

# On Structural Considerations for Governing the Cloud

*Completed Research Paper*

**Acklesh Prasad**

QUT Business School  
Queensland University of Technology  
Brisbane, QLD 4000, Australia  
[acklesh.prasad@qut.edu.au](mailto:acklesh.prasad@qut.edu.au)

**Peter Green**

UQ Business School  
University of Queensland  
Brisbane, QLD 4072, Australia  
[p.green@business.uq.edu.au](mailto:p.green@business.uq.edu.au)

**Jon Heales**

UQ Business School  
University of Queensland  
Brisbane, QLD 4072, Australia  
[j.heales@business.uq.edu.au](mailto:j.heales@business.uq.edu.au)

**Glen Finau**

School of Accountancy  
University of the South Pacific  
Suva, Fiji  
[finau\\_g@usp.ac.fj](mailto:finau_g@usp.ac.fj)

**ABSTRACT**

In this research, we suggest appropriate information technology (IT) governance structures to manage the cloud computing resources. The interest in acquiring IT resources a utility is gaining momentum. Cloud computing resources present organizations with opportunities to manage their IT expenditure on an ongoing basis, and are providing organizations access to modern IT resources to innovate and manage their continuity. However, cloud computing resources are no silver bullet. Organizations would need to have appropriate governance structures and policies in place to ensure its effective management and fit into existing business processes to leverage the promised opportunities. Using a mixed method design, we identified four possible governance structures for managing the cloud computing resources. These structures are a chief cloud officer, a cloud management committee, a cloud service facilitation centre, and a cloud relationship centre. These governance structures ensure appropriate direction of cloud computing resources from its acquisition to fit into the organizations business processes.

**Keywords**

Cloud computing, cloud governance structures, utility computing, relational theory.

**INTRODUCTION**

In this study, we suggest possible information technology (IT) governance structures for cloud computing. Cloud computing is an information technology service model where computing services (both hardware and software) are delivered on-demand to customers over a network in a self-service fashion, independent of device and location (Marston, Li, Bandyopadhyay, Zhang and Ghalsasi, 2011). IT governance structures relate to the configuration of organizational resources to govern IT resources. This exercise of understanding IT governance structures for the cloud computing environment is important because internal and external pressures (for example market share, processes efficiencies, cost reduction) are compelling organizations to turn to utility-based computing resources to manage these pressures. Utility-based computing resources relates to obtaining computing resources on an ongoing basis at a charge. This situation means that organizations already have taken, or are considering a path to cloud computing. However, while the adoption of cloud computing would externalize the IT service delivery landscape, its governance functions will remain central to organizations (Blair, 2010; Plummer, 2012). Successful organizations will need to update or evolve these governance functions in order to realize the business value associated with cloud services (Block, 2012). In fact, organization should consider their governance issues relating to their path to the cloud before making any decisions to engage with the cloud providers, and reorganize their infrastructure and processes.

Thus, in this research we address a key question: What are the appropriate IT governance structures for managing cloud computing resources? Our review of the extant literature suggests that there are practice-based conceptual deliberations on

the benefits of cloud computing and the surrounding technologies (for example, KPMG, Gartner). Academic contribution is starting to focus on business-related issues surrounding cloud computing (see for example, Brumec and Vrček, 2013; Marston et al., 2011; Misra and Mondal, 2011; Sultan, 2010). Our effort of focussing on governance structures is novel, and appropriately complements these business-fit considerations. The outcomes of cloud governance initiatives will have direct ramifications on organizations' business processes, including the accounting processes.

We posit that organizations' cloud-based IT governance structures will have a relational element with the providers of the cloud service. This situation concurs with the conceptual underpinning of the relational view of the firm (Borgatti and Cross, 2003; Dyer and Singh, 1998). Within this conceptual underpinning, organizations should identify their IT governance competences, but should also be able to identify synergies with the partners (cloud providers) to improve the relational rent of the cloud infrastructure. That is, effective cloud-based services will require a strong and consistent element of understanding with the cloud providers.

We adopted a mixed design, which included analysis of conceptual deliberations and an interpretive exercise with the champion adopters of cloud resources to suggest possible IT governance structures of cloud computing. We suggest a chief cloud officer, a cloud management committee, a cloud service facilitation centre, and a cloud relationship centre as IT governance structure for cloud computing. These governance structures ensure appropriate direction of cloud computing resources from its acquisition to fit into the organizations business processes. The rest of the paper progresses as follows. We present an overview of cloud computing in the next section. Following this, we present the study's theoretical underpinning and discuss the research design. We then discuss the findings of the study and provide future directions and concluding remarks on the study.

## **CLOUD COMPUTING – AN OVERVIEW**

The concept of cloud computing is an addition to an existing technology-related paradox. On one hand, the computing resources are getting exponentially more powerful with decrease in performance unit costs (Turban and Volonino, 2011). On the other hand, the pervasive use of computing resources and the resultant complex infrastructure is making the management of computing resources an expensive exercise for organizations (Marston et al., 2011). However, within this paradox, the impetus for a path to cloud computing is predominantly from a cost perspective. IT-related capital expenditure is often underutilized with servers and desktops used well below their power and capacity (Marston et al., 2011). Another factor is the significant cost of managing organizations computing resources. For example, a major State Government in Australia plans to outsource most of its IT functions after an alarming report warned it would cost up to \$7 billion to repair outmoded systems at the mercy of hackers (Houghton, 2012). Organizations also see feasible management of IT infrastructure management within the cloud computing environment. These promises of cloud has echoed expectations of cloud computing to be a \$206.6 billion business in 2016, with a substantial investment by the small to medium enterprises (SMEs) (Gartner, 2012). This level of interest in this environment proves a timely call to consider decision and management structures of adopting and utilizing these technologies.

Cloud computing provides two important initiatives. First is the promise of IT efficiency in terms of access and use of modern IT resources through a utility-based concept. Organizations are able to acquire scalable software and hardware resources at a fraction of the conventional capital expenditure cost. Second, organizations are able to use these modern IT resources to become agile, and achieve or protect their competitive advantage. Organizations would be able to radically redefine their business processes, and use modern business intelligence tools on real time data to meet changing consumer expectations. Cloud computing offers several opportunities to organizations. Essentially, these are different delivery models of cloud computing, all of which refer to the different layers of the cloud computing architecture.

The most common architecture is Software as a Service (SaaS). With SaaS, applications run on the cloud, eliminating the need to install and run the application on an organization's computer. Common social networking platforms like Facebook and Twitter are examples of SaaS applications. A Platform as a Service (PaaS) facilitates the development and deployment of applications without the cost and complexity of buying and managing the underlying hardware and software layers. A common PaaS example in business is the Salesforce's Force.com. An Infrastructure as a Service (IaaS) facilitates storage and computing capabilities as a service. Amazon's S3 storage service is a common example of IaaS. Organizations can also deploy cloud computing models in different ways. A public cloud serves a wider community where computing resources are available from a third party service provider via the Internet. This model is a cost-effective way to deploy IT solutions, and appeals well to SMEs. A private cloud is managed within an organization. Private clouds provide greater control over the cloud infrastructure, and appeals well to the larger organizations. A hybrid cloud is also available where non-critical information is outsourced to the public cloud, while business-critical services and data are kept within the control of the organization.

Many ideas and concepts within the cloud environment are not new. The concept of acquiring resources as utility has been present for a long time. However, today there is a compelling fit of the cloud-based IT resources and the nature of need of IT resources in organizations. The cloud computing environment offers several compelling promises for today's businesses. There is an opportunity for immediate access to critical software and hardware resources as an operational rather than a capital commitment. This situation makes the outcomes of investment in IT more apparent. This nature of access to computing resources opens the opportunity for innovation across organizations – something previously deemed a luxury commodity to larger organizations. SMEs would be able to access critical business analytics tools and resources for their data to identify important trends and opportunities. Cloud computing also makes most IT resources more accessible to developing markets that lack the resources for widespread deployment of IT services. Organizations also have a better control of service scalability through access to more reliable information to meet stakeholder demands for these services. Organizations can swiftly reorganize their IT resources to areas of need without causing distress to existing operations. These opportunities of cloud computing offers much promise to organizations in facilitating the fit of the IT resources to their business process. However, optimum leverage of the opportunities of cloud computing will require sound IT governance structures. In the next section, we discuss the theoretical framework through which we would suggest appropriate IT governance structures to manage the cloud resources.

### THEORETICAL FRAMEWORK

Organizations have the responsibility to govern their resources to meet the expectations of various stakeholders. A change in the nature of acquiring IT resources within the cloud computing environment does not alter this responsibility. However, organizations will have to adopt more liberal governance approaches to manage today's dynamic IT resources. In today's business environment, organizations' governance efforts should be their core capability. An organizational capability is a unique know-how to leverage the enabling potential of other common resources. This situation is consistent with the resource-based view of the firm (Barney, 1991; Wernerfelt, 1984). Under this view, organizations have common and unique resources. Common resources are readily available to all organizations, where as unique resources are competencies specific to organizations. Within this analogy, cloud computing resources are deemed common resources because they could be sourced by all organizations. As governance of IT resources is way to attain and sustain competitive advantage, organizations' IT governance structures should be their core competencies. This situation means that with a cloud computing environment, organizations would need to identify unique ways to manage common cloud resources. Through the lens of the resource-based view, a resource is a capability if it is rare, appropriable, and valuable. These qualities of the resource will enable it to provide an initial competitive advantage to an organization. If these qualities of a capability are non-substitutable, inimitable, and immobile, then it could provide a sustainable competitive advantage to an organization.

The importance of the cloud computing providers cannot be ignored when considering governance structures for cloud resources. This situation means governance of cloud computing resources would require governance capabilities and competencies across a network of alliances (the cloud providers). The relational view of the firm (Borgatti and Cross, 2003; Dyer and Singh, 1998) offers a useful framework to suggest IT governance structures inclusive of the cloud computing resource providers. The relational view of the firm posits that organizations' critical resources may extend beyond organizational boundaries (Dyer and Singh, 1998). This situation means that for governance of cloud computing resources, organizations would require to link their idiosyncratic capabilities to that of the cloud resource providers to secure competitive advantage. The outcome of this effort would be governance efforts that provides relational rent to an organization (Dyer and Singh, 1998; Dyer, 1997). This relational rent is possible through the creation of specialized capabilities, which would be a product of synergy of the capabilities of the organizations and the cloud computing resource providers (Amit and Schoemaker, 1993).

A fundamental requisite for an effective cloud environment would be partner-based knowledge sharing. Organizations often learn by collaborating with others (Levinson and Asahi, 1995). This situation has been proven in various industries (Powell, Koput and Smith-Doerr, 1996; von Hippel, 1988). These outcomes suggest that collaboration within the partners in the cloud environment is the key source of new ideas and innovation. New sources of ideas will direct organizations to develop and invest in performance-enhancing technology and infrastructures. The nature of relational IT Governance structures in cloud computing environment should be based on informal social contracts (Hill, Bartol, Tesluk and Langa, 2009). Many IT governance structures within informal social contracts rely on personal trust relationships, reputation, and goodwill (Dyer and Chu, 2003; Uzzi, 1997). IT governance structures with these values are likely to be less costly and promote elements of self-enforcement and monitoring (Dyer and Singh, 1998). Organizations, however, could develop hard matrices to evaluate their cloud-based performances. Provan and Kenis (2008) also share similar thoughts, and suggest that networks could be participant-governed, lead-organization governed, or administratively governed. Shared participant governance (Provan and Kenis, 2008) is a way to govern collaborative structures where there is a small number of participants and goal consensus

amongst these participants is high. In shared governance, partners collectively make decisions and manage the network activities (Provan and Kenis, 2008; Venkatraman and Chi-Hyon, 2004). Power in this network regarding decisions is symmetrical (Provan and Kenis, 2008), which calls for equitable contribution of resource utilization capabilities. These arguments suggest that governance of cloud-based IT resources require sharing and identifying synergies between the adopting organizations and cloud service providers. In the following section, we adopt the above theoretical framework and suggest an appropriate research design to identify appropriate IT governance structures for the cloud computing environment.

## RESEARCH DESIGN

There has been a significant discussion on the benefits and issues surrounding cloud computing (Gartner, 2012; Plummer, 2012). Further, a number of organizations are making dedicated use of cloud computing resources. For example, Gartner predicts public cloud services market will total \$109 billion in 2013. While the shift away from traditional IT acquisition models to public cloud services is still in the very early stages, there are organizations that have championed the adoption of cloud computing, and have achieved much success. For example, the Commonwealth Bank of Australia and Telstra Corporation have achieved much success from the cloud computing initiatives (Foo, 2012). We believe optimal understanding of IT governance structures for cloud computing could be obtained by assimilating the knowledge of cloud computing champions and the commentaries of various stakeholders.

For this reason, we adopted a mixed method interpretive design. An interpretive study is useful to unpack the diversity of issues involved in governing cloud computing resources (Yin, 1994). The interpretive approach affords an in-depth look at the dynamic relationship that exists between users and providers of cloud computing resources. This approach considers the shared meanings and experiences of people involved, in this case, the cloud computing stakeholders (Walsham, 1995). One interprets these meanings and experiences from perspectives of individuals themselves, given that multiple realities exist in organizations, shaped by their experiences and actions. That is, appropriate understandings on the IT governance of cloud computing resources exists in the interpretation of these understandings of the stakeholders of cloud computing. This effort becomes instrumental in making generalized assertions on appropriate IT governance structures for cloud computing resources.

First, we collated various academic and practice-related commentaries on cloud computing. Second, we conducted semi-structured interviews with the first movers of adopting cloud computing resources. We then performed thematic analysis of the rich data to obtain themes leading to IT governance structures for cloud computing resources. We used key words of cloud computing, cloud infrastructure, cloud computing management, cloud computing governance, and service-oriented architecture to filter cloud computing commentaries from the Internet. We also searched the Internet to collate a list of organizations that have successfully adopted cloud computing technologies. Thus, our sampling of target organizations was purposeful. We looked for cues to suggest adoption and success with cloud computing technologies. We identified twenty-three organizations in our sampling frame. We communicated to these organizations about the purpose of the study, the personnel of interest, and the nature of their involvement in the intended discussion. We were able to interview fifteen individuals from four organizations. The semi-structured interviews lasted about one hour, and we were able to interview more than one person in organizations representing different levels of management. Table 1 presents the demographics of the interviewees. The collection of data from different management levels permitted the elicitation of multiple viewpoints from individuals within the same division, and we could use these viewpoints to contrast across divisions.

The intent of this approach was to identify common conceptions that represent key IT governance structures for cloud computing resources. The interviews were semi-structured. The opening question was very general, seeking opinion on competencies required to govern cloud computing. The interviews then progressed with some focus around the capabilities and relations in governance, but with enough flexibility to capture perceptions on various perspectives of cloud computing governance. We analyzed the transcribed interview data and the academic and practice commentaries for its thematic content, resulting in a number of conceptions relating to possible IT governance structures for cloud computing resources. The conceptions emerged using the steps suggested by Dey (1993). These steps included establishment of the units of analysis, code attachment, and conception categorization into broader conceptions. We also provided copies of the transcribed notes and thematic analysis to the interviewees for verification and additional comments to ensure validity of our analysis. The next section discusses the findings of this study.

Interviewee	Position	Age	Industry	Experience (Years)
1	IT Manager	36	Retailing	8
2	Chief Information Officer (CIO)	41	Retailing	12
3	Manager Mobile Services	32	Communication	13
4	Manager Logistics	55	Retailing	15
5	IT Manager	33	Banking	6
6	CIO	38	Banking	20
7	Department Manager	28	Distribution	6
8	Department Manager	29	Distribution	8
9	Customer Service Manager	35	Banking	21
10	Risk and Operations Manager	42	Retailing	8
11	Director Operations	49	Banking	12
12	CIO	48	Distribution	3
13	IT Manager	33	Communication	5
14	Operations Manager	39	Communication	16
15	IT Manager	34	Distribution	13

**Table 1. Interviewee Demographics**

## RESULTS AND DISCUSSION

In the cloud computing environment, governance will be managing “who gets their say, and who has their say (Plummer, 2012). While the cloud providers would have a stronger say in this, as the cloud adoption grows, organizations would require significant control of their acquired cloud services. This governance of cloud services will have to be at three levels – business, service, and technical governance. Business-related governance of cloud deals with consumption and management of cloud services. Service governance is provider-related, and deals with tracking, measurement, monitoring, and enforcement of cloud services. Technical governance relates to governing of cloud technology, and is better applicable to private or hybrid cloud environment. Our analysis of the interview transcripts and academic and practice-related commentaries led to suggestions of four IT governance structures for cloud computing. We discuss these governance structures in the following subsections.

### Chief Cloud Officer

Chief Cloud Officer (CCO) relates to having an individual or a team lead by an individual in organization with expertise in cloud services and logistics. There was a strong consensus on the importance of this capacity in the commentaries and the interviewees’ views. This capacity mimics the role of the Chief Technology Officer. CCO would monitor the Cloud market, and would be a cloud subject matter expert (Block, 2012). According to Gartner, a CCO would assist the organization with cloud brokerage, providing and suggesting with the extras, as most cloud providers will provide the basic, and will manage aspects of technical governance (Plummer, 2012). According to Speed (2011) organizations must maintain knowledge of all critical information and processing assets held in the cloud, and maintaining sufficient skills (in-house or with a vendor independent of the provider) to be able to repatriate and re-establish systems and services. The interviewees shared the following on this capacity on their organization.

*“One important consideration when thinking about cloud computing is to have local expertise with us. This is especially important as there are many cloud providers, and there is a risk that one could be taken for ride. We have to ensure that we drive our cloud initiatives and know and what and how we need cloud services.” T6*

*“It is important that we know what we need to know before we engage in cloud services. This means we should have a proactive approach to adopting cloud services and should be drivers of our decisions. To do this, we need to build expertise on how cloud services will help our organization.” T11*

### Cloud Management Committee

In addition to expertise in cloud services, there was strong mention in commentaries, and in interviewees' views on the need to have a management structure to govern cloud services. Cloud Management Committee (CMC) relates organization of different levels of management and other stakeholders to oversee the adoption of cloud services. Views were shared that there needs to be understanding on impact and trajectory of benefits of cloud services to organizations. According to Gartner, organizations should not go chasing ghosts (ROI) in the Cloud (Gartner, 2012). As cloud computing adoption continues to grow, the ability to govern the services used will be a critical success factor, and the need for some degree of coordination of cloud services is essential. Within this governance structure, there should be a balanced representation of members to this committee, and there should be regular invitation of cloud-service stakeholders. This structure will have the primary role of setting strategic importance of cloud services. The interviewees' views related to this governance structure were:

*“There needs to be a strategic focus on cloud services from the outset. Organizations should only move to cloud when its alignment with strategic objective is ensured. Otherwise we could be assuming things that may never eventuate.” T8*

*“The decision makers need to understand the cloud environment. There is a need to move to the cloud as an organization-wide rather than a pocket-of-interest initiative. In addition, the sheer nature of the cloud computing means we may not be able to do all the things on our own. We will have to start including the providers of the services in our decision making relating to cloud.” T12*

*“While cloud providers will deliver standard service to all, organizations will have to convert them into their unique elements. To do this, we need to have a good understanding across our organization on how we need to include these services and make it a strategic tool for us. People (the various decision makers) need to get together and understand and set direction of organizations' cloud use. It will end up being a big thing and we need to think about it strategically.” T3*

### Cloud Service Facilitation

Cloud Service Facilitation relates to operational management of cloud services in organizations. This governance structure considers the issues in organization after the adoption of cloud services. The main resource within this structure will be the Cloud Service Manager (CSM). According to KPMG, this structure will be a single point of contact for the organization, and will be a key issue resolution centre, develop and administer performance monitoring, manage change facilitation, and consider tactical decisions relating to cloud services (Block, 2012). The CSM will deal with the economics of cloud, which will include cloud provider risk assessment, and enterprise agreements. According to Gartner, *“There's nothing worse for an IT leader than waking up one morning to discover that business users have bought cloud services with a credit card and no due diligence.”* Organizations must have a cloud servicing purchase requisition system, which should embed the traditional purchase requisition processes and controls. The interviewees' shared the following:

*“There needs to be a central cloud operational nervous system. This will complement the strategic initiative of the organization. A cloud requisition system is vital to keep a good control of cloud services and must manage a strong database of cloud suppliers.” T10*

*“The end product of cloud services to an organization must be carefully managed. Organizations have to ensure that service does not entail self-service, rather, it is a process of standard acquisition of commodities. Further, a requisition process, especially when it comes to increasing or decreasing services, must justify the economics of a level of change of cloud services. T2*

*A cloud management system is important. We need to manage it like any other commodity. Being another piece of technology, the IT productivity paradox will always be a concern. We must not get complacent with the utility nature of the technology; we need to justify every aspect of consumption of our cloud services. T6*

### Cloud Relationship Centre

A Cloud Relationship Centre (CRC) would be an IT governance structure dealing with relationship management. A CRC acts as a cloud service gateway, and would sit between the cloud service provider, and the cloud service users. The task of this centre would include ensuring dynamic and continuous relationship between corporate IT and business units, communication of cloud related security, architecture standards, and integration requirements, and business unit compliance. According to Gartner, issues relating to the security in cloud, the possibility of changing business models quickly are pertinent to organizations and should be considered within a CRC.

A CRC would need to monitor the use of cloud services, ways to stop someone from using the services, ensuring security and enforce policies about cloud use at all times. A CRC would broker all the requests from users of a service. They can intercept and interpret the requests to see if they fit within the policy and are safe. In a nutshell, service level governance means to track, measure, monitor, and enforce the services you provide. The interviewees also felt a service-level governance structure is important. They shared:

*“An acquired service does not mean automatic use. Service does not override the controls that are in place. Also, being a commodity does not mean sharing at will. There needs to be a coherent set of policies in place on how resources acquired through cloud should be used on a day-to-day basis.” T8*

*Acquired cloud services should be treated like a managing cupboard stationary when cutting cost. There needs to be coherent policies in place to monitor daily use of service resources.” T11*

*“Since cloud applications come from outside, there would effectively be no control of it once they are acquired. This is a dangerous contemplation. There is a need to ensure that users do not perceive the acquired IT as an unmanaged commodity.” T15*

## CONCLUSION

The importance of sourcing IT resources from the cloud is gaining momentum, and cloud computing is here to stay. While the concept of acquiring and consuming resources as a utility is not new, the thought of sourcing IT resources as a utility is presenting excellent opportunities to organizations to manage their IT cost, and have modern IT resources to facilitate innovation. However, a change in the way of acquiring IT resources does not negate organizations responsibility of appropriately managing these resources, and ensuring that these resources fit into their existing business process. Therefore, organizations need to consider appropriate governance structures to manage these resources. We adopted a mixed method design and have suggested four possible IT governance structures for cloud computing. These structures relate to having a strategic thought on cloud resources, the importance of having a cloud expert, cloud service polices, and manage and integrate cloud in organizations. We hope our effort will increase understanding on ways to approach the adoption of cloud technologies by establishing procedures at the outset to ensure the acquired IT resources contribute to the strategic intent of the organization, and swiftly fit into their existing business process. We envisage to progress this research further by developing and validating a model for governing the cloud, and we hope to share the progress of this part of research at AMCIS 2013.

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