Analysis of the Total Cost of Ownership for Cloud Computing Technology Adoption: A Case Study of Regional Municipal Government Sector

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Abstract

One of the key drivers of cloud computing adoption is usage-based IT service delivery alternative to on-premises IT infrastructure. Existing research supports the role of cloud computing for cost savings. We employed a mixed-method two-staged study to investigate the total cost of ownership of cloud computing in the local government sector of Queensland, Australia. The first qualitative study included 21 in-depth interviews of IT managers to understand the cost elements associated with cloud computing. This was followed by a quantitative study that analysed survey data collected from 480 IT staff across 47 local government organizations to investigate the impact of specific cost elements on cloud computing adoption. We found that cloud computing is perceived to save costs and more specifically for IT capital investments. However specific cost elements for training and operational costs may not reduce as expected. Research findings may assist to make investment decisions on cloud computing adoption.

Keywords: Total Cost of Ownership; Cloud Computing; Technology Adoption; Regional municipal governments.

1 Introduction

Cloud computing is a technology model which aims at allowing customers to utilize optimal computational resources hosted by service providers. Based on the expected benefits of cloud computing, namely high adaptability and low costs, many organizations deliberately do not investigate and analyse their choices (Armbrust et al. 2010). This approach rises cost-related risk factors for instance hidden costs or a vendor-lock-in (Martens et al. 2012) which might eliminates the pursued benefits. Therefore, organizations must lead an analysis of direct and indirect costs to alleviate risk factors. However, there are numerous inquiries concerning how cloud computing can assist in lessening IT costs. Additionally, actual cost reduction still needs to be demonstrated and supported to claim that cloud computing is cost effective.

On a different note, despite its potential benefits, the adoption rate of cloud computing in regional municipal government sectors in Australia has been poor compared to urban areas (IT Industry Innovation Council 2011). A lack of studies that provide a holistic investigation related to the cost impact of cloud computing adoption may have hindered decision making on the adoption of cloud computing in Australian regional municipal governments. This situation has prompted regional municipal governments to request further research related to the impact of the cost on the adoption of cloud computing (IT Industry Innovation Council 2011). The current gap has led us to the following research question: What is the impact of the total cost of ownership on the adoption of cloud computing in Australian regional municipal governments?

This paper is one of a series of outcomes being reported on different aspects of the research project on overall cloud adoption issues for regional governments in Australia. The paper is structured as follows. In the following section we define the term cloud computing and its cost-specific characteristics based on the extant literature. Next, we present the overall research framework and conceptual research model. Then we explain the methodology used to collect data for this research. We outline the findings and the discussion of the research data and its reliability. We finally draw conclusions based on the contributions made in terms of implications to service providers and managers.

2 Background and Related work

Cloud computing offers improvements in IT productivity through highly accessible hardware and software resources and business agility (Kim et al. 2009). The most widely used definition of the cloud computing model is introduced by the U.S. National Institute of Standards and Technology (NIST) 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 2011). Cloud computing has been proposed to reduce the total cost of computing (Cervone 2010; Alshamaila et al. 2013). By adopting cloud computing, a firm can reduce the time devoted to system maintenance and routine upgrades. Cloud computing also reduces infrastructure costs, decreases energy consumption, and lowers maintenance expenditures (Marston et al. 2011; Oliveira et al. 2014). Vendor specialization enables cloud service providers to offer IT functions at lower costs and pass the cost savings from economies of scale to the end user (Benlian and Hess 2011; Jones et al. 2017). As an enabler of the swift adoption of changing technologies, cloud computing offers cost-effective ways to transform businesses (Oliveira et al. 2014). Perceived benefits refer to the operational and strategic benefits an organization is expected to receive from cloud computing; some of these are mobility, efficient reduction of computing costs, easy installation and maintenance, and easy data analysis over the Internet (Armbrust et al. 2010).

Due to the usage dependent pricing model, significant cost savings can be gained through cloud computing and this is considered to be one of its major benefits (Alshamaila et al. 2013; Hsu et al. 2014). Other studies pointed out that start-up organizations can save on capital costs and challenges related to market entry via the use of cloud-based services (Grossman & Gu 2009; Schneider & Sunyaev 2016). Also, start-up businesses develop the ability to enter the market much more quickly by swiftly implementing new services with minimal to no initial capital investment required with the use of shared computing resources (Marston et al. 2011; El-Gazzar et al. 2016; Gangwar & Date 2016). Using cloud-based software can significantly reduce costs relating to updating and maintenance of IT systems, as operations and tasks are taken care of by a third party (Schneider & Sunyaev 2016).

An organisation can build up a financial decision model that looks at expenses for the IT internal base (server and capacity costs) and the outer provisioning by means for cloud computing services such as internet service provider costs, storage and data transfer costs (Strebel and Stage 2010). The first outcome of the research conducted by Strebel and Stage (2010), is that cloud computing is more cost-effective when more business applications and procedures are prepared to source by means of a cloud computing service. Interestingly the research by Strebel and Stage (2010), found that the cost-viability diminishes with the quantity of virtualized applications since internal servers can be utilized adequately. However, Martens et al. (2012) infer that the utilization of cloud computing services is valuable for high storage requirements.

Another research about cost benefit analysis is conducted by Kondo et al. (2009) which focuses on the overall system performance to investigate the costs and benefits in computing technologies. The overall result from this analysis is that, over the long run, technology is financially more sustainable, however it may requires high start-up investments at the beginning. For short and high routine tasks it is recommend to apply a commercial cloud service. They simply focus on specific cost factors, such as power, system, equipment, and information stockpiling in their approach (Kondo et al. 2009). Other research built up a product software tool to figure out setting-up and support costs for a cloud computing environment – i.e. hardware, software, power, and staff to concentrate from the provider perspective point of view (Li et al. 2009). Rather than concentrating on physical hardware they focus on most extreme virtual machines that can be implemented inside a data centre to respond in more adaptable ways towards client requests. Also, they accentuate the significance of settled costs that suppliers need to hold up amid the entire lifecycle (Li et al. 2009).

Martens et al. (2012) examined the significant costs of cloud computing services that is an essential main stay of basic leadership in cloud computing management and adoption. The total cost ownership model has been assessed and the study found that cloud computing services has led to impromptu strategies with a lack of an understanding of all cost elements of new technology adoption such as cloud computing.

3 Overall Research Framework

Studies of innovation adoption have focused on both individual and organization levels of analysis. Early literature on innovation was concerned with the acceptance of new ideas and innovations by independent individuals (Rogers 2003). Since the late 50's the field of innovation showed growing interest in organizational innovation. In this research the key theories of Technology-Organization-Environment (TOE) framework (Tornatzky and Fleischer 1990), and Diffusion on Innovation (DOI) (Rogers 2003) are used to understand cloud computing adoption factors in general and then we investigate specific cost factors for further investigation.

3.1 Technology-Organization-Environment (TOE)

The TOE framework structure demonstrated that the adoption of IT technology is affected by three diverse contexts: technological, organizational and environmental contexts (Tornatzky and Fleischer 1990). The technological context denotes the attributes of innovation, such as availability, complexity, and compatibility that influence adoption of innovation (Low et al. 2011). The organizational context denotes the attributes of an organization, for example, its size, the level of intricacy in managerial structure, level of management formalisation, and human capital. The environmental context incorporates external factors such as the structure of the relevant industry, competition, and government's regulations (Tornatzky and Fleischer 1990).

3.2 Diffusion of Innovation (DOI)

According to Rogers (2003) the DOI theory proposed five classifications (from earliest to latest adopters) of individual or corporate preparedness for innovation: innovators; early adopters; early majority; late majority; laggards. Within the organizational level DOI theory shows that innovativeness is related to independent variables such as individual (leader) characteristics, internal organizational structural characteristics, and external characteristics of the organization. (1) Individual characteristics describe the leader attitude toward change. (2) Internal characteristics of organizational structure include factors such as centralisation, complexity, formalization, organizational slack, interconnectedness and size of organization. (3) External characteristics of organizational refer to system openness (Rogers 2003).

3.3 Combining TOE and DOI

In this research the key theories of Technology-Organization-Environment (TOE) framework (Tornatzky and Fleischer 1990) and Diffusion on Innovation (DOI) (Rogers 2003) were combined to develop a combined model to understand the adoption of cloud computing. Previous studies were largely limited to the recognition of the technological determinants of cloud computing adoption (Low et al. 2011). Due to socio-technical factors introduced by cloud-based operations of a business; innovation, organizational and environmental factors are seen as critical as technological factors (Feuerlicht 2010). So, this combining of models is justified because it provides better understanding of the IS adoption phenomenon (Wang et al. 2010).

The selection of the two theories is further justified for two primary reasons. The first is that the TOE framework includes a focus on the environment context of technology adoption, which is not included in the DOI theory, and TOE is able to explain intra-firm innovation adoption (Oliveira and Martins 2011). The second rationale is the empirical support and theoretical foundation of the TOE framework and DOI theory (Lee et al. 2009). Amongst the studies that do consider technology adoption at the organization level, many of them draw upon either TOE framework (Nkhoma and Dang 2013; Ghobakhloo et al. 2011; Thiesse et al. 2011; Lin and Lin 2008), or DOI theory (Lin and Chen 2012; Tsai et al. 2010; Bradford and Florin 2003; Eder and Igbaria 2001). These theories have been individually applied to numerous studies to adoption of innovation at organization level. Also, both theories have been successfully combined together to a limited number of studies (Wang et al. 2010; Alam 2009; Chong et al. 2009). The theories meaningfully complement each other (Oliveira and Martins 2011).

4 Conceptual Research Model

A conceptual research model was developed based on the TOE framework and DOI theory. The three factors of the TOE framework include: technology contexts which primarily refers to cost, and security concern as relevant factors for cloud computing. Organization contexts include top management support; organization size, and employee's knowledge. Likewise, environment contexts comprise regulation support and information intensity (Low et al. 2011). These factors from TOE were combined with a single factor of the DOI theory: Innovation characteristics that includes issues such as compatibility and complexity (Rogers 2003). The three factors of TOE framework and the one factor of DOI theory were combined to determine anticipated benefits of adopting cloud computing (Aljabre 2012) as shown in Figure 1.

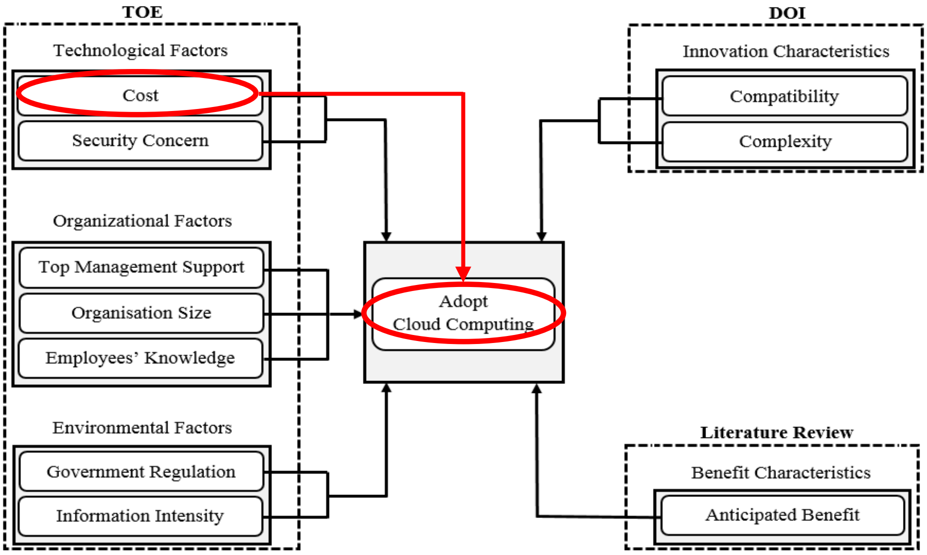

Figure 1: Overall Research Model and the scope of this research outcome

This research model was applied to a large research project that investigates the factors shown in Figure 1 and their influence towards the adoption of cloud computing in Australian regional municipal governments. The main focus of this paper is to investigate the cost factor and its impact on the adoption of cloud computing. As a result of that, this paper presents one of the significant findings from the research project. With an introduction of the overall research model, we discuss the research methodology in the next section.

5 Research Methodology

A mixed method was used in this research as mixed methods has the ability to address exploratory and confirmatory research questions simultaneously (Johnson and Onwuegbuzie 2004). Design of the mixed methods usually begin with a qualitative study followed by quantitative research (Venkatesh et al. 2013). An exploratory qualitative study would offer the vital adaptability to consider diverse choices of discussion with participants (Venkatesh et al. 2013). The confirmatory quantitative research can then provide efficient, affordable, and relatively accurate means to procure data to fulfil several goals (Zikmund 2003).

The data collection of this research was conducted in two major studies. Study 1 involved a qualitative investigation to understand the impact of the cost of cloud computing adoption in Australian regional municipal governments. Study 2 involved the use of quantitative questionnaire data to confirm the findings from the first study. The next two subsections describe the research activities and results from two studies in detail.

5.1 Study 1: Qualitative Investigation

The objective of the study 1 was to investigate and provide a qualitative overview of the concepts relating to the impact of cost on cloud computing adoption.

5.1.1 Interview Participants Description

Series of in-depth interviews were conducted between May and August 2014. We obtained inputs from 24 local government employees in Queensland 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). The sample reflects the geographical segments and size classifications of regional municipal governments throughout Queensland. Table 1 illustrates the size classification of the research sample according to staff numbers across several segments in the state of Queensland.

Segments	Size classification of the research sample					Total	%
	Extra small (0-50)	Small (51-100)	Medium (101-250)	Large (251-1000)	Very large (1000-up)		
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%**

Table 1. Size classification of the research sample

The interviews lasted between 30 and 50 minutes where the interviewer asked, among other things, questions about the types of cost elements to consider for cloud computing adoption. 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. The research reached the saturation level by the interview number 21, when we noticed that, there is no more new information or patterns in the data emerging from the interviews. Another three interviews were conducted to ensure inclusion of all segments and size classification of the local councils to obtain a comprehensive overview of issues.

The interview data were analysed using manual content analysis (Miles et al. 2014). Manual content analysis was undertaken with three concurrent flows of activities: data reduction, data display and conclusion verification. After the completion of each interview session, the recorded interviews were transcribed. Interview transcripts were reviewed to create summary sheets for every interview. This summary sheet included main themes, issues and brief answers to each question, resulting in an overall summary of the main points (Patton 2002). The summary sheets were reviewed to understand patterns from the research data (Miles et al. 2014).

5.1.2 Results

After the interview, we determined relevant cost elements associated with the decision to adopt cloud computing based on the thematic analysis. The major cost elements were re-validated with the interview respondents. The major cost elements were categorised as: infrastructure costs, maintenance costs, upgrade costs, energy and environmental costs, training costs, operational costs and opportunity costs with regards to other IS technologies. These cost elements were further investigated in Study 2.

Moreover, the impact of the overall cost on the adoption of cloud computing was investigated with an overall rating of Positive, Negative or Not sure by the respondents (refer to Table 2). These ratings were checked and accepted by the respondents after we sent our interviews' findings to them. This allows us to categorize the cost impact according to their importance of impact for Australian regional municipal governments. We found that, as expected, the usage-based pricing model was the primary reason for the attraction of cloud computing.

Impact	Frequency	%	Major Reason
Positive	16	76%	• Cloud computing is cost effective and can helping the organizations' saving financially.
Negative	3	14%	• Costly to completely adopt and transfer to cloud computing.
Not sure	2	10%	• There are still a lot to be proven with regard to cloud computing.

Table 2. Ranking of the cost impact

5.2 Study 2: Quantitative Study

The second study of this research was to confirm the findings from the exploratory study relating to the impact of cost on the cloud computing adoption. A questionnaire was developed based on the previous literature and the findings from qualitative study (study 1). Seven-point Likert scales were used across all the cost elements to measure their impact on cloud computing, with 1 representing strongly disagree and 7 representing strongly agree. Feedback on the initial questionnaire was sought from study 1. The survey was pretested by 30 IT managers, nine curtailed surveys were discarded and the remaining 21 surveys were considered. Table 3 illustrate the results of the pilot study.

Items	Total Correlation	Squared Multiple Correlation	Mean	Std. Deviation	Cronbach's Alpha of Each Item	Cronbach's Alpha
Maintenance Costs	.521	.694	6.29	1.160	.788	
Energy & Environment Costs	.622	.699	5.86	.791	.799	
Training Cost	.392	.420	5.50	.947	.844	
Infrastructure Costs	.513	.481	6.58	.801	.841	.846
Upgrade Costs	.506	.589	6.00	.909	.815	
Operation Costs	.765	.594	6.15	1.060	.812	
Opportunity Costs	.469	.657	5.40	.752	.809	

Table 3. Pilot study results

5.2.1 Survey Respondents Demographics

After the pilot, the survey was distributed online to Queensland's 77 local government councils, from which 47 local councils responded to the survey which represented a response rate of 61 percent. The participating councils had around 786 IT staff who were invited to participate and 480 of them responded. Table 4 provides descriptive statistics of the respondent's demographics.

Demographics	Frequency	Percent	Cumulative %
Roles in IT			
Management	238	50 %	49.6%
Systems development/ Analyst/ Programmer	138	28.8 %	78.3%
Systems administrator/ Operations/ User support	101	21 %	99.4%
Other	3	0.6 %	100%
Knowledge related to Cloud			
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%
Years' of experience in IT			
None	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%

Table 4. Respondents' demographics

5.2.2 Results

Figure 2 illustrates the study 2 results related to the total cost of ownership for cloud computing technology adoption. In our case, the total cost of ownership considers all costs associated with the adopted technology used throughout the entire value chain of the adopting organisation. Our results identified the following cost elements as part of the total cost of ownership: infrastructure costs, maintenance costs, upgrade costs, energy and environmental costs, training costs, operational costs and opportunity costs with regards to other IS technologies.

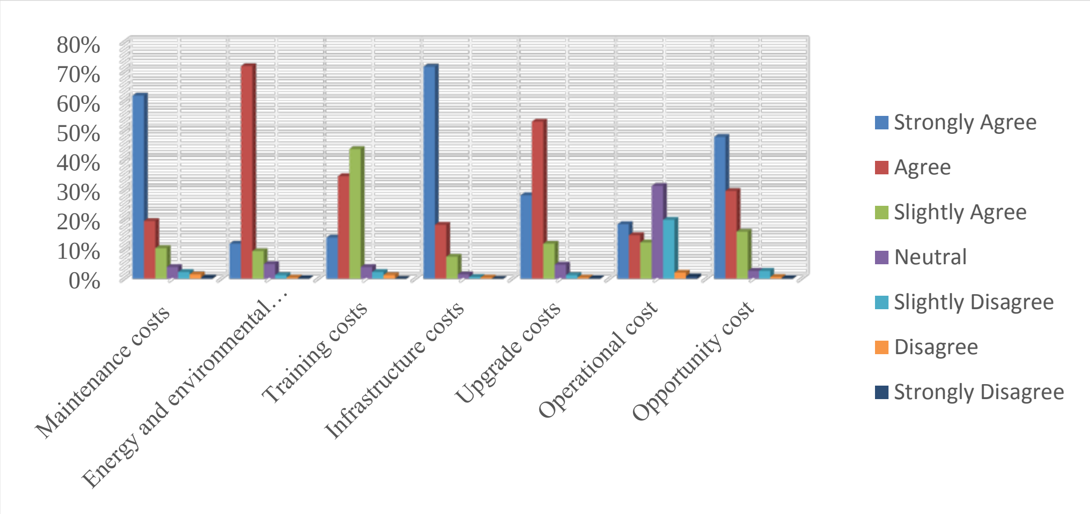

Figure 2: Total cost of ownership

The costs associated with maintenance, environment, infrastructure, upgrade and opportunity costs for IS investments all demonstrated expected results that participants largely agreed that these costs are perceived to reduce due to cloud computing adoption. However there were two cost elements that did not demonstrate expected results. About 43 percent of the research participants only *marginally* agree that cloud computing has low training costs, i.e. there was no convincing agreement on the effect of cloud computing on training costs. This is not surprising given that training costs may increase with the introduction of any new technology. This research also found that around 31 percent of the research participants were not sure that cloud computing reduce the operational process costs, and another 19 percent slightly disagreed that cloud computing reduce the operational process costs.

6 Tests for Model Fit, Reliability and Validity

6.1 Factor Analysis (FA) Tests

The results of the first stage Exploratory Factor Analysis (EFA), revealed that Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMO) of the items that measure the cost was 0.768, and KMO for cloud adoption was 0.665. In summary, each item loading was greater than the suggested 0.50, the loading was between .620 and .854 which is considered to be acceptable (Hair et al. 2006). Next, we conducted Confirmatory Factor Analysis (CFA) using AMOS Graphics 22. We first tested the one-factor congeneric measurement to each factor in the model (Dragovic 2004). In this research, CMIN/DF, RMR, GFI, AGFI, RMSEA, IFI, TLI, and CFI are taken in to account for this analysis as these are employed frequently and are mentioned in the literature (Byrne 1998; Hulland et al. 1996).

The research model was evaluated individually using this technique and the best fit of each congeneric measurement model was achieved. In this process, 2 items have been removed from the individual models to accomplish an enhanced fit to the data (see Table 5).

Factors	Fit Indices								Items Input	Items Output
	CMIN	GFI	AGFI	RMR	IFI	TLI	CFI	RMSEA		
Cost	.843	.998	.991	.011	1.000	1.001	1.000	.000	7	5
Adoption	.819	.999	.991	.005	1.000	1.002	1.000	.000	3	3
							Total Items		**10**	**8**

Table 5. One-factor congeneric measurement results

6.2 Model Reliability and Validity Tests

To test for model reliability and validity, we employed Cronbach's Alpha using the recommended acceptance score of ≥.70 (Stafford and Turan 2011). Each of the constructs in the research model exceeded the acceptance score by falling within the range of 0.756 for cloud adoption and 0.712 for cost. We also considered the Squared Multiple Correlation (SMC) (Holmes-Smith 2011) using the suggested value of SMC being >.30. The large majority of the items in the final model exceeded .50. In summary, the value of SMC illustrates that all the items used to measure the 2 main factors of the research model are dependable. We tested for convergent validity using Standardised Regression Weights (SRW) to check for construct consistency and the measurement limits of each of the items. The recommended factor loading to suggest significant validity of each item is an approximated value of ≥.50 (Hair et al. 2006; Holmes-Smith 2001). The SRW loading values of the factors in the final model were found to be between .519 and .987. Finally, the critical ratios (CR) of the research model items were between 11.739 and 22.541, which were more than the standard value of 1.96 suggested by Holmes-Smith (2001). This indicates that the research model retains significant regression validity.

7 Structural Equation Model (SEM) Test

The research model was designed to achieve the impact of the cost elements on the adoption of cloud computing in Australian regional municipal governments. Byrne (1999) explained that a structural equation model (SEM) allows us to figure out the factors that have a direct or indirect effect on the values of other latent factors. As shown in Table 6, the results of the structural model fit confirmed that the measurement model achieved a good fit and most of the different indicators that were reported in this research met the recommended levels.

Indices	Structural Model Fit	Conclusion
Normed Chi Square (CMIN)	2.847	Good
Root Mean Square Residual (RMR)	.055	Good
Goodness of Fit (GFI)	.852	Acceptable
Adjusted Goodness of Fit (AGFI)	.807	Good
Incremental Index of Fit (IFI)	.908	Good
Tucker-Lewis Index (TLI)	.899	Acceptable
Comparative Fit Index (CFI)	.907	Good
Root Mean Square Error of Approximation (RMSEA)	.062	Good

Table 6. Overall measurement of fit indices from SEM test results

Following on from these findings, Table 8 illustrates the results of regression analysis for the cost impact in our innovation adoption model. The SEM findings demonstrated in Table 7 are measured on the basis of estimated path coefficient (β) value with the critical ratio (t-value), and p-value. The standard decision rules t-value greater than 1.96, and the p-value is at least ≤ .05 are applied.

Paths #			Structural Model				Results
			Standardized (β)	S.E.	C.R. (t)	P	
Cost	→	Cloud Adoption	.269	.165	2.619	.009**	Supported

Table 7. Regression weights of the SEM and Results of the Hypothesized Path Relationships

The results of the regression tests that presented in Table 8 indicated and confirmed that the cost has a significant impact on the cloud computing adoption. The standardised regression coefficient (β) was .269 with critical ratio (t-value) 2.619, and p value at .009**. Based on these results, cloud computing as being less costly than other computing paradigms is also more likely to be adopted (See Figure 3).

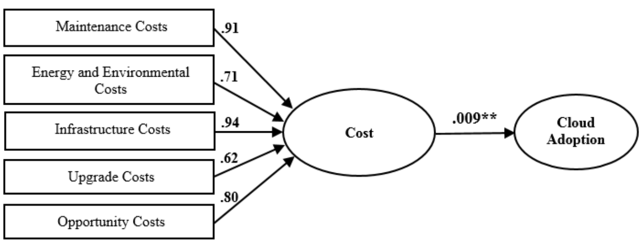

Figure 3: Structural equation model (SEM) test

This research model shows that there is a significant and positive relationship between cost and the adoption of cloud computing. This relationship is significant and positive with path coefficient (β) 0.269 with t-value about 2.619, and p value is < 0.01. The chief driving component for organizations to consider cloud-based operational models is the expected financial benefits (LGAQ, 2013). According to the literature there appears to be a dearth of studies related to the cost and the adoption of cloud computing. Most of the previous studies describing the role of cost and considered that cost is one of the significant advantages of cloud computing (Cervone 2010; Sultan 2010). Our research looked at the total cost of ownership that goes beyond price to consider all costs over the entire life of the cloud computing technology such as those related to quality, delivery, communication and maintenance. We found that while there is a significant relationship between the cost and cloud computing adoption, certain cost elements such as training costs and operational costs are not always well perceived to be reduced while adopting cloud services.

8 Research Contribution

Our research findings indicate that cloud computing offers economic benefits. Economic benefits include cost savings from decreased capital expenditures on IT, and reduced maintenance and energy costs. However we found that training and operational costs associated with cloud computing are not perceived to be part of the overall cost savings, i.e. stakeholders perceive these cost elements do not significantly contribute towards the overall cost savings. Previous studies have identified concerns of hidden costs, human resource requirements for upgrades and maintenance, the potential for the loss of overall control of resources, and the poor quality of operation as factors that may impact negatively towards the adoption of cloud computing (Lin and Chen 2012; Low et al. 2011). These cost elements must therefore be considered for the total cost of ownership of cloud computing technology.

To design and use strategies for extensive adoption of cloud computing, technology consultants should have a better understanding about the important factors and in particular the cost elements and their impact to the organization's adoption of cloud computing. Using the research findings by the service providers can assist the following: (1) Improve the awareness of the reasons behind the some regional municipal government's lack of interest on the adoption of cloud computing technology. (2) The providers of cloud computing technologies should have a better interaction with the regional municipal governments in terms of total cost of ownership of the technology.

Cost reduction is an important driver towards adoption of cloud computing in any organisation including Australian regional municipal governments. Our results imply that managers and decision makers should still investigate and evaluate the cost elements of cloud technologies to improve their knowledge and awareness about the value they receive from cloud services. The anticipated benefit such as reduction of costs can be effectively used by local council managers to deeply evaluate and organize their adoption and understand total cost of ownership of such technologies. The research findings underpin a comprehensive understanding of the cost impact on the adoption of cloud computing in regional municipal governments. Future research could build on this research by investigating the cost impact for cloud computing adoption in different sectors of the economy and industries.

9 Conclusion

Cloud computing is poised to be a viable alternative for IT infrastructure for many government organizations. This research focused on the analysis of the cost impact on cloud computing adoption. The cost elements as part of total cost of ownership were identified as maintenance costs, energy and environmental costs, training costs, new IT infrastructure costs, upgrade costs and operational process costs, and finally, cloud computing cost compared with other IS technologies (opportunity costs). The cloud computing technology has an underpinning cost saving feature due to the usage based payment structure and the associated research literature appear to support the cost benefits of cloud computing. The outcome of this research adds some empirical weight to support past findings. It has been affirmed that cloud computing reduce the costs of the IT infrastructure and the decreased cost of IT infrastructure will pave a way forward for some organizations to adopt the technology. However a comprehensive cost analysis to understand the total cost of ownership of cloud computing is recommended. We found that costs of training and running costs of the operational processes may not decrease while adopting cloud computing. This is true for any new technology adoption so cloud is not indifferent. What is important for organizations to consider is the trade-off between the technology related cost savings and the additional costs of trainings and operational processes. The findings of this research might be helpful to offer a detailed comprehension of how certain cost elements impact cloud adoption which may in turn lead to more informed managerial decision making regarding adoption of cloud computing services.

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