UNIVERSITY OF SOUTHERN QUEENSLAND

Cloud Computing Adoption in Regional Councils

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Abstract

Cloud computing is becoming increasingly important in information technology as an enabler for improved productivity, efficiency and cost reduction; and is expected to offer benefits for public sector organisations. Cloud computing has the potential to improve the reliability and scalability of information technology systems, which allows organisations such as regional municipal governments to focus more on their core business and strategy. Research about the use of cloud computing in the public sector in general is limited. There is a lack of exploratory studies that provide an in-depth and holistic investigation of the factors perceived to influence the adoption of cloud computing. There are no empirical studies about the factors that are perceived to influence the adoption of cloud computing in reference to Australia.

This research aimed at exploring perceptions of the potential for value creation from cloud computing in regional councils, to identify factors that are likely to influence adoption of cloud computing including factors that need to be considered when planning to adopt cloud, anticipated benefits of cloud adoption, and challenges and issues that faced cloud adoption.

This research aimed to improve understandings related to the factors that influence cloud computing adoption decision making in regional municipal governments. The research employed a mixed method approach (qualitative and quantitative). In-depth interviews of Australian councils' IT managers were conducted with the aim of providing insights into the factors that are perceived likely to influence adoption of cloud computing including factors that need to be considered when planning to adopt cloud, anticipated benefits of cloud adoption, and challenges and issues that faced cloud adoption. Survey data from 480 IT staff across 47 local government councils were collected to confirm the findings of the exploratory stage.

The factors that were examined included: compatibility, complexity, cost, security concern, top management support, organisation size, government regulation, and information intensity. The findings of this research are expected to assist in making investment decisions on cloud computing adoption.

Recommendation

- Australian councils should consider the potential of Cloud computing technology to drive much-needed improvements in overall productivity.
- The Australian Government should strongly support the development of an enhanced local Cloud computing industry, building on the inherent strengths that the stable Australian financial, policy and regulatory environment provides.
- There needs to be greater national support Regional council to encourage the use of Cloud computing technology in local government.
- Regional councils should expand their knowledge and skills in Cloud computing technology.
- The Department of Broadband Communications and the Digital Economy should review options for reducing costs of broadband (Internet) in regional areas.
- Regional councils should consider developing business cases to assist in making investment decisions on Cloud computing.
- There needs to be an engagement of cloud service providers with local government to build a dialogue on the adoption of cloud computing.
- Technology consultants should have a much better understanding about the important factors that affecting the organisation's adoption of Cloud computing and related technologies.

Research Introduction

The adoption of cloud computing is increasing worldwide, given the opportunities and benefits to organisations to improve their performance. 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 (Buyya et al. 2009; Marston et al. 2011; Tripathi & Parihar 2011; Zhang et al. 2010). There is some previous researches that concentrated about the challenges and the issues of cloud computing (Julisch & Hall 2010; Jensen et al. 2009; Pearson 2009; Wyld 2010). There is a lack of exploratory studies that provide an in-depth and holistic investigation of the factors that impact or influence the adoption of cloud computing (Low et al. 2011; Misra & Mondal 2011). There are no empirical studies about the factors that influence the adoption of cloud computing services in reference to Australian Regional councils. This limitation has hindered strategy development to improve the adoption of cloud computing in Regional councils (Department of Innovation Industry Science and Research 2011). There are calls for research on cloud computing adoption to guide implementation decisions from Regional councils to request further research (Department of Innovation Industry Science and Research 2011).

The research problem which the research intends to investigate can be stated as the identification of factors that has an impact or influence on the adoption of cloud computing in Regional councils.

Research Objectives

The main goal of this research is to explore and investigate the potential for value creation for Regional councils by identifying factors that are perceived likely to influence the adoption of cloud computing. This research also aimed to increase our knowledge and understanding on the factors that need to be considered when planning to adopt cloud. It aimed to increase our knowledge and understanding on anticipated benefits of the adoption of cloud computing and of the challenges and issues that are faced in the adoption of cloud computing. The main objectives of this research as followed:

1- To investigate the factors that need to be considered when planning to adopt cloud computing in Regional councils.
2- To explore the challenges and issues that influence the adoption of cloud computing in Regional councils.
3- To study the anticipated benefits of the adoption of cloud computing in Regional councils.
4- To explore the factors that encourage or discourage the adoption rate of cloud computing in Regional councils by evaluating the proposed model quantitatively with suitable sample size.

Scope of the Research

This research investigated the potential for value creation from adopting cloud computing in Regional councils. The extant literature on adoption of cloud computing appears to be limited in reference to Regional councils. That is, although literature addressing this issue exists, there is so many detail about the issues of interest addressed in this research. This research used a mixed methods design; an exploratory qualitative method as initial stage followed by a quantitative method to investigate the factors that influence the adoption of cloud computing in Regional councils. This research focused on IT staff in Queensland councils. The IT staff in this research divided into two groups. The first group is the IT managers. These individuals can include: IT director; IT manager who responsible for IT management and planning; and a director of IT services. These individuals were included because of their presumed level of information; knowledge and proficiency of cloud computing in Queensland councils. This might allow understanding of the issue from IT administration perspective. The second group is the IT staff who are working in IT department at Queensland councils. Those people can include: systems development, analyst, programmer, operations, systems administrator and user support, who are directly exposed to IT at the Queensland's councils. Those people were included because of their presumed level of skills, knowledge and experience in a relation to cloud computing adoption in their councils.

Background to Cloud Computing

The advent of IT such as cloud computing in recent years has attracted interest from different stakeholders, such as business organisations, institutions and government agencies (Buyya et al. 2009). This is fuelled by the potential of cloud computing to reduce cost of services. Cloud computing offers a shift from installed software to cloud based services that can accessed anywhere and anytime. Cloud computing offers scalability and on-demand provisioning of resources (Buyya et al. 2009).

Although the concept of cloud computing is fairly a new term, it has been in existence for a while (Vaquero et al. 2009; Lyer & Henderson 2010). It's root are related to other computing paradigms as grid computing and utility computing where terms used in cloud computing are taken from the those fields of computing (Buyya et al. 2009; Geelan 2009; Vaquero et al. 2009; Wang et al. 2008). According to Cafaro and Alonsio (2011) the roots of cloud computing can be taken back to early 1960s, when the concepts of utility computing and time-sharing were developed (Berman & Hey 2004). The main significant areas focused in computer science in this age were multiplexed information and computing service, which was a project far ahead of its time which failed due to the lack of public internet services, advanced communication technologies as well as lacking high speed processing and storage capacities. However, in this era the technologies of multitasking and time-sharing also emerged which were forerunners of cloud computing (Wang et al. 2008).

The mainframe era of computing was initiated in 1970's when companies as Tymeshare Inc. started renting out storage space and processing power through telephone lines (Bhattacharjee 2009).The beginning of personal computers was taken place in 1980s (Durkee 2010), in 1990s the dot-com bubble and the arrival of grid computing were taken place. Grid computing allowed for linking and sharing of computing resources, while the dot-com bubble led to the emergence of data centres. However, the technology of data centres were not utilised at 100% capacity which eventually led to the invention of modern cloud computing (Bhattacharjee 2009).

The first effort on cloud computing can be identified as the "Loud Cloud" company that founded by Marc Andreesen which was based on "build the web's next power play: custom-designed, infinitely scalable sites that blast off a virtual assembly line" (Sheff 2003). Loud cloud was a managed service provided which was the forerunner of providing services named as software as a service (SaaS). This service was done by utilising Infrastructure as a Service (IaaS) (Sheff 2003). In 2000 Microsoft launched web services as SaaS offering, followed in 2001 by IBM with their Autonomic Computing Manifesto (Kephart & Chess 2003) and with the improvement of Internet innovations and expanding requests of computer applications, cloud computing came as a multi-administration supplier that imparts data, programming, and open assets inside the Internet-based setting. In October 2007, cloud computing was initially introduced to the public through participation between two computing organisations, IBM and Google (Lohr 2007). This new idea carried a range of effects and progressions to various fields significant to IT.

The idea of cloud computing is said to be generally new and a developing ideal model (Bayrak et al. 2011; Buyya et al. 2009; Leimeister et al. 2010). In contrast, cloud computing is not a fully new idea, noting that it is similar to the 1990s' network computing and grid computing concept (Kim et al. 2009; Marston et al. 2011). Later, various analysts (Bayrak et al. 2011) guessed that the presence of cloud computing is because of the merging of prior advances, such as virtualisation, cluster computing, grid computing, broadband marketing and large scale data centres concentrated at inexpensive areas. As such, most scientists (Foster et al. 2008; Sotomayor et al. 2009) similarly talked about cloud technology in cooperation with grid technology and virtualisation technology.

Cloud computing has been defined from different perspectives since it is still at an exploring stage (Geelan 2009). One well-known definition is "*clouds or clusters of distributed computers, provide on-demand resources and services over a network, usually the Internet, with the scale and reliability of a*

data centre" (Grossman 2009). The European Network and Information Security Agency (ENISA) has defined cloud computing as "*on-demand service model for IT provision, often based on virtualisation and distributed computing technologies*" (Catteddu & Hogben 2009).

One of the common academic definitions described cloud computing as "*a type of parallel and distributed system consisting of collection of interconnected and virtualised computers that are dynamically provisioned and present as on or more unified computing resource based on Service-Level Agreements (SLAs) established through negotiation between service provider and customer*" (Buyya et al. 2009). Another academic definition defines cloud computing as "*a set of network enabled services, providing scalable, normally personalised, inexpensive computing platforms on demand, which could be accessed in a simple and pervasive way*" (Wang et al. 2008). These different definitions show the varied understanding of what cloud computing is from the different perspectives of different stakeholders such as; academicians, architects, consumers, developers, engineers and managers (CSA 2009).

The U.S. National Institute of Standards and Technology (NIST) includes some other important aspects of cloud computing in its definition: "*a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of services (example include, networks, servers, storage, applications and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction*" (NIST 2009). This definition promotes the availability of cloud computing and describes its five essential characteristics to its three delivery models and four deployment models as shown in Figure 1.

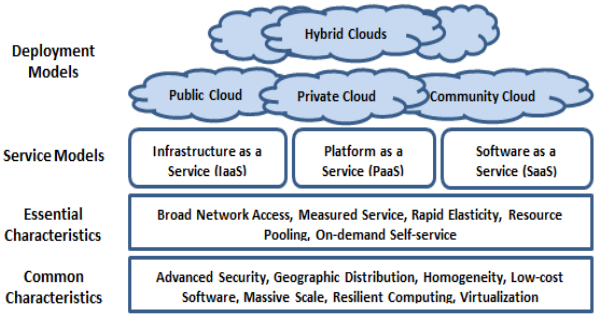

Figure 1. The NIST Cloud Definition Framework (NIST 2009)

Cloud Computing Characteristics

The five characteristics of cloud computing according to the definition provided by NIST are as follows: (NIST 2009).

- ***On-demand self-service.*** A consumer can unilaterally provision computing capabilities, such as server time and network storage, as needed automatically without requiring human interaction with each service's provider.
- ***Broad network access.*** The availability of cloud computing services on the Internet makes it easily accessible through standard mechanisms.
- ***Resource pooling.*** The provider's computing resources are pooled to serve multiple consumers using a multi-tenant model, with different physical and virtual resources dynamically assigned and reassigned according to consumer demand. 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 (example include, country, state or data centre). Examples of resources include storage, processing, memory, network bandwidth, and virtual machines (CSA 2010; Mell & Grance 2009).
- ***Rapid elasticity.*** Capabilities can be rapidly and elastically provisioned, in some cases automatically, to quickly scale out, and rapidly released to quickly scale in. To the consumer, the capabilities available for provisioning often appear to be unlimited and can be purchased in any quantity at any time.

- ***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.

Cloud Delivery/Service Models

Cloud services can be categorised on the basis of the following three service/delivery models Software as a Service (SaaS); Platform as a Service (PaaS); and Infrastructure as a Service (IaaS) (Broberg et al. 2011; CSA 2009; Mell & Grance 2009). These delivery/service model levels can be assumed as a layered architecture where services of the top layer can be created from the services of an underlying layer.

Based on the resources of virtualised computer, storage, and network, the primary layer Infrastructure as a Service (IaaS) is developed. The second layer Platform as a Service (PaaS) offers cloud development environments, which are created up on infrastructure services for providing application development and deployment abilities. At the user application level Software as a Service (SaaS) is built to providing applications and application programming interfaces (API) (Buyya et al. 2011). Each of these delivery/service models will be explored next.

- ***Software as a Service (SaaS).*** The SaaS service model facilitates the usage of service provider's programmes operating on a cloud infrastructure where consumers have the ability of accessing and using applications using a number of client devices by a client interface (ex: Web browser). The consumers have only a limited number of user-based application settings and they are unable to manage or change the base cloud infrastructure such as operating systems, servers, storage, or network (Buyya et al. 2011; Clemons & Chen 2011; Marston et al. 2011; Mell & Grance 2009; Son & Lee 2011; Velte et al. 2010; Wang et al. 2008). Examples of SaaS include, Salesforce, Netsuite and Google Apps.

- ***Platform as a Service (PaaS).*** There are similarities between this cloud computing service model and SaaS model. This model allows the consumers to adopt and develop applications acquired onto the infrastructure of the cloud with the support of programming languages as well as the tools provided by the service provider. Similar to the SaaS model, the cloud infrastructure cannot be managed or controlled by the consumers, but the user developed application as well as application hosting environments can be controlled by the consumers (Buyya et al. 2011; CSA 2010; Dillion et al. 2010; Mell & Grance 2009; Velte et al. 2010). Examples of PaaS include, Microsoft Azure Service Platform, Salesforce-Force.com, Google App Engine Amazon Relational Database Services and Rack Space Cloud Sites.

- ***Infrastructure as a Service (IaaS).*** This service model supplies processing, networking and other basic computing resources for consumers (Howell-Barber et al. 2013), where they can install and run different software such as operating systems and other programs. Similar to above mentioned service models, the consumers are incapable of managing or controlling the cloud infrastructure but they have the facility of controlling to operating systems, storage as well as other installed applications. Moreover, consumers have a limited control over certain components of the network such as firewalls (Howell-Barder et al. 2013; Buyya et al. 2011; CSA 2010; Marston et al. 2011; Mell & Grance 2009; Yadav & Hua 2010). Examples of IaaS include, Amazon S3 (Simple Storage Service), Elastic cloud computing (EC2) and Rack-space Cloud Servers.

Cloud Deployment Models

More recently, the cloud community has categorised four cloud deployment models (public, private, hybrid, and community cloud) (Catteddu & Hogben 2009; CSA 2009; Dustin-Amrhein et al. 2010; Mell & Grance 2009).

- ***Public cloud.*** This deployment model supports the cloud infrastructure to be available for the general public. Armbrust et al. (2010) states that the infrastructure is owned by an organisation that provides cloud services. Examples of popular cloud services are Amazon EC2, Google App-Engine, and

Force.com (Marston et al. 2011). According to Dustin-Amrhein et al. (2010), this model enables clients to set the level of security that they are required, and negotiate for SLA.

- ***Private cloud.*** In this deployment model, the cloud infrastructure is created only to focus in a single organisation. The management and control of the infrastructure can be done by the organisation itself or by a third party, while the infrastructure can be set in within the organisation premises or away from the premises (Armbrust & Fox 2009; Dustin-Amrhein et al. 2010). According to Armbrust & Fox (2009), there are several reasons for setting up a private cloud within an organisation: (1) Based on security consideration related to aspects of privacy of data and trust making private cloud a favourable option for the firms**.** (2) For optimising the usage and allocation of existing resources internal to the firms**.** (3) Cost of data transfer is higher between local IT infrastructure and a public cloud. Further to this, Buyya et al. (2011) and Dustin-Amrhein et al. (2010) pointed out that there is an essential need for organisations to have full control over the critical activities existing behind firewalls.

- ***Hybrid cloud.*** In this cloud deployment model, two or more clouds (private, community or public) are connected by generic technology enabling portability of applications and data. This cloud deployment model is used by organisations with the aims of resource optimization, improving core competencies through outsourcing minor business functions onto the cloud maintaining its core activities within the premises through the private cloud (Marston et al. 2011). According to the Cloud Security Alliance (CSA) (2009), Hybrid cloud is aimed at resolving the issues related to standardization and cloud interoperability.

- ***Community cloud.*** The community cloud deployment model is designed in a way to support a certain types of communities which have similar requirements for example (security requirements, policies and compliance considerations) such that the infrastructure of the community cloud is distributed parallel across several organisations (Marston et al. 2011). The cloud infrastructure may be established within or outside the organisational premise and managed by the organisation itself or by a third party (Dustin-Amrhein et al. 2010). Up to a certain level, the cloud community behaves as having a demographical balance and economic scalability (Dustin-Amrhein et al. 2010). Examples for this cloud deployment model are cloud services offered by the governments such as passport, central excise, national ID, railway, tax as well as visa and immigration where the consumers (in this case the citizens) have the ability to access the relevant information related to the above mentioned at various department levels (Local governments, state, or centre) using the internet, phone or IVR (Dustin-Amrhein et al. 2010; Marston et al. 2011).

Anticipated Benefits Related to Cloud Computing

Relevant literature indicates that potential profits from the cloud based models is perceived to be the main cause behind the organisations appetite for adopting cloud computing (LGAQ 2013). Potential benefits can be outlined as significantly lower initial costs (Saeed et al. 2011; Saini et al. 2011), improved standardisation of services (Beaubouef 2011), improved scalability as well as accessibility which made cloud computing to be implemented across a number of sectors (Saeed et al. 2011; Liang et al. 2011).

One other advantage of cloud computing is that there is minimal requirement for provision of resources and maintenance after the implementation, that the implementing organisation can concentrate more on its core business activities (Liang et al. 2011). Moreover, cloud computing can minimise the costs of infrastructure and platforms, increased network security and service scalability and improved speed of adoption which are key benefits in relation to e-government services (Das et al. 2011). Cloud computing is viewed as utility computing as a price will be charged dependent upon use (Beaubouef 2011). Regarding environmental concerns, cloud computing model is viewed favourably (Cellary & Strykowski 2009). There are different benefits of cloud computing, and some of these benefits will be mentioned next.

- Protection, care and technical support
- Disaster recovery
- Green technology
- Policies management
- Promoting business development
- Improving service delivery
- Reduced IT infrastructure cost
- Ease of use and flexibility

The essential qualities of cloud computing include reducing hardware and license expenses, lower up-front expenses, greater simplicity of implementation, focussing internal assets somewhere else and constrained IT assets, scalability and manageability (Lenart 2011; LGAQ 2013). Cloud computing does not remove the necessity for IT branch staff, on the grounds that clients still oblige access to the Internet and application configuration. Cloud computing permits IT administrator to focus on core business functions. As with any ICT operation, potential cloud computing adopters must be vigilant in testing their IT foundation and operations.

Research Methodology

The data collection of this research was conducted in two major phases. Phase 1 involved a qualitative investigation to understand the factors that influence the adoption of cloud computing in Regional councils. Phase 2 involved the use of quantitative questionnaire data to confirm the findings from the phase 1. The next two subsections describe the methods and results from two phases in detail.

Qualitative Investigation

The first phase of this research is exploratory in nature seeking to investigate and provide a qualitative overview of the concepts relating to the factors that influence the adoption of cloud computing in Regional councils.

A series of in-depth interviews were 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), see Figure 2. 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 municipal governments.

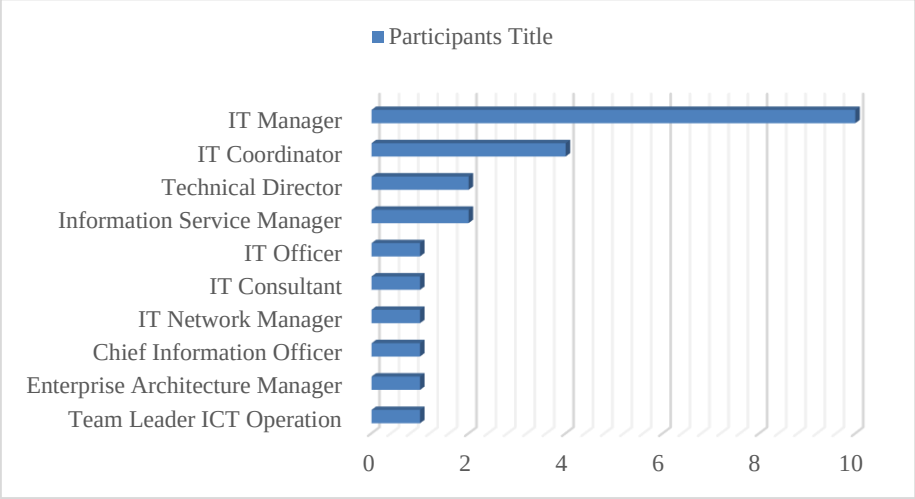

Figure 2. Participants Title

As shown in Figure 3 the sample reflects the geographical spread and size classifications of regional municipal governments throughout Queensland, Coastal with 25 percent; Resource with 12 percent; Indigenous with 17 percent; Rural/Remote with 29 percent; South East Queensland with 17 percent.

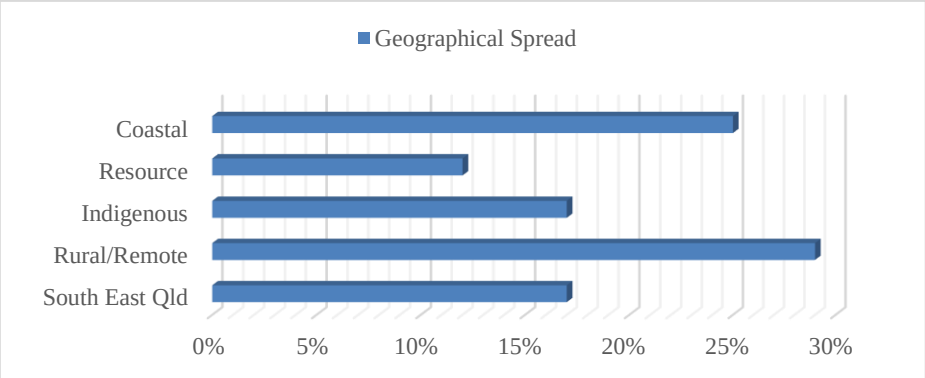

Figure 3. Geographical Spread

Questionnaire (Online survey)

The second phase of this research is confirmatory in nature seeking to confirm the findings from the exploratory stage relating to the factors that influence the adoption of cloud computing in Regional councils.

A questionnaire was selected as the instrument for the second phase of data collection in this research. A questionnaire provides quick, affordable, efficient, and relatively accurate means to procure data to fulfil several goals (Zikmund 2003; Zikmund et al. 2013). The questionnaire was developed based on the previous literature on technological and organizations studies and the findings from qualitative study (exploratory stage), we developed the questionnaire to empirically test the research question. An online survey method was chosen because of the accessibility of the internet for all intended participants and the belief that participants would prefer this approach. In order to make the survey available 24/7, an online survey service provider was found and the online survey link was offered for 3 months from March 1, 2015 to May 31, 2015.

The survey was distributed online to Queensland's 77 Councils through USQ's Custom Survey System. IT Managers from 47 Councils responded to the survey which represented a response rate of 61 percent as shown in Table 1.

Survey Details		
Survey participant	**No. of councils**	**Percent**
Survey received	47 Councils	61%
Survey not replied	30 Councils	39%
Total	77 Councils	100%
Not Respondents Councils Details		
No. of councils	**Percent**	**Reasons**
9 Councils	12%	Because of government regulations
8 Councils	11%	Because their IT were outsourcing
13 Councils	16%	Because they did not reply to the survey

Table 1. Survey Details

- **Respondents' Demographics**

The respondent's demographics data in this research including: roles in the field of IT, knowledge related to cloud computing, and total years' experience with cloud computing. Each of these respondent's demographics data will addressed next.

Role in the Field of IT

Table 2 represents the participant's roles in the field of IT in the study. The table shows that 238 of the respondents with 49.6 percent reported they were in an IT management role, 138 of the respondents with 28.8 percent were in systems development/analyst/programmer roles, 101 of the respondents with 21 percent were in IT as operations/systems administrator/user support roles, and only 3 of the respondents with 0.6 percent indicated other roles including ICT management strategy, project management asset, and IT support.

Roles in IT	Frequency	Percent	Cumulative %
Management	238	50%	49.6%
Systems development/ Analyst/ Programmer	138	28.8%	78.3%
Operations/ Systems administrator/ User support	101	21%	99.4%
Other	3	0.6%	100%
Total	**480**	**100%**	

Table 2. Roles in the Field of IT

Figure 4 illustrates the frequency of roles in the field of IT. The mean of roles in the field of IT is 1.73. This range indicates that most roles of the participants in the field of IT is in the management.

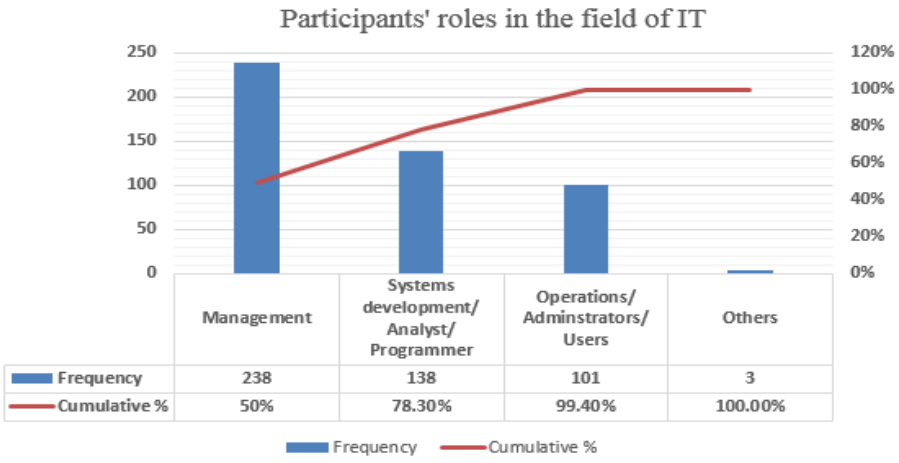

Figure 4. Chart of Roles in IT Frequency

Knowledge Related to Cloud Computing

Table 3 represents the participant's knowledge related to cloud computing in the study. The table indicates that nearly half of the respondents 238 with 49.6 percent reported had good knowledge related to cloud computing, 111 of the respondents with 23.1 percent reported had some knowledge about cloud. 106 of the respondents with 22.1 percent reported had a little knowledge about the cloud. Just 20 of the respondents with 4.2 percent reported had an excellent knowledge. There were only 5 respondents with 1 percent reporting no knowledge about cloud computing. These results indicate that most of the respondents have considerable knowledge related to cloud computing.

Knowledge related to cloud	Frequency	Percent	Cumulative %
No knowledge	5	1%	1.0%
Little knowledge	106	22.1%	24.2%
Some knowledge	111	23.1%	73.8%
Good knowledge	238	49.6%	95.8%
Excellent knowledge	20	4.2%	100%
Total	**480**	**100 %**	

Table 3. Knowledge Related to Cloud Computing

Figure 5 illustrates the frequency of the participants' knowledge in relation to cloud computing. The mean of the participants' knowledge in cloud computing is 4.05. This range indicates that most of the participants have good knowledge in relation to cloud computing.

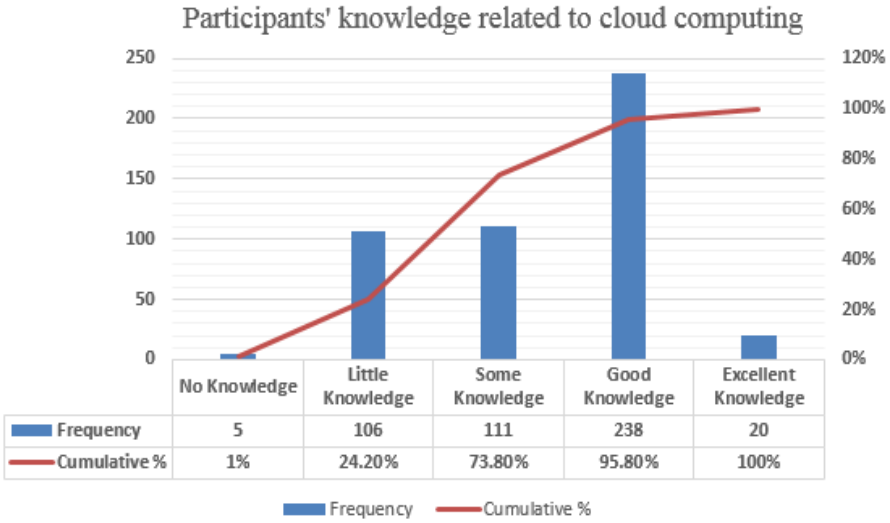

Figure 5. Chart of Knowledge Related to Cloud Frequency

Total Years' Experience with Cloud Computing

Table 4 represents the participant's years of experience with cloud computing in the study. The table indicates that more than half of the respondents 250 with 52.1 percent reported an experience with cloud computing between 2-5 years, followed by 111 of the respondents with 23.1 percent reported an experience with cloud computing between 6-10 years. About 95 of the respondents with 19.8 percent reported an experience with cloud computing less than 1 year. 12 of the respondents with 2.5 percent were never have an experience with cloud computing, followed by 8 of the respondents with 1.7 percent reported an experience with cloud computing between 11-14 years. The lowest rate was the respondents who reported an experience more than 14 years, with only 0.8 percent. These results indicate that most of the respondents have considerable experience related to cloud computing.

Years' of experience	Frequency	Percent	Cumulative %
Never	12	2.5%	2.5%
Less than 1 year	95	19.8%	22.3%
2-5 years	250	52.1%	74.4%
6-10 years	111	23.1%	97.5%
11-14 years	8	1.7%	99.0%
More than 14 years	4	0.8%	100%
Total	**480**	**100%**	

Table 4. Years' of Experience with Cloud Computing

Figure 6 illustrates the frequency of the participants' years of experience with cloud computing. The mean of the participants' years of experience with cloud computing is 3.04. This range indicates that most of the participants' years of experience with cloud computing is between 2-5 years.

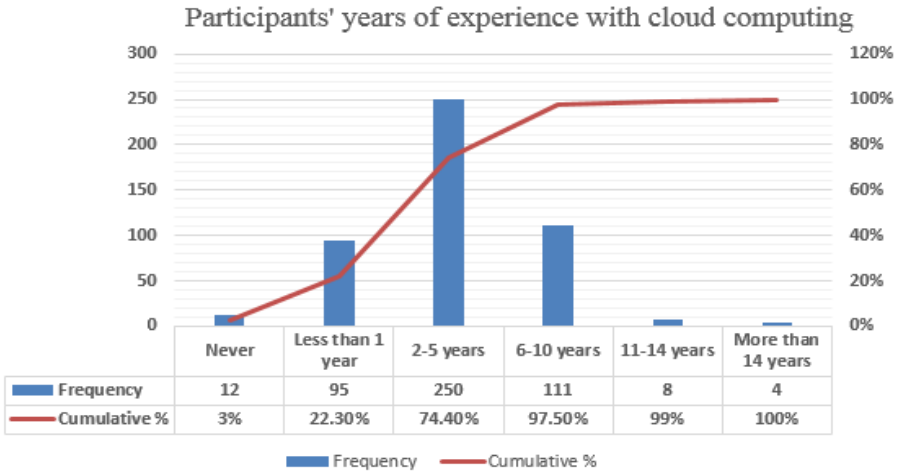

Figure 6. Chart of Years' of Experience with Cloud Computing Frequency

Cloud Based Applications Used by Organisation

Table 5 represents the cloud based applications that used by organisation in the study. The table indicates that the most common applications for cloud were: email with 75.8 percent, office productivity with 68.8 percent, data back-up/storage/sync with 66.9 percent, telephone service/VoIP with 61.5 percent, disaster recovery with 56.7 percent, security with 50 percent, compliance with 37.1 percent, remote access/VPN with 32.9 percent, project management with 27.5 percent, and human resources with 25.6 percent. The other cloud based applications that have response rate about 10 percent and more, were: collaboration software with 18.3 percent, web conferencing with 13.5 percent, file storage/sharing with 11 percent, social networking and web hosting with 10 percent. The rest of the cloud based applications mentioned in Table 5 have a response rate lower than 10 percent.

Cloud based applications that used by organisation	Frequency	Percent
Communication Applications		
Email	364	75.8%
Email marketing	14	2.9%
SMS/text messaging	25	5.2%
Telephone service/VoIP	295	61.5%
Web conferencing	65	13.5%
Social networking/Web 2.0	48	10%
Media monitoring	25	5.2%
Management Applications		
Office productivity	330	68.8%
Project management	132	27.5%
Accounting management	13	2.7%
Grant management	8	1.7%
Donor management	4	0.8%
Volunteer management	10	2.1%
Human resources	123	25.6%
Client/member database/CRM	12	2.5%
Payroll	12	2.5%
Billing and invoicing	13	2.7%
Data analytics	12	2.5%
Training	28	5.8%
Security Applications		

Security	240	50%
Data backup/storage/sync	321	66.9%
Disaster recovery	272	56.7%
Compliance	178	37.1%
Other Applications		
File storage/sharing	53	11%
Website hosting	48	10%
Collaboration software	88	18.3%
E-commerce processing	11	2.3%
Remote access/VPN	158	32.9%

Table 5. Cloud Based Applications that Used by Organisation

Factors to be Considered in Cloud Adoption

Figure 7 demonstrates the research findings related to the factors that need to be considered for the adoption of cloud computing in Regional councils. This suggests that internet connectivity seen as strongly important with nearly 85 percent, followed by internet speed with 70 percent. Then, data back-up with nearly 65 percent, security with 53 percent, and cost with 50 percent. In other opinion, participants seen integration as just important with nearly 58 percent, followed by reliability, cost, and security with over 40 percent. Next, employees' knowledge with 38 percent, availability with 35 percent, and data back-up with 28 percent.

Other participants seen data storage location as slightly important with nearly 50 percent, followed by provider dependability with 43 percent. Then, availability and reliability were closely to 40 percent, followed by employees' knowledge with 37 percent. Where, data sovereignty seen as neutral with nearly 32 percent, followed by transportability with 30 percent.

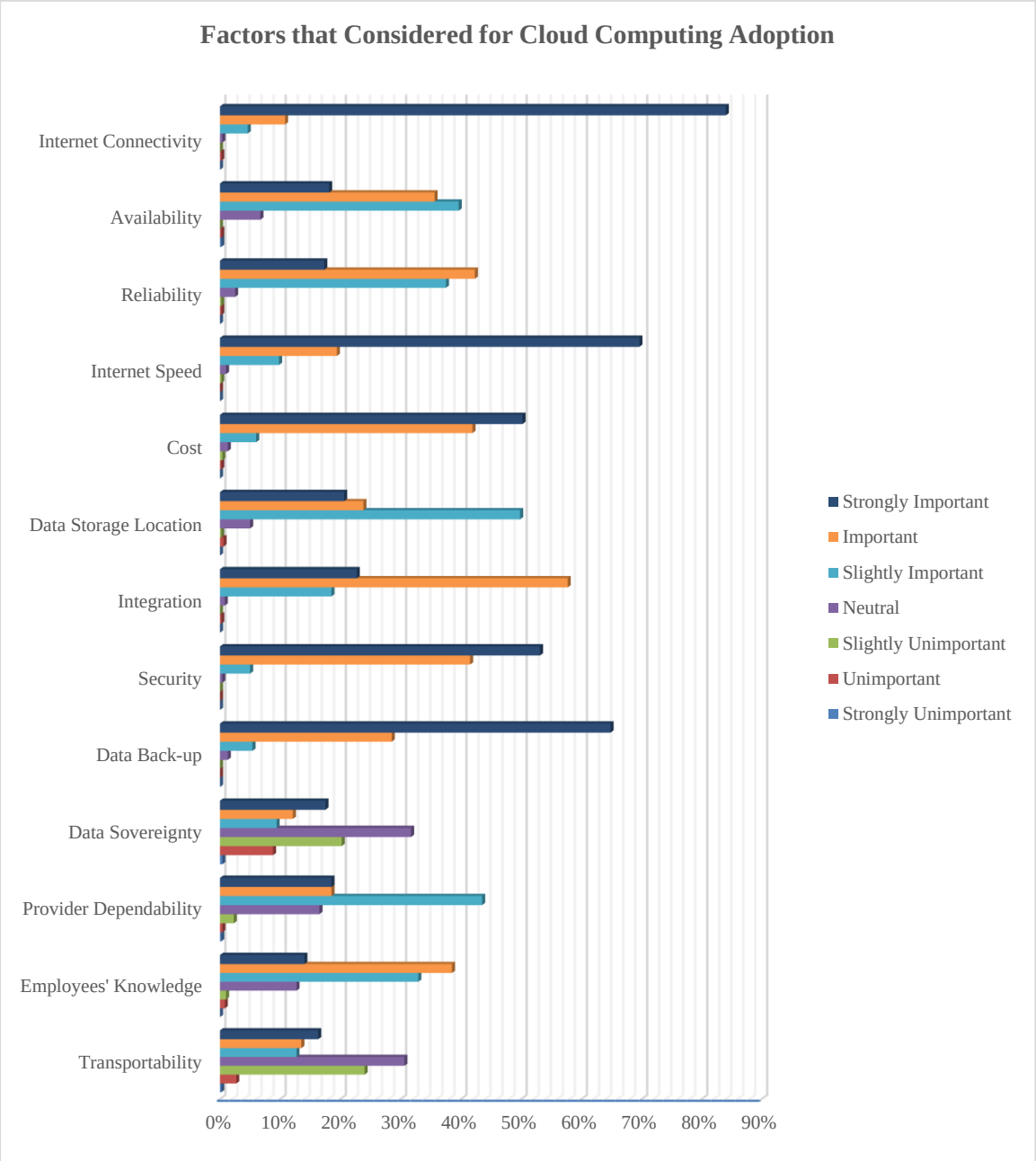

Figure 7. Factors Considered for Cloud Adoption

In general, there are no empirical studies specifically about the factors required to be considered when planning to adopt cloud computing services in reference to Australian Councils. This limitation has hindered strategy development to improve the adoption of cloud computing in local governments. There are only a few studies that describing the importance of individual factors such as internet connectivity (Tweneboah-Koduah 2012); internet speed (Magele 2005; Voorsluys et al. 2011); reliability (Voorsluys et al. 2011); availability (Ahuja & Mani 2012); data storage location (Jaeger et al. 2008); security (Paquette et al. 2010); data sovereignty (Tweneboah-Koduah et al. 2014); cost (Li et al. 2009); integration (Tripathi & Parihar 2011); data back-up (Hemant et al. 2011); employees' knowledge (Kuan & Chau 2001; Lippert & Forman 2005) as factors to be considered when planning to adopt CC. The findings of this part of the research add some empirical weight to support previous findings related to the factors that need to consider when planning to adopt CC. Also, the findings of this part of the research come with new factors that important to consider for cloud adoption. These new factors are provider dependability; and transportability.

Anticipated Benefit for Cloud Adoption

Figure 8 demonstrates the research findings related to the anticipated benefits for the adoption of cloud computing in Regional councils. This suggests that reduce IT infrastructure seen as most important as strongly agree with nearly 75 percent, followed by reduce level of risk with 70 percent, provide better services, storage capacity, disaster recovery and back-up all of these benefits indicated by the participants as strongly agree with 65 percent, and remote access seen as most important as strongly agree with nearly 53 percent. Also, time efficiencies confirmed by the participants as strongly agree with 40 percent, followed by reduce staff with 38 percent, availability of the services with 33 percent, and flexibility with 25 percent.

Other participants seen cost reduction as important as agree with nearly 58 percent, followed by flexibility with 57 percent. Next, availability of services with 54 percent, and time efficiencies seen as important as agree with nearly 41 percent. Remote access with 34 percent, and reduce staff with 28 percent.

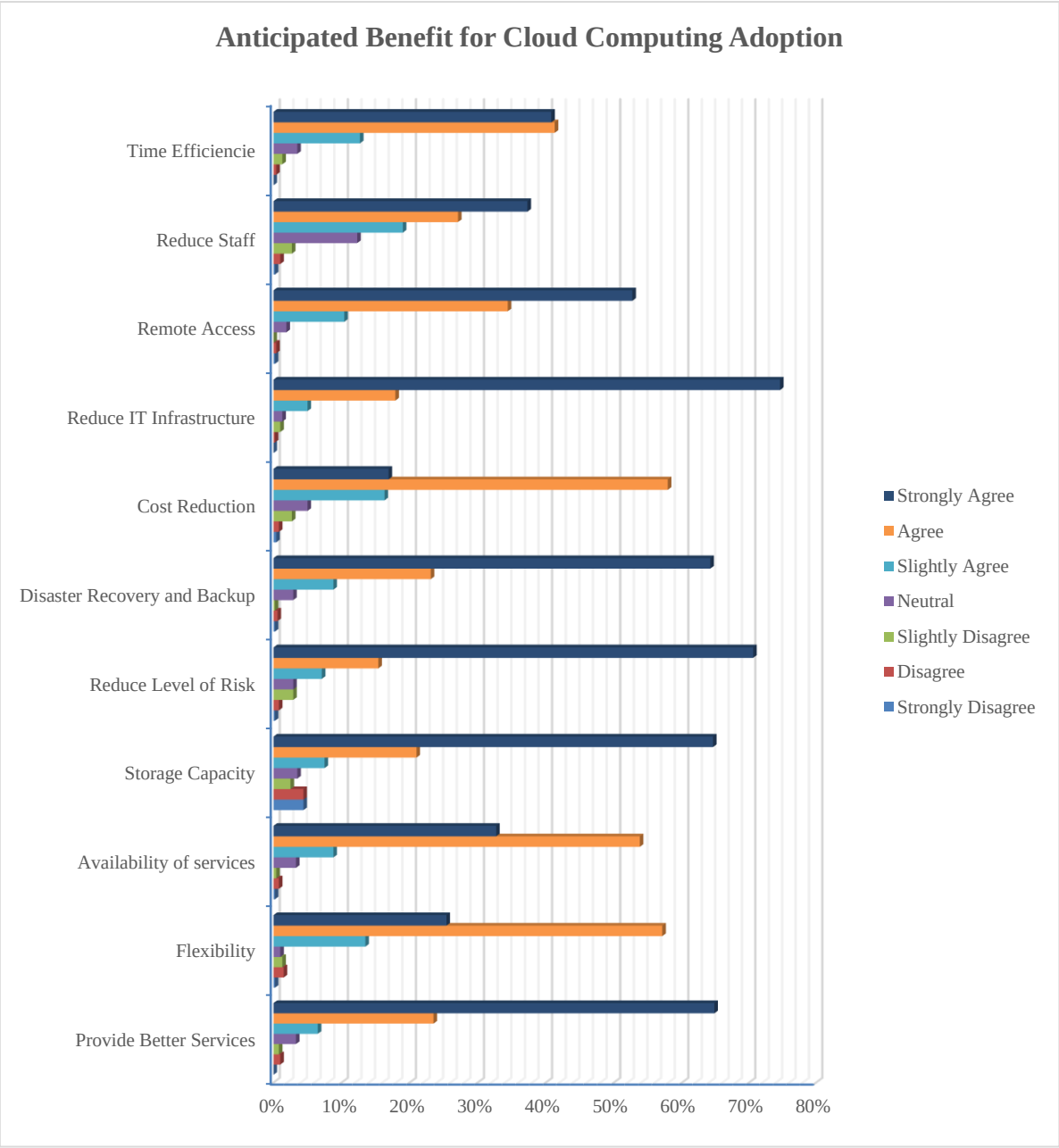

Figure 8. Anticipated Benefit for Cloud Adoption

This research focuses on the anticipated benefits of cloud computing adoption in Regional councils' environment. Since there is limited literature related to Regional councils and cloud computing. Also, there is a lack of studies that provide an in-depth and holistic investigation of all the actual anticipated benefits of adopting cloud computing (Low et al. 2011; Misra & Mondal 2011). That is, we could not find any studies that listed all benefits of cloud computing and explained why and how they are benefits. The findings derived from this part of the research have shown that cloud computing adoption in government organisations resulted in significant cost reductions, improved service delivery and reduced IT infrastructure. Furthermore, time-effective and convenient services were delivered to the public. From the points of benefits provided by cloud computing, there is a great result for Councils IT staff to take them away the responsibility of the maintenance burden in the councils. Adopting cloud network redundancy eliminates disaster recovery risks and its high costs. There can always be new tools and applications to improve IT features.

Figure 9 illustrates the research findings related to the challenges and issues that influence the adoption of cloud computing in Regional councils. This figure indicates that the need of an effective network seen as strongly important with nearly 80 percent, followed by loss of control over data with 70 percent, cost with 62 percent, security with 58 percent, back-up with 57 percent, and availability of different providers with 55 percent, and data storage location with 32 percent.

Other participants seen integration as just important with 62 percent, followed by privacy with 49 percent. Then, security, back-up, and availability of different providers with 33 percent. Also, they seen cost and policy maker as important with 28 percent. But, others seen trust as slightly important with 50 percent, followed by policy maker with 47 percent, data storage location with nearly 39 percent, and privacy with 30 percent. Data that presented in Figure 6.6, indicated that participants seen lack of real understanding of cloud computing as neutral with nearly 39 percent, followed by business transformation with 26 percent.

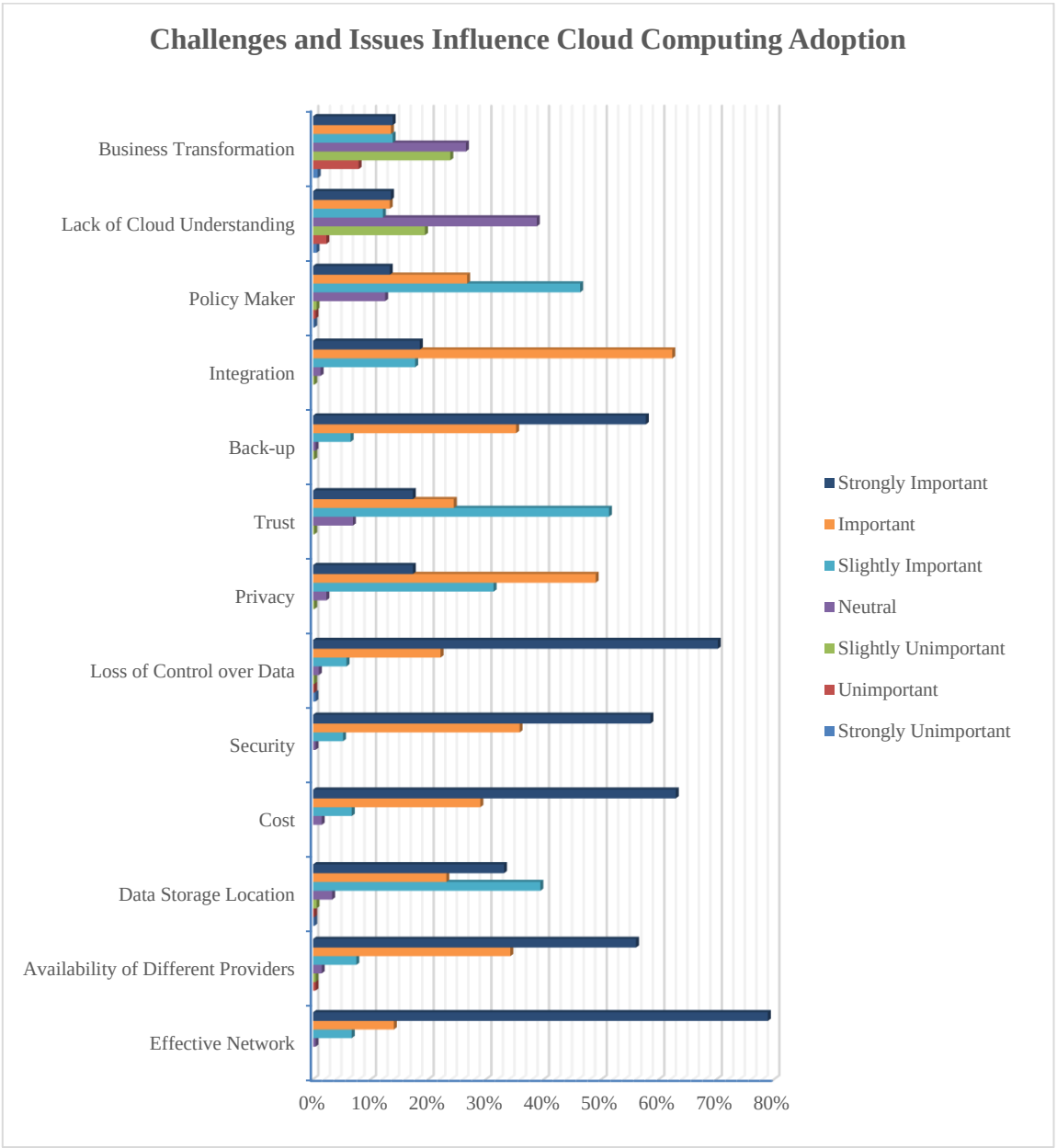

Figure 9. Challenges and Issues Influence Cloud Adoption

Recent developments have ensured the increasing fame of cloud computing as it is an online shared computing resource. Based on the above arguments, it can be deduced that even though it is economical and ensures an increase in performance, productivity and competency, there are a lot of challenges and issues related to the cloud adoption. Based on the findings of previous studies, the findings of this research is completely different. Because, most of the previous studies found that security as the most important issue that influence cloud adoption (Behl 2011; Julisch & Hall 2010; Jensen et al. 2009). But, the findings of this research found out that the effective network as the strongly important issue that faced Regional councils to adopt cloud computing.

To look at literature in related to the challenges and issues that influence the cloud adoption we found that some of the research findings are similar to the findings from the literature, such as Effective network (Liu & Wassell 2011); security and loss control over data (Gharehchopogh & Hashemi 2012; Duffany 2012); data storage location (Jaeger et al. 2008); cost (Saeed et al. 2011; Saini et al. 2011); back-up of data (Hemant et al. 2011); privacy (Yadav & Singh 2012); integration (Tripathi & Parihar 2011); trust (Pearson & Benameur 2010). The other findings of this part of the research seen as new findings in related to the challenges and issues that influence the adoption of cloud computing. These new issues are: availability of different providers; policy makers; lack of real understanding of the cloud; and business transformation.

Innovation change factors

How significant are the innovation factors (**compatibility**, and complexity) in driving your organisation's adoption of cloud computing environment?

Compatibility

"Compatibility, if things were compatible with what we are running, it will have a positive impact. I think there is no problem with this factor, because it is based on the CSPs and most of the CSPs find solution to this factor" (C19-RTL)

Definition:
Compatibility is the degree to which innovation fits with the potential adopter's existing values, previous practices current needs (Rogers 2003).

According to the literature, compatibility is one of the constructs which significantly influence the adoption rate of innovations (Rogers 2003). Studies which investigated the diffusion process of innovations have found compatibility to be a significant determinant (Teo et al. 1997; Premkumar & Roberts 1999; Premkumar 2003; Ching & Ellis 2004; Daylami et al. 2005; Zhu et al. 2006a).

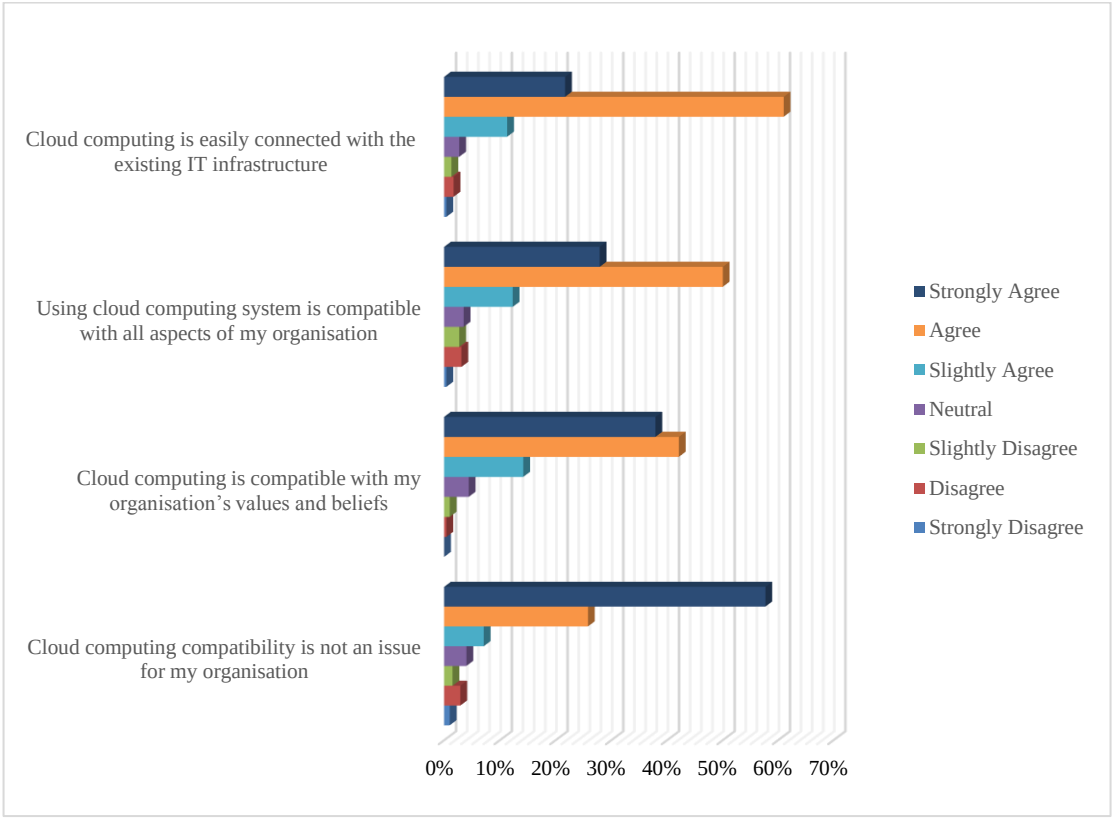

Figure 10. Compatibility Measurement

Innovation change factors

How significant are the innovation factors (compatibility, and **complexity**) in driving your organisation's adoption of cloud computing environment?

Complexity

"About the complexity, comparing to other type of technologies cloud computing technology is less complex. We do not see any more complex than what we currently have right now" (C55-URS)

Definition:
Complexity is the degree to which an innovation is perceived to be relatively difficult to understand and use (Rogers 2003).

The complexity of an innovation is able to act as an obstacle to the new technology adoption (Premkumar & King 1994; Low et al. 2011). A technology which is shows the characteristics of difficulty in understanding and usage is considered to be complex. If it takes extensively long time to be mastered or perform general tasks by a user, that technology is said considered to be complex. Thus, for improving the rate of adoption, technologies must have the essential characteristic of user friendliness (Sahin 2006). Complexity is proved to be a key aspect in the decision for adoption (Tiwana & Bush 2007; Chaudhury & Bharati 2008).

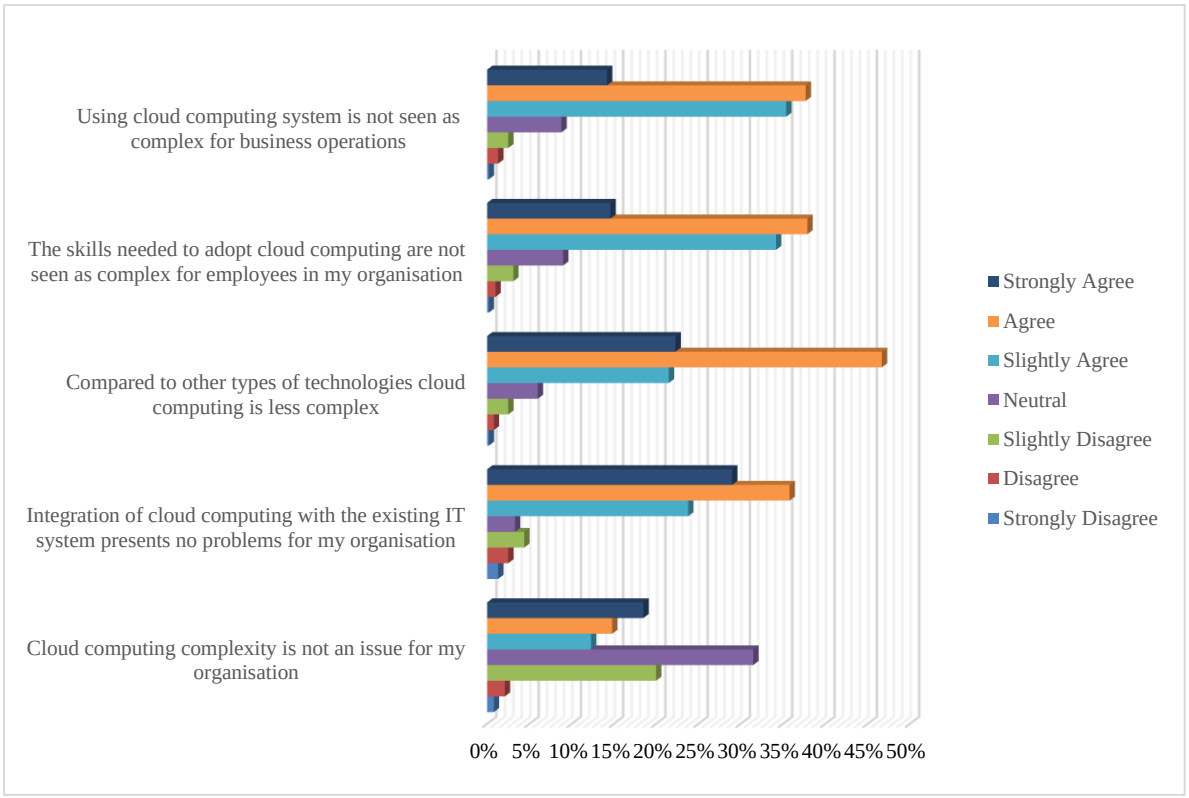

Figure 11. Complexity Measurement

Technological change factors

How significant are the technological factors (**cost**, and security concern) in driving your organisation's adoption of cloud computing environment?

Cost

"The cost reduction needs to be justified. If proved that cloud computing technology is cost saving that means it will positive to adopt it" (C11-RAV)

Definition:
Cost is refer to how a business can remain economically viable, feasible and imperishable, hardware costs and associated administrative costs have to be properly interpreted (Li et al. 2009).

Cost savings is one of the primary capabilities of cloud computing (Cervone 2010). Cloud services providers state that their services can considerably cut down the total IS cost of an organisation including fixed costs such as initial investment, variable costs such as upgrading and maintenance as well as training costs (Zhu et al. 2006a). The minimal level of cost of getting the services improves the possibility of aim to adopt cloud computing.

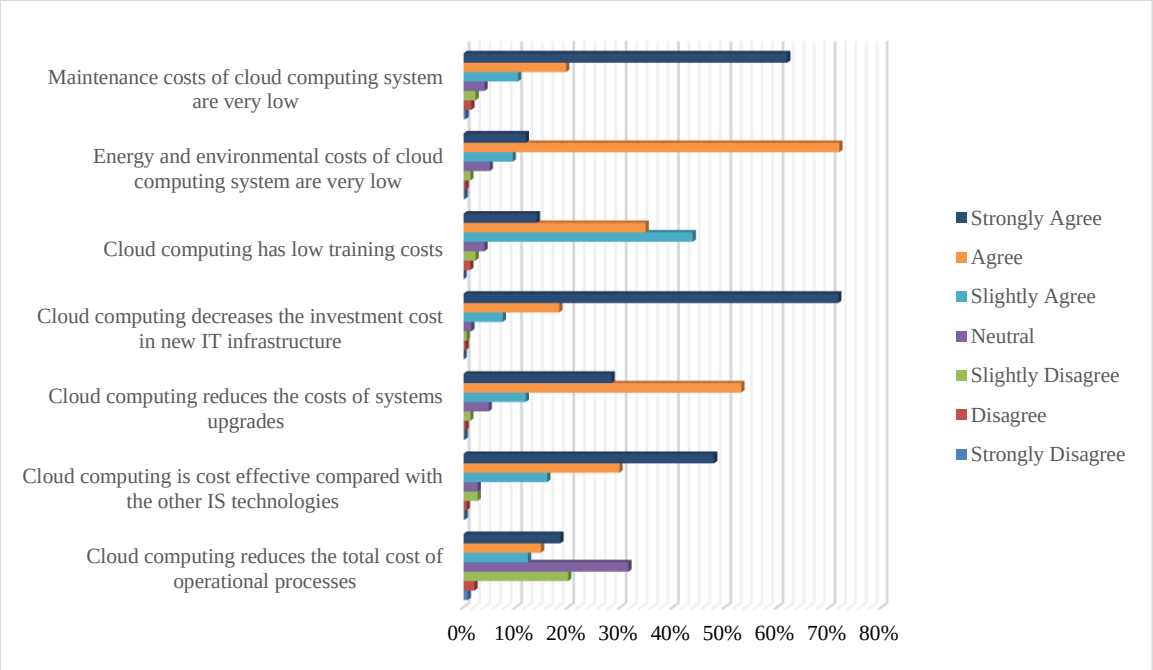

Figure 12. Cost Measurement

Technological change factors

How significant are the technological factors (cost, and **security concern**) in driving your organisation's adoption of cloud computing environment?

Security Concern

"I think security in the cloud will probably be, will most likely be stronger than security in the house in most case. So, I think moving to the cloud would be a more secure environment than what we are currently in" (C40-UDV)

Definition:
Security concern is refer to the level of data and the system security within the organisation (Paquette et al. 2010).

In terms of cloud computing, security is the level which cloud computing is considered as being more secure in comparison to other models of computing. Cloud services providers' state that they have the ability to safeguard organisations data more strongly than the organisations themselves (Kaufman 2009). Security in this research is defined as the security of services, data centres and media. This construct takes into account, the privacy and confidentiality of the organisations data (Paquette et al. 2010; Subashini & Kavitha 2011).

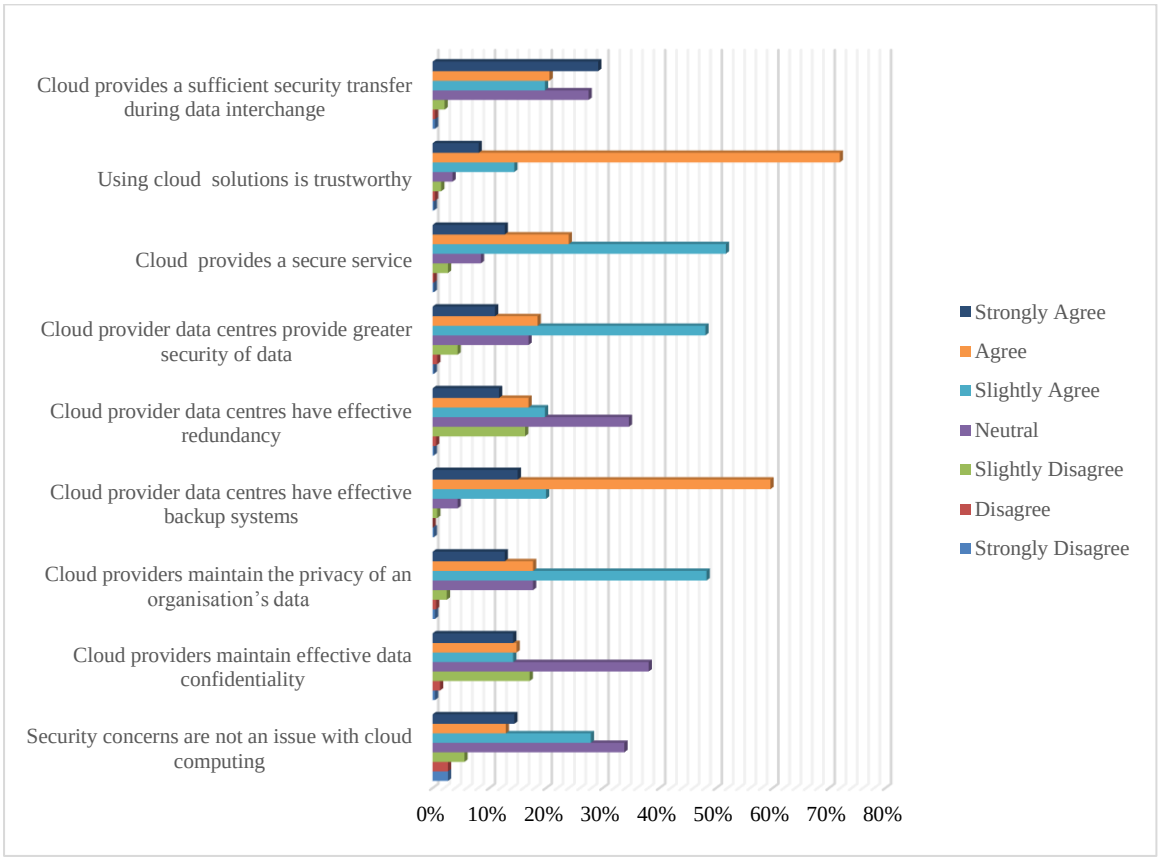

Figure 13. Security Concern Measurement

Organisational change factors

How significant are the organisational factors (**top management support**, organisation size, and employees' knowledge) in driving your organisation's adoption of cloud computing environment?

Top Management Support

"Top management support has a positive effect on this one because all our top CEO Managers agree that moving to cloud base will increase the council performance and will help the council to provide good services to our customers" (C18-URS)

Definition:
Top management support is perceived to be the primary linkage between individual ICT innovation adoption and the organisational ICT innovation adoption.

Top management support can affect the adoption of new technology innovation (Premkumar & Michael 1995; Eder & Igbaria 2001; Daylami et al. 2005). Through a revision of the predictors and biases in IT, Jeyaraj et al. (2006) revealed that support by top management is perceived to be the key link between individual and organisational ICT innovation adoption. These results are in line with the findings by Lertwongsatien and Wongpinunwatana (2003), who revealed that organisations have a less tendency to adopt new technologies without the support by top management.

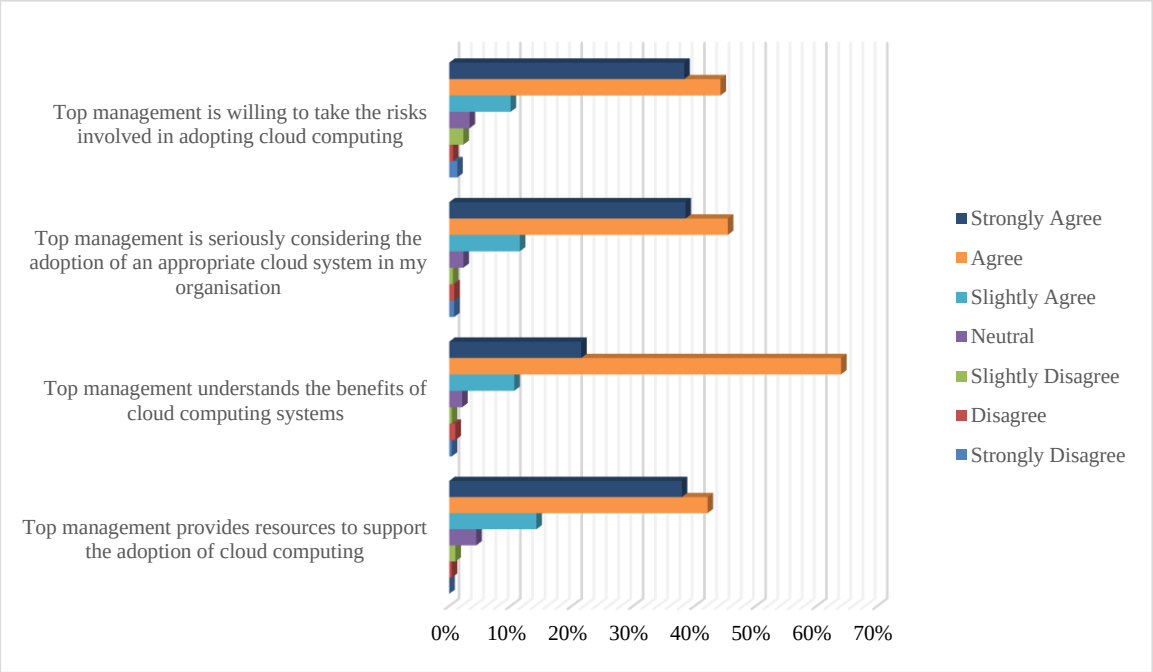

Figure 14. Top Management Support Measurement

Organisational change factors

How significant are the organisational factors (top management support, **organisation size**, and employees' knowledge) in driving your organisation's adoption of cloud computing environment?

Organisation Size

"I think that it is easier for smaller organisations. I think it is also easier for young organisations that have not yet sunk capital investment into a whole portfolio of technology and applications so smaller and younger organisations are more likely top mover to cloud" (C68-URL)

Definition:
Organisation size is explained as the size of the organisation including employees and resources (Rogers 2003).

One of the significant factors associated with IT innovation is the size of the organisation (Hong & Zhu 2006). Some experiential researches have pointed out that a positive correlation exist between size and adoption of new technology in an organisation (Pan & Jang 2008). It is proposed that organisations of smaller size are poses far more flexibility in relation to changing the path (Jambekar & Pelc 2002). Others has been repeatedly found that due to the greater litheness and capacity of taking risk, larger organisations incline to adopt more innovations (Zhu et al. 2004). Apparent tactical importance of cloud computing in innovative technological development is affected by the vital factor of size of the organisation.

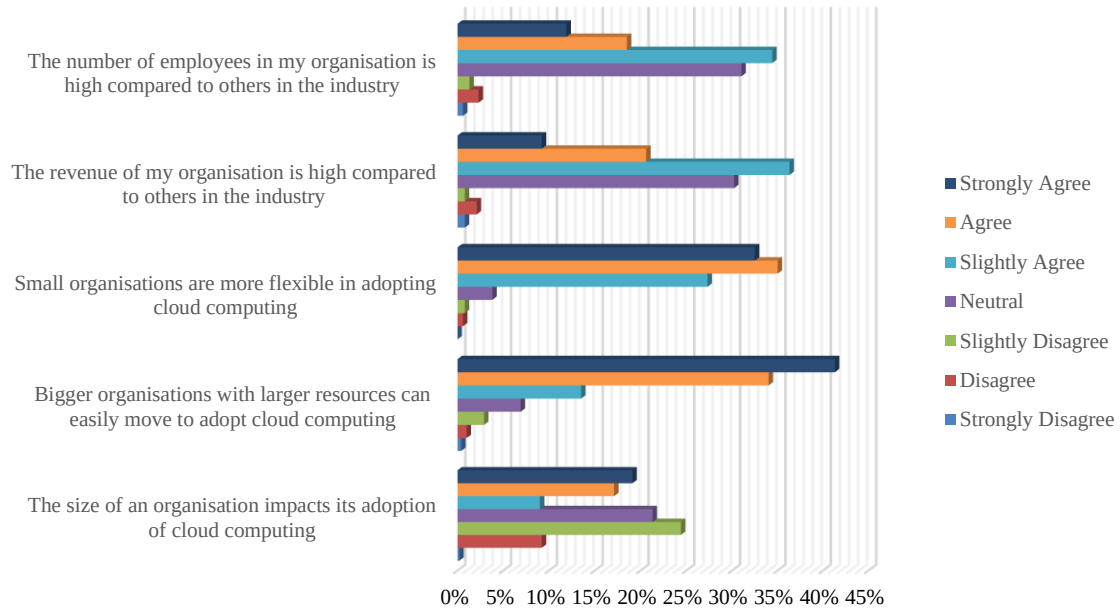

Figure 15. Organisation Size Measurement

Organisational change factors

How significant are the organisational factors (top management support, organisation size, and **employees' knowledge**) in driving your organisation's adoption of cloud computing environment?

Employees' Knowledge

"Employees' knowledge I believe it will have a positive impact if the employees and the end users were familiar with using it, they would be a lot quicker to pick up on it and to use it" (C19-RTL)

Definition:
Employee's knowledge can be defined as the similar experiences which can be envisioned on a band that explains the level of connections between the present and practices and experiences of the past (Lippert & Forman 2005).

Identification of previous similar practices by the employee can be considered on a scale which explains the level of connection among previous experiences and the current practice (Lippert & Forman 2005). An organisation that having employees with extensive level of knowledge on innovation encounter less confrontations and issues against introducing and practicing new technologies. Practical experiences has been noted which supports the positive correlation between adopting IS and IS knowledge level of the employees (Kuan & Chau 2001; Thong 1999).

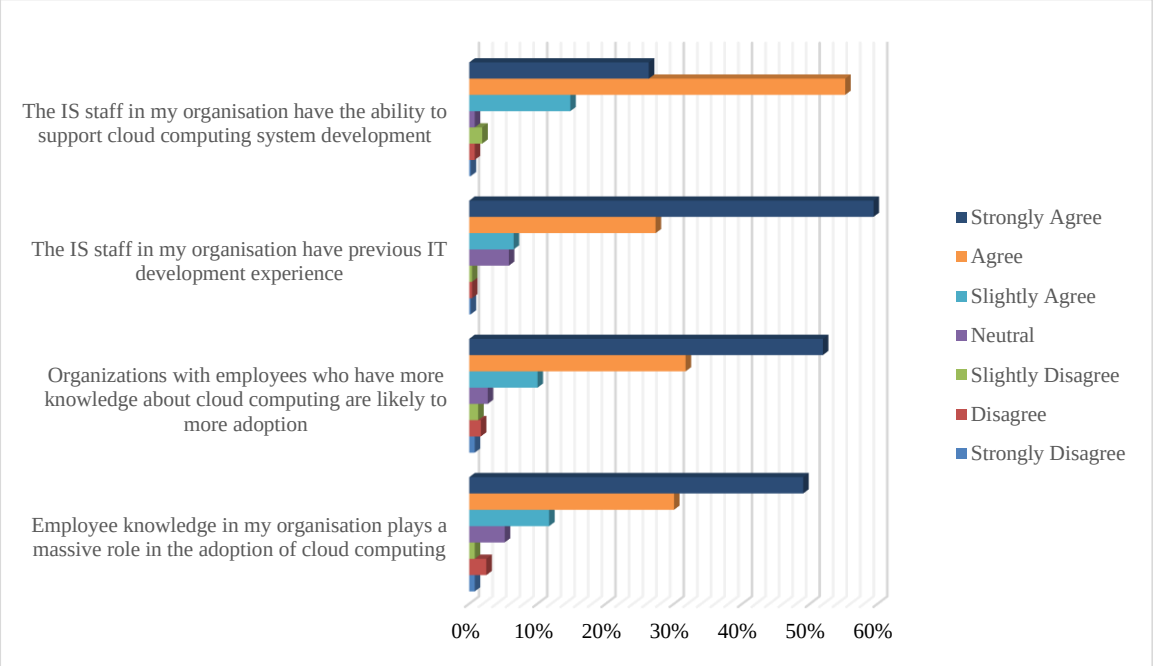

Figure 16. Employees' Knowledge Measurement

Environmental change factors

How significant are the environmental factors (**government regulation**, and information intensity) in driving your organisation's adoption of cloud computing environment?

Government Regulation

"Government regulation has the potential to drive the use of cloud services as regulations are refined to make it easier for councils/agencies to utilise. Government regulation could also force the use of cloud solutions in some circumstances" (C61-URM)

Definition:
Government regulation is explained as the support provided by the authority for influence the improvement of IS innovations in organisations (Jaeger et al. 2008).

Government guidelines can be explained as the support provided by the government for the purpose of encouraging the amplification of organisations IS innovation (Jaeger et al. 2008). The notion which organisations are having on the current laws and regulations can be evaluate during this procedure. By formulating rules for safeguarding businesses using cloud computing technology, governments can promote the adoption of cloud computing (Best et al. 2008; Carrico & Smalldon 2004).

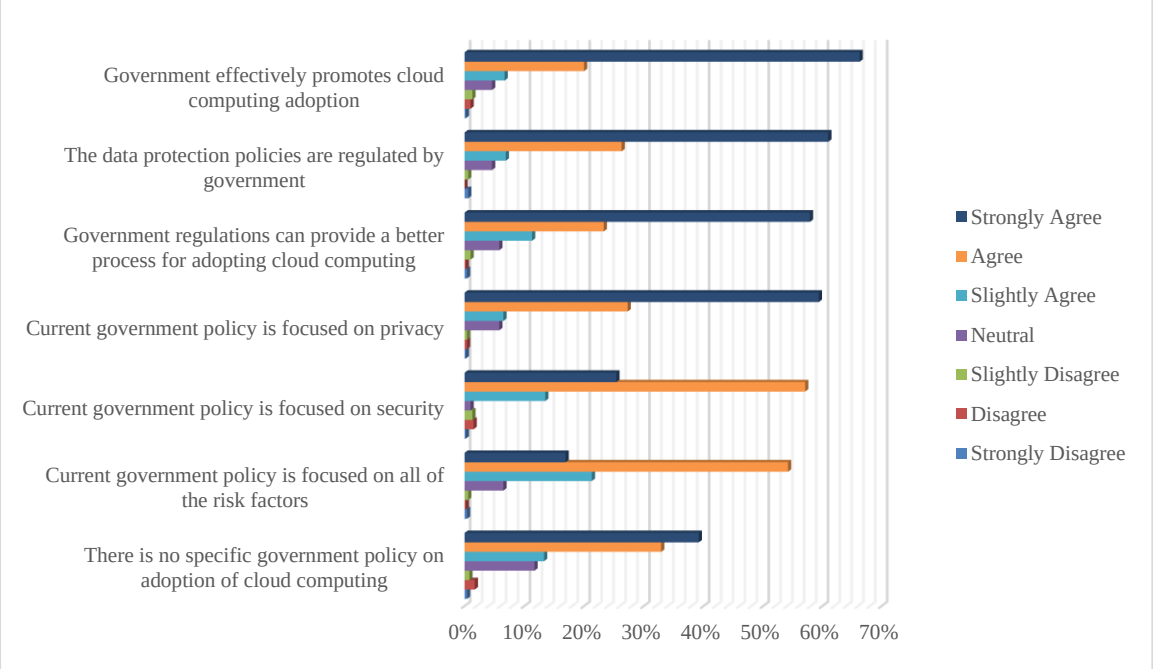

Figure 17. Government Regulation Measurement

Environmental change factors

How significant are the environmental factors (government regulation, and **information intensity**) in driving your organisation's adoption of cloud computing environment?

Information Intensity

"Information intensity I think that would have a positive impact. Because cloud computing will provide our systems with quick and good access to the information" (C19-RTL)

Definition:
Information intensity can be define as the level to which information is available in the product or service of a business (Thong 1999).

Organisations in different sectors have different information intensity, for example financial organisations need to have access to most current information. Information intensity is the organisation's reliance on accessing up to date, reliable, relevant and accurate information whenever they need it. Have reported that organisations that use more advanced ICT technologies have more ability to access internal, external, and previously encountered information (Chau & Tam 1997; Chong et al. 2009). It allows the quick retrieval of such information, and facilitates information accessibility (Huber 1990). Organisations whose businesses depends up-to-date information are more likely to adopt cloud computing.

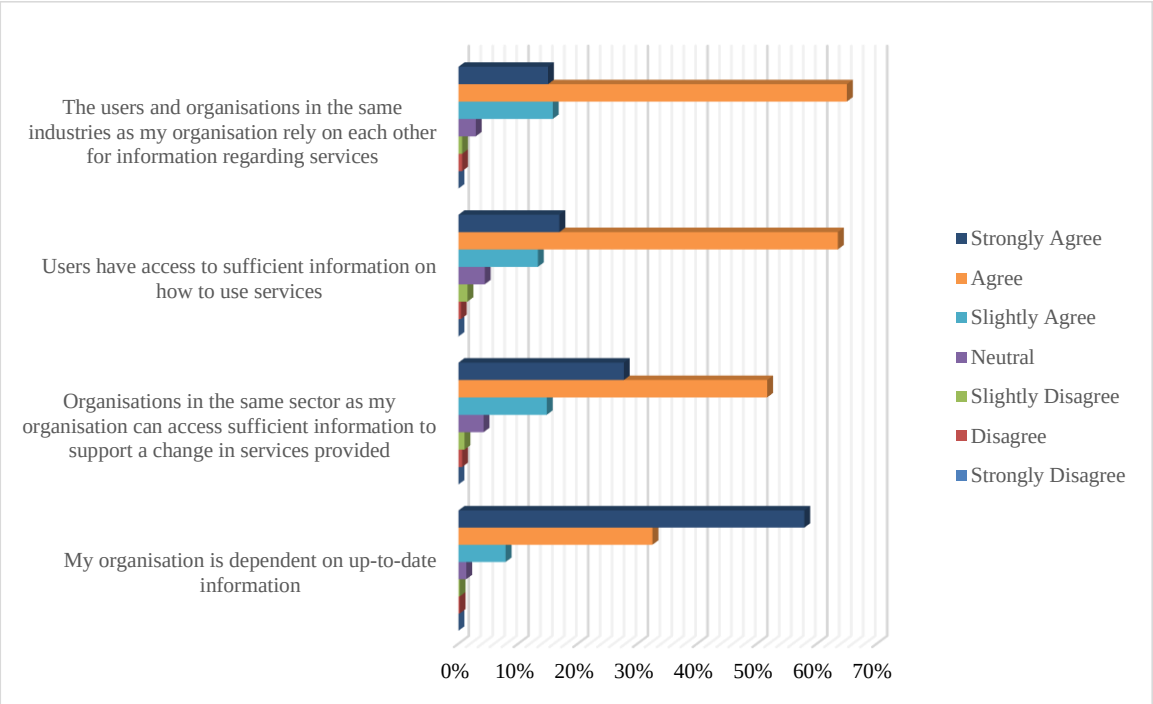

Figure 18. Information Intensity Measurement

The deliverables of this research contribute significantly not only to the future IS research projects, but also for the improvements of the public services particularly the regional governments. Research supports such regional governments to use cloud computing effectively and efficiently by considering the influence of different factors. The detail discussion is carried out below about the implication of this research for many different groups of users: service providers and technology consultants, managers, and governments.

Implications for technology consultants and service providers

The outcomes of this research are particularly important for the technological consultants. Regional councils can be considered as organisations, which represents a vital segment of the market and the country's economy by providing various important services to the local citizen and business. The service provider plays a significant role in implementation and that it is quite clear when the firm and public intermediaries are alert of each other's individual input and a working connection is recognised (Brown & Lockett 2004).

Organisations that are unsuccessful in adopting technologies may become influential undesirable opinion leaders (Leonard-Barton 1988). The providers of these services should focus in investigating appropriate role models, study the different problems faced by the organisations, should be aware of the organisational context and take a more positive role to encourage successful diffusion in these organisations. To design and use strategies for the extensive adoption of cloud computing, technology consultants should have a much better understanding about the important factors that affecting the organisation's adoption of cloud computing and related technologies.

The service providers of cloud computing technologies should have a better interaction with the regional governments, who are experiencing these novelties, in an attempt to deliver a healthy environment for the adoption of cloud computing, and to reduce uncertainties surrounding the adoption of cloud computing in these regional governments.

The process of adopting these technologies sometimes take time due to the fact that decision makers of the regional governments are not aware of the potential benefits that these technologies brings to the business. To have a better understanding and awareness of the anticipated benefits of these adoptions play a vital role in decision-making process.

It has been explored as a part of this research that IT managers of these regional governments related their late response to the adoption of cloud computing to the lack of better understanding of these technologies and knowledge level of employees on this kind of services. Service providers should develop strategies to promote the anticipated benefits of cloud computing.

Technology consultants and service providers should take necessary actions to mitigate the feelings of uncertainties associated with adoption of cloud computing. The location of the data storage is one of the uncertainties around cloud computing. Factors such as internet connectivity, cost, security, trust, integration, backup, provider dependability, employee knowledge, and transportability are significant concerns when planning to adopt cloud computing in a business. The service provider should be capable of delivering secure and reliable environments in the most accessible, economical, and convincing way. This leads to a supportive environment for the business. Service providers should provide the technical support 24/7 to minimise the concerns of customers on data stored remotely away from their locations.

Some of the Regional councils had not felt that they were adequate enough for cloud computing adoption due to many reasons. One possible explanation for this is that service providers identify alternating environment of IT industry, and they are playing a vital role in order to be an active facilitator for these services. At the same time, they don't want their valuable investments of hardware and software to be affected. This can make stakeholders have a negative impression on service providers, who themselves have no clear aims and stance about these cloud computing technologies. It can be

suggested that further research need be carried out in this area before conclude the role of service providers in the diffusion of cloud computing, particularly as the user may be affected by the views of the service provider the extent to which cloud computing provider confident in the advantages that technology will create in their business.

Using the research proposed model in this research by the service providers can assist the following:

- Improve the awareness of the reasons behind the some regional municipal government's lack of interest on the adoption of cloud computing technology.
- The providers of cloud computing technologies should have a better interaction with the regional governments, who are experiencing these novelties, in an attempt to deliver a healthy environment for the adoption of cloud computing, and to get rid of any uncertainties surrounding the adoption of cloud computing in these regional governments.
- To improve clients' confidence on could computing service providers should demonstrate their vision and aim of delivering cloud-computing technologies versus in-house services.

Implications for Managers

One of the major challenges decision makers face in business is uncertain and rapidly growing business environment. The major problems, which impact selections, change with time; effects are not yet known when adoptions are made, and often there is a lengthy period between the choices itself and when its consequences become well defined. Managers can use many different related studies to develop their process of decision making in this environment. Cloud computing adoption model proposed in this research supports managers to identify the potential adoption and develop their knowledge about the important factors that influences the outcome of such adoptions.

As demonstrated by the empirical analysis, the anticipated benefits play an important role in the adoption of cloud computing in Regional councils. These results imply that managers and decision makers should investigate and evaluate the advantages of adopting to such technologies and also they better improve their knowledge and awareness about these services. These developments will support to decrease the level of uncertainties associated with cloud computing adoption. The potential benefits and its instrument explained and discussed can be effectively used by local council managers to deeply evaluate and organise their adoption and implementation of such technologies. This will lead them to understand how cloud computing can enhance the efficiency of their work by increasing the productivity and making them have a great control of their daily work.

The outcomes of this research deliver a set of verified and reliable measures for investigation the support of cloud computing. It can be seen that to choose the ideal cloud service provider, managers must play a vital role with great attention. As explained earlier compatibility, complexity, cost, and security concern can be considered as the most important factors when adopting these technologies to business. The main task of selected service provider to deliver high level technical and organisational support to reduce the uncertainties associated with technical and organisational matters. The managers must consider the size of their organisations when selecting the most suitable cloud computing system for their firm. Findings of the research also suggest that the type of cloud computing adopted is significantly affected by the computing support delivered by the service provider. This indicates that organisations should try to obtain the all possible supports from the service provider in all critical stages; from early stage to full employment of the technology and the final stage of application.

Finally, cloud computing adoption model developed in this research based on an integrative approach can be significantly supportive to the Regional councils, who have the intention to use these technologies and want to conduct an in-depth analysis of the potential cloud computing resources and associated capabilities. The research tool can be further modified to access the situation of Councils. The result of such assessment can be used to estimate their strengths or drawbacks and the mode in which the adopted abilities can improve or decrease these in firming their competitive place. The experience that managers develop by interacting with this adoption model will enable them to use it for other different technologies. They can enhance their disunion making abilities in the adoption of suitable technologies to their specific organisational environment.

In comparison to other models, TOE framework and the DOI theory combination contains a multitude of factors technology, organisation, environmental context, and innovation characteristics which provides higher flexibility and benefits than the other models. TOE framework (Tornatzky & Fleischer 1990) and DOI theory (Rogers 1995) can provide a better understanding of the adoption phenomenon of IT/IS through an easy to understand the methodology, which is supported by a solid theoretical basis and a reliable empirical support. Hence, the combination of TOE framework and the DOI theory shows that it can enhance the decision taking the skill of managers of Regional councils.

Implications for government

The growth and development of cloud computing may lead to evaluation of government policies and incentives encouraging the technology adoption in Regional councils. Through facilitating considerate of the aspects that affect the adoption and implementation of ICT technologies such as cloud computing, this research model can support harnessing the benefits of the ICT execution efforts of the Australian government. The research outcomes can underpin a comprehensive understanding of the factors that need to be considered when planning to adopt CC, anticipated benefits, and challenges and issues of the implementation of cloud computing in the local government councils ultimately leading to support the ICT implementation process by the Australian government. Hence, it can be assumed that cloud computing has a potential to reduce the cost of IT operations in regional governments.

Considering the above factors, this specific research provides valuable information for a multitude of entities including the government, managers, technology consultants, organisations as well as service providers. Hence, the research can be considered as applicable to the swift development of cloud computing technologies of the modern times. Ultimately, the above mentioned was aimed at providing strategies in the establishment and improving the development and use of cloud computing within Regional councils.

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