CPR/MIS 2016: G: Investigating the Role of Top Management Support between Institutional Pressures and Cloud Implementation Success

Abstract

While cloud computing adoption is on the rise, barriers continue to play a critical role in delaying the progress of some cloud computing adoption efforts. In 2010 the United States federal government launched the 'Cloud First' policy which requires government agencies to consider the adoption of cloud computing when the solution is secure, reliable and cost effective (Kundra, 2010). Unfortunately, cloud computing adoption among federal agencies has been sluggish. This study investigates pressures asserted to facilitate cloud computing adoption. Although a vast amount of literature exists, very few studies empirically investigate cloud computing adoption from an institutional perspective in concert with top management support. This study aims to fill the gap where the literature is lacking concerning the adoption of cloud computing by federal agencies.

Keywords

Cloud Computing; Top Management; Institutional Theory

1. Problem and Motivation

Cloud computing adoption is an innovative information technology strategy embraced by organizations to achieve operational efficiencies such as scalability, flexibility, reliability, and cost savings through internet-hosted services. Considering the vast benefits, cloud computing adoption has been gradual due to a myriad of barriers challenging organizations across industries. The Federal Government is no exception to this apparent phenomenon. Despite the advantages of cloud computing, adoption among U.S. federal agencies has been sluggish. Seeking to leverage the benefits of cloud computing, the federal government instituted a Cloud First policy that requires its agencies to assess practicable cloud computing options prior to pursuing any new investments (Kundra, 2010). To accelerate the shift to the cloud, Office of Management and Budget (OMB) directed agencies to migrate at least three services to a cloud-based solution by June of 2012. In response to the policy, several federal agencies contracted for cloud computing services from commercial vendors (Kundra, 2011). However, implementation of cloud services was impeded by multiple challenges for federal agencies such as meeting federal security requirements, acquiring cloud knowledge and expertise, certifying and accrediting vendors, and ensuring data portability and interoperability, when faced with implementing cloud computing technology (Government Accountability Office, [GAO], 2012). These challenges have significantly affected federal agencies' ability to harness the benefits of cloud computing and raises concern for the implementation strategy of cloud computing in the federal government.

Persistent struggles to take advantage of cloud computing technology motivates this study as it prevents agencies from reducing maintenance costs of existing infrastructure, eliminating duplicative IT systems supporting similar business processes, and dedicating more time to core business processes. This study proposes to investigate the roles of top management support and information security awareness and their impact on cloud implementation success of federal agencies.

2. Background and Related Work
2.1 Previous Work

Previous studies on cloud computing primarily focused on organizational factors affecting adoption and employed the use of several theories to investigate these factors. For example, Bhattacherjee and Park (2013) used migration theory to investigate the behavioral intentions and other drivers that facilitated end-users' abandonment of their existing technology in favor of migrating to cloud computing. Incorporating the Social Exchange Theory into the Technology Acceptance Model, Obeidat and Turgay, (2013) formulated and validated the Technology Trade Theory (Triple T) in their empirical analysis of factors affecting cloud adoption initiatives by IT executives. Although valuable to cloud computing knowledge development, none of these studies examined the influence of institutional pressures and the role of moderators such as top management support and information security awareness on cloud computing adoption.

As an innovative technology, cloud computing adoption has been studied employing the use of Diffusion of Innovation (DOI) theory (Alhammadi et al., 2015 and Stieninger et al., 2014). Researchers have also used the Technology Acceptance Model (TAM) to study cloud computing adoption (Stieninger et al., 2014 and Behrend et al., 2011). Several cloud computing adoption studies have also employed the use of the Technology, Organization, Environment (TOE) framework (Oliveira et al., 2014 and Low et al., 2011).

Drawing from Institutional Theory and Transaction Costs Economics, Yigitbasioglu (2015) used the qualitative methodology to provide evidence on cloud computing adoption from the perspective of external auditors in Australian accounting firms with forensic accounting practices. Yigitbasioglu found that mimetic pressure and institutions such as top management were significant in cloud computing adoption. His study called attention to the critical role that top management plays in supporting the adoption of new technologies through resource provision and commitment. Employing a combination of DOI theory and TOE framework, Alhammadi et al., (2015) investigated the factors which influence the adoption of cloud computing. They found that security had a statistically significant relationship with cloud adoption. Consistent with other studies, they found that top management support, organization readiness, and enterprise status was found to significantly influence cloud computing adoption. Their usage of DOI found support for compatibility as it had a significant impact on cloud computing adoption. Oliveira et al., (2014) used a combination of DOI theory and the TOE framework to investigate direct and indirect effects of the innovation characteristics and the TOE contexts on the adoption of cloud computing by firms in Portugal. They surveyed CIOs, directors, and senior IS managers from 369 firms in the manufacturing and service industries. Their quantitative findings suggest that relative advantage, complexity, technological readiness, top management support, and firm size influence a firm's adoption of cloud computing. Hsu et al., (2014) examined the determinants of cloud adoption through the lens of

TOE. They surveyed 200 Taiwanese firms consisting of Taiwan's information and communications technology (ICT) manufacturing, ICT service, general service, and general manufacturing industries. They found that perceived benefits and IT capability are positively related to cloud computing adoption while business concern is negatively related. They also found that it is not firm size but firm's IT capability that significantly affects their cloud adoption intention. In their application of migration theory, Bhattacherjee and Park (2013) investigated the behavioral intentions and other drivers that facilitate end-users' abandonment of their existing technology to migrate to cloud computing. They found that intention to migrate to the cloud had a strong and significant effect (standardized ß=0.578; P<0.000) on cloud migration behavior. Park and Ryoo (2012) used Two-Factor Theory of Technology Usage to investigate factors which inhibits end-users' switching behavior to cloud services as well as those factors that enables switching behavior. They found that switching benefits had a significantly positive effect on intention to switch (standardized ß=0.179; P<0.01) and switching costs had a significantly negative effect on intention to switch (standardized ß=-0.128; P<0.01). Focusing on the diffusion and adoption of cloud computing in high tech industries, Low et al., (2011) employed the Technology-Organizational-Environment (TOE) Framework to investigate factors that affect the adoption of cloud computing by firms belonging to the high-tech industry. Cegielski et al. (2012) employed the Organizational Information Processing Theory to assess how firms' information processing requirements and capabilities combine to affect the intention to adopt cloud computing technology in supply chains. Finally, the Technology Acceptance Model (TAM) was used by Behrend et al. (2011) in their investigation of factors leading to successful implementation of cloud computing in a community college setting. A concluding theme of this literature review is that previous research has recognized drivers and benefits of cloud computing adoption as well as barriers to cloud computing adoption. This study extends the work of Liange et al. (2007) who studied the impact of external institutional pressures on the degree of usage of enterprise resource planning (ERP) systems by adapting their framework in the context of cloud computing adoption.

3. Institutional Pressures and Moderators

3.1 Institutional Theory

Institutional theory has been applied in the field of information systems by several researchers (Zheng et al., 2013, Basaglia et al., 2008, and Liang et al., 2007). Institutional theory views the social world as significantly comprised of institutions – rules, practices, and structures that set conditions on action. Neo-institutional theory, emerged with the seminal works of Meyer and Rowan (1977) and DiMaggio and Powell (1983). A central tenant of neo-institutional theory asserts that organizations and organizational actors seek to gain legitimacy through the process of homogeneity to ensure their survivability. Homogeneity in organizational fields occurs as the result of institutional isomorphic changes within organizational environments. DiMaggio and Powell (1983) introduce three isomorphism mechanisms as a compelling means to influence an organizational actor to resemble another organizational actor subjected to the same environmental circumstances. It is expected that each isomorphic mechanism will have a significant role in cloud computing adoption.

Coercive Isomorphism

Coercive Isomorphism is formal and informal pressures and cultural expectations exerted on organizations by organizations upon which they are dependent (DiMaggio and Powell, 1983). In the extant literature, coercive pressures have been found to exact dominance on actors dependent upon them for resources (Salge et al., 2015, Mignerat and Rivard, 2009, Teo et al., 2003). Subordinate organizations often depend upon their superior organization for resources in order to sustain their current level of operations. If the subordinate organization is viewed as legitimate, or subscribing to the tenants of the superior organization, then resources will be provided. Coercive pressure could have a direct or indirect effect and can be influenced by other variables. Zheng et al. (2013) found that Total Management Commitment was influenced by coercive pressures from superior organizations and latent-user organizations to support the adoption of Government to Government usage of e-government. Teo et al. (2003) found that coercive pressures significantly influenced organizations' intention to adopt financial exchange data interchanges (FEDI). In the context of cloud computing adoption in the Federal Government, coercive pressures stem from government mandates and policies established which direct Federal Agencies to adopt cloud services (Kundra, 2010). Thus, the following hypothesis is presented:

H1: Coercive pressures will have a positive association with cloud implementation success.

Normative Isomorphism

DiMaggio and Powell (1983) references professionalization as a collective struggle of professionals to establish their occupational legitimacy through formal education and membership in professional networks. This normative isomorphic organizational change not only encourages a behavior of building and sharing knowledge norms among the organizational network but it enables a common approach to problems by members with the same educational background (Teo et al., 2003). Two aspects of professionalization identified by DiMaggio and Powell (1983) as sources for isomorphism are formal education and social networks. For Federal organizations, institutional intervention to promote knowledge building is essential to sustained production of innovation or establishment of productive norms of its IT specialists employing cloud computing technologies throughout the Federal Government (King et al., 1994). For example, organizations that require formal education and certification for its members responsible for implementing cloud services may facilitate a shared environment of cloud knowledge and skills thus strengthening norms. DiMaggio and Powell (1983) suggest that sharing norms of adoption innovation facilitates consensus, which increases the strength of these norms and their influence on organizational behavior. The following hypothesis is provided:

H2: Normative pressures will have a positive association with cloud implementation success.

Mimetic Isomorphism

Uncertainty, misunderstood technologies, and ambiguous goals are all mimetic pressures that may lead organizations to capitalize on the experience of other organizations by modeling themselves after the other organization (DiMaggio and Powell, 1983). The imitation or modeling of an organization after another organization deemed successful within the institutional environment because of mimetic pressures enables decision makers to minimize experimentation

costs and avoid risks that are borne by early adopters (Teo et al., 2003). Since cloud, computing is a relatively new technology; it has the characteristics of uncertainty, ambiguity, and misunderstanding. Hence the following hypothesis:

H3: Mimetic pressures will have a positive association with cloud implementation success.

3.2 Top Management Support

Several researchers have used institutional theory in combination with other theories to complement institutional theory by compensating for its scarcity in specifically explaining how subordinate organizations decide which actions to take to respond to external pressures (Zheng et al., 2013 and Jensen et al., 2009). Zheng et al. (2013) invoked institutional theory to address conformity to pressures from superior organizations and resource-based view to explain how public administration organizations utilize their internal resources and capabilities to respond to external pressures. Zheng et al. (2009) integrated sensemaking theory with institutional theory to provide a multi-level analysis for IS implementation. Sensemaking theory compliments institutional theory by addressing how the human agency influences the social practices from which the institutions are created (Zheng et al., 2009). This study uses Top Management Support to compliment institutional theory as it explains how key leaders use its resources in response to institutional pressures. Top management support has been acknowledged considerably in the IS literature (Al Shaar et al., 2015, Liu et al., 2015, Chollet et al., 2012, and Lin, 2010). Drawing on the work of Lin (2010) this study operationalizes top management support as the degree to which top management understands the importance of cloud computing adoption and the extent to which top management is involved in cloud computing adoption. The involvement and participation of top management, such as the CEO and CIO, in managing IT and committing resources to cloud services illustrates the degree of importance placed on cloud computing (Jarvenpaa and Ives, 1991). Zheng et al. (2013) found that top management had positive and significant ($p < 0.001$) influence on the allocation of IT human resources and financial resources which lead to the intention to adopt technology. Hence, it is essential that top management assess the needs of its employees and build strong ties to fulfil those needs, thus encouraging motivation for employees to innovate and solve problems (Al Shaar et al., 2015). Top management support reduces uncertainty of the team throughout the adoption process because the team can count on the resources necessary to see the task to completion (Chollet et al., 2012). Top management participation has been found to have significant influence on assimilation of technology within an organization. Liang et al. (2007) confirmed top management participation to positively affect the degree of technology usage ($p < 0.05$). Not only must top management champion support for cloud computing, but they must ensure training and education is available for deploying cloud strategies and manage expectations for cloud adoption. Drawing on an argument put forth by Lin (2010), top management support is crucial in enhancing the incorporation of technology into the fabric of business strategy that facilitates cloud computing adoption, the following is hypothesized:

H4a: Top management support will positively influence the relationship between coercive pressures and cloud implementation success.

H4b: Top management support will positively influence the relationship between normative pressures and cloud implementation success.

H4c: Top management support will positively influence the relationship between mimetic pressures and cloud implementation success.

3.3 Information Security Awareness

Concerns for security in the cloud environment have been discussed thoroughly in the literature by several researchers (Modi et al., 2013, Ogigau-Neamtiu, 2012, Shaikh and Sasikumar, 2012, and Cebula and Young, 2010). They agree that securing the cloud computing environment is a complex and challenging endeavor but critically necessary to facilitate cloud adoption. Part of the challenge of securing the cloud environment is understanding the source of security risks associated with the cloud environment. Rubóczki and Rajnai (2015) suggest the complex issue of cloud security requires a solid understanding of cloud solutions for various security domains and expert understanding of compliance and risk management. Cebula and Young (2010) presents a taxonomy of operational security risks and organizes them in four classes, 1) actions of people, 2) systems and technology failures, 3) failed internal processes, and 4) external events. This taxonomy enables a source identification matrix for security issues found at each level of the cloud computing environment. Modi et al. (2013) survey security issues in the cloud at various levels and propose that since cloud computing is a merger of several known technologies; inherent in those existing technologies are vulnerabilities, which facilitate risks in the cloud computing environment. One example is virtualization, which is used extensively to create virtual machines that could be distributed among different organizations residing in the same public cloud. Virtual machines share the physical resources in the environment and are susceptible to compromise (Shaikh and Sasikumar, 2012). If hackers gained access to the host operating system, then they could gain control of each guest operating system in that environment. Another example is vulnerabilities of internet protocols such as HTTP. Because it is a web application protocol that requires session state, HTTP is subject to session riding and session hijacking (Modi et al., 2013). Security issues such as phishing and data loss because of the vulnerabilities in the underlying technologies have been attributed to holding back the growth of the cloud computing market (Sinjilawi et al., 2014). Since each level of the cloud computing environment has security vulnerabilities, understanding responsibilities of actors involved in securing the environment is necessary. Ogigau-Neamtiu, (2012) assesses the cloud computing environment and divides responsibility between the cloud provider and the client based on the service deployment model. For example, in an IaaS deployment the cloud provider is responsible for security of that level of service, which includes security of the physical hardware, virtualization software, and the environment. The client is responsible for securing everything else above that level. Understanding the cloud provider/client responsibilities for each service deployment creates information security awareness. IS awareness has been found to modify the behavior of individuals thereby fostering a secure environment. In their investigation of antecedents of information security policy compliance, Bulgurcu and Cavusoglu (2010) found that information security awareness (ISA) significantly influenced employees' compliance with security policies. They formed information security awareness with two dimensions, general

information security awareness (GISA) and information security policy awareness (ISPA). Awareness of the information security throughout the organization is imperative to facilitate growth of the cloud computing market. Information security awareness has been found to significantly influence compliance behavior among employees of information security policies (Humaidi and Balakrishnan, 2015). Thus, the following is hypothesized:

H5a: Information security awareness will positively influence the relationship between coercive pressures and cloud implementation success.

H5b: Information security awareness will positively influence the relationship between normative pressures and cloud implementation success.

H5c: Information security awareness will positively influence the relationship between mimetic pressures and cloud implementation success.

3.4 Conceptual Model

Drawing on DiMaggio and Powell (1983) Neo-Institutional Theory, the conceptual model for this study explores the effects of Top Management and Information Security Awareness on cloud implementation success from a federal government perspective.
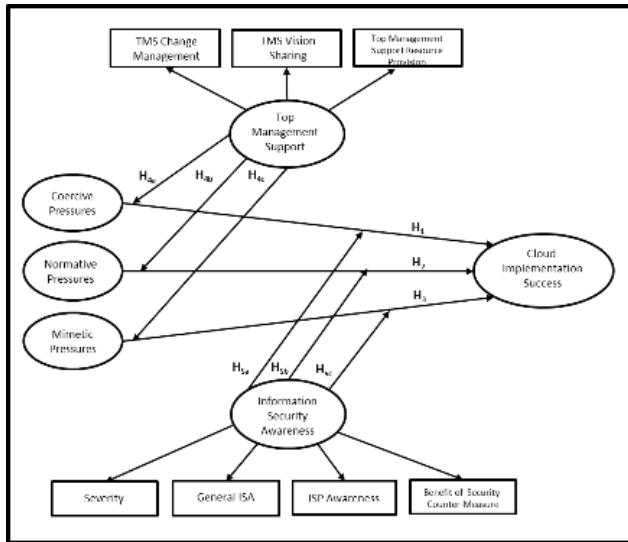
3.5 Methodology

The purpose of this survey research is to investigate the effects of institutional pressures on cloud implementation success and moderation imposed on that relationship by top management support and information security awareness. Pinsonneault and Kraemer (1993) define survey research as a quantitative method, requiring standardized information from and/or about the subjects being studied. Survey research is appropriate for the proposed study due the investigation of expected relationships between independent and dependent variables and the effects of moderating variables. It is an adequate method of collecting primary data from individuals who are responsible for resourcing and implementing the cloud environment and expected to be impacted by institutional pressures. The proposed study will employ a quantitative, non-experimental, correlational design. A cross-sectional design will be used, as data will be collected at one point in time. The advantages of a cross-sectional design are that it is less time consuming, less expensive, and large amounts of data can be collected. An email-based survey method (questionnaire) will be used to collect data.

The population for the proposed study is the more than 3,500 federal IT Specialists employed by 16 operational and support components (agencies or organizations) of DHS. The unit of analysis for this study will be conducted at the individual level. Of the 16 agencies, Information Technology Managers, Program Managers and Specialists will be included as participants in the proposed study. The sample for this study will be determined using the stratified sampling technique. Stratified sampling has been shown in the literature to be unbiased and representative of the total population. This study will use a sample size of at least 220 participants as required to use SEM. A sample size check utilizing G Power calls for a minimum sample size of 129 participants will be required at the effect size of 0.15, alpha at 0.05, and power at 0.95.

The survey instrument proposed for data collection for this research is a questionnaire consisting of items measuring specific variables adapted from the literature reviewed for this study. Herath and Rao (2009) suggest adopting items from previously validated scales reduces problems with the reliability and validity of the questionnaire. Items on the survey will be measured using a 7-point Likert scale. A pilot test will be conducted to ensure initial reliability of the scales I have adopted and modified. A preliminary reliability test will be conducted with a Cronbach's alpha test (Herath and Rao, 2009).

This study will employ Structural Equation Modeling (SEM) using the Partial Least Squares (PLS) method to analyze data collected and test hypothesized relationships between the variables in this study. SEM provides a general and convenient framework for statistical analysis that includes traditional multivariate statistical analysis, which includes factor analysis, regression analysis, and discriminant analysis (Hox and Bechger, 1998). In a review of PLS-SEM articles, Ringle et al. (2012) found that a common argument for using PLS-SEM is that the technique excels at prediction and almost all model estimations use the coefficient of determination R^2 values to characterize the ability of the model to explain and predict the endogenous variables. Researchers have used SEM in several studies where non-experimental data was collected and analyzed and is thus appropriate for this research (Bhattacherjee and Park, 2012, Park and Ryoo, 2012, and Teo et al., 2003).

This study will use previously used items measuring specific variables adapted for this study.

Table 1. Operationalization of variables

Variable	Role	Adapted from
Intention to Adopt Cloud Computing	Dependent Variable.	Teo et al. (2003).
Coercive Pressures	Independent Variable.	DiMaggio and Powell, (1983).
Normative Pressures	Independent Variable.	DiMaggio and Powell, (1983).
Mimetic Pressures	Independent variable	DiMaggio and Powell, (1983).

Top Management Support	Moderating variable.	Liang et al., (2007).
Information Security Awareness	Moderating variable.	Humaidi and Balakrishnan, (2015)

4. Results

4.1 Implications

The findings of the proposed research offer guidance to management and IT practitioners regardless of their participation in cloud computing implementation. The moderating role of top management expects to play a critical role in cloud computing adoption and if taken for granted then failure to achieve success could be the result of a lack of participation on top management's part. Institutional forces such as policies and mandates are not expected to facilitate cloud computing adoption alone. They will require moderation from other constructs. Top Management will find that having the personnel with the proper skillsets and training to enhance existing knowledge facilitates success in cloud computing implementation.

4.2 Limitations

The proposed study will have some limitations. One limitation is that the sample is limited to federal employees of DHS, which implies that the study reflects only the perspective of federal employees. A significant number of federal contractors employed by DHS play a critical role in information technology implementation throughout DHS. Another limitation is that the research will be conducted within DHS and may not be representative of the entire federal government. Other departments in the federal government could be experiencing significant progress in cloud computing adoption.

5. Contributions

This research will provide a distinctive theoretical contribution to institutional theory by advancing our understanding of the process by which moderating factors impact cloud implementation success. In addition to contributing to the Top Management literature, this research advances knowledge in the cloud computing literature by being the first to provide empirical evidence in examining federal organizations. Finally, this research contributes to future research on why agencies choose specific cloud service implementations.

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