Security and Privacy Concerns for Australian SMEs Cloud Adoption: Empirical Study of Metropolitan vs Regional SMEs

Ishan Senarathna
Department of Information Systems and Business Analytics
Deakin Business School

William Yeoh
Department of Information Systems and Business Analytics
Deakin Business School
william.yeoh@deakin.edu.au

Matthew Warren
Department of Information Systems and Business Analytics
Deakin Business School

Scott Salzman
Department of Information Systems and Business Analytics
Deakin Business School

Abstract

New national infrastructure initiatives such as the National Broadband Network (NBN) allow small and medium-sized enterprises (SMEs) in Australia to have greater access to cost-effective Cloud computing. However, the ability of Cloud computing to store data remotely and share services in a dynamic environment brings with it security and privacy concerns. Evaluating these concerns is critical to address the Cloud computing underutilisation issue and leverage the benefits of costly NBN investment. This paper examines the influence of privacy and security factors on Cloud adoption by Australian SMEs in metropolitan and regional area. Data were collected from 150 Australian SMEs (specifically, 79 metropolitan SMEs and 71 regional SMEs) and structural equation modelling was used for the analysis. The findings reveal that privacy and security factors do not significantly influence the decision-making of Australian SMEs in the adoption of Cloud computing. Moreover, the results indicate that Cloud computing adoption is not influenced by the geographical location (i.e., metropolitan or regional location) of the SMEs. The findings extend the current understanding of Cloud computing adoption by Australian SMEs. The results will be useful to SMEs, Cloud service providers and policy makers devising Cloud security and privacy policies.

Keywords: Cloud adoption, SMEs, Security, Privacy, Structural equation modelling

1 Introduction

The National Broadband Network (NBN) enables Australians to access affordable, high-speed Internet and telephone services (NBNCO, 2015a) and, therefore, increases the proliferation of Cloud computing across Australia. In particular, Cloud computing has become increasingly important for Australian small- and medium-sized enterprises (SMEs), as Cloud computing affords SMEs access to the information and communication technology (ICT) applications that, previously, only large companies could afford (NBNCO, 2015b). Many Cloud service providers, such as Amazon Web Services and Salesforce.com, are offering SMEs cost-effective solutions to lower their operating costs and improve their productivity (Marston et al., 2011). Gartner defined Cloud computing as "a style of computing in which scalable and elastic IT-enabled capabilities are delivered as a service using Internet technologies" (Plummer et al., 2009). Besides shifting a specific business function to an outsourcer (Lee & Kim, 1999), Cloud computing constitutes a more radical move and involves the automation of a business process or a subset of activities. While having similar benefits as ICT outsourcing, Cloud computing is

more flexible because it is location independent, and this enables customers to access and use the services wherever they have access to the Internet. Also, Cloud computing is device independent, which means the service is able to function on a wide variety of devices. As Marston et al. (2011) explained, Cloud computing provides almost direct access to shared computing resources, thus SMEs can launch new operations quickly with little or no upfront capital investment, enabling a faster time to market. In fact, Forrester Research estimated that the global Cloud computing market will grow from $732 million in 2011 to $3.2 billion in 2020 (ACMA, 2014). International Trade Administration predicted that businesses will spend over $191 billion on Cloud services by 2020, compared to $72 billion in 2014 (ITA, 2015). The International Data Corporation (IDC) forecast a 2017 Cloud market worth $107 billion, over twice as much as its 2013 estimate of $47.4 billion (IDC, 2015).

Cloud computing is a new business model, which is particularly valuable for SMEs with limited budgets for ICT investment (Mudge, 2010). Cloud computing is commercially viable for many SMEs due to its flexibility and pay-as-you-go cost structure (Sultan, 2011). However, within the SME sector, and despite the potential benefits, the adoption rate of Cloud computing is still relatively low in Australia compared with other countries in the Asian region (ACCA, 2012). According to the Australian Communications and Media Authority, less than half of the SMEs in Australia are currently using Cloud services, due in particular to concerns over privacy and security factors (Ericson, 2015; NBNCO, 2015b). The most recent global survey on Cloud computing conducted by Dresner Advisory Services revealed that security concerns are a primary barrier to adoption of Cloud computing (Ericson, 2015). Currently, Cloud computing poses an inherent challenge to privacy because Cloud computing services usually present data in an unencrypted form on a machine owned and operated by a different organisation than the data owner. The research literature indicates that the main inhibiting factor for Cloud computing adoption is the fear of sending organisational data to a third party (Rittinghouse & Ransome, 2009; Shimba, 2010). Further, previous findings suggest that Cloud computing adoption is more than just technology adoption (Tehrani & Shirazi, 2014). It includes a number of important changes relating to cross-border data transfer, storing data with a third party, remotely accessing resources and utilising applications through the Internet.

In other words, there are a number of privacy and security issues associated with Cloud computing, including lack of user control, potential unauthorised secondary usage, data proliferation, cross-border data flow, multi-tenancy, and lack of standardisation (Pearson & Benameur, 2010). Because Cloud computing providers employ multiple data centres at different geographical locations around the world to optimally serve consumers' needs, jurisdictional issues can cause regulatory and legislative complexities. In most Cloud service scenarios, consumers have no idea where their data are stored, due to the dynamic nature of the Cloud (Pearson & Benameur, 2010). Legal and regulatory issues arise that require careful consideration, because the physical location of data centres determines the set of laws that govern the management of data (Sahandi, Alkhalil & Justice, 2012). It is also interesting to note that IT adoption mainly refers to in-house IT infrastructure, whereas Cloud computing adoption involves accessing resources outside the organisation via the Internet. Yet the security and privacy issues related to Cloud computing adoption among Australian SMEs have not been the subject of previous empirical research. Therefore, this research aims to investigate the security and privacy concerns of Australian SMEs adopting Internet-based Cloud computing, with a focus on metropolitan and regional SME organisations.

Section two of the paper reviews the literature and proposes the research hypotheses. Section three outlines the quantitative research methodology and measurement validity. Section four discusses the empirical findings, research contributions and limitations, and provides suggestions for further studies. Section five concludes the study.

2 Literature Review and Hypotheses

2.1 Cloud Computing

Cloud computing provides different types of services delivered under different deployment models and uses a pay-as-you-go method. Three service models are extensively used by the Cloud computing community to categorise Cloud computing services (Ahuja & Rolli, 2011; Dillon et al., 2010; George & Shyam, 2010), such as Software as a Service (SaaS), Platform as a Service (PaaS), and Infrastructure as a Service (IaaS) on demand and pay-as-you-go. SaaS in Cloud computing eliminates the need to install and run an application on the client's computer (Marston et al., 2011). In addition, it is not necessary for SMEs to worry about software licensing or upgrading, because it is performed by the Cloud service providers. SMEs need to focus on Service Level Agreement or contract only. According to Sullivan (2010), there are various types of services that come under SaaS, namely, Customer Relationship Management (CRM), video conferencing, IT service management, accounting, web analytics, and web content management. Similarly, application design, development, testing, deployment and hosting are services provided by PaaS. The development and deployment of applications without the cost and complexity of buying and managing the underlying hardware and software layers is facilitated by PaaS (Marston et al., 2011). Further, Sullivan (2010) explained that IaaS provides services such as server space, networking equipment, memory, storage space and computing capabilities.

Services provided by Cloud computing can be categorised according to the level of service and mode of provision. Deployment models are recorded based on these service characteristics. Four Cloud computing deployment models have been defined in the Cloud computing community (i.e., public Cloud, private Cloud, hybrid Cloud and community Cloud) (Chang et al., 2013; Gangwar et al., 2015; Tehrani & Shirazi, 2014; Zhao et al., 2014). A public Cloud computing service model is available from a third-party service provider via the Internet. It is a cost-effective way to deploy IT solutions and provides many benefits, such as being elastic and service-based, as, most of the time, resources are not utilised to maximum capacity, which wastes money. The scalability of Cloud computing significantly reduces the time resources are idle and allows SMEs to use only the amount of computing resources they need. They can instantly scale resources up or down when demand increases or decreases. Public Cloud is the most commonly used model and is especially suitable for SMEs because it provides near-immediate access to hardware resources, with no upfront capital investments for users, leading to a faster time to market for many businesses. This treats IT as an operational expense, rather than a capital expense ('Opex' as opposed to a 'Capex' model) (Marston et al., 2011). Private Cloud computing provides greater control over the Cloud computing infrastructure and can be managed within the organisation. Therefore, it is often suitable for large organisations, as they are using larger installations (Marston et al., 2011). Hybrid Cloud computing is a combination of public and private Cloud computing models that addresses the limitations of each (Zhang et al., 2010). The community Cloud computing infrastructure is controlled and shared by a group of organisations and supports a specific community with shared concerns (e.g., mission, security requirements, policy and compliance considerations) (Sasikala, 2011).

2.2 Cloud Computing Adoption in SMEs

The Australian Bureau of Statistics defined SMEs as businesses with less than 200 employees, with medium-sized businesses employing 20–199 staff, and small businesses employing fewer than 20 staff (DIISR, 2011). Australian SMEs play a substantial role in economic development; they represent 96% of all Australian business and 69% of the total workforce, and account for 33% of Gross Domestic Product (GDP) (ACMA, 2014). Senarathna et al. (2015) suggested that, in many instances, using Cloud computing provides the first opportunity for SMEs to try new software approaches in a cost-effective manner. Often SMEs are unable to afford their own dedicated IT, but they have an IT budget sufficient to buy the bandwidth and pay according to their need and usage (Monika et al., 2010). In a Cloud computing environment, SMEs can reduce their capital expenditure for IT infrastructure and, instead, utilise and pay for the resources and services provided by Cloud computing (Rittinghouse & Ransome, 2009). A

KPMG report on Australian lessons and experiences showed that using Cloud computing allowed Australian organisations to adopt innovative IT technologies quickly, without paying upfront for capital investment (McCabe & Hancook, 2009). According to Lawrence et al. (2010), all direct and indirect go-to-market models in Cloud computing are able to cater to the needs of SMEs, but they are not necessarily suitable for large enterprises because of their organisational scale and complexity. It has been found that the current charging pattern and other aspects of Cloud computing make it more suitable for SMEs than for larger organisations (Misra & Mondal, 2010). Further, the public Cloud service provides a more valuable service to SMEs, as they require many of the same business services provided to large organisations (e.g., software such as CRM, ERP, HRM and payroll, and hardware such as server and storage), even though they may only have a PC and an Internet connection (Handler et al., 2012).

Cloud adoption in Australia is growing rapidly, with key global players such as Amazon Web Services extending their offerings in the region with new data centres, while a host of local and regional Cloud providers are also expanding (Miller, 2014). Telstra (2011) stated that its entire network is robust and sufficiently extensive to provide reliable Cloud services to customers in metropolitan and regional areas. Moreover, the NBN was introduced as an investment in infrastructure to provide high capacity data communications across the nation. The NBN planned to reach 93% of the Australian homes, schools and businesses that could be accessed by the NBN through optic fibre, providing peak speeds of up to 25Mbps. The NBN consists of the provision of broadband services over a mix of three technologies: optic fibre, fixed wireless, and next-generation satellite (Matthew, 2014). The NBN could enable SMEs in Australia to further embrace Cloud computing services. Minifie (2014) argued that businesses need reliable high bandwidth, low-latency uploads and downloads, and sufficient international backbone bandwidth. Minifie (2014) also argued that bottlenecks in suburbia and regional and remote areas should be addressed to enable rapid Cloud adoption. In addition, the findings of Sultan (2011) and Bharadwaj and Lal (2012) revealed that Cloud computing is likely to be a more attractive option for most SMEs because of flexible cost structure and scalability. Further, Cloud services can be used easily by SMEs due to relative advantage, flexibility and scalability features (Salleh et al., 2012). According to Gartner, the public Cloud services market (the most popular services needed by SMEs) would reach US$250 billion by 2017, with continuous rapid growth from 2011 to 2017 (Anderson et al., 2013). Therefore, there is a burgeoning need to conduct focussed research on the issue.

2.3 Hypotheses Development

To ensure a comprehensive coverage, the constructs used in this study are explored through a myriad of theoretical, practitioner and government underpinnings. The academic, government and practitioner literatures for each construct was reviewed and is listed separately in Table 1. Based on the literature, Cloud security and privacy factors are discussed in detail.

Constructs	Academic	Government	Practitioner
Cloud security	Gangwar et al., 2015; Li et al., 2015; Oliveira et al., 2014; Ross & Blumenstein, 2015; Safari et al., 2015; Stieninger & Nedbal, 2014; Tang and Liu, 2015; Tarmidi et al., 2014; Tehrani & Shirazi, 2014; Zhao et al., 2014	Anthony, 2012; DBCDE, 2013; DFD, 2011b, 2011c, 2011d; DOC, 2014; IMO, 2012; IMO, 2013; ITIIC, 2011; Jansen & Grance, 2011; SWI, 2012	ACCA, 2014; Ben, 2014; Dave, 2012; Handler et al., 2012; Herhalt & Cochrane, 2012; Hutley, 2012; Mark, 2011; Minifie, 2014; Pearson, 2012; Ren et al., 2012; Telstra, 2011
Cloud privacy	Fairchild, 2014; Fakieh et al., 2014; Gangwar et al., 2015; Kauffman et al., 2014; Mahmood et	Anthony, 2012; DBCDE, 2013; DFD, 2011b, 2011c, 2011d; DOC, 2014; IMO,	ACCA, 2014; Ben, 2014; Dave, 2012; Herhalt & Cochrane, 2012; Hutley, 2012;

	al., 2014; Ross & Blumenstein, 2015; Safari et al., 2015; Stieninger & Nedbal, 2014; Tang & Liu, 2015; Tehrani & Shirazi, 2014; Vanessa, 2014	2012; IMO, 2013; ITIIC, 2011; Jansen & Grance, 2011	Ko et al., 2011; LEMT, 2011; Mark, 2011; Minifie, 2014; Pearson, 2012; Ren et al., 2012; Telstra, 2011

Table 1: Constructs used to examine Cloud computing adoption

2.4 Cloud Privacy

Privacy is an important issue in technological innovations, particularly when it has an online interaction. In the Cloud environment, privacy reflects a consumer's concerns about information being stored in the Cloud and accessed by other individuals anywhere in the world (Vanessa, 2014). In other words, input data for Cloud services are uploaded by a user to the Cloud, which the user does not own or control. As Abadi (2009, pp. 2–3) indicated, "Computer power is elastic, but only if the workload is parallelisable ... data is stored at an un-trusted host ... data is replicated, often across large geographic distances", which are some of the Cloud characteristics that make the Cloud a risk. Featherman and Pavlou (2003) recognised privacy as a key factor hindering the uptake of some ICT technologies, due to the open nature of the Internet. Privacy risk is typically a major concern of businesses considering Cloud computing (Aziz, 2010; Hailu, 2012). According to a survey carried out among Chief Information Officers (CIOs) in Europe, approximately 70% of CIOs were prevented from launching Cloud computing solutions due to their own concerns over privacy and security fears (Wijesiri, 2010). In particular, lack of transparency creates legal issues that are affected by the Cloud's physical location, which creates difficulties in determining jurisdiction. Because of this key issue, the Australian Federal Government is concerned about the locations of outsourced personal data storage and strongly prefer for Cloud services to be located only within Australia's borders (Hutley, 2012). It is notable that the European Union (EU) has privacy regulations that prohibit the transmission of some types of personal data outside the EU (Sultan, 2010).

In a survey conducted by Tang and Liu (2015), the respondents indicated that data privacy issues were their top concern in considering whether to adopt Cloud computing. According to Gupta, Seetharaman and Raj (2013), privacy is the top concern of 50% of organisations in considering whether to adopt Cloud computing. A study by Safari, Safari and Hasanzadeh (2015) likewise showed that privacy is a significant determinant in the adoption of Cloud computing. Xu and Gupta (2009) included privacy concerns as a way of evaluating the potential adoption of location-based services. Chen, Paxon and Katz (2010) expressed concern that privacy has emerged as one of the most significant disadvantages of joining a Cloud computing group. According to Alkhater, Wills and Walters (2014), privacy is the main concern for organisations thinking about Cloud computing, because they cannot fully control the information stored on Cloud-based servers. Tancock, Pearson and Charlesworth (2013) also argued that privacy issues form the major hurdle to large-scale acceptance of Cloud computing. Trust in privacy has also been shown to be a primary determinant of IT innovation acceptance and diffusion in organisations (Li, Hess & Valacich, 2008; Schoorman, Mayer & Davis, 2007).

Transferring personal data to a third party without privacy policies in place creates huge risks in terms of data loss, data theft, data damage and data misuse. Even with policies in place, risks remain (Ko et al., 2011) but the associated controls that support the policies, help minimise the risk. The Victorian State Government identified key legal issues with Cloud computing, including information privacy related to Cloud services and their relationship with the Australian Privacy Principles (Anthony, 2012). The Australian Government's Department of Finance and Deregulation published a best practice guide to help agencies navigate typical legal issues in Cloud computing agreements, with the intention of emphasising privacy concerns (DFD, 2011b). Further, the Australian Federal Information Management Office provided a best practice guide ('Privacy and Cloud Computing for Australian Government

Agencies') to better understand how to comply with privacy laws and regulations when choosing Cloud-based services (IMO, 2013). Along these lines, this study hypothesises that:

H1: *Cloud privacy influences the decision-making of Australian SMEs considering whether to adopt Cloud computing.*

2.5 Cloud Security

Information security refers to the "preservation of confidentiality, integrity and availability of information; in addition, other properties such as authenticity, accountability, non-repudiation and reliability can also be involved" (Pearson, 2012, p. 14). The foundations of information security are based upon the confidentiality, integrity, availability, accountability, assurance and resilience of information (Friedman & West, 2010). In recent studies, information security concerns have been cited as the most significant barrier to Cloud adoption (Armbrust et al., 2010; Kshetri, 2013; Xiao & Xiao, 2013). Security issues in Cloud computing were generally discussed by many researchers (Jamil & Zaki, 2011; Kshetri, 2013; Zissis & Lekkas, 2012) and with specific reference to SMEs (Adam, 2014; Alshamaila, 2013; Gupta et al., 2013). Further, several studies have demonstrated that security is one of the major challenges keeping end-users away from Cloud computing (Gens et al., 2009; Shaikh & Haider, 2011). In particular, major issues pertaining to data security in the Cloud computing environment include data location and data transmission, data availability, data security (Mahmood, 2011), malicious insiders, outside attacks and service disruptions (Behl, 2011). Other major challenges include the delegation of confidentiality, and the availability and integrity of data provided to a third party. The security of Cloud computing is complicated because of the multi-tenancy of the virtualised resources (Opala, 2012). Cloud users may think that Cloud computing simplifies security issues for users by outsourcing the responsibility to another party who is presumed to be highly skilled in such matters (Anthes, 2010). Industry practitioners have reported that security was a critical concern in the initial stages of Cloud computing adoption (Chakraborty et al., 2010; McCabe & Hancock, 2009). Bhayal (2011) stated that Cloud security is the most important concern among Cloud clients, as the data owner does not know where the data are stored and data hosts cannot be considered completely reliable.

According to Benlian and Hess (2011), research regarding the adoption of Cloud computing has considered security as a barrier and Feuerlicht, Burkon and Sebesta (2011) identified security as a potential risk and challenge in Cloud computing adoption. The security issues of Cloud computing related to third parties' involvement also pose challenges (Subashini & Kavitha, 2011). According to Katzan (2010), Cloud computing security is not just about authenticity, authorisation and accountability; it is more concerned with data protection, disaster recovery and business continuity. The architecture of Cloud computing also leads to many new security issues, such as data leakage, virtualisation vulnerability and hypervisor vulnerability (Gonzalez et al., 2012). Garg and Stiller (2014) suggested that Cloud security risks also include contractual loopholes, confidentiality, information security and service outages. A survey of CIOs and IT executives by the IDC rated security as their main Cloud computing concern, and almost 75% of respondents were worried about security (Sultan, 2010). Dillon and Vossen (2014) also found that security issues were the most limiting factor for Cloud adoption. Security is one of the concerns about Cloud computing that continues to delay adoption (Jamwal, Sambyal & Sambyal, 2011). Sarwar and Khan (2013) found that security is the biggest issue in Cloud computing as, while utilising storage service in a remote location, the consumers are generally unaware of what happens to their data. According to Forrester research, Sahandi et al. (2012) reported that security concerns are the most commonly cited reason why enterprises are not interested in SaaS Cloud. Therefore, this study hypothesises that:

H2: *Cloud security influences the decision-making of Australian SMEs considering the adoption of Cloud computing.*

2.6 Metropolitan vs Regional

The location of an organisation is an important consideration in innovation adoption (Carcary et al., 2014; Drew, 2003; Gengatharen & Standing, 2005; Minifie, 2014). Robert and Mira (2010) argued that SMEs in regional areas are particularly constrained by great distances. Vanessa (2014) suggested that it is useful to examine different geographic regions to further distinguish the differences between urban and rural areas in facilitating Cloud computing adoption behaviour. Alshamaila et al. (2013) pointed out that the nature of Cloud computing transcends boundaries and regional ICT infrastructure is not considered a major obstacle for the adoption process. Cheng and Kam (2008) observed that Cloud computing allows for computing resources to be distributed across regional locations for seamless access. Further, Trend Micro's annual security survey found that significant regional differences, such as regional differences in Cloud security, are less likely to adopt Cloud computing (Dave, 2012). Therefore, the geographical location of the SMEs was considered and included as the control variable of this study. Thus, this study also hypothesises that:

H3: *The decision-making process to adopt Cloud computing is different between Australian SMEs in metropolitan and regional areas.*

Based on the aforementioned hypotheses, Figure 1 presents the research model of this study. In this model, latent variables, that is, Cloud privacy (CP) (Hypothesis 1) and Cloud security (CS) (Hypothesis 1), are the independent variables that could influence the decision of Australian SMEs considering whether to adopt Cloud computing. These latent variables are measured using three items each, while SME location (regional vs metropolitan) represents the control variable. Cloud adoption is the dependent variable and measured by four items. The detail of the items is available at: https://goo.gl/RD76uf

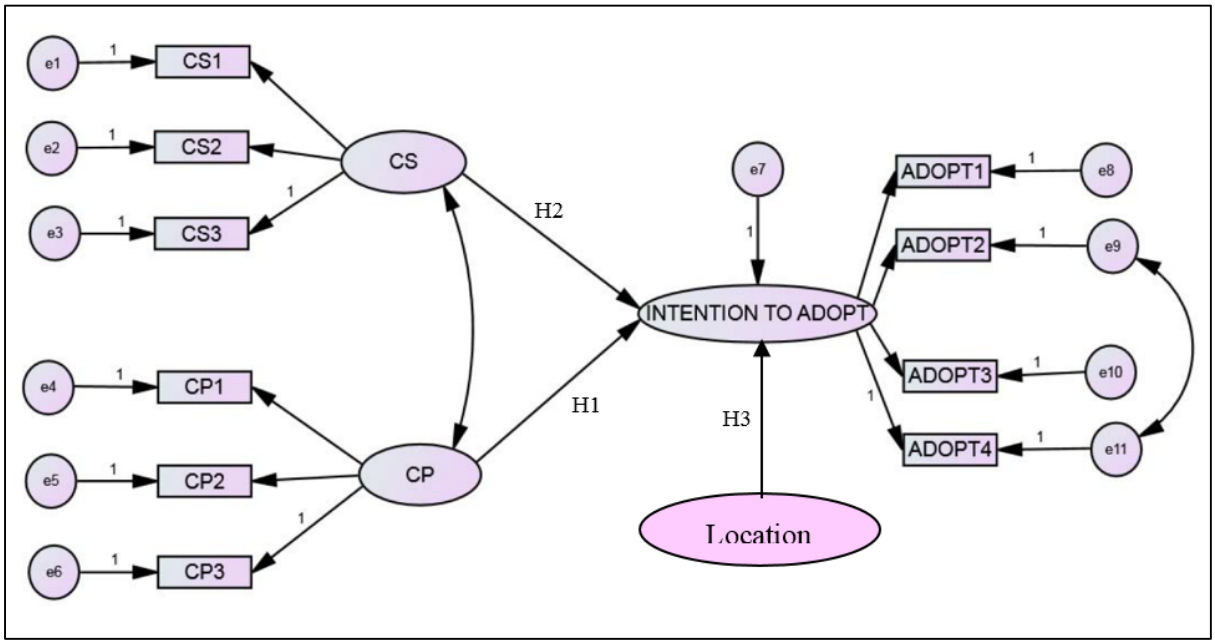

Figure 1. Research model

3 Methodology

A positivist paradigm quantitative research method was applied in this study. In this study, a structured questionnaire was used to collect the quantitative data from Australian SMEs in metropolitan and regional areas. Data were collected from the SME IT managers or decision-makers.

The Australian Communications and Media Authority reported that 94% of SMEs are connected to some form of Internet service (ACMA, 2014). Hence, an online survey was used for data collection. The questionnaire was divided into two parts. The first part of the survey

captured the demographic details of the responding organisations, and the second part of the survey captured perceptions of the security and privacy of Cloud computing. For each construct, three to four items were formulated capturing the perception and adoption of Cloud computing by SMEs. All of the reflective indicators of a construct were measured on a 7-point Likert scale, using scales ranged from (1) 'strongly disagree' to (7) 'strongly agree'. As recommended by Bryman and Bell (2015), ethical approval to undertake research is an important step, hence ethics approval was obtained from the Faculty Human Ethics Advisory Group (available at: https://goo.gl/btILDT). This was performed to protect the respondents from any adverse consequences that could result from conducting this research.

3.1 Measurement Reliability and Validity

The researchers used structural equation modelling (SEM) (IBM SPSS AMOS) to perform the data analysis. First, the reliability of the measurement was assessed based on the composite reliability and Cronbach's alpha coefficient. As shown in Table 2, the minimum composite reliability and Cronbach's alpha values for all constructs in this study were above the recommended threshold value of 0.7 (Hair et al., 2010; Malhotra, 2010), suggesting good reliability.

Construct	Items	Loading	AVE	Cronbach's alpha	Composite reliability
Cloud adoption	ADOPT1	0.994	0.989	0.993	0.871
	ADOPT2	0.982			
	ADOPT3	0.994			
	ADOPT4	0.987			
Cloud security	CS1	0.774	0.834	0.703	0.815
	CS2	0.777			
	CS3	0.834			
Cloud privacy	CP1	0.730	0.847	0.750	0.889
	CP2	0.882			
	CP3	0.820			

Table 2: Measurement reliability and validity results

Second, to assess convergent validity, the average variance extracted (AVE) for each construct must meet the minimum recommended value of 0.50 (Fornell & Larcker, 1981). The AVE for the constructs of this study ranged from 0.834 to 0.989, hence adequately demonstrating convergent validity. Third, confirmatory factor analysis was conducted to assess the factor loadings of each construct. As depicted in Table 3, the results indicate that items load higher on their constructs and higher than cross-loadings. Overall, the results have good reliability, convergent validity and discriminant validity, and thus are appropriate for testing the research model. Moreover, to reduce the likelihood of common methods bias, items were randomised within the instrument to limit the ability of participants to detect underlying construct patterns (Straub et al., 1989). Because both the dependent variable and independent variables were measured using the same instrument, Harman's one-factor test (Podsakoff et al., 2003) was also performed, ie., all items were entered into an unrotated exploratory factor analysis to determine whether a single factor emerges or a single factor accounts for the majority of the variance. In this test, three factors emerged clearly; therefore, common methods bias is not an issue in our data set.

Construct	Items	ADOPT	CS	CP
Cloud adoption	ADOPT1	**0.994**	0.013	0.006
	ADOPT2	**0.982**	0.027	0.010
	ADOPT3	**0.994**	0.010	0.004
	ADOPT4	**0.987**	0.013	0.006

Construct	Items	ADOPT	CS	CP
Cloud security	CS1	−0.088	**0.774**	−0.182
	CS2	−0.017	**0.777**	0.044
	CS3	0.157	**0.834**	−0.012
Cloud privacy	CP1	−0.123	−0.094	**0.730**
	CP2	0.083	0.010	**0.882**
	CP3	0.065	−0.043	**0.820**

Table 3: EFA results

4 Results and Discussion

Table 4 summarises the demographic characteristics of the SME respondent organisations. Not surprisingly, those states with larger populations provided higher response rates.

Survey participant organisations (N=150 SMEs)		
State/Territory		
VIC	29	19.3%
NSW	30	20.0%
QLD	41	27.3%
WA	19	12.7%
SA	17	11.3%
TAS	11	7.3%
NT	3	2.0%
	N=150	100%

Table 4: Demographic characteristics of respondent organisations

The locations of the organisations were categorised based on regional Australian postcodes (TCP, 2015). Table 5 shows that 52.7% of the respondents in the sample were from metropolitan areas, and 47.3% were from regional areas.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Metropolitan	79	52.7	52.7	52.7
	Regional	71	47.3	47.3	100.0
	Total	150	100.0	100.0	

Table 5: Frequencies of respondent location

The descriptive analysis of all the multi-item factors in the research model used to examine the hypotheses are presented as follows.

4.1 ADOPT (Intention to Adopt)

Table 6 shows the frequency distribution of the items used to measure the perception of SMEs to adopt Cloud computing. The means of the items of ADOPT ranged from $\overline{X}$ = 5.43 (stdev. 1.759) to $\overline{X}$ = 5.57 (stdev. 1.569). The highest mean was for item ADOPT2: 'Our organisation feels that organisations' needs can be met by Cloud computing' ($\overline{X}$ = 5.57; stdev. 1.569). The lowest mean was for item ADOPT4: 'Our organisation will adopt Cloud computing within the next 12 months' ($\overline{X}$ = 5.43; stdev. 1.759). The overall mean of ADOPT was $\overline{X}$ = 5.51, which indicates a high degree of agreement by SMEs to adopt Cloud computing. The majority of the respondents agreed or strongly agreed that they are planning or intending to adopt Cloud computing in the near future.

Item	SME Responses							Mean	Std. Dev.
	Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree		
ADOPT1	8	7	3	17	5	69	41	5.50	1.670
ADOPT2	7	4	4	18	7	69	41	5.57	1.569
ADOPT3	7	6	5	16	6	69	41	5.53	1.625
ADOPT4	10	7	4	17	2	69	41	5.43	1.759
Overall mean								**5.51**	

Table 6: Frequency distribution of the ADOPT

4.2 Cloud Security

Table 7 depicts the frequency distribution of the items of CS. The means of the items of CS ranged from $\overline{X}$ = 4.29 (stdev. 0.824) to $\overline{X}$ = 4.92 (stdev. 0.799). The highest mean was for item CS1: 'Our organisation is not concerned about the security of the Cloud computing' ($\overline{X}$ = 4.92; stdev. 0.799). The lowest mean was for item CS2: 'Our organisation considers that Cloud computing is more secure than traditional computing' ($\overline{X}$ = 4.29; stdev. 0.824). The overall mean of CS was $\overline{X}$ = 4.60, which indicates a fair degree of agreement of SMEs' perceptions of CS to adopt Cloud computing. This factor was not correlated with ADOPT, with a correlation coefficient of only 0.006.

Item	SME Responses							Mean	Std. Dev.
	Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree		
CS1	0	0	5	36	78	28	3	4.92	0.799
CS2	0	0	20	80	37	12	1	4.29	0.824
CS3	0	1	16	60	49	16	8	4.58	1.018
Overall mean								**4.60**	

Table 7: Frequency distribution of the CS

4.3 Cloud Privacy

Table 8 presents the frequency distribution of the items of CP. The means of the items of CP ranged from $\overline{X}$ = 3.19 (stdev. 1.161) to $\overline{X}$ = 3.57 (stdev. 1.200). The highest mean was for item CP3: 'Our organisation feels Cloud computing can be trusted' ($\overline{X}$ = 3.57; stdev. 1.200). The lowest mean was for item CP1: 'Our organisation prefers to store data in the Cloud data centre located within Australia' ($\overline{X}$ = 3.19; stdev. 1.161). The overall mean of CP was $\overline{X}$ = 3.34, which indicates a fair agreement of SMEs' perception of CP to adopt Cloud computing. This factor was not correlated with ADOPT, with a correlation coefficient of only 0.044. In short, the results show that, although Cloud security and privacy factors are considered somewhat important by the SMEs, these factors do not significantly influence the SMEs' decision to adopt Cloud computing.

Item	SMEs Responses							Mean	Std. Dev.
	Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree		
CP1	8	37	47	40	13	5	0	3.19	1.161
CP2	11	29	42	52	12	4	0	3.25	1.158
CP3	9	18	36	61	17	9	0	3.57	1.200
Overall mean								**3.34**	

Table 8: Frequency distribution of the CP

Next, the hypotheses proposed in the study were tested using SEM. The model fit was evaluated with comparative fit index (CFI), root mean square error of approximation (RMSEA) and relative chi-square (CMIN/DF). The results indicated a good model fit, as the CFI was 0.985, the RMSEA was 0.073, and the CMIN/DF was 1.803 (i.e., less than 3). As shown in Figure 2, the analysis revealed that Cloud security and privacy factors do not have a significant influence in relation to Cloud computing adoption by SMEs.

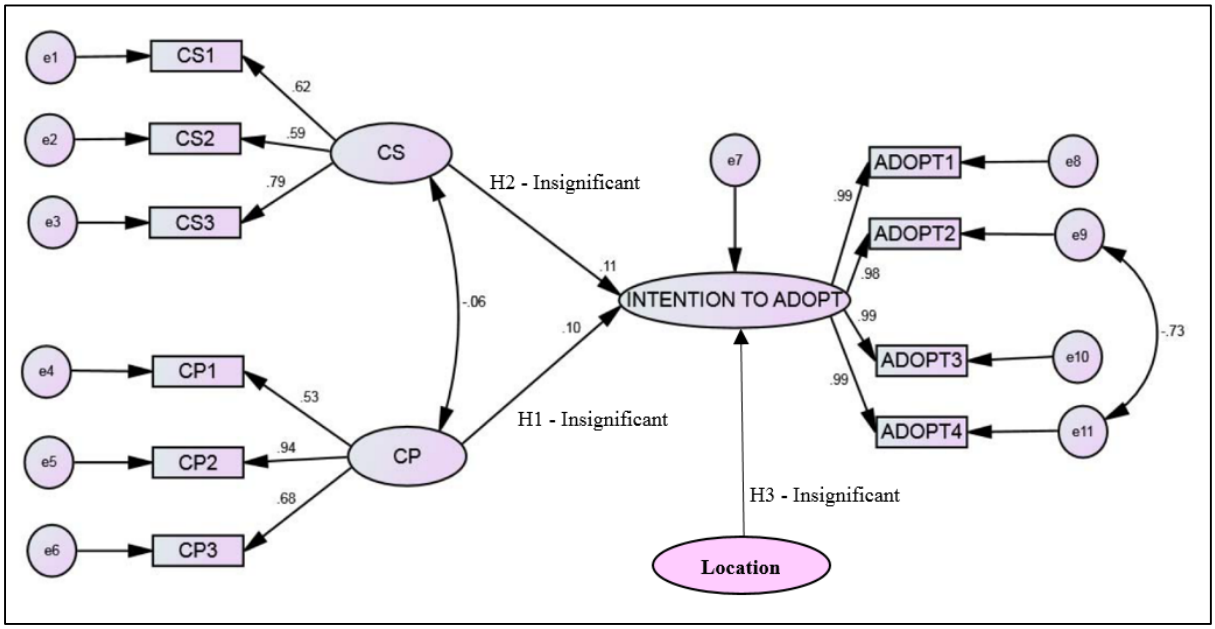

Figure 2. Results of AMOS structural model analysis

Hypothesis 1, which proposes that higher levels of privacy in the Cloud computing environment, as perceived by SMEs, may motivate them to adopt Cloud computing services, was not supported by the analysis (path coefficient = 0.10, $p>0.5$). This finding is not consistence with previous research by Chen and Chang (2013), indicating that privacy influence the decision of technological innovation adoption. The second hypothesis (H2), which proposes that higher levels of security in the Cloud computing environment may motivate SMEs to adopt Cloud computing services, was not supported (path coefficient = 0.11, $p>0.5$). A possible explanation for this may be that the SMEs were not fully aware of the security and privacy issues related to Internet-based Cloud computing provision. It is also possible that SMEs, which are usually on a tight budget, are more concerned about cost-effectiveness rather than security and privacy issues.

As can be observed in Table 9, the ANOVA analysis indicated that the SME location difference between metropolitan and regional areas was not statistically significant (F (1, 148) 1.601 and $p>0.05$). In other words, this result revealed that variances of Cloud computing adoption among the locations of the SMEs do not differ. Therefore, H3 is not supported. This finding is in contrast with the assertions of previous studies (e.g., Carcary et al., 2014; Minifie, 2014). For

instance, Minifie (2014) argued that regional location was an inhibiter for Cloud computing, and recommended that the bottlenecks in the suburbs and regional areas should be addressed. Carcary et al. (2014) suggested location as a potential barrier to Cloud computing adoption. However, the present finding indicates that the perceptions of Australian SMEs considering Cloud adoption is not different between metropolitan and regional areas. A possible explanation for this is that Internet connection is easily accessible in regional areas, offering SMEs convenient access to Cloud computing services. In fact, according to the Australian Communications and Media Authority, 94% of SMEs in Australia, including those in regional areas, were connected to the Internet, with 87% of these utilising a broadband service (ACMA, 2014). Hence, the location of the SME does not exert a significant influence on the Cloud adoption.

	Sum of Squares	***df***	**Mean Square**	**F**	**Sig.**
Between groups	1.601	1	1.601	1.685	.196
Within groups	140.631	148	.950		
Total	142.232	149			

Table 9: SME geographical location and Cloud adoption ANOVA

4.4 Contributions

This paper contributes to Cloud adoption research. The study bridges the research gap and provides insightful evidence on these issues, especially within the context of Australian SMEs. It is one of the first scholarly, empirical studies of Australian SMEs, with 150 observations across metropolitan and regional areas. Contrary to the existing literature (Tang & Liu, 2015; Vanessa, 2014; Dillon & Vossen, 2014), the survey findings indicate that company location, security and privacy factors do not play the most significant role in the decision-making process of SMEs considering whether to adopt Cloud computing. A possible reason for this might be that they are not fully aware of Cloud computing and its nature. Also a fair explanation is that SMEs are typically less concerned about security and privacy threats, in part because they do not have dedicated IT staff and the associated knowledge. Thus, this study extends our current understanding of Cloud computing adoption by Australian SMEs and contributes to the literature of Cloud computing and organisational innovation adoption.

Additionally, a methodological contribution of the study is the synthesis of the existing literature to define forms of measurement and operationalisation. The research constructs were developed through a comprehensive review of theoretical, practitioner and government underpinnings. As the field of Cloud computing is still relatively new, the research constructs provide foundations for further studies on the adoption of specific Cloud services, such as IaaS, PaaS and SaaS.

This study has practical contributions. The new understandings (i.e., that security and privacy factors do not possess significant influences on SMEs) enable SMEs, Cloud service providers, IT practitioners and policy makers to concentrate on other critical factors that have more impact on Cloud computing adoption, such as broadband affordability and speed. As SMEs are generally not capable of spending significant amounts of investment on ICT, it is essential for Cloud service providers, professional bodies and the government to devise strategies for the widespread adoption of Cloud computing for this SME category. It is also essential to reduce the feeling of uncertainty regarding Cloud computing adoption by SMEs through a wider coverage of NBN, especially for those in regional areas.

4.5 Limitations and Future Research

As with any research work, this research has some limitations that also offer opportunities for future studies. The first limitation is that this research focuses only on SMEs within Australia,

excluding SMEs from other countries. Therefore, the findings of this study are limited and should be considered carefully in other regions, as they may not be applicable to SMEs from different parts of the world. Hence, this study would have benefited from the inclusion of perspectives of SMEs from other countries.

Second, this study is limited in terms of its qualitative data. Further qualitative research, such as case studies and longitudinal studies, are required to gain a solid understanding of this phenomenon. Third, Cloud computing adoption by SMEs is still in its initial stage, and further detailed research incorporating other important aspects in this area is required. Future studies could focus on variables such as cultural factors and the differences in legal systems in the use of technology throughout different countries.

5 Conclusion

This paper has empirically examined how security and privacy concerns for Cloud computing are influencing the adoption by SMEs in Australia. Through an online survey method, this study concludes that security and privacy factors are not significantly influential for Australian SMEs in Cloud adoption decisions. Further, the findings reveal that Cloud computing adoption is not influenced by the geographical location of the SMEs (i.e., metropolitan vs regional). This research contributes to the emerging literature of Cloud computing adoption.

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