



Understanding cloud computing adoption issues: A Delphi study approach



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ABSTRACT

This research paper reports on a Delphi study focusing on the most important issues enterprises are confronted with when making cloud computing (CC) adoption decisions. We had 34 experts from different domain backgrounds participated in a Delphi panel. The panelists were IT and CC specialists representing a heterogeneous group of clients, providers and academics, divided into three subpanels. The Delphi procedure comprised three stages: brainstorming, narrowing down and ranking. The panelists identified 55 issues of concerns in the first stage, which were analyzed and grouped into 10 categories: security, strategy, legal and ethical, IT governance, migration, culture, business, awareness, availability and impact. The top 18 issues for each subpanel were ranked, and a moderate intrapanel consensus was obtained. Additionally, 16 follow-up interviews were conducted with the experts to get a deeper understanding of the issues and why certain issues were more significant than others. The findings indicate that security, strategy and legal and ethical issues are the most important. The discussion resulted in highlighting certain inhibitors and drivers for CC adoption into a framework. The paper is concluded with key recommendations with focus on change management, competence and maturity to inform decision-makers in CC adoption decisions.

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1. Introduction

Recently, enterprises have shown increasing interest in the adoption of cloud computing (CC) services to support critical business functions. According to Luftman et al., (2012), CC is among the five most influential technologies on a global basis, and was considered to be the third most significant IT investment in 2013 (Kappelman and McLeon, 2013). The CC market is growing; according to a recent McKinsey report, 60% of small and medium-sized enterprises (SMEs) have already purchased at least one cloud service, and 30% have purchased five or more cloud services (Avrane-Chopard et al., 2014).

CC offers unique capabilities for companies, which can quickly move into a competitive position and take advantage of service-based IT solutions at a low cost. This utility provides opportunities for companies to globalize their processes rapidly, and distributed business operations become easier to perform (Iyer and Henderson, 2010; Iyer and Henderson 2012). With decreased costs and less effort required to invest in and maintain the hardware and software, enterprises have more time to focus on their core business

activities (Garrison et al., 2012). Additionally, CC services offer features such as elasticity and scalability, which increase the flexibility and agility to undertake the necessary business changes that are required in an innovative and high-competitive environment (Venters and Whitley, 2012).

Although several benefits of CC are well known and documented, enterprises are still concerned about the risks and consequences of moving business-critical applications to the cloud. For instance, the distributed nature of CC leads to many different issues, including security and privacy threats, national and international regulations, and the external business environment in which the enterprise operates (Armbrust et al., 2010; Kern Kreijger et al., 2002; Marston et al., 2011). A main critique of CC is that the security cost, and the privacy and availability concerns may outweigh its benefits (Kshetri, 2013). Several surveys have concluded that the security issue in particular is the most serious barrier to CC adoption within enterprises (Kshetri 2013; Cloud Security Alliance 2013), and consequently, research studies from computer science have focused primarily on different technical issues in terms of security issues and threats (Hashizume et al. 2013; Dorey and Leite 2011; Zissis and Lekkas 2012). Moreover, reliability and trust are emphasized as barriers in particular for SMEs (Gupta et al. 2013), and compatibility issues (e.g., vendor interoperability, connectivity to existing technology, inter-organizational connectivity) have been

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identified as an adoption inhibitor (Cegielski et al. 2012; Schneider and Sunyaev 2014; Stieninger et al. 2014).

However, while there are studies that have focused on technological aspects regarding CC implementation (Brender and Markov 2013; McGeogh and Donnellan 2013; Garg et al. 2013), the decision regarding whether to adopt CC solutions is additionally complicated by a number of strategic issues (Schneider and Sunyaev 2014). Several studies have pointed out that there is a lack of knowledge and empirical evidence regarding which issues are most important for CC adoption decisions (Schneider and Sunyaev 2014; Yang and Tate 2012). Our research study seeks to contribute to this literature gap, and our research focus is threefold. First, the purpose of this study was to identify the most important issues related to CC adoption decisions in enterprises. Second, we wanted to determine the relative significance of the identified issues. Third, we wanted to elaborate on why these identified issues were important.

Due to the nature of our problem, we decided to utilize the Delphi method. This particular research method is appropriate for “identifying and prioritizing issues for managerial decision-making” (Okoli and Pawlowski 2004, p.1), and 34 experts constituted the Delphi panel in this study. Moreover, we combined our Delphi study results with follow-up interviews with some of the panelists. This methodological approach was appropriate for this study and provided opportunities to achieve a broad overview of CC adoption issues and stakeholders’ priorities. The following three research questions (RQs) guided this research:

RQ1: What issues confront enterprises when adopting CC services?

RQ2: What is the relative importance of these issues?

RQ3: Why are these issues important?

The remainder of the paper is organized as follows. First, we present some key concepts of CC and the background and motivation for why this research is needed. Thereafter, the methodological approach is introduced, followed by the presentation and discussion of the results. Finally, further implications for research, practice, and management are identified.

2. Background

According to the National Institute of Standards and Technology (NIST), CC is defined as “a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction” (Mell and Grance 2011, p.2). The current CTO of Cisco described cloud service models, saying, “I see it as three layers: SaaS (software-as-a-service), which delivers applications such as Google Apps and Salesforce.com; PaaS (platform-as-a-service), which provides foundational elements for developing new applications; and IaaS (infrastructure-as-a-service), which is what Amazon has led with, showing that infrastructure can also be accessed through the cloud” (Creeger 2009, p.52).

There are several deployment models for CC (Mell and Grance 2011). In a public cloud, the technology is available to all or adapted to a certain industry. A private cloud can be created for a particular company and can be operated by the organization itself or outsourced to other suppliers. In a community cloud, the cloud infrastructure is limited to a specific community of consumers from organizations that may have shared demands (e.g., security requirements, policy, and compliance considerations). In a hybrid cloud, public and private cloud services are combined.

It was foreseen that, by 2015, businesses will be more oriented towards agility (Andriole 2012). CC was speculated to be among

technology trends that will define how organizations acquire, deploy, and maintain information technology (IT) in the future, and the concern for researchers has to focus on “what are the obstacles to cloud adoption, rank-ordered by concern, cost, and impact?” (Andriole 2012, p.68). CC has recently received increased attention from the IS research community (Lacity and Reynolds 2014; Venters and Whitley 2012; Chen and Wu 2012; Loebbecke et al. 2012; Galliers et al. 2012). However, the issues and the implications of CC are still poorly understood (Luftman et al. 2012), and CC is yet an immature research area (Lacity and Reynolds 2014; Lacity et al. 2010). With the increasing development of service models for IT delivery and businesses’ interest in such models, scholars are encouraged to contribute to “advancing the knowledge base on phenomena related to IT-based services” (Fielt et al. 2013, p.46).

Thus, there are several reasons that have motivated our research on CC adoption. First, IS researchers have recommended several future research directions to gain more knowledge about the benefits and challenges of CC. These recommendations encompass CC economics, strategy and policy issues, technology adoption and implementation issues, regulatory issues, among others (Marston et al. 2011), and focus on the service dimensions of the cloud in terms of efficiency, creativity, and simplicity (the cloud’s desires) (Venters and Whitley 2012).

Second, we position our research as a contribution to IS studies on IT services, which have recently received an increased attention in both academia and industry (e.g., increased focus on service-oriented architecture (SOA), web services, and CC). Thus, there has been a call for more research to advance the knowledge base on phenomena related to IT services, including CC (Fielt et al. 2013). Future research needs to take on an interdisciplinary perspective to add knowledge to the science of service by exploring the value of CC across different industries. This involves studying economic, technical, and organizational issues of CC adoption (Bardhan et al. 2010).

Third, as CC represents a paradigm shift from traditional IT outsourcing (ITO) to netsourcing (Dibbern et al. 2004; Susarla et al. 2003; Kern, Lacity, et al. 2002), the ITO literature has prompted research that focuses on IT delivery as a service and has suggested future research directions for CC (Lacity et al. 2010; Lacity et al. 2009; Schneider and Sunyaev 2014). The existing body of research on ITO provides an appropriate foundation for investigating cloud-sourcing decisions (Muhic and Johansson 2014). However, while traditional ITO shares common characteristics with cloud sourcing, there is a need to gain a broader understanding of specific features and strategic issues of CC as a sourcing model, which traditional ITO solutions do not possess (Schneider and Sunyaev 2014; Malladi and Krishnan 2012). In order for businesses to maximize their benefits from adopting CC services, they need to consider three key elements: potential risks, opportunities, and challenges (Marston et al. 2011). Therefore, the challenge for businesses is to “strategically decide whether and how to pursue various service transformation” (Su et al. 2009, p.381). This puts the responsibility on executives to “have extensive judgment and insight regarding organizational structures, interdependencies, processes, and habits to thoroughly comprehend decision alternatives and the set of required structural choices” (Schneider and Sunyaev 2014, p.1). Thus, there is a need for further research regarding strategic motivations, internal and environmental influences, and dynamic interactions between these influences (Schneider and Sunyaev 2014; Lacity et al. 2010).

With regard to the abovementioned backdrop, there is a need for more empirical research to explore and to advance our knowledge on the issues that are of most concern when enterprises consider adopting CC services. This is necessary to provide guidelines for decision-makers in enterprises considering migration to CC services.

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