as a whole can more quickly and effectively respond to changing market conditions (Sambamurthy et al., 2003).

We infer from these prior findings that the internal IT service perceptions of an organization should influence the degree to which that organization's IT resources enable IT agility. Although we posit they are related, we argue that a favorable IT service environment alone cannot improve IT agility. Whereas organizational mechanisms might be in place to support the provision of favorable customer service, if the IT services provided do not fulfill customer needs, it is less likely that IT agility will be realized. When a favorable service climate facilitates high levels of service quality (i.e., the ability to meet customer service needs), we expect IT agility to be one inevitable result. A favorable IT service environment will therefore be both directly and indirectly related to IT agility, partially mediated by the effect of IT service quality.

H3. The relationship between internal IT service perceptions and IT agility is partially

mediated by IT service quality.

METHODOLOGY

Our study targeted IT employees (including employees, managers, and executives) from an online research panel via Amazon Mechanical Turk™, representing professional respondents throughout the United States. Again, this was an unmatched, single-informant study targeting a large number of organizations. Such online panels can provide access to high-quality online data from working professionals (Bennett & Robinson, 2000) and yield highly generalizable results (Barchard & Williams, 2008; Birnbaum, 2004). Online panels are used frequently in behavioral research (e.g., Barchard & Williams, 2008; Bennett & Robinson, 2000; Birnbaum, 2004), and they are starting to be used more frequently in IT research (e.g., Kim & Son, 2009; Lowry & Moody, 2015; Lowry, Moody, Galletta, & Vance, 2013; Lowry, Posey, Bennett, & Roberts, 2015; Posey, Roberts, Lowry, Bennett, & Courtney, 2013). Using a third party, we could guarantee respondent anonymity, an important factor in soliciting candid responses when dealing with sensitive workplace topics (Bennett & Robinson, 2000).

Amazon Mechanical Turk is an online market for crowdsourcing work tasks in which one can post so-called human intelligence tasks that are self-selected and solved by people all over the world (Schulze, Krug, & Schader, 2012). Studies in different research areas show that the experimental results from participants recruited on Amazon Mechanical Turk are comparable with those of lab experiments or online experiments with student participants, while being comparatively fast and inexpensive (Horton, Rand, & Zeckhauser, 2011; Mason & Suri, 2012; Paolacci, Chandler, & Ipeirotis, 2010). These studies also show that Amazon Mechanical Turk's subjects' demographics are more diverse than traditional subjects (e.g., students), and its relatively low pay does not produce results that are substandard to studies offering much higher

compensation. Hence, Amazon Mechanical Turk leverages the many benefits of online market research panels, such as increased generalizability, better random sampling from target populations, increased distance between researchers and subjects, and increased actual and perceived anonymity (e.g., Lowry et al., 2013; Lowry et al., 2015; Posey et al., 2013) but without the delays and higher expenses associated with market panels.

The corresponding institutional review board approved the study, and all participants gave their informed consent to participate. We followed classic procedures for preventing mono-method bias a priori, such as using established scales, randomizing the appearance of questions, and using different scaling for some measures (Podsakoff, MacKenzie, Lee, & Podsakoff, 2003). We also followed some additional guidelines for preventing common-method bias and improving data quality in online panel studies; using the guidelines established in Lowry et al. (2013) and Lowry et al. (2015), we did the following: (1) randomizing the order of questions, (2) providing warnings that several of the questions were unrelated to each other and to pay extra careful attention, (3) breaking up the survey so that it appeared in multiple easy-to-read pages as opposed to long pages, (4) providing attention traps in which they were randomly required to answer in a specific way on certain questions to discover cheating or rushing, (5) carefully recording the time spent on the survey sections to discover any subjects who were not seriously engaged in the survey, (6) screening based on their IP addresses, language, and geographic locations, (7) preventing "ballot stuffing" and (8) having them qualitatively describe the nature of their IT responsibilities along with their title and number of people managed, so that we could further ascertain the degree to which they were indeed IT employees, managers, and executives.

Participants

The sample consisted of 400 individual informants from different organizations who

were full-time working IT professionals, managers, or executives who were at least 25 years old. Of the respondents, 59.3% were senior managers or executives and 40.7% were IT employees without management responsibilities. The respondents had an average IT work experience of 6.14 years (SD = 9.09 years). The average number of employees managed was 7.01 (SD 28.56). Table 2 summarizes the sample's demographics.

In an effort to determine whether our sample of IT employees worked in an internal IT service role (i.e., providing IT services for internal business partners), we examined and coded the free-response descriptions of each participant's job responsibilities, assigning each participant to one of three possible IT employee types: internal IT service provider, external IT service provider (i.e., consultant or IT employee at an IT firm), or undetermined (i.e., response not given or not enough detail). Roughly 60% of our respondents clearly indicated that their job entailed providing IT services to internal business clients (e.g., "I manage employees in the IT department for a manufacturer; we handle all technical related issues for work partners"), while less than 10% indicated that they worked for an IT firm or as an external IT consultant (e.g., "I

Table 2. Frequencies of Demographic Data (*n* = 400 IT Employees)

Demographic item	Possible responses	Frequencies
Gender	Male	66.5%
	Female	33.5%
Education	< High School	N/A
	High School / GED	1.8%
	Some College	17.0%
	2-Yr degree	14.2%
	4-Yr degree	52.8%
	Master's degree	13.0%
	Doctoral degree	0.3%
	Professional degree	1.0%
Age	≤ 24	N/A
	25–34	9.5%
	35–44	49.3%
	45–54	29.0%
	55–64	8.0%
	> 64	4.3%
Manager/executive?	Yes	59.3%
	No	40.7%

help design and implement IT solutions for small businesses"). The remaining descriptions (roughly 33%) were too general to determine whether the participant was internal or external; however, in most cases, they were more likely to be internal (e.g., "I am an IT project/program manager").

Survey Instrument

The participants completed a confidential online survey, all measures of which were based on a seven-point Likert-type scale, as detailed in Appendix 1. The internal IT service perceptions measure was derived from (Jia & Reich, 2008, 2013), but again, we used this with single informants rather than multiple, matched informants. Furthermore, because we sided with the service quality literature that solely looks at performance perceptions rather than the gap between expectations and performance, we used the performance dimension of IT service quality from Watson et al. (1998) but did not use their expectations dimension. In pilot testing, we found similar levels of IT service quality evaluations from IT and non-IT employees. Thus, for simplicity, we used IT employees to evaluate their IT departments' service quality. Our measurement is thus *internally perceived IT service quality.*

Finally, we measured IT agility, which is often measured by asking managers or executives to report on their own organizations. Golden & Powell (2000) review a number of organizational agility instruments and combined them into a single, categorized set of survey-based measures. In the IT context, Mirani & Lederer (1998) propose a set of measures that assess the agility-related benefits that accrue to an organization from IT capabilities. Others employ similar instruments (Chang & King, 2005). Adapting the Mirani and Lederer instrument, Fink & Neumann (2007) propose the measures of IT agility we used in our study. These surveys are often administered to IT managers, because many studies involving IT agility also address IT-

specific constructs (e.g., Broadbent et al., 1999; Eardley et al., 1997; Sambamurthy et al., 2003). However, we saw no reason for why IT professionals are incapable of answering the same questions, especially when they are direct and not rooted in managerial or strategic language. Because we found that non-managers of IT had virtually the same insights as managers, limiting IT agility measurements only to managers and executives seemed unnecessary.

ANALYSIS AND RESULTS

Validity Checks and Overall Data Quality

Given our gathered data, we established validity using the latest established procedures. We accomplished this by determining which constructs are formative and which are reflective (Diamantopoulos & Winklhofer, 2001), assessing factorial validity as determined by discriminant validity and convergent validity (Lowry & Gaskin, 2014; Straub, Boudreau, & Gefen, 2004), evaluating multicollinearity (Cenfetelli & Bassellier, 2009), and checking for common methods bias (Podsakoff et al., 2003). We used partial least squares (PLS), using SmartPLS version 2.0 (Ringle, Wende, & Will, 2005) for model validation and analysis because PLS is especially adept at validating mixed models of formative and reflective indicators and because it is considered more appropriate for unproven models and exploratory nomologies than covariance-based structural equation modelling (e.g., LISREL, AMOS) (Chin, Marcolin, & Newsted, 2003; Gefen & Straub, 2005; Lowry & Gaskin, 2014). Because procedures on establishing validity are widely known, we provide the details and results of these procedures in Appendix 2.

In summary, we found that each construct used in this study exhibits reasonable levels of validity and a lack of common methods bias. One exception was the first-order reflective constructs that compose IT agility, which had high loadings on each other, indicating lack of

discrimination. Thankfully, these discriminated against IT service quality and worked well with the model, as IT agility was formatively created by them. For these kinds of second-order constructs, multicollineary is a bigger threat (Cenfetelli & Bassellier, 2009), and these constructs passed that test well. We also established strong reliabilities of our reflective constructs. The measures used to operationalize the internal IT service perceptions and IT service quality constructs (as well as IT agility) capture the conceptual domain of the constructs, and they behaved as expected from a psychometric perspective. To establish reliability, PLS computes a composite reliability score as part of its integrated model analysis, which is a more accurate measurement of reliability than Cronbach's α because it does not assume the loadings or error terms of the items to be equal (Chin et al., 2003) (See Table 3).

Table 3. Reliability Results for Reflective Sub-constructs

Construct	Sub-construct	Composite reliability
IT agility	Information agility	0.854
	System agility	0.792
	Strategic agility	0.849
Internal IT service perceptions	Service evaluation	0.782
	Service level	0.828
	Service vision	0.829

We now present and discuss the results of our tested model. We first explain our method for establishing the hypothesized mediation of the effect of internal IT service perceptions by IT service quality. We then explain our model testing results in light of the three hypotheses.

Establishing Partial Mediation

Our model's relationships predict partial mediation, not full mediation. That is, we predict that internal IT service perceptions will directly influence IT service quality and that IT agility will be influenced by both IT service quality and internal IT service perceptions (see Fig. 1). Before running the final analysis on our model, we thus needed to check whether this relationship is partially mediated by IT service quality or whether IT service quality acts as a full

mediator or not a mediator at all. Consequently, we tested for partial mediation based on the standard mediation tests by Baron & Kenny (1986), which were extended to PLS, as demonstrated by Lowry, Romano, Jenkins, & Guthrie (2009).[i]

All paths were statistically significant when analyzed separately: standalone Path A between the IV (internal IT service perceptions) and the potential mediator (IT service quality) had a β of 0.689 and was significant at $t_{(1, 399)} = 20.12$. Standalone Path B between the potential mediator (IT service quality) and the DV (IT agility) had a β of 0.536 and was significant at $t_{(1, 399)} = 4.79$. Standalone Path C between the proposed IV (internal IT service perceptions) and the DV (IT agility) had a β of 0.524 and was significant at $t_{(1, 399)} = 15.52$. Given that the model was an appropriate candidate for the potential presence of mediation, the final step was to test Path C while controlling for Paths A and B. The result of this analysis was as follows: Path A had a significant β of 0.654 at $t_{(1, 399)} = 18.48$. Path B had a significant β of 0.299 at $t_{(1, 399)} = 4.82$. Path C had a significant β of 0.311 at $t_{(1, 399)} = 5.22$. All paths were retained in the model but were significantly weakened when run together—supporting a partial-mediation model (see Table 4).

Table 4. Summary of Mediation Analyses

Path	Standalone path test β	Controlled mediation test β
A: Internal IT service perceptions → IT service quality	0.689	0.654
B: IT service quality → IT agility	0.536	0.299
C: Internal IT service perceptions → IT agility	0.524	0.311

Final Results

Again, we used PLS, SmartPLS version 2.0 (Ringle et al., 2005), for model analysis. To do so, we generated a bootstrap with 500 re-samples and did not apply a "missing values" algorithm, as is sometimes done with PLS. Fig. 2 depicts the results of this analysis, including the full measurement-model results exploded down to the indicator level. The explained variance is indicated inside each construct. The path coefficients, or betas (βs), are indicated on the paths

between two constructs, along with their direction and significance. Six covariates were added to the model to account for other possible factors that might also affect perceptions of IT agility. Table 5 summarizes the hypotheses, the path coefficients, and the *t*-values for each path for the study.

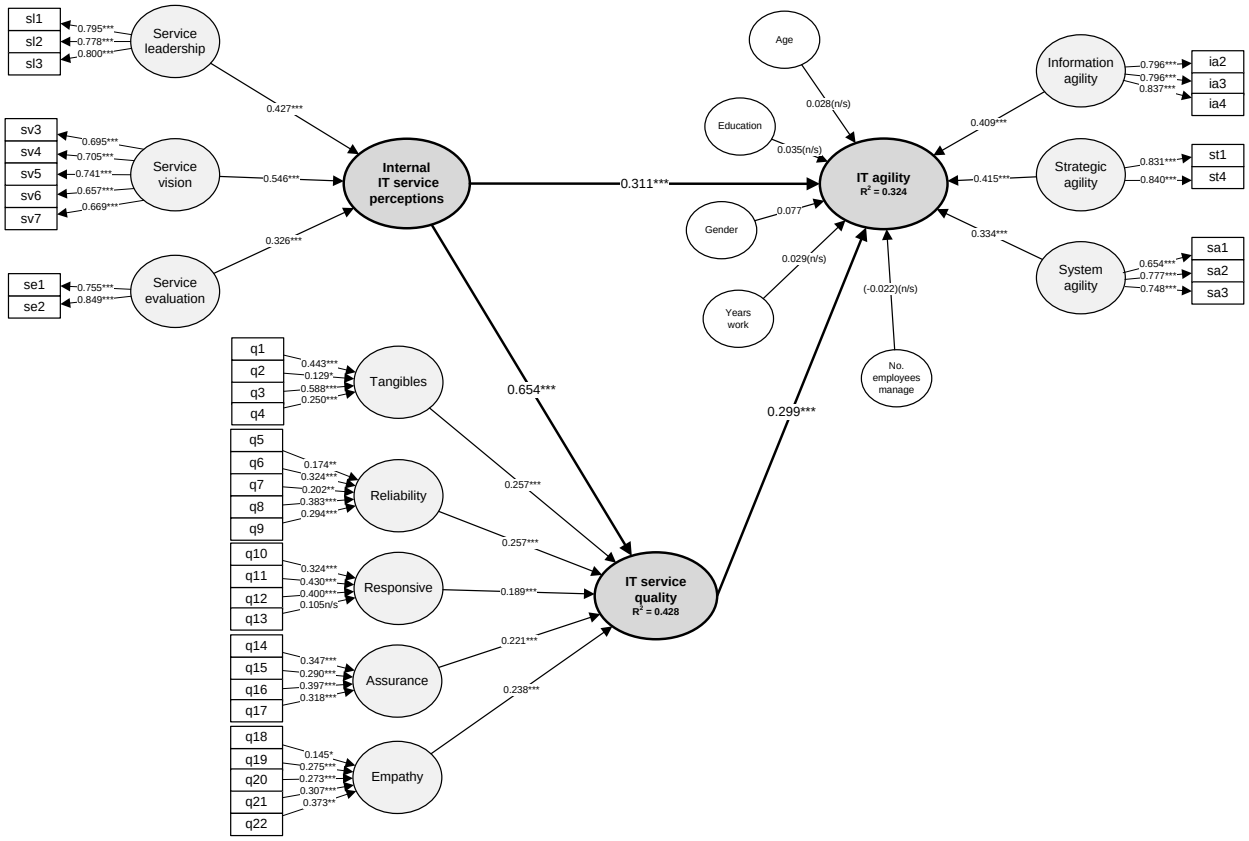

Fig. 2. Full Results of Second-Order and First-Order Measurement Model

Table 5. Final Model Testing Results

Tested paths (hypotheses & covariates)	Path coefficient (β)	*t*-value	Supports model?
H1. Internal IT service perceptions→ IT service quality	0.654	17.52***	yes
H2. IT service quality → IT agility	0.299	5.23***	yes
H3. Internal IT service perceptions → IT agility	0.311	5.96***	yes
Age → IT agility	0.028	0.46 n/s	no
Education level → IT agility	0.035	0.54 n/s	no
Gender → IT agility	0.077	1.76 n/s	no
Years of work experience → IT agility	0.029	0.35 n/s	no
Number of employees managed → IT agility	(-0.022)	0.45 n/s	no

***$p < 0.001$, n/s = not significant

DISCUSSION

Businesses continually seek effective IT management strategies to better leverage IT resources. Modern organizations' ability to adapt to changing market environments increasingly depends on their IT departments (Galliers, 2006; Peppard & Ward, 2004). Although prior research has generated helpful insights on various IT organizational issues, gaps remain in understanding how organizational context factors can help organizations leverage the IT function (Jia & Reich, 2013; Walsh, 2014) to adapt to business needs. IT strategy research highlights the role of IT service in driving positive IT service quality (Jia & Reich, 2013; Jia et al., 2008); however, there is limited understanding of other positive outcomes of favorable IT service. We contribute to the literature by hypothesizing a partially mediated relationship wherein internal IT service perceptions positively influences IT agility, both directly and indirectly, through facilitating positive IT service quality. Our results support the hypotheses within our model and provide evidence for internal IT service perceptions as an important predictor of other organizational variables in addition to IT service quality. This section discusses the theoretical and practical implications of these results, admits several limitations, and indicates opportunities for future research.

Contributions to Theory

Our study makes several important contributions to theory and measurements of IT strategy. Most importantly, we demonstrate a strong theoretical and empirical link between internal IT service perceptions and IT agility, from which we derive two important implications. First, the benefits derived from an IT function with a positive, service-oriented climate are not limited to improvements in IT service quality. The literature from which internal IT service perceptions is derived places a heavy focus on service quality as a key outcome of a favorable

service environment, and IT service quality is thus a natural starting point for understanding the impacts of internal IT service perceptions. Our research indicates that compelling opportunities remain for future research to find additional ways to leverage internal IT service perceptions in theories predicting other downstream outcomes, such as information quality or systems quality (Delone & McLean, 2003; Jia & Reich, 2013).

A second implication of this link between internal IT service perceptions and IT agility is a unique angle from which to view IT agility issues. As Jia et al. (2008) are cited in Schein (2000), "climate theories expand the horizon of IT research and bring about an alternative lens to study IT phenomena" (p. 311). Prior IT agility research focuses on IT resources, either more generally in terms of IT investment (Sambamurthy et al., 2003) or in terms of actual technical infrastructure (Kayworth, Chatterjee, & Sambamurthy, 2001; Weill et al., 2002). The findings of this research contribute important empirical support to a smaller portion of the agility literature that emphasizes the crucial role of IT personnel in provisioning services to meet business needs to support agility (Fink & Neumann, 2007; McKay & Brockway, 1989). Focusing on developing a favorable IT service environment may be an important strategic decision that organizations can use to develop and maintain a competitive advantage in the markets. This is a more nuanced view of IT resources and one that we hope will be leveraged in future research as theorists offer solutions to IT-agility-related problems.

Moreover, most researchers only survey IT managers and executives when studying IT agility, under the assumption that only these respondents can provide valid strategic insights. We agree that IT executives are likely to know more about the fundamentals of strategy than IT staff. However, we posit that responding to IT agility measures does not require advanced strategy knowledge—instead, these measures are very straightforward and without strategic or

managerial language and can thus be readily and accurately answered by full-time IT professionals who have meaningful knowledge of their organizations. To test this supposition, we compared the means of all our model constructs using a MANOVA. Indeed, there was no significant difference in perceptions between managers/executives and regular IT staff (Table 6). Moreover, we also ran the number of employees they managed in the model as an exploratory covariate, and it had no statistical effect. Hence, we question whether the extant practice of limiting IT agility measures to managers and executives is really necessary. Again, we agree that IT executives generally have stronger knowledge of strategy than do IT staff, but strategic knowledge is not what IT agility measures consider; thus, advanced strategic knowledge is not needed to provide valid responses to IT agility. Instead, IT agility measures are straightforward perceptual surrogates of organizational factors that represent IT agility.

Table 6. Comparing Measurements by Managerial versus non-Managerial Employees

Manager/executive?	**IT agility**	**IT service**	**IT quality**
Yes (n = 237	5.63 (SD = .84)	5.29 (SD = .86)	5.43 (SD = .81)
No (n = 163)	5.64 (SD = .83)	5.16 (SD = .84)	5.35 (SD = .82)
F test from MANOVA	$F_{(1,398)} = 0.006$	$F_{(1,398)} = 2.449$	$F_{(1,398)} = 1.010$
p-value	$p = .938$	$p = .118$	$p = .316$
Significant difference?	No	No	No

Last, we highlight our findings on the partial mediation of the effect of internal IT service perceptions by IT service quality. Although we have shown an important relationship between IT service quality and IT agility, incorporating the mediating role of IT service quality enriches our findings considerably. Finding that the positive effects of internal IT service perceptions are partially mediated by IT service quality presents a strong argument that these two constructs should both be considered in future models to fully understand the influence of the IT service quality construct.

Contributions to Practice

IT managers often have strained relationships with business customers who are hoping

for better service and quicker response time; in other words, they struggle to provide solutions for customers' continually changing needs. Organizations continually push for agility in the market as they strive to compete, and this push is spreading to IT agility as well. Our finding that internal IT service perceptions directly influences IT agility indicates that executives should not look only at IT capabilities and the quality of IT service provided but also be aware of the service environment being fostered by IT managers within the IT department of the organization. Improving the IT service environment and IT service quality will help organizations to reach their goals with respect to IT agility.

Furthermore, the benefits of internal IT service perceptions that our results highlight are inherently personnel-focused—as opposed to technology- or infrastructure-focused—and IT managers can greatly benefit from acknowledging the role of their IT employees in providing value to the organization. Many organizations have the financial resources to invest in hardware or software, but our research indicates that it is also important for IT management to create a service-oriented climate to fully realize this investment. This is congruous with prior research showing the added value that IT employees can provide to organizations in taking their in-role, and especially their extra-role, behaviors seriously (Hsu, Shih, Hung, & Lowry, 2015).

Limitations and Future Research

Although we took great care in characterizing and assessing the internal IT service perceptions, IT service quality, and IT agility constructs, our study has several key limitations that suggest compelling future research opportunities.

We relied on a single informant from each IT organization (rather than gathering multiple, matched data points from one organization or a limited number of organization, which is the standard practice for IT climate research). This deliberate methodological choice supports

greater generalizability of our findings to more organizations but limits our ability to fully assess the service climate of a given IT organization. Specifically, the original IT service climate construct is defined in terms of *shared* perceptions of IT employees. Using a single informant allowed us measure the level of IT service perceived by an individual IT employee/manager/executive but prevented us from measuring the extent of "sharedness" within the organization (i.e., the extent of agreement among multiple IT employees from a single organization). Likewise, some of these items directly deal with the interactions between IT employees and internal business clients. For this reason, we differentiate our particular conceptualization and measurement as "internal IT service perceptions."

Likewise, our single-informant approach challenged the traditional focus on IT customers to determine service quality, because we used self-assessment by IT employees/managers/executives. For similar reasons as those for IT service climate, we differentiate our use as "internally perceived IT service quality." Ideally, non-IT members of an organization would be also used to provide insights into IT service quality, in a matched study design. Unfortunately, this was not possible with our use of Amazon Mechanical Turk. While we argue that IT employees have deep insights into the level of service they provide and are more familiar with their exact tasks than most non-IT employees, our measurement assumes openness and honestly, which means there is potential for bias. In other words, IT employees who have a positive viewpoint of their efforts may be too generous in their assessments, whereas IT employees who have an axe to grind or are overly pessimistic may under-assess their efforts. Of course, other biases exist with non-IT employees because of not fully understanding the IT function, or having had unusually positive or negative IT experiences. Nonetheless, gathering their viewpoints would allow for data triangulation and perhaps better discriminant validity.

For simplicity, we used IT employees to evaluate their IT departments' service quality. Thus, our use of absolute assessments of IT service quality (SERVPERF)—rather than gap assessments—means that it will be more difficult to compare our results with those obtained using the SERVQUAL measurement tool (Jia & Reich, 2013). This raises two issues that are worth considering in future research. First, can IT employees, managers, and executives provide meaningful self-assessments of service quality, given the right measures and prompts, or can service quality only be appropriately evaluated by non-IT customers? Second, it would be useful for future research to further examine the utility of the SERVQUAL instrument with the SERVPERF tool, especially considering the degree to which gap assessments versus perceived absolute are value-added.

Furthermore, it is important to note that the real-world relationships between the constructs in our model are more complex than the simplified, three-hypothesis model we have produced and validated. Our use of traditional formative measurements from the literature—e.g., the first-order reflective factors of internal IT service perceptions and IT agility and the first-order formatives for IT service quality—might be oversimplifying reality and downplaying more complex interrelationships. For example, the actual relationships may have bi-directional elements or contain feedback loops, such as the possibility that IT service quality also influences internal IT service perceptions or that increases in IT agility generate further increases in IT service quality. There might also be more meaningful, direct, and disparate relationships between the first-order constructs that are obscured using the second-order factors directly with each other. As is the case in most organizational theories, our model is a simplification of a much more complex set of processes, so there remain compelling opportunities for future research to more specifically investigate these processes to generate additional insights to balance between

the accuracy, succinctness, and usefulness of theoretical models versus real-world phenomena.

Finally, also related to real-world issues, a fundamental concern with these constructs and associated measures, taken as a one-time snapshot, is lack of causality. Some of the first-order constructs may share antecedents that have not been identified. Moreover, we cannot establish causality in the model using survey data. Given that experimentation is an unrealistic approach to conducting organizational studies, as few would agree to acting in a "control" or "treatment" role, longitudinal study of these phenomena is likely the best approach to establishing causality. Although the use of secondary data may be possible, the concern is whether secondary data sources (e.g., public financial filings required of publically traded firms) have enough useful information to act as meaningful surrogates for IT agility, internal IT service perceptions, or IT service quality.

CONCLUSION

Businesses continue to make large investments in IT resources, and it is crucial for them to implement effective management strategies to better leverage these resources. Modern organizations are increasingly dependent on IT resources to remain agile and competitive in a rapidly changing market (Galliers, 2006; Peppard & Ward, 2004). We developed and empirically tested a theoretical model of how an organization's internal IT service perceptions relates to its IT agility. We hypothesized and found a partially mediated relationship wherein internal IT service perceptions positively affects IT agility, both directly and indirectly, through facilitating positive IT service quality. Thus, our results have important implications for future research and practice, as the IT community continues to seek to adopt effective strategies for managing and leveraging its expensive resources.

REFERENCES

Abbott, P., Zheng, Y., Du, R., & Willcocks, L. (2013). From boundary spanning to creolization: A study of Chinese software and services outsourcing vendors. *The Journal of Strategic Information Systems,* 22(2), 121-136.

Abdel-Hamid, T. K., Sengupta, K., & Swett, C. (1999). The impact of goals on software project management: An experimental investigation. *MIS Quarterly,* 23(4), 531-555.

Agarwal, R. & Sambamurthy, V. (2002). Principles and models for organizing the IT function. *MIS Quarterly Executive,* 1(1), 1-16.

Akter, S., Ray, P., & D'Ambra, J. (December 4-7, 2011). *Viewing systems as services: The role of service quality.* Paper presented at the 2011 International Conference on Information Systems (ICIS 2011), Shanghai, China,

Allen, B. R. & Boynton, A. C. (1991). Information architecture: In search of efficient flexibility. *MIS Quarterly,* 15(4), 435-445.

Arvidsson, V., Holmström, J., & Lyytinen, K. (2014). Information systems use as strategy practice: A multi-dimensional view of strategic information system implementation and use. *The Journal of Strategic Information Systems,* 23(1), 45-61.

Babakus, E. & Boller, G. W. (1992). An empirical assessment of the SERVQUAL scale. *Journal of Business Research,* 24(3), 253-268.

Baker, E. W. & Niederman, F. (2014). Integrating the IS functions after mergers and acquisitions: Analyzing business-IT alignment. *The Journal of Strategic Information Systems,* 23(2), 112-127.

Barchard, K. & Williams, J. (2008). Practical advice for conducting ethical online experiments and questionnaires for United States psychologists. *Behavior Research Methods,* 40(4), 1111-1128.

Baron, R. B. & Kenny, D. A. (1986). The moderator mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. *Journal of Personality and Social Psychology,* 51(6), 1173-1182.

Bassellier, G. & Benbasat, I. (2004). Business competence of information technology professionals: Conceptual development and influence on IT-business partnerships. *MIS Quarterly,* 28(4), 673-694.

Benlian, A. (2013). Effect mechanisms of perceptual congruence between information systems professionals and users on satisfaction with service. *Journal of Management Information Systems,* 29(4), 63-96.

Benlian, A., Koufaris, M., & Hess, T. (2012). Service quality in software-as-a-service: Developing the SaaS-Qual measure and examining its role in usage continuance. *Journal of Management Information Systems,* 28(3), 85-126.

Bennett, R., J. & Robinson, S. L. (2000). Development of a measure of workplace deviance. *Journal of Applied Psychology,* 85(3), 349-360.

Bharadwaj, A. S. (2000). A resource-based perspective on information technology capability and firm performance: An empirical investigation. *MIS Quarterly,* 24(1), 169-196.

Birnbaum, M. H. (2004). Human research and data collection via the Internet. *Annual Review of Psychology,* 55(803-832.

Boehm, B. (1981). *Software Engineering Economics*. New York, NY: Prentice-Hall.

Boulding, W., Kalra, A., Staelin, R., & Zeithaml, V. A. (1993). A dynamic process model of service quality: From expectations to behavioral intentions. *Journal of Marketing Research,* 30(1), 7-27.

Broadbent, M., Weill, P., Clair, D. S., & Kearney, A. T. (1999). The implications of information

technology infrastructure for business process redesign. *MIS Quarterly,* 23(2), 159-182.
Byrd, T. A. (2001). Information technology: Core competencies, and sustained competitive advantage. *Information Resources Management Journal,* 14(2), 27-36.
Cai, Z., Liu, H., Huang, Q., Liang, L., & Shen, X.-L. (Dec 05, 2013). *Relational capital and performance: Assessing the mediating role of supply chain agility and the moderating role of environmental contexts.* Paper presented at the 47th Hawaii International Conference on System Sciences, Waikoloa, HI, 4229-4238.
Carr, J. Z., Schmidt, A. M., Ford, J. K., & DeShon, R. P. (2003). Climate perceptions matter: a meta-analytic path analysis relating molar climate, cognitive and affective states, and individual level work outcomes. *Journal of Applied Psychology,* 88(4), 605.
Cenfetelli, R. T. & Bassellier, G. (2009). Interpretation of formative measurement in information systems research. *MIS Quarterly,* 33(4), 689-708.
Chakravarty, A., Grewal, R., & Sambamurthy, V. (2013). Information technology competencies, organizational agility, and firm performance: Enabling and facilitating roles. *Information Systems Research,* 24(4), 976-997.
Chang, J. C.-J. & King, W. R. (2005). Measuring the performance of information systems: A functional scorecard. *Journal of Management Information Systems,* 22(1), 85-115.
Chatterjee, S., Moody, G. D., Lowry, P. B., Chakraborty, S., & Hardin, A. (2015). Strategic relevance of organizational virtues enabled by information technology in organizational innovation. *Journal of Management Information Systems,* 32(3), 158-196.
Chen, D., Q., Mocker, M., Preston, D. S., & Teubner, A. (2010). Information systems strategy: Reconceptualization, measurement, and implications. *MIS Quarterly,* 34(2), 233-260.
Chen, X. & Siau, K. (December 16-19, 2012). *Effect of business intelligence and IT infrastructure flexibility on organizational agility.* Paper presented at the 2012 International Conference on Information Systems (ICIS 2012), Orlando, FL,
Chin, W. W., Marcolin, B. L., & Newsted, P. R. (2003). A partial least squares latent variable modeling approach for measuring interaction effects: Results from a Monte Carlo simulation study and an electronic-mail emotion/adoption study. *Information Systems Research,* 14(2), 189-217.
Chou, S.-W. & Chiang, C.-H. (2013). Understanding the formation of software-as-a-service (SaaS) satisfaction from the perspective of service quality. *Decision Support Systems,* 56(C), 148-155.
Couger, J. D., Higgins, L. F., & McIntyre, S. C. (1993). (Un) structured creativity in information systems organizations. *MIS Quarterly,* 17(4), 375-397.
Cronin, J. J., Jr. & Taylor, S. A. (1992). Measuring service quality: A reexamination and extension. *Journal of Marketing,* 56(3), 55-68.
Cronin, J. J. & Taylor, S. A. (1994). SERVPERF versus SERVQUAL: Reconciling performance-based and perceptions-minus-expectations measurement of service quality. *Journal of Marketing,* 58(1), 125-131.
Daniel, E. M., Ward, J. M., & Franken, A. (2014). A dynamic capabilities perspective of IS project portfolio management. *The Journal of Strategic Information Systems,* 23(2), 95-111.
Delone, W. H. & McLean, E. R. (2003). The DeLone and McLean model of information systems success: A ten-year update. *Journal of Management Information systems,* 19(4), 9-30.
Diamantopoulos, A. & Winklhofer, H. M. (2001). Index construction with formative indicators: An alternative to scale development. *Journal of marketing research,* 38(2), 269-277.

Duncan, N. B. (1995). Capturing flexibility of information technology infrastructure: A study of resource characteristics and their measure. *Journal of Management Information Systems,* 12(2), 37-57.

Eardley, A., Avison, D., & Powell, P. (1997). Developing information systems to support flexible strategy. *Journal of Organizational Computing and Electronic Commerce,* 7(1), 57-77.

Ein-Dor, P. & Segev, E. (1982). Organizational context and MIS structure: Some empirical evidence. *MIS quarterly,* 6(3), 55-68.

Erdil, S. T. & Yildiz, O. (2011). Measuring service quality and a comparative analysis in the passenger carriage of airline industry. *Procedia - Social and Behavioral Sciences,* 24(2011), 1232-1242.

Fink, L. & Neumann, S. (2007). Gaining agility through IT personnel capabilities: The mediating role of IT infrastructure capabilities. *Journal of the Association for Information Systems,* 8(8), 440-458.

François, A. C., Fernando, J., & Jay, P. M. (2007). The validity of the SERVQUAL and SERVPERF scales: A meta-analytic view of 17 years of research across five continents. *International Journal of Service Industry Management,* 18(5), 472-490.

Gallagher, K. P. & Worrell, J. L. (2008). Organizing IT to promote agility. *Information Technology and Management,* 9(1), 71-88.

Galliers, R. D. (2006). Strategizing for agility: Confronting information systems inflexibility, In K. C. Desouza (Ed.), *Agile Information Systems: Conceptualization, Construction, and Management* (1-15). Newton, MA: Butterworth-Heinemann.

Gefen, D. & Straub, D. (2005). A practical guide to factorial validity using PLS-graph: Tutorial and annotated example. *Communications of the Association for Information Systems,* 16(5), 91-109.

Golden, W. & Powell, P. (2000). Towards a definition of flexibility: In search of the Holy Grail? *Omega,* 28(4), 373-384.

Gorla, N. & Somers, T. M. (2014). The impact of IT outsourcing on information systems success. *Information & Management,* 51(3), 320-335.

Gorla, N., Somers, T. M., & Wong, B. (2010). Organizational impact of system quality, information quality, and service quality. *The Journal of Strategic Information Systems,* 19(3), 207-228.

Gunasekaran, A. (1999). Agile manufacturing: a framework for research and development. *International Journal of Production Economics,* 62(1-2), 87-105.

Henfridsson, O. & Lind, M. (2014). Information systems strategizing, organizational sub-communities, and the emergence of a sustainability strategy. *The Journal of Strategic Information Systems,* 23(1), 11-28.

Horton, J. J., Rand, D. G., & Zeckhauser, R. J. (2011). The online laboratory: Conducting experiments in a real labor market. *Experimental Economics,* 14(3), 399-425.

Hsu, J., Shih, S.-P., Hung, Y. W., & Lowry, P. B. (2015). The role of extra-role behaviors and social controls in information security policy effectiveness. *Information Systems Research* 26(2), 282-300.

Jia, R. & Reich, B. H. (December 14-17, 2008). *IT service climate: The validation of an antecedent construct for IT service quality.* Paper presented at the 29th International Conference on Information Systems (ICIS 2008), Paris, France, 1-12.

Jia, R. & Reich, B. H. (2011). IT service climate—An essential managerial tool to improve client

satisfaction with IT service quality. *Information Systems Management,* 28(2), 174-179.
Jia, R. & Reich, B. H. (2013). IT service climate, antecedents and IT service quality outcomes: Some initial evidence. *The Journal of Strategic Information Systems,* 22(1), 51-69.
Jia, R., Reich, B. H., & Pearson, J. M. (2008). IT service climate: An extension to IT service quality research. *Journal of the Association for Information Systems,* 9(5), 294-320.
Jiang, J. J., Klein, G., & Carr, C. L. (2002). Measuring information system service quality: SERVQUAL from the other side. *MIS Quarterly,* 26(2), 145-166.
Kassim, N. M. & Zain, M. (2004). Assessing the measurement of organizational agility. *Journal of American Academy of Business,* 4(1/2), 174-177.
Kayworth, T., R., Chatterjee, D., & Sambamurthy, V. (2001). Theoretical justification for IT infrastructure investments. *Information Resources Management Journal,* 14(3), 5-14.
Kettinger, W. J. & Lee, C. C. (1994). Perceived service quality and user satisfaction with the information services function. *Decision Sciences,* 25(5/6), 737-766.
Kettinger, W. J. & Lee, C. C. (2005). Zones of tolerance: Alternative scales for measuring information systems service quality. *MIS Quarterly,* 29(4), 607-623.
Kharabe, A., Lyytinen, K., & Grover, V. (December 15-18, 2013). *Do organizational competencies influence how enterprise systems foster organizational agility?* Paper presented at the 34th International Conference on Information Systems (ICIS 2013), Milan, Italy,
Kharabe, A. & Lyytinen, K. J. (December 16-19, 2012). *Is implementing ERP like pouring concrete into a company? Impact of enterprise systems on organizational agility.* Paper presented at the 2012 International Conference on Information Systems (ICIS 2012), Orlando, FL,
Kim, S. & Son, J. (2009). Out of dedication or constraint? A dual model of post-adoption phenomena and its empirical test in the context of online services. *MIS Quarterly,* 33(1), 49-70.
Kopelman, R. E., Brief, A. P., & Guzzo, R. A. (1990). The role of climate and culture in productivity, In B. Schneider (Ed.), *Organizational Climate and Culture* (Vol. 282-318). San Francisco, CA: Jossey-Bass.
Lawler, E. E., Hall, D. T., & Oldham, G. R. (1974). Organizational climate: Relationship to organizational structure, process and performance. *Organizational Behavior and Human Performance,* 11(1), 139-155.
Lee, C. C. & Kettinger, W. J. (November 4, 1996). *A test of the psychometric properties of the IS adapted SERVQUAL measure.* Paper presented at the National INFORMS Meeting, Atlanta, GA,
Lind, M. R. & Zmud, R. W. (1991). The influence of a convergence in understanding between technology providers and users on information technology innovativeness. *Organization Science,* 2(2), 195-217.
Lowry, P. B. & Gaskin, J. (2014). Partial least squares (PLS) structural equation modeling (SEM) for building and testing behavioral causal theory: When to choose it and how to use it. *IEEE Transactions on Professional Communication,* 57(2), 123-146.
Lowry, P. B. & Moody, G. D. (2015). Proposing the control-reactance compliance model (CRCM) to explain opposing motivations to comply with organizational information security policies. *Information Systems Journal,* 25(5), 433–463.
Lowry, P. B., Moody, G. D., Galletta, D. F., & Vance, A. (2013). The drivers in the use of online whistle-blowing reporting systems. *Journal of Management Information Systems,* 30(1),

153-190.
Lowry, P. B., Posey, C., Bennett, R. J., & Roberts, T. L. (2015). Leveraging fairness and reactance theories to deter reactive computer abuse following enhanced organisational information security policies: An empirical study of the influence of counterfactual reasoning and organisational trust. *Information Systems Journal,* 25(3), 193–230.
Lowry, P. B., Romano, N. C., Jenkins, J. L., & Guthrie, R. W. (2009). The CMC interactivity model: How interactivity enhances communication quality and process satisfaction in lean-media groups. *Journal of Management Information Systems,* 26(1), 159-200.
Luftman, J. & Ben-Zvi, T. (2010). Key issues for IT executives 2009: Difficult economy's impact on IT. *MIS Quaterly Executive,* 9(1), 203-213.
Majchrzak, A. & Malhotra, A. (2013). Towards an information systems perspective and research agenda on crowdsourcing for innovation. *The Journal of Strategic Information Systems,* 22(4), 257-268.
Mani, D., Barua, A., & Whinston, A. B. (2010). An empirical analysis of the impact of information capabilities design on business process outsourcing performance. *MIS Quarterly,* 34(1), 39-62.
Mao, H., Liu, S., & Zhang, J. (December 15-18, 2013). *How the effects of IT capability and knowledge capability on organizational agility are contingent on environmental uncertainty and information intensity.* Paper presented at the 34th International Conference on Information Systems (ICIS 2013), Milan, Italy,
Mason, W. & Suri, S. (2012). Conducting behavioral research on Amazon's Mechanical Turk. *Behavior Research Methods,* 44(1), 1-23.
Mathew, S. K. & Chen, Y. (2013). Achieving offshore software development success: An empirical analysis of risk mitigation through relational norms. *The Journal of Strategic Information Systems,* 22(4), 298-314.
McKay, D. & Brockway, D. (1989). Building IT infrastructure for the 1990s. *Stage by stage,* 9(3), 1-11.
Mirani, R. & Lederer, A. L. (1998). An instrument for assessing the organizational benefits of IS projects. *Decision Sciences,* 29(4), 803-838.
Mondragon, A. E. C., Lyons, A. C., & Kehoe, D. F. (2004). Assessing the value of information systems in supporting agility in high-tech manufacturing enterprises. *International Journal of Operations & Production Management,* 24(12), 1219-1246.
Nazir, S. & Pinsonneault, A. (2012). IT and firm agility: An electronic integration perspective. *Journal of the Association for Information Systems,* 13(3), 150-171.
Overby, E., Bharadwaj, A., & Sambamurthy, V. (2006). Enterprise agility and the enabling role of information technology. *European Journal of Information Systems,* 15(2), 120-131.
Paolacci, G., Chandler, J., & Ipeirotis, P. G. (2010). Running experiments on Amazon Mechanical Turk. *Judgment and Decision making,* 5(5), 411-419.
Parasuraman, A., Zeithaml, V. A., & Berry, L. L. (1988). SERVQUAL: A multiple-item scale for measuring consumer perceptions of service quality. *Journal of Retailing,* 64(1), 12-40.
Parasuraman, A., Zeithaml, V. A., & Berry, L. L. (1994). Reassessment of expectations as a comparison standard in measuring service quality: Implications for further research. *Journal of Marketing,* 58(1), 111-124.
Parker, C. P., Baltes, B. B., Young, S. A., Huff, J. W., Altmann, R. A., Lacost, H. A., & Roberts, J. E. (2003). Relationships between psychological climate perceptions and work

outcomes: A meta-analytic review. *Journal of Organizational Behavior*, 24(4), 389-416.
Peppard, J. & Ward, J. (2004). Beyond strategic information systems: Towards an IS capability. *Journal of Strategic Information Systems* 13(2), 167-194.
Petter, S., DeLone, W., & McLean, E. (2008). Measuring information systems success: Models, dimensions, measures, and interrelationships. *European Journal of Information Systems*, 17(3), 236-263.
Piccoli, G. & Ives, B. (2005). Review: IT-dependent strategic initiatives and sustained competitive advantage: A review and synthesis of the literature. *MIS Quarterly*, 29(4), 747-776.
Pitt, L. F., Watson, R. T., & Kavan, C. B. (1995). Service quality: A measure of information systems effectiveness. *MIS Quarterly*, 19(2), 173-187.
Podsakoff, P. M., MacKenzie, S. B., Lee, J. Y., & Podsakoff, N. P. (2003). Common method biases in behavioral research: A critical review of the literature and recommended remedies. *Journal of Applied Psychology*, 88(5), 879-903.
Posey, C., Roberts, T. L., Lowry, P. B., Bennett, R. J., & Courtney, J. (2013). Insiders' protection of organizational information assets: Development of a systematics-based taxonomy and theory of diversity for protection-motivated behaviors. *MIS Quarterly*, 37(4), 1189-1210.
Ringle, C. M., Wende, S., & Will, S. (2005). SmartPLS 2.0 (M3) Beta. Retrieved September 17, 2010, from http://www.smartpls.de
Rockart, J. F., Earl, M. J., & Ross, J. W. (1996). Eight imperatives for the new IT organization. *Sloan Management Review*, 38(1), 43-55.
Ross, J. W., Beath, C. M., & Goodhue, D. L. (1996). Develop long-term competitiveness through IT assets. *Sloan Management Review*, 38(1), 31-42.
Sambamurthy, V., Anandhi, B., & Varun, G. (2003). Shaping agility through digital options: Reconceptualizing the role of information technology in contemporary firms. *MIS Quarterly*, 27(2), 237-263.
Sambamurthy, V., Wei, K. K., Lim, K., & Lee, D. (2007). *IT-enabled organizational agility and firms' sustainable competitive advantage.* Paper presented at the 28th International Conference on Information Systems (ICIS 2007), Montreal, QC, Canada,
Schein, E. H. (2000). Sense and nonsense about culture and climate, In M. F. Peterson, C. Wilderom & N. M. Ashkanasy (Eds.), *Handbook of Organizational Culture & Climate* (xxiii-xxx). Thousand Oaks, CA: Sage Publications.
Schneider, B. (1990). The climate for service: An application of the climate construct, In B. Schneider (Ed.), *Organizational Climate and Culture*. San Francisco, CA: Jossey-Bass.
Schneider, B. & Bowen, D. E. (1985). Employee and customer perceptions of service in bank: Replication and extension. *Journal of Applied Psychology*, 70(1985), 423-433.
Schneider, B., Gunnarson, S. K., & Niles-Jolly, K. (1994). Creating the climate and culture of success. *Organizational Dynamics*, 23(1), 17-29.
Schneider, B. & White, S. S. (2004). *Service quality: Research perspectives* (Vol. 107). Thousand Oaks, CA: Sage.
Schneider, B., White, S. S., & Paul, M. C. (1998). Linking service climate and customer perceptions of service quality: Test of a causal model. *Journal of Applied Psychology*, 83(2), 150-163.
Schulze, T., Krug, S., & Schader, M. (December 16-19, 2012). *Workers' task choice in crowdsourcing and human computation markets.* Paper presented at the 2012

International Conference on Information Systems (ICIS 2012), Orlando, FL,
Silva, L. & Hirschheim, R. (2007). Fighting against windmills: Strategic information systems and organizational deep structures. *MIS Quarterly,* 31(2), 327-354.
Straub, D. W., Boudreau, M. C., & Gefen, D. (2004). Validation guidelines for IS positivist research. *Communications of the Association for Information Systems,* 14(2004), 380-426.
Sun, Y., Fang, Y., Lim, K. H., & Straub, D. (2012). User satisfaction with information technology service delivery: A social capital perspective. *Information Systems Research,* 23(4), 1195-1211.
Swanson, E. B. (1994). Information systems innovation among organizations. *Management Science,* 40(9), 1069-1092.
Tallon, P. P. & Pinsonneault, A. (2011). Competing perspectives on the link between strategic information technology alignment and organizational agility: Insights from a mediation model. *MIS Quarterly,* 35(2), 463-486.
Tan, C. W., Benbasat, I., & Cenfetelli, R. T. (2013). IT-mediated customer service content and delivery in electronic governments: An empirical investigation of the antecedents of service quality. *MIS Quarterly,* 37(1), 77-109.
Thouin, M. F., Hoffman, J. J., & Ford, E. W. (2009). IT outsourcing and firm-level performance: A transaction cost perspective. *Information & Management,* 46(8), 463-469.
Tiwana, A. & Konsynski, B. (2010). Complementarities between organizational IT architecture and governance structure. *Information Systems Research,* 21(2), 288-304.
van Dyke, T. P., Kappelman, L. A., & Prybutok, V. R. (1997). Measuring information systems service quality: Concerns on the use of the SERVQUAL questionnaire. *MIS Quarterly,* 21(2), 195-208.
Van Dyke, T. P., Prybutok, V. R., & Kappelman, L. A. (1999). Cautions on the use of the SERVQUAL measure to assess the quality of information systems services. *Decision Sciences,* 30(3), 877-891.
Walsh, I. (2014). A strategic path to study IT use through users' IT culture and IT needs: A mixed-method grounded theory. *The Journal of Strategic Information Systems,* 23(2), 146-173.
Watson, R. T., Pitt, L. F., & Kavan, C. B. (1998). Measuring information systems service quality: Lessons from two longitudinal case studies. *MIS Quarterly,* 22(1), 61-79.
Watts, S. & Henderson, J. C. (2006). Innovative IT climates: CIO perspectives. *The Journal of Strategic Information Systems,* 15(2), 125-151.
Weill, P., Subramani, M., & Broadbent, M. (2002). Building IT infrastructure for strategic agility. *MIT Sloan Management Review,* 44(1), 57-65.
Weill, P. & Vitale, M. (2002). What IT Infrastructure capabilities are needed to implement E-Business models? *MIS Quarterly Executive,* 1(1), 17-34.
Woolley, B. & Hobbs, G. (December 3-5, 2008). *Agility in information system.* Paper presented at the 19th Australasian Conference on Information Systems, Christchurch, New Zealand, 1079-1088.
Xu, J. D., Benbasat, I., & Cenfetelli, R. T. (2013). Integrating service quality with system and information quality: An empirical test in the e-service context. *MIS Quarterly,* 37(3), 777-794.
Zain, M., Rose, R. C., Adbullah, I., & Masrom, M. (2005). The relationship between information technology acceptance and organizational agility in Malaysia. *Information &*

Management, 42(6), 829-839.
Zeithaml, V. A. (1988). Consumer perceptions of price, quality, and value: A means-end model and synthesis of evidence. *Journal of Marketing*, 52(3), 2-22.

---

[i] Using this approach, "a variable functions as a mediator when it meets the following conditions: variations in levels of the independent variable significantly account for variations in the presumed mediator (i.e., Path A), variations in the mediator significantly account for variations in the dependent variable (i.e., Path B), and when paths A and B are controlled, a previously significant relation between the independent and dependent variables is no longer significant, with the strongest demonstration of mediation occurring when Path C is zero" (Baron & Kenny, 1986, p. 1176). A partial mediation relationship exists if the beta coefficients for Path A and B are decreased by the presence of Path C, and Path C is significant. Paths A, B, and C must be present and significant on their own for a model to be a candidate for mediation or partial mediation.

ONLINE APPENDIX 1. MEASUREMENT ITEMS AND SCALES

Construct	Sub-construct	Code	Items	Citation
Internal IT service perceptions (For IT employees)	Service leadership	**ITSL1**	My unit manager spends time on planning and coordinating our work and service.	Adapted from Jia & Reich (2008, 2013)
		ITSL2	My unit manager constantly tracks our service performance (e.g., schedule, budget, quality).	
		ITSL3	My unit manager regularly discusses work performance goals with us.	
	Service vision	**ITSV1**	In my unit's daily work, there is an emphasis on providing excellent service to our organization's clients.	
		ITSV2	My unit often suggests new ways to solve organization problems.	
		ITSV3	There has been true effort in our unit to establish ourselves as a respected partner of our clients.	
		ITSV4	People in my unit know how to disagree with clients in a professional manner.	
		ITSV5	People in my unit can quickly adapt to changes in our clients' requirements.	
		ITSV6	People in my unit try to be flexible when working with our clients, rather than strictly following rules and procedures.	
		ITSV7	My unit frequently shares information with clients.	
		ITSV8	My unit actively solicits comments and feedback from clients.	
	Service evaluation	**ITSE1**	Our compensation is linked to client evaluations of our service performance.	
		ITSE2	In my most recent performance review, I was evaluated on how well I served the clients.	
		ITSE3	Customer service is an important criterion of our formal performance evaluation.	
IT-dependent organizational agility	IT-dependent system agility	**SA1**	IT shared across the organization saves money by reducing system modification or enhancement costs.	Fink & Neumann (2007)
		SA2	IT shared across the organizationallows other applications to be developed faster.	
		SA3	IT shared across the organizationallows previously infeasible applications to be implemented.	
		SA4	IT shared across the organizationprovides the ability to perform maintenance faster.	
	IT-dependent information agility	**IA1**	IT shared across the organization enables faster retrieval or delivery of information or reports.	
		IA2	IT shared across the organizationenables easier access to information.	
		IA3	IT shared across the organizationpresents information in a more concise manner or better format.	
		IA4	IT shared across the organizationincreases the flexibility of information requests.	

	IT-dependent strategic agility	**ST1**	IT shared across the organizationenhances competitiveness or creates strategic advantage.	
		ST2	IT shared across the organizationenables the organizationto catch up with competitors.	
		ST3	IT shared across the organizationaligns well with stated organizational goals.	
		ST4	IT shared across the organizationhelps establish useful linkages with other organizations.	
		ST5	IT shared across the organizationenables the organizationto respond more quickly to change.	
IT service quality (IS-SERVPERF)	Tangibles	**PQUAL1**	IT has up-to-date hardware and software.	Watson, Pitt, & Kavan (1998)
		PQUAL2	IT's physical facilities are visually appealing.	
		PQUAL3	IT employees are well dressed and neat in appearance.	
		PQUAL4	The appearance of the physical facilities of IT units are in keeping with the kind of services provided.	
	Reliability	**PQUAL5**	When IT employees promise to do something by a certain time, they will do so.	
		PQUAL6	When users have a problem, IT employees show a sincere interest in solving it.	
		PQUAL7	IT employees are dependable.	
		PQUAL8	IT employees provide their services at the times they promise to do so.	
		PQUAL9	IT employees insist on error-free records.	
	Responsiveness	**PQUAL10**	IT employees tell users exactly when services will be performed.	
		PQUAL11	IT employees give prompt service to users.	
		PQUAL12	IT employees are always willing to help users.	
		PQUAL13	IT employees are never too busy to respond to users' requests.	
	Assurance	**PQUAL14**	The behavior of IT employees instills confidence in users.	
		PQUAL15	Users feel safe in their transactions with IT employees.	
		PQUAL16	IT employees are consistently courteous with users.	
		PQUAL17	IT employees have the knowledge to do their job well.	
	Empathy	**PQUAL18**	IT employees give users individual attention.	
		PQUAL19	IT employees have operating hours convenient to all their users.	
		PQUAL20	IT employees give users personal attention.	
		PQUAL21	IT employees have the users' best interests at heart.	
		PQUAL22	IT employees understand the specific needs of their users.	

All items are scaled as follows: 1 = strongly disagree, 2 = disagree, 3 = somewhat disagree, 4 = neutral, 5 = somewhat agree, 6 = agree, 7 = strongly agree.

ONLINE APPENDIX 2. VALIDITY ANALYSIS SUPPORT

Determining Which Constructs Are Formative and Which Are Reflective

A key step of preparation for assessing factorial validity is to determine which constructs are formative and which are reflective (Diamantopoulos & Winklhofer, 2001). The basic difference is that items within *formative constructs* are theoretically distinct and thus are not replaceable with other items in the same construct; in contrast, the items in *reflective constructs* are theoretically the same and thus are replaceable with each other (Diamantopoulos & Winklhofer, 2001). This theoretical and methodological distinction has recently become a serious issue in IS research where it has been discovered that many previous IS studies have been misspecified because they did not distinguish between reflective and formative constructs (Petter, Straub, & Rai, 2007). Such misspecification can lead to problems in empirical results and theoretical interpretations, including the potential increase in Type I and Type II errors (Petter et al., 2007).

We thus used several works (e.g., Cenfetelli & Bassellier, 2009; Diamantopoulos & Winklhofer, 2001; Lowry & Gaskin, 2014; Petter et al., 2007) as the basis for determining which constructs were formative and which were reflective. In this assessment, the most important consideration is to see how the constructs were theoretically formed and validated in other literature, to make sure no contradictions exist in their current use, and to model the constructs consistently. Internal IT service perceptions and IT-dependent organizational agility (Fink & Neumann, 2007) were both previously theorized, modeled, and validated as constructs composed of formative first-order constructs measured by reflective items. IT service quality (Watson et al., 1998) has been extensively theorized, modeled, and validated as a second-order construct composed of first-order formative sub-constructs. Because we are interested only in overall service quality, we chose to simplify this conceptualization as one large, first-order formative construct (this choice was later revised because of potential multicollinearity, as we explain later in this section). We have no theoretical or methodological reason to contradict these previous construct conceptualizations, and thus we have validated and modeled our constructs accordingly.

Establishing Factorial Validity

Factorial validity is established by demonstrating convergent and discriminant validity, which are two highly interrelated concepts that must co-exist. *Convergent validity* is the basic idea that measurement items that should be related are related. Convergent validity is established "when items thought to reflect a construct converge, or show significant, high correlations with one another, particularly when compared to the convergence of items relevant to other constructs, irrespective of method" (Straub, Boudreau, & Gefen, 2004, p. 391). *Discriminant validity* is the basic idea that items that should not be related are in fact not related. Discriminant validity is established when items thought to diverge show insignificant and low correlations with one another (Straub et al., 2004). Importantly, factorial validity is established in different ways for reflective and formative constructs; thus, we address these analyses separately.

Factorial Validity of Reflective Constructs

To establish the factorial validity of our reflective constructs, we followed procedures by Gefen & Straub (2005) and Lowry & Gaskin (2014), and further demonstrated in (Lowry, Romano, Jenkins, & Guthrie, 2009; Lowry, Vance, Moody, Beckman, & Read, 2008). For an especially conservative analysis, we used two established techniques to establish convergent validity and two established techniques to establish discriminant validity.

Convergent Validity of Reflective Constructs

First, we examined the outer model loadings. Per Gefen & Straub (2005), convergent validity can be established when the *t*-values of the outer model loadings are significant. In every case, each latent variable's indicators strongly converged on the latent variable and were highly significant, as summarized in Table A2.1. As a second check, we correlated the latent variable scores against the indicators as a form of factor loadings, and then examined the indicator loadings and cross-loadings to establish convergent validity. Though this approach is typically used to establish discriminant validity (Gefen & Straub, 2005), convergent validity and discriminant validity are inter-dependent and help establish each other (Straub et al., 2004). Thus, following Lowry & Gaskin (2014), convergent validity is also established when each loading for a latent variable is substantially higher than those for other latent variables. This is done by correlating the latent variable scores against the indicators as a form of factor loadings (Gefen & Straub, 2005). Table A2.2 summarizes the loadings shown in grey. From this analysis, we dropped six indicators that we judged to not load highly enough on their latent constructs, as opposed to other constructs.

Table A2.1. Outer-Model Weights of Reflective Items to Test Convergent Validity

Latent Construct	Sub-construct	Indicator	Outer-model weight	t-statistic
Internal IT service perceptions	Service leadership	sl1	0.958***	126.53
		sl2	0.973***	231.29
		sl3	0.958***	152.23
	Service vision	sv1	0.926***	96.81
		sv2	0.888***	57.57
		sv3	0.948***	157.35
		sv4	0.914***	75.04
		sv5	0.939***	103.14
		sv6	0.922***	82.30
		sv7	0.896***	64.21
		sv8	0.907***	77.30
	Service evaluation	se1	0.910***	71.97
		se2	0.949***	128.27
		se3	0.939***	119.02
IT-dependent organization agility	IT-dependent system agility	sa1	0.953***	125.29
		sa2	0.969***	185.21
		sa3	0.953***	130.65
		sa4	0.957***	164.90
	IT-dependent information agility	ia1	0.973***	160.06
		ia2	0.975***	276.01
		ia3	0.972***	244.74
		ia4	0.970***	221.59
	IT-dependent strategic agility	st1	0.932***	82.30
		st2	0.937***	95.86
		st3	0.951***	133.90
		st4	0.935***	101.54
		st5	0.960***	190.00

Table A2.2. Items to Latent Variables Analysis for Discriminant Validity

Item	L_serv_SL	L_serv_SV	L_serv_SE	L_ag_SA	L_ag_IA	L-ag_ST
sl1	.861	.662	.520	.327	.304	.320
sl2	.897	.641	.515	.296	.291	.305
sl3	.899	.639	.508	.308	.294	.310
sv1	.595	.724	.521	.320	.301	.299
sv2	.604	.720	.481	.381	.374	.370
sv3	.538	.838	.576	.409	.386	.363
sv4	.455	.771	.569	.320	.301	.270
sv5	.469	.801	.523	.294	.302	.262
sv6	.392	.767	.463	.287	.273	.240
sv7	.281	.712	.412	.277	.287	.255
sv8	.518	.783	.630	.265	.257	.281
se1	.456	.575	.832	.197	.170	.192
se2	.543	.678	.893	.357	.337	.355
se3	.526	.731	.835(d)	.349	.334	.347
sa1	.357	.555	.382	.846	.708	.632
sa2	.453	.623	.490	.882	.757	.714
sa3	.448	.557	.500	.848	.700	.667
sa4	.415	.579	.463	.812 (d)	.800	.697
ia1	.396	.588	.440	.778	.906 (d)	.773
ia2	.362	.534	.355	.659	.867	.706
ia3	.415	.583	.427	.652	.881	.745
ia4	.446	.591	.447	.616	.848	.753
st1	.384	.499	.468	.581	.713	.830
st2	.348	.478	.406	.536	.673	.759(d)
st3	.456	.610	.443	.636	.714	.764(d)
st4	.435	.479	.374	.554	.671	.794
st5	.337	.540	.383	.661	.785	.796 (d)

(d) = item dropped to improve convergent and discriminant validity

Discriminant Validity of Reflective Constructs

We used two approaches to establish discriminant validity, per Gefen & Straub (2005) and Lowry & Gaskin (2014). First, we examined the factor loadings to ensure significant overlap did not exist between the constructs (again see Table A2.2). Second, we examined the square roots of the AVEs described in, as summarized in Table A2.3. The basic standard followed here is that the square root of the AVE for any given construct (latent variable) should be higher than any of the correlations involving the construct (Fornell & Larcker, 1981; Staples, Hulland, & Higgins, 1999). The numbers are shown in the diagonal for constructs (bolded and underlined). Strong discriminant validity was shown between the subcontracts of the two reflective constructs; however, the discrimination within the IT agility construct was lacking between IT-dependent information agility and IT-dependent strategic ability. However, whether these were merged into one sub-construct or retained separately made no difference in the overall outcome of the model; thus, we retained them separately.

Table A2.3. AVE Analysis to Establish Discriminant Validity

Constructs	Sub-constructs	SL	SV	SE	SA	IA	ST
Internal IT service perceptions	SL	**.963**					
	SV	.851	**.918**				
	SE	.739	.788	**.952**			
IT agility	SA	.677	.729	.579	**.963**		
	IA	.670	.734	.572	.932	**.975**	
	ST	.662	.719	.573	.926	.966	**.963**

Bolded, underline items are the square roots of the AVEs; SL = service leadership; SV = service vision; SE = service evaluation; SA = system agility; IA = information agility; ST = strategy agility

Factorial Validity of Formative Constructs

Establishing factorial validity for formative indicators is more challenging than validating reflective indicators. The established procedures that exist to determine the validity of reflective measures do not apply to formative measures (Petter et al., 2007; Straub et al., 2004). Further, the procedures for validating formative measures are less known and established (Diamantopoulos & Winklhofer, 2001). However, standards in IS research are beginning to emerge (Cenfetelli & Bassellier, 2009).

Validating items within formative measures is particularly challenging because these items can move in different directions apart from each other. Whereas reflective indicators must demonstrate considerably high correlations among each other (i.e., exhibit high conceptual overlap) to be valid internally, the indicators of a formative construct need not meet this criterion, and instead need to represent distinct facets of the overall construct being modeled (Bollen & Lennox, 1991; Diamantopoulos & Winklhofer, 2001; Petter et al., 2007). Reflective items are interchangeable, but formative items are not interchangeable; hence, reliability measurements are not appropriate for formative constructs (Diamantopoulos & Winklhofer, 2001). Specifically, internal consistency examinations of formative constructs with Cronbach's α and average variance extracted (AVE) calculations are not methodologically appropriate (Cenfetelli & Bassellier, 2009; Marakas, Johnson, & Clay, 2007; Petter et al., 2007).

Researchers have traditionally used theoretical reasoning alone to support the validity of formative constructs (Diamantopoulos & Winklhofer, 2001). Over time, methodological approaches have emerged to improve the validation of formative constructs, such as using the modified multitrait-multimethod (MTMM) approach and assessing multicollinearity (Marakas et al., 2007; Petter et al., 2007; Straub et al., 2004). This foundation has been improved on in (Cenfetelli & Bassellier, 2009), which we follow for our validation process.

As an initial step, we assessed the absolute indicator contributions (i.e., zero-order correlations) of the individual items for service quality against the overall average of service quality. The idea with this step is to improve internal validity by removing items not exhibiting a significant association with the overall construct (Cenfetelli & Bassellier, 2009; Diamantopoulos & Winklhofer, 2001). It would be more ideal to do this using a MIMMIC model (cf., Posey, Roberts, Lowry, & Bennett, 2015) where all of the formative items of service quality were correlated to the average of a reflective construct representing overall service quality. However, no such reflective construct is available to us. All of the items exhibited significant associations with the overall measure at the 0.05 level of significance.

We also performed inter-item correlational diagnostics to assess if there were high correlations among the formative indicators, as these can significantly weaken formative measures (Diamantopoulos & Siguaw, 2006). However, the biggest potential issue that must be addressed is multicollinearity (Cenfetelli & Bassellier, 2009). Thus, we assessed the possibility of multicollinearity among all the indicators (reflective and formative) in the model. Variance inflation factors (VIFs) less than 10.0 are traditionally viewed as justification for a model's lack of multicollinearity, with less than 5.0 being ideal.

Recently, formative methodologists have called for a more stringent cutoff of less than 3.3 to be used (Cenfetelli & Bassellier, 2009; Diamantopoulos & Siguaw, 2006; Petter et al., 2007).

Several concerns emerged from this analysis. Although all of the reflective indicators had VIFs of 5.0 or less, only a few of the formative indicators were below the more stringent 3.3 cutoff. Moreover, nearly one-half of the individual regression coefficients for service quality exhibited negative beta coefficients. This seemingly counterintuitive result suggested two potential issues with the service quality measure. First, the sheer number of unique quality items modeled in the linear regressions allows for a considerable number of absolute indicator contributions (i.e., zero-order correlations) to be nullified in the presence of other significant indicators. In other words, these indicators' absolute contributions become minimized when other significant indicators are modeled simultaneously at the same level of analysis (Cenfetelli & Bassellier, 2009). Second, this finding might also suggest that some small levels of multicollinearity might be present in the model, and that the construct should be modeled as a higher-order construct (Petter et al., 2007). Thankfully, this methodological suggestion is congruent with how IT service quality has been theorized and validated in the past. Thus, we modeled service quality as a multidimensional construct as suggested by methodologists (Petter et al., 2007). To do so, rather than using service quality as an overall first-order formative measure (as we intended initially), we modeled service quality according to the literature as a second-order construct made up of tangibles, reliability, responsiveness, assurance, and empathy (Watson et al., 1998). This allows us to not only eliminate the effects of multicollinearity from these items but also in the final model analysis to better ascertain which sub-constructs of IT service quality contribute or do not contribute to our model.

Establishing Lack of Mono-Method Bias

To diminish the likelihood of common methods bias occurring in our data collection, we randomized items within the instrument so that participants would be less apt to detect underlying constructs, another potential source of common methods bias (Cook & Campbell, 1979; Straub et al., 2004). We also used a mix of first-order constructs that were reflective and formative. However, all data were collected using a similar-looking online survey; thus, we still needed to test for common methods bias to establish that it is not a likely negative factor in the data remaining for our analysis. The traditional approach to establishing lack of common methods bias is to conduct a Harman's single-factor test; however, the validity of this approach is increasingly under criticism; thus, we used the straightforward approach suggested by Pavlou, Liang, & Xue (2007). Following this approach, we simply examined a correlation matrix of the constructs and to determine if any of the correlations are above 0.90, which is evidence that common methods bias could exist (Pavlou et al., 2007). To be conservative, we conducted this analysis for the constructs and for the sub-constructs. All construct correlations were below this threshold (see Table A2.4 and Table A2.5, respectively). Several sub-constructs within a given construct were above this threshold, but never in relation to other constructs. Given the fact our model had formative items, and second-order factors, such correlation analysis cannot definitively ascertain whether common-method bias exists but provides a good indication it is likely not an important factor.

Table A2.4. Second-order Measurement Model Statistics

Construct (2nd Order)	Mean	SD	(1)	(2)
Internal IT service perceptions (1)	4.65	1.92		
IT agility (2)	4.38	2.20	.721	
IT service quality (3)	4.29	2.20	.709	.820

Table A2.5. First-order Measurement Model Statistics

Sub-construct (1st Order)	Mean	SD	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Service leadership (1)	4.58	2.17										
Service vision (2)	4.69	1.98	.851									
Service evaluation (3)	4.14	2.18	.739	.788								
System agility (4)	4.22	2.25	.677	.729	.579							
Information agility (5)	4.48	2.31	.670	.734	.572	.932						
Strategic agility (6)	4.37	2.22	.662	.719	.573	.926	.966					
Quality: Tangibles (7)	4.11	2.17	.627	.676	.519	.764	.774	.770				
Quality: Reliability (8)	4.25	2.31	.610	.727	.562	.776	.807	.802	.889			
Quality: Responsiveness (9)	4.11	2.30	.610	.739	.577	.769	.796	.795	.875	.968		
Quality: Assurance (10)	4.50	2.35	.613	.726	.543	.794	.820	.807	.889	.969	.953	
Quality: Empathy (11)	4.35	2.27	.623	.731	.544	.791	.813	.810	.896	.962	.954	.968

REFERENCES FOR ONLINE APPENDICES

Bollen, K. & Lennox, R. (1991). Conventional wisdom on measurement: A structural equation perspective. *Psychological Bulletin,* 110(2), 305-314.

Cenfetelli, R. T. & Bassellier, G. (2009). Interpretation of formative measurement in information systems research. *MIS Quarterly,* 33(4), 689-708.

Cook, T. D. & Campbell, D. T. (1979). *Quasi-Experimentation: Design and Analysis for Field Settings*. Chicago, IL: Rand McNally.

Diamantopoulos, A. & Siguaw, J. A. (2006). Formative versus reflective indicators in organizational measure development: A comparison and empirical illustration. *British Journal of Management,* 17(2006), 263-282.

Diamantopoulos, A. & Winklhofer, H. M. (2001). Index construction with formative indicators: An alternative to scale development. *Journal of marketing research,* 38(2), 269-277.

Fink, L. & Neumann, S. (2007). Gaining agility through IT personnel capabilities: The mediating role of IT infrastructure capabilities. *Journal of the Association for Information Systems,* 8(8), 440-458.

Fornell, C. & Larcker, D. F. (1981). Evaluating structural equation models with unobservable variables and measurement error. *Journal of Marketing Research,* 18(1981), 39-50.

Gefen, D. & Straub, D. (2005). A practical guide to factorial validity using PLS-graph: Tutorial and annotated example. *Communications of the Association for Information Systems,* 16(5), 91-109.

Jia, R. & Reich, B. H. (2008). *IT service climate: The validation of an antecedent construct for IT service quality.* Paper presented at the Twenty Ninth International Conference on Information Systems, Paris, France, 1-12.

Jia, R. & Reich, B. H. (2013). IT service climate, antecedents and IT service quality outcomes: Some initial evidence. *The Journal of Strategic Information Systems,* 22(1), 51-69.

Lowry, P. B. & Gaskin, J. (2014). Partial least squares (PLS) structural equation modeling (SEM) for building and testing behavioral causal theory: When to choose it and how to use it. *IEEE Transactions on Professional Communication,* 57(2), 123-146.

Lowry, P. B., Romano, N. C., Jenkins, J. L., & Guthrie, R. W. (2009). The CMC interactivity model: How interactivity enhances communication quality and process satisfaction in lean-media groups. *Journal of Management Information Systems,* 26(1), 159-200.

Lowry, P. B., Vance, A., Moody, G., Beckman, B., & Read, A. (2008). Explaining and predicting the impact of branding alliances and Web site quality on initial consumer trust of e-commerce Web sites. *Journal of Management Information Systems,* 24(4), 201-227.

Marakas, G. M., Johnson, R. D., & Clay, P. F. (2007). The evolving nature of the computer self-efficacy construct: An empirical investigation of measurement construction, validity, reliability, and stability over time. *Journal of the Association for Information Systems,* 8(1), 16-46.

Pavlou, P., Liang, H., & Xue, Y. (2007). Understanding and mitigating uncertainty in online exchange relationships: A principal-agent perspective. *MIS Quarterly,* 31(1), 105-136.

Petter, S., Straub, D. W., & Rai, A. (2007). Specifying formative constructs in information systems research. *MIS Quarterly,* 31(4), 623-656.

Posey, C., Roberts, T. L., Lowry, P. B., & Bennett, R. J. (2015). Multiple indicators and multiple causes (MIMIC) models as a mixed-modelling technique: A tutorial and an annotated example. *Communications of the Association for Information Systems*

Staples, D. S., Hulland, J. S., & Higgins, C. A. (1999). A self-efficacy theory explanation for the management of remote workers in virtual organizations. *Organization Science,* 10(6), 758-776.

Straub, D. W., Boudreau, M. C., & Gefen, D. (2004). Validation guidelines for IS positivist research. *Communications of the Association for Information Systems,* 14(2004), 380-426.

Watson, R. T., Pitt, L. F., & Kavan, C. B. (1998). Measuring information systems service quality: Lessons from two longitudinal case studies. *MIS Quarterly,* 22(1), 61-79.