An Investigation of the Main Factors to be Considered in Cloud Computing Adoption in Australian Regional Local Councils

Omar Ali
School of Management and Enterprise, University of Southern Queensland, Toowoomba, Australia,
Email: Omar.Ali@usq.edu.au

Jeffrey Soar
School of Management and Enterprise, University of Southern Queensland, Toowoomba, Australia

Jianming Yong
School of Management and Enterprise, University of Southern Queensland, Toowoomba, Australia

ABSTRACT

Technology plays an important role in helping organisations control quality and costs, and taking advantage of opportunities in a highly competitive and increasingly complex business environment. Cloud computing offers greater access to computing power, storage, software, and remote data centres through the web. This research aims to investigate the factors to be considered for cloud computing adoption by Australian regional councils. The research employed in-depth interviews with IT managers from selected local government councils. The major factors to be considered for the adoption of cloud computing were identified as Internet connectivity, data storage location, cost, integration, data back-up, provider dependability, employees' knowledge, and transportability. The findings of this research may help managers increase their awareness about factors to be considered when planning to adopt cloud computing.

Keywords: *Cloud computing; factors; adoption; regional councils.*

Introduction

Cloud computing combines existing technologies to produce a standard platform for users to access shared and configurable computing resources through the Internet (Kuyoro et al., 2012; Nicho & Hendy, 2013). It offers the potential of reducing the need for expensive information technology (IT) infrastructure (Nicho & Hendy, 2013; Subashini & Kavitha, 2011) and can incorporate mobile technology and broadband Internet networks (Gupta et al., 2013).

Cloud computing is recognized for its potential in providing more accessible processes, storage, and communication (Paquette et al., 2010). Cloud services are increasingly available to individuals, companies, and government agencies (Paquette et al., 2010), offering software, hardware and platform as services (Paquette et al., 2010; Son & Lee, 2011). Cloud has changed computer services from an infrastructure investment to a service accessible at any time and place. A growing need for faster service delivery is expected to encourage organisations to adopt cloud computing for greater IT agility (Oliveira & Martins, 2011).

Cloud has particular potential in Australian rural and regional communities which are faced with pressures that are more extreme than in cities and are worsening as services are withdrawn by government and business (Baxter et al., 2011). In many rural areas, especially the more remote, certain services are not available, or are available at considerably higher cost and lower quality than in urban locations (Asthana, 2003; Baxter et al., 2011). New technology such as cloud computing could help improve access to services in a more cost-effective and timely manner.

The use of new technology such as cloud computing in rural communities will support local people so that they are able to continue to reside and work in regional and rural locations. There are also significant potential flow-on benefits to local economies that will result from reducing the 'population drain' from regional to metropolitan regions. This, in turn, supports local business and allows for amenities such as schools and health facilities to remain open.

A common barrier for adopting new technology in regional areas is the lack of and cost of providing and maintaining network infrastructure (Ashton & Thorns, 2004; Hammond & Paul, 2006). By utilising cloud computing, local councils will be able to avoid the need to support back-end infrastructure by utilising data centres in major cities or other hubs. This is beneficial as there is generally a shortage of necessary technical skills and institutional capacity in regional and rural areas (Ali et al., 2015a). The services provided by local councils could be better managed through cloud computing (Ali et al., 2015a) with minimal local IT infrastructure (Ali et al., 2015a; Beaubouef, 2011; Das et al., 2011; Sperling, 2010). Despite its potential benefit the adoption rate of cloud computing in regional councils in Australia has been lower compared to councils in urban areas (Department of Innovation, Industry, Science and Research, 2011).

Research about the use of cloud computing in the public sector in general is limited (Janssen & John, 2011) although there is some evidence of the benefits of cloud computing (Ali et al., 2015a; Buyya et al., 2009; Marston et al., 2011; Tripathi & Parihar, 2011; Zhang et al., 2010). There is a lack of exploratory studies that

provide an in-depth and holistic investigation of the factors to be considered when adopting cloud computing (Low et al., 2011; Misra & Mondal, 2011). There are no empirical studies about the factors required to be considered when planning to adopt cloud computing services in Australian regional councils. This limitation has hindered strategy development to improve the adoption of cloud computing in local governments (Department of Innovation, Industry, Science and Research, 2011). There are calls for research related to cloud computing adoption to guide implementation decisions from regional councils (Department of Innovation Industry Science and Research, 2011).The current gap in the literature has led to the formulation of the following research problem: What are the factors to be considered by Australian regional councils when planning to adopt cloud computing?

The paper is structured as follows: first, we provide an overview of cloud computing based on the extant literature; then we explain the methodology used to collect data for this research. The data collection involved in-depth interviews with IT managers in Australian regional councils. We outline the findings and the discussion of the research data. We conclude this paper with contributions, research limitations and potential areas for future research.

The basic concept of cloud computing

Cloud computing represents a paradigm shift in the IT domain (Kantarcioglu et al., 2011). It is the result of significant innovations in virtualization, utility computing, distributed computing, grid computing, storage, content outsourcing, security, Web 2.0, and networking (Catteddu, 2010). Cloud computing offers improvements in IT productivity through highly accessible hardware and software resources and business agility (Kim et al., 2009). Cloud computing offers: (1) parallel batch processing (i.e. the execution of a series of programs on a computer without manual intervention); (2) computer-intensive (i.e., computing applications that require multiple computational resources such as grid computing); (3) mobile interactive applications (i.e. two-way transfer of information between a user and the central point of a communication system) to meet consumer demands in real time (Kim et al., 2009).

The most widely used definition of the cloud computing model, developed by the U.S. National Institute of Standards and Technology (NIST), describes it as:

> *A model for enabling ubiquitous, convenient, on-demand network access to a shared pool of services (for example, networks, servers, storage, applications and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction (NIST, 2009).*

The NIST definition promotes the availability of cloud computing and describes its five essential characteristics: on-demand self-service; broad network access; resource pooling; rapid elasticity; and measured service (Ali & Soar, 2014; Mell & Grance, 2009; NIST, 2009). These characteristics are explained below.

On-demand self-service: With the help of the cloud service provider, consumers can avail themselves of the cloud service, that is, computing capabilities, network storage and application, 24/7 without the need for any human interaction.

Broad network access: The availability of cloud computing services on the Internet makes networks easily accessible through standard mechanisms.

Resource pooling: Cloud computing uses a multi-tenant model to assign and re-assign physical and virtual resources to consumers according to their demands (Cloud Security Alliance, 2010; Mell & Grance, 2009). There is a sense of location independence in that the customer generally has no control or knowledge over the exact location of the provided resources but may be able to specify location at a higher level of abstraction (e.g., country, state, or data centre). Examples of resources include storage, processing, memory, and network bandwidth.

Rapid elasticity: Cloud computing can scale resources both up and down as required. The cloud appears to be infinite to consumers, who can purchase as much or as little computing power as they need.

Measured service: One of the essential characteristics of cloud computing is measured service, whereby the usage of services and resources is constantly monitored, controlled and reported for fair pay-as-you-go model implementation.

Research methodology

This paper presents the results of one aspect of a much larger research project; a series of papers has been developed, each focusing on a different aspect of the adoption of cloud computing in Australian regional municipal governments. This paper focuses on only one of the research questions, relevant data and analysis. The research method explained below was used in relation to the larger research project for which the focus was on the key factors that are perceived to influence cloud adoption.

Research design

The main objective of this research project was to explore the potential for value creation from cloud computing at regional municipal governments in Australia. The research questions aim to investigate which factors and to what extent each of these factors are likely to influence adoption of cloud computing including factors to be considered when planning to adopt cloud, current level of policy for cloud adoption, anticipated benefits from cloud adoption, challenges and risks that face cloud adoption, and the current e-government technologies employed.

Epistemologically, for this exploratory work, a qualitative study was deemed appropriate as it enabled a deeper analysis of the underlying factors. With the purpose of exploring the potential for value creation from cloud computing at regional municipal governments, empirical work using in-depth interviews as the data collection method was deemed appropriate, as interviews can provide the flexibility needed. Some researchers suggest that using in-depth interviews in the context of a qualitative approach may facilitate exploring all the

factors and the communication of all stakeholders within an ICT innovation adoption process (Leedy & Ormrod, 2005). So, this paper is focused only on presenting the aspect that is related to the factors which need to be considered when organisations plan to adopt cloud computing.

Data collection

A series of in-depth interviews was conducted between May 13, 2014 and August 12, 2014. These obtained inputs from 24 local government employees at senior management levels: IT Manager (10); IT Coordinator (4); Technical Director (2); Information Service Manager (2); IT Officer (1); IT Consultant (1); IT Network Manager (1); Chief Information Officer (CIO) (1); Enterprise Architecture Manager (1); and Team Leader ICT Operation (1). These occupational groups were selected based on the assumption that they represent key stakeholder groups likely to be responsible for planning and adoption of cloud computing for regional councils.

Participants were selected from the 77 government councils that are dispersed around Queensland. According to the classification provided by the Local Government Association of Queensland (LGAQ) (2013), the 77 government councils were classified into five segments: Coastal, Resource, Indigenous, Rural/Remote and South East Queensland. These segments were classified based on the geographical location of the councils (see Table 1). The principal motivation behind using these established segments is to investigate which of them have an effective communication infrastructure base to move to cloud computing and which do not and why. These segments are further classified by size of the council. The size of the council is determined based on the number of employees in the each council, that is, extra small (less than 50); small (50-100); medium (100-250); large (250-750); and very large (750-1500). Based on the classification of the councils, the researcher selected one council from every segment and size to ensure inclusion of all segments to obtain a comprehensive overview of issues.

The sample of 24 interviewed council officials reflects the geographical spread and size classifications of government councils throughout Queensland (Coastal – 25 per cent; Resource – 12 per cent; Indigenous – 17 per cent; Rural/Remote – 29 per cent; South East Queensland – 17 per cent).

Table 1: Size classification

Segments	Size classification					Total	%
	Extra small	Small	Medium	Large	Very large		
Coastal	0	1	2	2	1	6	25%
Resource	0	1	0	2	0	3	12%
Indigenous	0	2	2	0	0	4	17%
Rural/Remote	2	1	2	1	1	7	29%
South East Qld	0	0	1	1	2	4	17%
Total						24	100%

To improve the reliability of this research, the process explained by Kirsch (2004) was followed for collecting data. This process defines a set of procedures: firstly, identify and select the research issues; secondly, determine whom to interview; and finally, determine how the interviews will be conducted.

The interviewer followed a sequence of steps: planning the interview, introductions at the commencement of the interview and establishing rapport with the respondent through small talk (Gaskell, 2000). Ethical clearance was obtained through the University of Southern Queensland (USQ). Each interview was structured around four questions, with the interviewers asking probing questions based on responses. The following questions were asked:

(1) Please describe your role in the field of IT/IS?
(2) What is your background, experience and knowledge in relation to cloud computing?
(3) How long have you been involved with cloud computing projects and in what capacity?
(4) What are the actual factors to be considered by Australian regional councils when planning to adopt cloud computing?

The interviews lasted between 30 and 50 minutes. The interview questions were designed as open-ended questions to encourage the interviewees to provide answers that revealed their attitudes and perceptions relating to the research topic (Carson et al., 2001). A total of 24 interviews were carried out with IT managers of the chosen councils. The research reached saturation level with interview number 18, when the researcher noticed that no more new information or patterns in the data were emerging from the interviews. Another six interviews were conducted to ensure inclusion of all segments and size classification of the councils to obtain a comprehensive overview of issues (refer to Table 1). Only 21 interviews were used in this study. Three interviews were excluded from the analysis because it was discovered during the interview that these three IT managers did not come from an IT background and did not have any experience or knowledge related to cloud computing.

Data analysis

The interview data was analysed using manual content analysis (Miles & Huberman, 1984). The manual content analysis in this research included three concurrent flows of activities: (1) data reduction; (2) data display; and (3) conclusion (Ali et al., 2015b; Faust, 1982; Hsieh & Shannon, 2005; Miles & Huberman, 1984).

Data reduction refers to the process of focusing, transforming, selecting, abstracting, and simplifying the raw data collected through interviews (Miles & Huberman, 1984; Miles et al., 2014). After the completion of each interview session, the recorded interviews were immediately transcribed. The interview transcripts were reviewed to create summary sheets for each interview (Carson et al., 2001; Rao & Perry, 2007). A summary sheet is a single sheet consisting of a series of focusing or summarising questions about a particular field contact. These summary sheets included main themes, issues, problems and brief answers to each question, resulting in an overall summary of the main points in the research data (Miles et al., 2014; Patton, 2002; Schilling, 2006). Then the summary sheets were reviewed to develop a pattern code for the research data. Pattern codes are explanatory codes that identify an emergent theme, pattern or explanation suggested to the analyst. These codes convert various materials to meaningful and parsimonious units of analysis, that is, into a smaller number of overarching themes or constructs (Miles et al., 2014; Weber, 1990).

The next step of the analysis was to develop data display. Data display involves the organised assembly of information to permit the researcher to draw conclusions and take actions (Faust, 1982; Miles & Huberman, 1984; Miles et al., 2014). During this step, the researcher designs rows and columns of a matrix for qualitative data, after reviewing the previously created summary sheets and pattern codes.

The final step of the manual content analysis process is conclusion. During the process of data collection, the qualitative analyst decides on the 'meaning' of the different collected notes, patterns, explanations, possible configurations, causal flows and propositions (Bradley, 1993; Glaser & Strauss, 1967; Miles et al., 2014) so as to draw conclusions and to verify them. The summarizing and coding of data in the data reduction phase leads to new ideas on what should be entered into the matrix for data display. Entering data into the matrix requires further data reduction and as the matrix fills up, preliminary conclusion is drawn (Miles & Huberman, 1984; Miles et al., 2014).

Research validity

Research adopting qualitative methods including in-depth interviews should be examined for their validity (Silverman, 2000). Validity can be established through the use of different methods of cross-checking (Rao & Perry, 2003). Three research design tests commonly used as quality control measures are: construct validity, internal validity, and external validity (Yin, 2009).

***Construct validity*:** It describes the progress of suitable operational measures for the concepts being researched (Emory & Cooper, 1991). Construct validity exists in in-depth interviews because the researcher is attempting to establish agreement relating the meaning of a construct through a series of interviews (Carson et al., 2001). This method is flexible for various interviews and permits the refined approach of the construct. Construct validity can be achieved by triangulating the interview questions and constructs through the use of two carefully worded questions that determine the same issue from different perspectives (Rao & Perry, 2003). Each interview included two carefully worded questions that determined the same issue from different perspective such as: "*What is the impact of security concerns when planning to adopt cloud computing? How? (Please explain)" to "Do security concerns have a significant impact when planning to adopt cloud computing? How? (Please explain)".*

***Internal validity*:** It refers to the validity and causal relationships of the influence of a variable on other variables within a system (Zikmund, 2000). Exploratory research methods such as in-depth interviews uncover causal tendencies or generative mechanisms suggestive of a causal link in only limited circumstances, and such links are hard to confirm (Perry et al., 1999). The internal validity was achieved in this research by asking probing questions. These types of questions are required to be asked by the interviewer to encourage participants to elaborate on their own areas of interest and expertise. The total number of probing questions increased as more information was collected (Carson et al., 2001). Each interview had some probing questions to elicit additional details about factors such as "*Is cost an important factor to be considered when planning to adopt cloud computing?*" and *"Why does the Internet speed need to be considered as an important factor*

when focusing on the adoption of cloud computing?". Probing and prior knowledge are used to establish cause and effect linkages when they arise during in-depth interviews (Carson et al., 2001).

***External validity*:** It describes the capability of the research results to be generalised beyond the project scope (Sekaran, 2000). For this purpose, the participants selected for the in-depth interviewing process were chosen because of their knowledge, expertise, and leadership in this field of research, and because their position in the industry influences many people (Carson et al., 2001). Therefore, their deliberate selection ensured that there was enough external validity present for the exploratory purposes of in-depth interviews.

Findings and discussion

The main factors to be considered for cloud computing adoption as identified by the participants based on their knowledge and experience as IT managers were: (1) Internet connectivity which includes Internet speed, availability of services, and reliability of Internet access; (2) data storage location which includes security and data sovereignty; (3) adoption and operating cost of cloud adoption; (4) integration of cloud with the existing system; (5) data back-up; (6) provider dependability; (7) employee knowledge; and (8) transportability (See Table 2). Each of these factors will be discussed next.

Table 2. Main factors to be considered for cloud computing adoption

Theme	Frequency (# of interviewees)	Per cent of interviewees
• Internet connectivity	19	90%
➢ Internet speed	17	81%
➢ Reliability	9	43%
➢ Availability	9	43%
• Data storage location	15	71%
➢ Security	8	38%
➢ Data sovereignty	4	19%
• Cost	11	52%
• Integration	7	33%
• Data backup	4	19%
• Provider dependability	4	19%
• Employee knowledge	3	14%
• Transportability	2	10%

Internet connectivity

This research strongly confirmed the findings in the literature review that Internet connectivity is one of the significant factors to be considered for cloud computing adoption. Approximately 90 per cent (19/21) of the sample population noted that Internet connectivity influenced their adoption because rural and regional areas do not have access to a high-speed Internet:

> *Another factor is about Internet connection, because we are in a regional area our Internet connection or the options for Internet connectivity are limited and also it is expensive and that is a major limiting factor from our point of view (C61-URM).*

Internet connectivity was identified as the most basic issue to be addressed when talking about IT/IS adoption. Internet connectivity is defined in terms of certain factors such as accessibility and availability that determine the ability of the Internet to meet a satisfactory level of service (Magele, 2005). Any organisation planning to adopt cloud must ensure reliable and stable Internet connectivity (Tweneboah-Koduah, 2012). The participants identified Internet speed, availability, and reliability as factors that affect Internet connectivity.

The importance of Internet speed was discussed by approximately 81 per cent (17/21) of the sample population. The participants pointed out that without high speed of the Internet cloud computing is useless:

> *If you do not have high-speed Internet, you are not going to be able to run your business on cloud computing (C40-UDV).*

Cloud computing can be delivered through increasingly available high-speed broadband (Voorsluys et al., 2011). Within the high-speed Internet connectivity this technology can be adopted to support organisations in improving productivity.

The importance of having a reliable Internet connection was discussed by approximately 43 per cent (9/21) of the sample. The participants pointed out that cloud computing would not be as effective if the dependability of the connection for cloud computing is not proven and not as strong as it should be:

> *Because we are in a remote location, the reliability of Internet connection is one of our main considerations because if we lose connectivity, we just do not have access to anything (C16-RAL).*

For business solutions it is very important that cloud service providers must be consistent and accessible to support 24/7 operations (Voorsluys et al., 2011). Different features and requirements related to reliability must be considered when choosing a cloud service provider and the negotiated terms must be made part of the service-level agreement (SLA) (Voorsluys et al., 2011).

Approximately 43 per cent (9/21) of the sample indicate that the availability of the services that organisations provided through using cloud computing is one of the significant factors required to be considered when planning to adopt cloud computing. The participants said that without the required availability, the advantages that cloud computing promises to provide would not eventuate:

> *It is the ability to be able to connect to the data when you want it. That depends on availability of connections and connection speeds and the other things (C21-RTX).*

Availability refers to the uptime of a system, a network of systems, hardware and software that collectively provide a service during its usage (Ahuja & Mani, 2012). Technically there are several levels where availability can be achieved. These levels include application level, data center level, and infrastructure level (Rackspace, 2010). All requirements that relate to availability of the service need to be considered when selecting a cloud service provider (Ahuja & Mani, 2012). It is important to make sure that cloud service providers offer environments that are highly scalable and high in availability (Ahuja & Mani, 2012).

Data storage location

This research confirmed prior research findings that data storage location is one of the significant factors required to be considered for cloud computing adoption. Approximately 71 per cent (15/21) of the sample selected commented that this was an important factor. Sometimes data are stored off-shore and it is essential to know the location and details of the off-shore storage system, arrangements for maintenance and identification of parties involved. Some of the participants highlighted the importance of the data storage location:

> *It is one of the important factors, we tend to store our own data in-shore because it is just too expensive to ship it elsewhere (C7-RTS).*

As cloud computing becomes widely used, there is a wide range of policy issues related to data storage locations that require considerable attention (Jaeger et al., 2008). These include issues of privacy, security, data sovereignty, communications capacity, and government surveillance (Ali et al., 2015c; Delaney & Vara, 2007; Ma, 2007). There has been a lack of policy related to the storage of data in cloud computing (Ali et al., 2015c; Jaeger et al., 2008).

Approximately 38 per cent (8/21) of the sample highlighted that security of data was one of the significant factors related to data storage location required to be considered for cloud computing adoption. They stated various reasons for why they believed that the security of data should be considered before transferring to and completely adopting cloud computing technology. The IT managers were concerned with external factors that may negatively affect the storage systems ,and unauthorized access of data:

> *Because we are in a public cloud, we could be sharing an infrastructure with other organisations, so the security of the information has to be encrypted both in terms of stored new information in the cloud, and also in the transmission of that information (C34-UFV).*

Other participants who were concerned with security wanted to store their data within the country to ensure better protection for organisations and their stakeholders. This was seen as a way of reducing the risks of security breaches and similar risks:

> For security concerns we like to store the data within Australia and keep the data under the Australian government policy (C74-RTM).

> *Our governments do not want to store their information off-shore especially if it is sensitive information. Like the commercial-sensitive or personal-sensitive information, there are still some policies and still some concerns about storing that information off-shore in a different jurisdiction (C34-UFV).*

Security issues have been so far the main reason for public permission (Joshi et al., 2001; Paquette et al., 2010; Wyld, 2010). Governments need to ensure the security of citizen data and ensure availability of critical infrastructure (Curran et al., 2011; Joshi et al., 2001). Protection of citizen data has also been identified in studies as the main concern of governments when adopting cloud computing (Duffany, 2012; Gharehchopogh

& Hashemi, 2012). Analysis carried out by the Department of Economic and Scientific Policy of the European Union showed that approximately 63 per cent of government Chief Information Officers had security reservations when endorsing cloud computing publicly (Tweneboah-Koduah et al., 2014). Another assessment conducted by KPMG also identified security concerns as the major obstacle in the public adoption of cloud computing throughout Europe, America, and Asia Pacific (Herhalt & Cochrane, 2012). Data security risks arising from cloud computing include: (1) data confidentiality due to the concentration of data on a common cloud infrastructure; (2) loss of control over data by organisations using cloud services; and (3) amenability of authentication and transmission stages to data interception (Tweneboah-Koduah et al., 2014).

Related to the data storage location issue, this research found that maintaining sovereignty over the data was identified as an important factor to be considered in transitioning to cloud computing technology. Approximately 19 per cent (4/21) of the population held this view. Participants wanted to ensure that their data, their rights, and their sovereignty are protected under Australian government laws:

> *Data space sovereignty is a big issue there. Make sure that the Australian laws apply to it. Then we basically have access to the data (C45-RAV).*

The fact that many organisations have their storage servers distributed across different countries, and out of reach of their jurisdiction heightened concerns about data sovereignty (Tweneboah-Koduah et al., 2014). Regardless of whether cloud service providers are located on or offshore, an assurance is required by governments that their sovereignty would not be threatened by overriding effects of laws in the jurisdiction of cloud service providers application or data storage (Tweneboah-Koduah et al., 2014).

Cost

Approximately 52 per cent (11/21) of the respondents stated that cost is one of the significant factors required to be considered for cloud computing adoption. They said that there were no figures to justify cloud computing as a cost effective solution:

> *I suppose one of the biggest things for us that cloud computing has to be a cost effective solution. We need to prove that cloud computing is cost effective (C15-RAL).*

Hardware and associated administrative costs need to be accurately estimated by businesses to determine how they can remain economically viable and feasible (Forell et al., 2011; Li et al., 2009). Such economic feasibility can be assessed by applying costing models (Ramgovind et al., 2010). The organisation wanting to implement cloud computing needs to compare the cost of transferring to the cloud as opposed to staying on the hardware systems (Cardoso & Simões, 2012; Greenberg et al., 2009). These costings should include items relating to transferring the remote business aspects to the cloud, increasing bandwidth to increase efficiency and ensuring feasibility (Assuncao et al., 2009; Kim, 2009; Kondo et al., 2009).

Integration

In this research, the integration of systems, applications and software was another major factor found to be important when considering whether to adopt cloud computing. Approximately 33 per cent (7/21) of the participants considered integration to be a very important factor as the software and other systems would not perform appropriately if the organisations cannot integrate them appropriately:

> *Integration is one of the biggest issues. How do you integrate your cloud technologies with your current legacy applications? Because we are housing applications in different locations and the applications are used to working in environments that have zero or very low latency, we are not going to get that in our cloud environment, that is going to be one of the biggest issues (C40-UDV).*

Lack of integration between networks makes it difficult for organisations to combine their IT systems with cloud computing and realize the gains from the technology (Tripathi & Parihar, 2011; Tweneboah-Koduah et al., 2014). Organisations need to automatically provision services, manage virtual machine instances, and work with both cloud-based and enterprise-based applications using a single tool set that can function across existing programs and multiple cloud service providers (Brohi & Bamiah, 2011).

Data back-up

Approximately 19 per cent (4/21) of the participants pointed out the necessity of data back-ups in case of unexpected issues:

> *We need to recover it. So, back-ups! And…with the cloud we really do not know unless we do some really strong research. It is fair enough for them to say, 'oh we have data centres and we have back-up data centre over here'…and sure that they do have a lot of redundancy built in, but really, we need to satisfy ourselves that the data centres are as strong as they really make out that they are (C15-RAL).*

> *If they can guarantee that they have a back-up solution, they have got policies and procedures in place, so if there is a catastrophic failure, we will be back up and running within a decent time frame and none of the data get lost. Because we would be losing hundred thousand dollars a year (C74-RTM).*

There is no assurance of back-up of data in cloud computing (Hemant et al., 2011). Recovery of data from cloud is critical for businesses in the case of failure. The cloud providers in turn might rely on seamless back-ups to enforce resilience of their infrastructure. Since these back-ups might be done without the customer's active informed consent, it could lead to serious security issues and threats. One of the top threats identified by Cloud Security Alliance (2010) is 'data loss or leakage' where records may be deleted without a back-up of the original content. From a larger context, a record might be unlinked, or data stored on unreliable media could be effectively destroyed in the event of a key management failure. It is the sole responsibility of cloud service providers to protect the delicate enterprise data by constantly backing up data to ensure quick recovery.

Provider dependability

Provider dependability emerged as a new theme that was not identified in the literature as a factor affecting the decision to adopt cloud computing. Provider dependability is the degree of trust that is placed in a provider in relation to having control over an organisation's data. Approximately 19 per cent (4/21) of the sample found that provider dependability is a significant factor that is required to be considered for the adoption of cloud computing. This trust that is placed in cloud service providers might result in loss of control over the data.

> *The risk around the dependability of the cloud is that we are essentially giving a trust to the cloud providers, as a result of that a lot of control over our data transfer to the cloud providers and we just have a little control over that data. So, that we are, guards against risk need to be higher (C68-URL).*

Employees' knowledge

Approximately 14 per cent (3/21) of the sample population described how the employees adopting cloud computing should have enough skills and knowledge to manage the new technology that they are utilizing to provide quality service to their stakeholders:

> *Basically we need to make sure that the employee's knowledge or experience is comparable to known cloud computing environments (C53-RTL).*

> *If the staff in the organisation have a full experience with the cloud computing, it would certainly affect the decision, but whether it would actually encourage them (C25-RTM).*

According to Rogers (2003) employees' cloud computing adoption behaviour can be affected by the accumulated experience of using new innovations. In the case of cloud computing, familiarity with technologies such as virtualization, cluster computing or utility computing can have a direct influence upon employee perceptions regarding cloud computing services. Several studies have found prior experience to be important in technology adoption decisions (Bandura, 1977; Igbaria et al., 1995; Kuan & Chau, 2001; Lippert & Forman, 2005). Consequently, prior experience could be expected to play a facilitative role in the adoption decision.

Transportability

Another new finding of this study is that transportability is an important factor when considering to adopt cloud computing. Transportability is the capability and flexibility of the equipment, systems, and associated hardware that permits them to be moved from one location to another to interconnect with locally available complementary equipment, systems, associated hardware, or other complementary facilities. Approximately ten per cent (2/21) of the sample population explained that this factor can be connected to another factor earlier mentioned which was the availability of data back-ups. The participant explained that in order to have data back-ups, transportability of data should be available and accessed:

We need to make sure that we have the flexibility to recover back our data, in case we decided to move from one cloud service provider to another one, or decided to return the data back to our house. So, transportability of the data is an important factor that we need to discuss with the cloud service provider (C45-RAV).

Conclusion

Government organisations have started looking for new options for interacting with other organisations as well as citizens. Cloud computing has the potential to significantly change the roles of IT departments in business and government sectors because of its potential benefits.

This research in general focused on the factors to be considered for cloud computing adoption. The major factors to be considered for the adoption of cloud computing in Australian regional councils were identified as Internet connectivity which includes Internet speed, availability, and reliability; data storage location which includes security and data sovereignty; adoption and operating cost; integration; data back-up; provider dependability; employees' knowledge; and transportability.

It is evident that this research study adds some empirical weight to support previous findings. For example, some participants in the research study referred to the need for better Internet connectivity for more widespread adoption in their organisations; others pointed out the need for better integration. But some of the participants also noted security issues and highlighted the need for educational awareness of security and regulations in various jurisdictions in which data centres are hosted. Some pointed out the need to prove that cloud computing is cost effective. The findings of this research study are useful in providing a better understanding of how certain factors impact adoption which may in turn lead to more informed managerial decision making processes regarding adoption of cloud computing service systems.

This research contributes to the ICT technology adoption literature by studying factors required to be considered for cloud computing adoption in regional councils. Looking at regional councils' adoption of Information Systems innovations can help enrich knowledge and understanding of the innovation adoption process in this era of rapid development of new technologies. This research leads to important practical implications for technology consultants. Regional councils provide services to citizens and businesses, and consequently represent an important market segment for software vendors and cloud service providers. Cloud service providers may need to improve their interaction with regional councils who are involved in cloud computing, in an effort to create a healthy environment for cloud computing adoption, and to remove any doubts surrounding this technology. The findings of this research may help managers evaluate possible adoption by increasing their awareness about factors to be considered when planning to adopt cloud computing. Taking all the above into account, this research presents some useful information for organisations, technology consultants and vendors. This research is viewed as being relevant to the current era of rapid developments in cloud computing technologies.

There has not been much research done on cloud computing in reference to Australia. Future research could build on this research by investigating the factors required to be considered for cloud computing adoption in different sectors of the economy and industries.

References

Ahuja, S. P. and Mani, S. (2012) Availability of services in the era of cloud computing. *Network and Communication Technologies*, 1 (1) pp 2-6.

Ali, O. and Soar, J. (2014) Challenges and issues within cloud computing technology. Proceedings of the 5th International Conference on Cloud Computing, GRIDs, and Virtualization, pp 55-63.

Ali, O., Soar, J. and Yong, J. (2014) Impact of cloud computing technology on e-government. Proceedings of the Conference on Information and Software Technologies, Springer International Publishing, 456 pp 272-290.

Ali, O., Soar, J., McClymont, H., Yong, J. and Biswas, J. (2015a) Anticipated benefits of cloud computing adoption in Australian regional municipal government: An exploratory study. Pacific Asia Conference on Information Systems (PACIS), pp 1-17.

Ali, O., Soar, J., Yong, J., McClymont, H. and Angus, D. (2015b) Collaborative cloud computing adoption in Australian regional municipal government: An exploratory study. Proceedings of the 19th IEEE International Conference on Computer Supported Cooperative Work in Design, pp 540-548.

Ali, O., Soar, J., Yong, J. and McClymont, H. (2015c) Level of policy for cloud computing adoption in Australian regional municipal government: An exploratory study. Proceedings of the 11th International Conference on Grid & Cloud Computing and Applications, pp 30-35.

Armbrust, M. and Fox, A. (2009) Above the Clouds: A Berkeley View of Cloud Computing. *Technical Report*, University of California, pp 1-25.

Ashton, H. and Thorns, D. (2004). Information and communication technologies (ICTs) to make or break community. *Future Times*, 4 pp 6-8.

Assuncao, M., Costanzo, A. and Buyya, R. (2009) Evaluating the cost-benefit of using cloud computing to extend the capacity of clusters. Proceedings of the 18th ACM International Symposium on High Performance Distributed Computing, Munich, Germany, pp 141-150.

Asthana, S. (2003) Allocating resources for health and social care: The significance of reality. *Health and Social Care in the Community,* 11 (6) pp 486-493.

Bandura, A. (1977) *Social Learning Theory*, New York: Prentice Hall.

Baxter, J., Hayes, A. and Gray, M. (2011) Families in regional, rural and remote Australia. *Australian Institute of Family Studies*, pp 1-8.

Beaubouef, B. (2011) Cloud can bring out the best of ERP. Accessed December 21, 2013, available at: <http://www.gbeaubouef.wordpress.com/2011/11/23/cloud-erp-advantage/>.

Bhardwaj, S., Jain, L. and Jain, S. (2010) Cloud computing: A study of infrastructure as a service (IaaS). *International Journal of Engineering and Information Technology,* 2 (1) pp 60-63.

Bradley, J. (1993) Methodological issues and practices in qualitative research. *Library Quarterly,* 63 (4) pp 431-449.

Broberg, J., Buyya, R. and Goscinski, A. (2011) *Cloud Computing: Principles and Paradigms*. Wiley Press, USA.

Brohi, S. N. and Bamiah, M. A. (2011) Challenges and benefits for adopting the paradigm of cloud computing. *International Journal of Advanced Engineering, Science and Technology*, 2 pp 286-290.

Buyya, R., Yeo, C. S., Venugopala, S., Broberg, J. and Brandic, I. (2009) Cloud computing and emerging IT platforms: Vision, hype, and reality for delivering computing as the 5th utility. *Future Generation Computer Systems,* 25 (6) pp 599-616.

Cardoso, A. and Simões, P. (2012) Cloud computing: Concepts, technologies and challenges, virtual and networked organizations, emergent technologies and tools. *Computer and Information Science*, Springer, Berlin, 248 pp 127-136.

Carson, D., Gilmore, A., Perry, C. and Gronhaug, K. (2001) *Qualitative Marketing Research*. Sage Publications, London.

Catteddu, D. (2010) Cloud computing: benefits, risks and recommendations for information security. In: Serrão, C., Aguilera, V., Cerullo, F. (eds.) *Web Application Security*. Communications in Computer and Information Science, Springer, Berlin, Heidelberg, 72 p 17.

Clemons, E. and Chen, Y. (2011) Making the decision to contract for cloud services: Managing the risk of an extreme form of it outsourcing. Proceedings of the 44th Hawaii International Conference on System Sciences, Hawaii, pp 1-10.

Cloud Security Alliance (2009) Security Guidance for Critical Areas of Focus in Cloud Computing. Cloud Security Alliance (CSA), pp 1-76.

Cloud Security Alliance (2010) Top Threats to Cloud Computing. Cloud Security Alliance (CSA), pp 1-14.

Cureton, L. (2009) Cloud computing in the federal government: On a cloudy day how it will astound you. Goddard CIO Blog, Accessed November 02, 2014, available at: <http://blogs.nasa.gov/cm/blog/Goddard-CIO Blog.blog/posts/post_1237089048316.html>.

Curran, K., Carlin, S. and Adams, M. (2011) Security issues in cloud computing. *Elixir*, 38 pp 4069-4072.

Das, R.M., Patnaik, S. and Misro, A.K. (2011) Adoption of cloud computing in e-government. *Advanced Computing Communications in Computer and Information Science*, 133 pp 161-172.

Delaney, K. J. and Vara, V. (2007) Google plans services to store users' data. *Wall Street Journal*, Accessed on March 16, 2014, available at: <http://online.wsj.com/article/SB119612660573504716.html?mod=hps_us_whats_news>.

Department of Innovation, Industry, Science and Research (2011) Cloud Computing - Opportunities and Challenges. *IT Industry Innovation Council*, pp 1-31.

Dillion, T., Wu, C. and Chang, E. (2010) Cloud computing: Issues and challenges. Proceedings of the 24th IEEE International Conference on Advanced Information Networking and Applications (AINA), Perth, WA, pp 27-33.

Duffany, J. L. (2012) Cloud computing security and privacy. Proceedings of the 10th Latin American and Caribbean Conference for Engineering and Technology, pp 1-9.

Dustin-Amrhein, P. A., De Andrade, A., Armstrong, E. A. B., Bartlett, J., Bruklis, R. and Cameron, K. (2010) Cloud computing use cases. *White Paper*. Version 3.0 (eds.), pp 1-7.

Emory, C. and Cooper, D. (1991) *Business Research Methods*, Irwin, Boston.

Faust, D. (1982) A needed component in prescription of science: Empirical knowledge of human cognitive limitations. *Knowledge,* 3 pp 555-570.

Forell, T., Milojicic, D. and Talwar, V. (2011) Cloud management: Challenges and opportunities. Proceedings of the IEEE International Symposium on Parallel and Distributed Processing, pp 881-889.

Gaskell, G. (2000) Individual and Group Interviewing. In M. Bauer, and G. Gaskell, (eds.), *Qualitative Researching with Text, Image and Sound*, Sage, London.

Gharehchopogh F. S. and Hashemi, S. (2012) Security challenges in cloud computing with more emphasis on trust and privacy. *International Journal of Science and Technology Research*, 1 (6) pp 49-54.

Glaser, B. and Strauss, A. L. (1967) *The Discovery of Grounded Theory: Strategies for Qualitative Research*, Chicago: Aldine.

Greenberg, A., Hamilton, J., Maltz, D. and Patel, P. (2009) Cost of a cloud: Research problems in data centre networks. *ACM - SIGCOMM Computer Communication Review*, 39 (1) pp 68-73.

Gupta, P., Seetharaman, A. and Raj, J. R. (2013) The usage and adoption of cloud computing by small and medium businesses. *International Journal of Information Management*, 33 (4) pp 861-874.

Hammond, A. and Paul J. (2006) *A new model for rural connectivity*, World Resources Institute, Development Thought Enterprise, pp 1-14.

Hemant, P., Chawande, N. P., Sonule, A. and Wani, H. (2011) Development of servers in cloud computing to solve issues related to security and backup. Proceedings of the IEEE International Conference on Cloud Computing and Intelligence Systems, pp 158-163.

Herhalt J. and Cochrane, K. (2012) Exploring the cloud: A global study of governments adoption of cloud. *Industrial Report*, KPMG Global, pp 1-48.

Hsieh, H. F. and Shannon, S. E. (2005) Three approaches to qualitative content analyses. *Qualitative Health Research,* 15 (9) pp 1277-1288.

Igbaria, M., Guimaraes, T. and Davis, G. B. (1995) Testing the determinants of microcomputer usage via a structural equation model. *Journal of Management Information Systems*, 11 (4) pp 87-114.

Jaeger, P. T., Lin, J. and Grimes, J. M. (2008) Cloud computing and information policy: Computing in a policy cloud. *Journal of Information Technology and Politics*, 5 (3) pp 269-283.

Janssen, M. and John, A. (2011) Challenges for adopting cloud-based software as a service in the public sector. Proceedings of European Conference on Information Systems, pp 1-13.

Joshi, J., Ghafoor, A., Aref, W. G. and Spafford, E. H. (2001) Digital government security infrastructure design challenges. *Computer*, 34 (2) pp 66-72.

Kantarcioglu, M., Bensoussan, A. and Hoe, S. R. (2011) Impact of security risks on cloud computing adoption. *Forty-Ninth Annual Allerton Conference*, Allerton House, UIUC, Illinois, USA, pp 670-674.

Kim, W. (2009) Cloud computing: today and tomorrow. *Journal of Object Technology*, 8 (1) pp 65-72.

Kim, W., Kim, S. D., Lee, E. and Lee, S. Y. (2009) Adoption issues for cloud computing. *The* Proceedings of the 11th International Conference on Information Integration and Web-Based Applications and Services, pp 3-6.

Kirsch, L. J. (2004) Deploying common systems globally: The dynamics of control. *Information Systems Research*, 15 (4) pp 374-395.

Kondo, D., Javadi, B., Malecot, P., Cappello, F. and Anderson, D. P. (2009) Cost benefit analysis of cloud computing versus desktop grids. Proceedings of the IEEE International Symposium on Parallel and Distributed Processing, pp 1-12.

Kuan, K. and Chau, P. (2001) A perception-based model for EDI adoption in small businesses using a technology-organization-environment framework. *Information and Management,* 38 (8) pp 507-521.

Kuyoro, S. O., Omotunde, A. A., Ajaegbu, C. and Ibikunle, F. (2012) Towards building a secure cloud computing environment. *International Journal of Advanced Research in Computer Science*, 3 (4) pp 166-171.

Leedy, P. D. and Ormrod, J. E. (2005) *Practical Research: Planning and Design*, 8th (eds.), Pearson Merrill Prentice Hall, Englewood Cliffs, NJ.

Li, X., Li, Y., Liu, T., Qiu, J. and Wang, F. (2009) The method and tool of cost analysis for cloud computing. Proceedings in the IEEE International Conference on Cloud Computing, pp 93-100.

Lippert, S. and Forman, H. (2005) Utilization of information technology: Examining cognitive and experiential factors of post-adoption behaviour. *The IEEE Transactions on Engineering Management,* 52 (3) pp 363-381.

Local Government Association Queensland (2013) Digital Productivity Report, *Local Government Association Queensland* (LGAQ), pp 1-36.

Low, C., Chen, Y. and Wu, M. (2011) Understanding the determinants of cloud computing adoption. *Industrial Management and Data Systems*, 11 pp1006-1023.

Ma, W. (2007) Google's G drives raise privacy concerns. *Popular Mechanics*, Accessed on March 16, 2014, available at: <http://www.popularmechanics.com/technology/industry/4234444.html>.

Magele, T. (2005). E-security in South Africa. *White Paper*, Accessed on October 24, 2014, available at: <www.forgeahead.co.za/E-Security%20in%20South%20Africa%20-%20final.doc>.

Marston, S., Li, Z., Bandyopadhyay, S., Zhang, J. and Ghalsasi, A. (2011) Cloud computing the business perspective. *Decision Support Systems,* 51 (1) pp 176-189.

Mell, P. and Grance, T. (2009) Draft NIST working definition of cloud computing, 15 pp 1-7.

Miles, M. B. and Huberman, M. (1984) *Qualitative Data Analysis*, Sage Publication, Newbury Park.

Miles, M. B., Huberman, M. and Saldana, J. (2014) *Qualitative Data Analysis*, Sage Publication, London.

Misra, S. C. and Mondal, A. (2011) Identification of a company's suitability for the adoption of cloud computing and modelling its corresponding return of investment. *Journal of Mathematical and Computer Modelling*, 53 pp 504-521.

Nicho, M. and Hendy, M. (2013) Dimensions of security threats in cloud computing: A case study. *Review of Business Information Systems*, 17 (4) pp 160-170.

National Institute of Standards and Technology (NIST) (2009) Cloud computing. Computer Security Resource Centre, Accessed on October 27, 2014, available at: <http://csrc.nist.gov/groups/SNS/cloudcomputing/>.

Oliveira, T. and Martins, M. (2011) Literature review of information technology adoption models at firm level. *The Electronic Journal Information Systems Evaluation*, 14 (1) pp 110-121.

Paquette, S., Jaeger, P. T. and Wilson, S. C. (2010) Identifying the security risks associated with governmental use of cloud computing. *Government Information Quarterly,* 27 (3) pp 245-253.

Patton, M. Q. (2002). *Qualitative Research and Evaluation Methods*, Thousand Oaks, CA: Sage Publications.

Perry, C., Riege, A. and Brown, L. (1999) Realism's role among scientific paradigms in marketing research. *Irish Marketing Review*, 12 (2) pp 16-23.

Rackspace. (2010). Architecting High Availability Linux Environments within the Rackspace Cloud. A detailed exploration into the technical requirements and business implications of Cloud High Availability. *White*

Paper, Accessed on October 3, 2015, available at: <http://c0179631.cdn.cloudfiles.rackspacecloud.com/High_Availibilty_Cloud_Feb_16.pdf>.

Ramgovind, S., Eloff, M. M. and Smith, E. (2010) The Management of security in cloud computing. Proceedings of the IEEE International Conference on Cloud Computing, pp 1-7.

Rao, S. and Perry, C. (2003) Convergent interviewing to build a theory in under-researched areas: Principles and an example investigation of Internet usage in inter-firm relationship. *Qualitative Market Research*, 6 (4) pp 236-247.

Rao, S. and Perry, C. (2007) Convergent interviewing: A starting methodology for an enterprise research program, in D. Hine, and D. Carson (eds.), *Innovative Methodologies in Enterprise Research*, Edward Elgar, Northampton, Massachusetts.

Rogers, E. (2003) *Diffusion of Innovations*. 5th (eds.), Free Press, New York, NY.

Schilling, J. (2006) On the pragmatics of qualitative assessment: Designing the process for content analysis. *European Journal of Psychological Assessment*, 22 (1) pp 28-37.

Sekaran, U. (2000) *Research Methods for Business: Skill-Building Approach*. John Wiley and Sons, New York.

Silverman, D. (2000) *Doing Qualitative Research: A practical handbook*. Sage Publications, London.

Sohan, Y. and Zeng, H. (2010) Cloud: A computing infrastructure on demand. Proceedings of the 2nd International Conference on Computer Engineering and Technology, Chengdu, China, pp 423-426.

Son, I. and Lee, D. (2011) Assessing a New IT Service Model, Cloud Computing. Pacific Asia Conference on Information Systems (PACIS), pp 1-11.

Sperling, E. (2010) Cloud Computing Heads South of the Border. Accessed on September 19, 2013, available at: <http://www.forbes.com/2010/02/13/cloud-computing-outsourcingtechnology-cio-network-latin-america.html>.

Subashini, N. and Kavitha, V. (2011) A survey on security issues in service delivery models of cloud computing, *Journal of Network and Computer Applications*, 34 pp 1-11.

Tripathi, A. and Parihar, B. (2011) E-governance challenges and cloud benefit. *VSRD International Journal of Computer Science and Information Technology,* 1 (1) pp 29-35.

Tweneboah-Koduah, S. (2012) Knowledge management: Critical factor for successful implementation of e-government applications. Proceedings of the 12th European Conference on E-Government, Spain, pp 713-721.

Tweneboah-Koduah, S., Endicott-Popovsky, B. and Tsetse, A. (2014) Barriers to government cloud adoption. *International Journal of Managing Information Technology,* 6 (3) pp 1-16.

Velte, T., Velte, A. and Elsenpeter, R. (2010) Cloud computing: A practical approach. *International Journal of Scientific and Engineering Research,* 3 (8) pp 1-6.

Voorsluys, W., Broberg, J. and Buyya, R. (2011) *Cloud Computing Principles and Paradigm*. John Wiley and Sons.

Wang, L., Tao, J. and Kunze, M. (2008) Scientific cloud computing: Early definition and experience. Proceedings of the 10th IEEE International Conference on High Performance Computing and Communications, Dalian, China, pp 1-18.

Weber, R. P. (1990) Basic Content Analysis, Newbury Park CA: Sage Publications.

Wyld, D. C. (2010) The cloudy future of government IT: Cloud computing and the public sector around the world. *International Journal of Web Semantic Technology*, 1 (1) pp 1-20.

Yin, R. (2009) *Case study research, design and methods*. Sage Publications, Beverley Hills.

Zhang, Q., Cheng, L. and Boutaba, R. (2010) Cloud computing: State-of-the-art and research challenges. *Journal of Internet Services and Applications*, 1 (1) pp 7-18.

Zikmund, W. G. (2000. *Business Research Methods*. Harcourt Inc, USA.

Appendix

Cloud Service Models

Cloud services can be categorised on the basis of the following three service/delivery models: software as a service; platform as a service; and infrastructure as a service (Ali et al., 2014; Broberg et al., 2011; Cloud Security Alliance, 2009; Mell & Grance, 2009). These service/delivery models are explained below.

Software as a Service (SaaS): The SaaS service model enables consumers to use the service provider's applications running on a cloud infrastructure. Consumers can access the applications using various client devices through a thin client interface such as a Web browser (e.g., web-based email). They do not have access to, manage, or control the underlying cloud infrastructure, that is, network, servers, operating systems, storage or even individual application capabilities. Consumers do have access to limited user-specific application configuration settings (Clemons & Chen, 2011; Cloud Security Alliance, 2010; Cureton, 2009; Mell & Grance, 2009; Velte et al., 2010; Wang et al., 2008).

Platform as a Service (PaaS): The PaaS service model enables the consumer to deploy consumer-created or -acquired applications onto the cloud infrastructure with the help of programming languages and tools the provider supports. As in the SaaS model, the consumer does not manage or control the underlying cloud infrastructure, but can control the deployed applications and possibly the application-hosting environment configurations (Cloud Security Alliance, 2010; Cureton, 2009; Dillion et al., 2010; Velte et al., 2010).

Infrastructure as a Service (IaaS): The IaaS service model provides consumers with processing, storage, network and other fundamental computing resources (Bhardwaj et al., 2010). The consumer can deploy and run arbitrary software, including operating systems and applications. The consumer cannot manage or control the underlying cloud infrastructure but has control over operating systems, storage and deployed applications and possibly has limited control over select networking components, such as host firewalls (Bhardwaj et al., 2010; Cloud Security Alliance, 2010; Mell & Grance, 2009; Sohan & Zeng, 2010).

Cloud Deployment Models

There are four cloud deployment models (public; private; community; hybrid) (Ali et al., 2014; Catteddu, 2010; Cloud Security Alliance, 2009; Dustin-Amrhein et al., 2010; Mell & Grance, 2009). These deployment models are:

Public cloud: This model enables the cloud infrastructure to be made available to the general public or to a large industry group. The infrastructure is owned by an organisation that provides cloud services (Dustin-Amrhein et al., 2010).

Private cloud: In this model, the cloud infrastructure is deployed solely for a single organisation. The organisation may itself manage the infrastructure or outsource it to a third party, and the cloud infrastructure may exist on the organisation's premises or be based off-premise (Armbrust & Fox, 2009; Dustin-Amrhein et al., 2010).

Community cloud: This model deploys the cloud infrastructure to several organisations at the same time and supports a specific community that shares similar concerns (e.g., security requirements, policy and compliance considerations). The cloud infrastructure may be managed by the organisations or by a third party and may exist on the organisations' premise or be based off-premises (Dustin-Amrhein et al., 2010).

Hybrid cloud: In this model, the cloud infrastructure is composed of two or more clouds (private, community or public) that remain unique entities, but are bound together by standardized or proprietary technology that enables data and application portability (e.g., cloud bursting for load-balancing between clouds) (Cloud Security Alliance, 2009; Cureton, 2009).