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The effects of IT capabilities and delivery model on cloud computing success and firm performance for cloud supported processes and operations

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ABSTRACT

Our study examines the effect of relational, managerial and technical IT-based capabilities on cloud computing success; and analyzes how this success impacts firm performance with respect to the processes and operations supported by cloud computing. Additionally, we investigated the complex relationships that exist between IT capabilities and the public, private and hybrid cloud delivery models. Data from a sample of 302 organizations were collected to empirically test our model. The results indicate that a relational IT capability is the most influential factor to facilitate cloud success compared to technical and managerial IT capabilities. Furthermore, an evaluation of the interrelationships indicates that the public and hybrid cloud delivery models may be more dependent on relational IT capabilities for cloud success while the flexibility and agility of the firm's internal IT (technical IT capability) facilitates the public cloud. We discuss how IT-based capabilities may be used to leverage cloud delivery models to positively influence the successful implementation of cloud computing, and ultimately, firm performance for the processes and operations supported by the cloud.

1. Introduction

Cloud computing is quickly changing the nature of business and represents a projected $3.3 trillion transformation in the computing environment (Ballmer, 2010). A large number of organizations and government agencies are expected to rely on the cloud for more than half of their IT services by 2020 (Gartner, 2011). About 90% of business and technology leaders expect to implement some type of cloud computing by 2015 (Berman, Kesterson-Townes, Marshall, & Srivathsa, 2012) leaving many organizations scrambling to develop coherent plans for successful cloud deployment (Windstream, 2014). Cloud computing represents a transformational shift in IT that is rapidly changing the way in which organizations manage and deliver IT services over the internet (Shawish & Salama, 2014). As cloud computing becomes mainstream with a broad set of enterprise applications, the role of IT in organizations is strategically shifting toward reliance on external suppliers of infrastructure, software and services (Fauscette, 2013).

Many organizations are transitioning to cloud computing because it offers dynamic and scalable resources using internet-based services like Software as a Service (SaaS), Infrastructure as a Service (IaaS) and Platform as a Service (Paas) (Sharma, 2014). As organizations move more of their business functions into the cloud, some are reporting benefits like geographic expansion, better collaboration among business units, improved customer service and increased agility, as well as time to market and process efficiency (Windstream, 2014). However, despite the cloud's promise to enable organizational flexibility and agility, many organizations face challenges developing a strategy for the execution and deployment of cloud resources (e.g., internal assessments, vendor selection) (Windstream, 2014). For example, the pace at which organizations are migrating to cloud technologies suggests a shorter IT planning horizon which may have implications for the success of cloud computing (c.f., Newkirk, Lederer, & Johnson, 2008). This presents a dilemma because firms in certain industries that are slower to adopt cloud-based services will likely find themselves at a competitive disadvantage (Windstream, 2014).

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Recent research has examined the direct relationship between IT capabilities and cloud deployment success (Garrison, Kim, & Wakefield, 2012). However, it is likely that greater complexity underlies the relationships among the factors involved in determining the relative value of IT capabilities (Bharadwaj, 2000) and the role each plays in positively affecting firm performance. Within the context of cloud computing our study examines how the three main cloud delivery structures (i.e., public, private and hybrid) interact with a firm's internal IT capabilities to influence cloud success and firm performance with respect to the processes and operations supported by cloud computing. Because a firm's IT capabilities represent the ability to combine physical and human capital in ways that drive performance (Teece, Pisano, & Shuen, 1997), unraveling the relationships between the various cloud delivery structures and IT capabilities will lead to a greater understanding of how IT capabilities are effectively utilized in changing technological environments. When organizational technology experiences dynamic shifts, such as the move to cloud computing, we expect that the various IT-based capabilities will play prominent and distinct roles in the organizational response.

One objective of our study is to examine the relationship between firm-specific IT capabilities, cloud success and firm performance because the value of IT continues to be of importance to both practitioners and researchers (e.g., Kohli & Grover, 2008; Melville, Kraemer, & Gurbaxani, 2004; Santhanam & Hartono, 2003). Research also argues that the role of IT capabilities is more complex than is suggested by the direct effect models in the literature (Fink, 2011). Therefore, the present study examines the more complex interweaving of the three IT-based capabilities with the three cloud delivery models to clarify their differential influence on the success of cloud computing. We examine relational, technical and managerial IT capabilities in a cloud success model and assess how those relationships may be affected by the public, private or hybrid cloud delivery choice. Our study goes beyond the basic model of Garrison et al. (2012) and contributes to the understanding of how organizations respond to technological shifts with the internal IT capabilities at their disposal. A recent review of cloud studies (Venters & Whitley, 2012) recommends ongoing research that examines the capabilities that are necessary for firms to effectively implement and use cloud computing.

Innovative technology adoptions such as cloud computing present challenges to the organization's bottom line (Zhuang, 2005). To this point, Lim and Oh (2012), claim that cloud delivery models may impact differently the effects of IT capabilities on cloud success. Therefore, research that focuses on *how* a firm uses its capabilities to successfully meet those challenges will inform others about the specific IT capabilities that will more likely lead to cloud success. The research questions addressed in our study include: (1) What is the distinct influence of relational, technical and managerial IT capabilities on cloud implementation success? (2) How do the relationships in the model differ according to the cloud delivery structure that is chosen? The research model is tested using data collected from a global sample of 302 organizations that have adopted one of three general types of cloud delivery structures: public cloud, private cloud, or hybrid cloud. The empirical results indicate that, in general, relational IT capabilities are the most influential in cloud success. However, the results also show the specific ways in which firms combine their IT capabilities to best facilitate public, private or hybrid cloud delivery structures. While relational IT capability offers advantages for private and hybrid cloud delivery, technical IT capabilities are an important facilitator of the public cloud, and managerial IT capability is fundamental in any cloud delivery approach.

2. Literature review

2.1. IT-based capabilities and resource-based theory

In general, capabilities represent the ability of the organization to combine resources (i.e., physical and human capital) in ways that result in greater performance (Teece et al., 1997). Capabilities also describe the ability to combine unique competencies with firm resources to diversify the firm from competitors (Teece et al., 1997). A variety of IT-based capabilities have been identified and include managerial IT skills, technical IT skills and IT infrastructure (Byrd & Turner, 2001; Dehning & Stratopoulos, 2003; Mata, Fuerst, & Barney, 1995), IT-enabled processes (Bharadwaj, 2000), and relationship infrastructure and IT business experience (Bhatt & Grover, 2005; Fink, 2011; Zhang, Sarker, & Sarker, 2008). IT capabilities encompass both IT-based assets and routines (Ravichandran & Lertwongsatien, 2005; Sambamurthy & Zmud, 2000). A common finding among the research examining IT capabilities is the significant positive relationship between different IT capabilities and performance or competitive advantage (e.g., Bharadwaj, 2000; Caldeira & Ward, 2003; Dehning & Stratopoulos, 2003; Santhanam & Hartono, 2003; Zhang et al., 2008).

Since capabilities are considered organizationally embedded, non-transferable and firm-specific (Dehning & Stratopoulos, 2003; Makadok, 2001), they have the attributes that, when leveraged, may lead to firm level competitive advantage. IT-based capabilities are commonly studied using resource-based theory (RBV) which views the firm in terms of its available resources and how those resources may be combined in effective growth strategies and firm diversification (Wernerfelt, 1984). Management researchers state that firm performance originates from firm-specific capabilities and assets that, along with isolating mechanisms, helped to establish and sustain competitive advantage (e.g., Feeny & Ives, 1990; Nelson & Winter, 1982; Prahalad & Hamel, 1990; Teece, 1988; Wernerfelt, 1984). The resource-based approach in explaining the sources of competitive advantage in the firm often highlights firm-level efficiency advantages (Teece et al., 1997), which may be achieved when IT capabilities are sufficiently leveraged.

It has been noted that direct effects models in prior research clearly show that IT capabilities contribute to firm advantage; however, due to their simplicity they fall short in explaining the complexities that underlie the relationship (Fink, 2011). Recent research on resource-based (i.e., business and managerial) and process-based (technical and behavioral) IT capabilities concluded that different structural mechanisms are responsible for determining the value of different IT capabilities. For example, while technical and behavioral capabilities did not directly influence IT-based competitive advantage, they had a significant indirect influence via their effect on physical and managerial capabilities (Fink, 2011). This supports the notion that the value of different IT capabilities may result from more complex interrelationships and causally ambiguous processes (Bharadwaj, 2000). While RBV is fundamental to establishing the link between IT capabilities and performance or advantage, research that examines IT capabilities in more complex relationships will clarify the strategic value of IT.

2.2. Cloud computing

Cloud computing is defined as a shared pool of on-demand computing resources that are accessible over the internet and dynamically configured to optimize resource utilization (Garrison et al., 2012; Shawish & Salama, 2014). Cloud computing offers users ubiquitous and convenient access to a shared pool of computing resources consisting of networked servers, storage and software applications that are configured based on user requirements, rapidly provisioned to correspond with demand, and made