

On Cloud Computing Service Considerations for the Small and Medium Enterprises

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Abstract

The concept of cloud computing services is appealing to the small and medium enterprises (SMEs), with the opportunity to acquire modern information technology resources as a utility and avoid costly capital investments in technology resources. However, the adoption of the cloud computing services presents significant challenges to the SMEs. The SMEs need to determine a path to adopting the cloud computing services that would ensure their sustainable presence in the cloud computing environment. Information about approaches to adopting the cloud computing services by the SMEs is fragmented. Through an interpretive design, we suggest that the SMEs need to have a strategic and incremental intent, understand their organizational structure, understand the external factors, consider the human resource capacity, and understand the value expectations from the cloud computing services to forge a successful path to adopting the cloud computing services. These factors would contribute to a model of cloud services for SMEs.

Keywords

Cloud computing services, small to medium enterprises, technological–organizational–environmental framework, innovation, security

Introduction

We suggest how the small and medium enterprises (SMEs) could adopt the cloud computing services. The definitions of the SMEs vary in different countries and economic zones within the developed world. For example, the European Union (EU) classifies SMEs as enterprises that employ fewer than 250 persons. In the United States, the SMEs typically have less than 500 employees, with a maximum of 750 employees. In Australia, SMEs are businesses with less than 200 employees, and the Australian Taxation Office (ATO) defines them as economic groups with turnover of up to \$250 million. Regardless of these variations, the SMEs make up about 70 to 95 percent of active businesses in most economies, and they are large employers across the economy. They are the powerhouse of any economy.

Cloud computing services is an information technology service model where computing services (both hardware and software) are delivered on-demand to customers over a network in a self-service fashion, independent of device and location (Marston et al. 2011). Cloud computing is an example of the IT provisioning model (Böhm et al. 2011). However, cloud computing represents a shift from the traditional product-based IT provisioning model (for example, outsourcing) to a service-based provisioning model (Armbrust et al. 2010). Within the traditional IT outsourcing value chain, categories (for example, infrastructure, applications, and business processes) may be outsourced separately and managed by the outsourcing organization. In this situation, an organization could manage a large number of providers with complex outsourcing relationships. In contrast, the cloud computing model is a service-oriented (Jacob et al. 2008) model. The cloud computing service links the stronger service-oriented hardware

outsourcing to the as-a-service concept for software. Within this environment, infrastructure-based services are now offered dynamically to the needs of customers.

There are predictions that the global market for the cloud computing services will grow rapidly in the next few years. For example, the global research firm IDC predicts a compound annual growth rate of 27.4 percent in public cloud services up to 2014, rising to a total global market value of over US\$55 billion (IDC Group 2011). Other major IT research and advisory firms predict that cloud computing services will grow as much as five times faster than traditional IT services. This situation indicates that greater varieties of cloud computing services are being provided to the market, much of which could benefit the SMEs.

A number of SMEs are using the cloud computing services to manage their emails, host their websites, and manage data using file-server management tools similar to Dropbox. However, there are some compelling fits between the offerings of the cloud computing services and the IT requirements of the SMEs. First, the opportunity to acquire the IT resources on a utility basis, which relates to obtaining the computing resources on an ongoing basis at a charge exists (McAfee 2011). This offering is beneficial to the SMEs as they find it hard to make an upfront capital commitment to acquire the IT resources. Second, the opportunity to acquire IT resources on an as-needed basis exists. That is, the SMEs could acquire the IT resources quickly when their demand increases (or decreases) due to changed economic conditions. Third, the cloud computing service provides mobility and convenience (Gupta et al. 2013). SMEs' employees often work outside the office location, and the cloud computing services would allow them access to data and other business resources remotely (Marston et al. 2011). Sourcing applications and storing data in the cloud avoids continuous hardware upgrades thereby preventing maintenance constraints from utilizing different applications (Mahesh et al. 2011). Finally, the cloud computing services allow the SMEs to share and collaborate on organizational data and information. Document sharing and editing of the same document by several people at the same time (via Google Docs) and collaboration (via Skype, Google chat) are compelling for users to adopt the cloud computing services (Marston et al. 2011).

There are a number of constraints to adopting the cloud computing services. These constraints include data, information, and channel security (Brender et al. 2013; Gupta et al. 2013), vendor dependency (Armbrust et al. 2010; Marston et al. 2011), and privacy and ownership of organizational resources (Takabi et al. 2010). The perceived benefits, however, appear to outweigh these inherent constraints, and they appear to compel the SMEs to look towards the cloud for their IT resource requirements. However, the SMEs need to determine their path and establish their pace of seeking the cloud computing services. This consideration is important because lack of control and understanding on adopting the cloud computing services could result in serious financial and operational stress for the SMEs and exposure to the stated constraints. While there are ample discussions and deliberations on the benefits of the cloud computing services to the SMEs (see for example, Armbrust et al. 2010; Brender et al. 2013; Demirkan et al. 2013; Gupta et al. 2013; Marston et al. 2011; McAfee 2011), extant literature has not focused much on how the SMEs should determine the path to the cloud computing services. Thus, we address the following key question in this paper. What factors should the SMEs consider to decide a path to adopting the cloud computing services?

We adopt an interpretive design to address the above research question. We analyzed the extant literature, deliberations from the practice, and available views of the SMEs that are the first movers to adopt the cloud computing services to identify the path to the cloud computing services. Our findings suggest that the SMEs have a strategic and incremental intent, understand their organizational structure, understand the external factors, consider the human resource capacity, and understand the value expectations from the cloud computing services to forge a path to adopting the cloud computing services. The rest of this paper is organized as follows. We provide an overview of cloud computing in the next section. Then we present our theoretical framework and the research design. Following this work, we discuss our findings, suggest directions for future research, and state our contributions to theory and practice.

An Overview of the Cloud Computing Services

The concept of providing the computing resources as a service is not new. Cloud computing is based on a collection of a number of old and few new concepts like the Service-Oriented Architectures (SOA), distributed and grid computing as well as virtualization (Youseff et al. 2008). However, today, the cloud computing services are being presented in a very efficient and shared way that effectively pushes the benefits of the shared computing environment to the user. Furthermore, there has been a significant increase in the quality of remotely hosted offerings, the ease with which they can be implemented, and the widespread availability of high-speed Internet connections. These factors make implementation of the cloud computing services much more effective and appealing.

Organizations could source the cloud computing services from the private, public, community, and hybrid cloud deployment models (Marston et al. 2011). With the public cloud, the cloud computing services are available from a third party service provider via Internet to the mass like common utilities (for example, electricity). This option is cost effective and economical for the SMEs to acquire the cloud computing services. With the private cloud, cloud computing services are operated solely for a single organization, and they would be managed internally, or by a third-party and hosted internally or externally. Such a cloud service is suitable to the large enterprises. The community cloud service is managed by organizations with similar interests, and it is a less restrictive form of private cloud services. Organizations could also source cloud computing services from a number of these models, and they would be part of a hybrid cloud computing services environment.

A number of services are offered through the cloud computing services environment. Youseff (2008) presents a unified ontology of cloud computing as shown in Figure 1. Organizations could seek application services from the cloud, commonly called software as a service (SaaS). With SaaS, applications would be hosted by the cloud computing service provider, and the service user would consume the application through the Internet. This arrangement relieves the user from managing complex applications, and it allows the provider to upgrade applications without causing any inconvenience to the users. Common SaaS providers are Yahoo Mail, Gmail, Facebook, Twitter, Microsoft Office Live, Google Apps, and Salesforce.com.

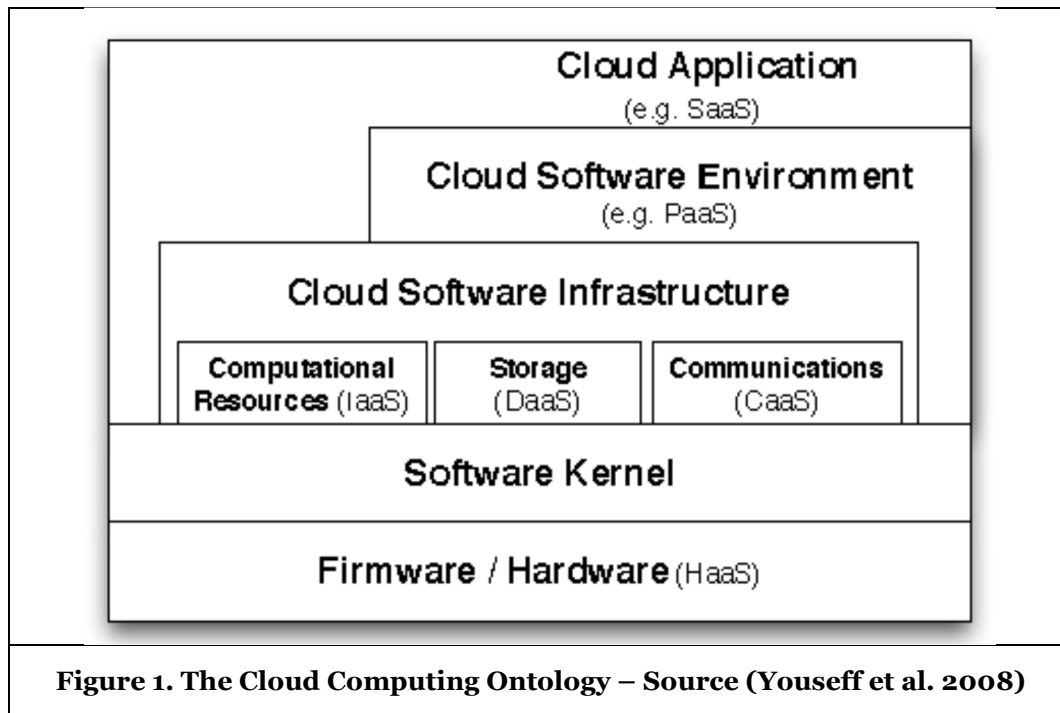


Figure 1. The Cloud Computing Ontology – Source (Youseff et al. 2008)

Organizations could also acquire software platforms from the cloud computing environment. Termed platform as a service (PaaS), the service-seeker organization manages the software configuration in

collaboration with the PaaS-provider using the PaaS provider's resources. The PaaS provider then provides the platform in the form of networks, servers, storage, and other services. Common examples of the PaaS environment include the Google's App Engine. Software infrastructures could also be acquired through the cloud computing environment. Infrastructure-as-a-Service (IaaS) facilitates storage and computing capabilities as a service. IaaS cloud providers have a large pool of these resources, and they supply these resources on an on-demand basis. The IaaS service seekers generally use the Internet or the dedicated virtual private networks (VPN) to access these services. Amazon's S3 storage service is a common example of an IaaS. Storage-as-a-Service (DaaS) allows users to obtain demand-flexible storage on remote disks, which they can access from everywhere. Communication-as-a-Service (CaaS) focusses on communication capabilities such as network security, dedicated bandwidth or network monitoring. The above discussion indicates that the cloud computing services provide significant affordable opportunities to the SMEs to manage their business operations with modern IT resources. Next, we discuss a framework that provides impetus to the SMEs to acquire modern IT resources.

Theoretical Framework

Organizations adopt IT resources at a different pace and with a different intensity (Guimaraes et al. 1986; Ravichandran 2000). The Technological–Organizational–Environmental (TOE) framework (Tornatzky et al. 1990) provides guidance about how organisations form intentions to adopt information technology (IT). While the cloud computing services, *per se*, are not a radically new form of technology innovation, the fact that its adoption would significantly affect organizations' business processes and data management means organizations need a strategy to adopt these resources. Tornatzky and Fleischer (1990) posit that technological, organizational and environmental variables influence an organization's intention to adopt IT. A number of studies have used the TOE framework to determine the drivers of IT adoption in contexts such as e-business adoption and use of the Internet for transforming business processes (see for example, Furneaux et al. 2011; Grover 1993; Iacovou et al. 1995; Zhu et al. 2003). More recently, Henderson et. al., (2012) used the TOE framework to suggest inter-organizational and internal in-house adoption of XBRL.

The TOE is useful in investigating the adoption of IT innovations at the organizational level (Tornatzky et al. 1990). The technology factors focus on perceptions on various aspects of technology that influence its adoption. Organizational factors relate to attributes of the organization that may impact the adoption decisions. Environmental factors relate to the surroundings in which the organization conducts business that may affect adoption decisions (Tornatzky et al. 1990). These three factors are critical for the establishment and survival of the SMEs, and they would determine the extent of sourcing the IT resources from the cloud computing service providers.

The TOE framework has been applied in a recent study on the adoption of cloud computing. Lian et. al., (2014) conducted an exploratory study to understand the critical factors affecting the decision to adopt cloud computing in a Taiwan hospital. They included four generic factors (human, and the three TOE factors) and determined their rankings in relation to their importance. The SMEs, however, operate with a different set of constraints compared to larger organizations (Grandon et al. 2004). The SMEs have limited financial resources for capital investments; they are vulnerable to changes in the economy; and they find it difficult to attract technical human resources to manage their IT resources. The SMEs also treat innovative technologies differently to other organizations. For example, consistent with Rogers (2003) diffusion of innovation concept, very few SMEs would be innovators or early adopters. Rather, the majority of SMEs would let the technology mature and adopt them as the early or late majority adopters (Nguyen 2009; Sultan 2011).

The cloud computing services environment has matured steadily over the years. However, the stated concerns of data and channel security (Brender et al. 2013; Gupta et al. 2013), vendor dependency (Armbrust et al. 2010; Marston et al. 2011), and privacy and ownership of organizational resources (Takabi et al. 2010) means that there is a need for a better understanding of the various technological, organizational and environmental factors to decide a path for adopting the cloud computing services for the SMEs. The next section presents the study's research design to identify these factors.

Research Design

We collated data from three critical sources about this question to determine a path to cloud computing services for the SMEs. Essentially, the design entails a triangulation approach as part of an interpretive design. An interpretive study (Yin 1994) is useful to unpack the diversity of issues involved in taking a path to adopting the cloud computing services. This approach allows one to consider the shared meanings and experiences of people involved (Walsham 1995), in this case, the cloud computing customers, the service providers and the intermediaries on the appropriate path to adopting the cloud computing services for the SMEs. Our data collection is limited to only one Country – Australia. However, the makeup of the Australian is similar to that of other developed markets, meanings the outcome of this study is relevant to most developed markets.

First, we collated various academic commentaries and publications on the cloud computing environment relating to the SMEs. We used keywords such as “cloud computing for SMEs”, “cloud for the mid-market”, “cloud computing services”, “cloud computing platform”, “cloud infrastructure”, “cloud computing management”, and “service-oriented architecture” to filter the cloud computing commentaries and publications from the IEEE Xplore Digital Library, the Science Direct, and the Business Source Elite databases. These keywords were derived from reviewing the literature on cloud computing and SMEs. These keywords were the most common terms used to describe either “cloud computing” or “cloud computing for SMEs.” Second, we searched the Internet with similar keywords to obtain the practice-related commentaries on cloud computing services for the SMEs. Third, we used search terms like cloud computing success stories for SMEs, cloud computing for the mid-market, cloud computing tips for SMEs, and competing with cloud for SMEs to search the Internet for stories and commentaries on cloud computing by the SMEs that have adopted the cloud computing services and the cloud computing service providers. We did not conduct any interviews with the SMEs at this stage because we plan to do this task while validating a subsequent model for a path to cloud computing services for the SMEs. Table 1 below notes the number of documents and reports sourced from each of the groups. We were unable to obtain self-success stories from the SMEs, however, we were able to obtain commentaries on different approaches to adopting the cloud computing services (for example, the benefits of using the intermediaries).

Group	Number of Reports and Documents
Academic Commentaries and Publications	30
Practice-Related Commentaries	11
SMEs and Cloud Computing Services Providers	14

Table 1. Number of Reports and Documents Used

We summarized and tabulated the deliberations from the three sources on cloud computing services for the SMEs. We then analyzed the summarized data, resulting in a number of factors to consider towards a path to cloud computing services for the SMEs. The factors emerged using the steps suggested by Dey (1993). These steps included establishment of the units of analysis, code attachment, and conception categorization into broader conceptions. We used both open and pre-set coding because our theoretical framework provided some guidelines on possible factors for a path to cloud computing services for the SMEs. Three individuals performed coding, and the coding report was then compared and analyzed to finalize the key themes and resulting broad conceptions – the key factors for a path for the cloud computing services for the SMEs. The coding refinement process involved detailed discussions between the three coders on the identified themes and the meanings of these themes. The next section discusses the findings of this study.

Results

Our analysis of the various sources of data revealed that the SMEs should have a *strategic and incremental intent, understand their organizational structure, understand the external factors, consider the human resource capacity, and understand the value expectations* to forge a path to adopting the cloud computing services. We discuss these factors in the following sections.

A Strategic and Incremental Intent

The SMEs are thinking about the cloud computing services (IDC Group 2011). For example, Gartner predicts that the worldwide market for cloud computing will grow by 18-20 percent in the next few years (Linthicum 2013). Cloud computing is here to stay and organizations that are sourcing the cloud computing services would end up having a long-term commitment to these services. Thus, the SMEs need to have a strategic focus when considering the cloud computing services. IDC Group (2011) suggests it is important to integrate business priorities and IT priorities with cloud deployment strategy. The SMEs strategic goals and supporting IT strategies need to be clearly articulated and understood so that any cloud strategy can be built on a secure foundation. Investments in cloud computing services must be designed to support the SMEs strategic intent to secure sustained financial objectives.

There was consensus that within this strategic intent, adoption of the cloud computing services should be incremental. This approach is necessary because the SMEs would have limited financial resources to implement the cloud computing services, and this would necessitate targeted adoption of the cloud computing services (IDC Group 2011). Furthermore, the appreciation of the technology by the key personnel would be slow (Lian et al. 2014). According to Martin (2010), cloud computing is a different way of working from what most SMEs are used to, and building familiarity and trust takes time. It is important to start small, and as employees grow more comfortable with the new work environment, more services could be added. Thus, a strategic intent with incremental progression into the cloud computing services is an important consideration for the SMEs.

With this strategic intent, frequent (re)assessment is required to keep maximizing cloud benefits. Different cloud providers offer similar services at different prices, and often these prices are subject to frequent change. An important factor for the SMEs is to decide which is the “right” cloud provider. This depends on the quality of service (QoS) that a cloud provider is offering and the cost that the provider is charging for their services. For the cloud computing customers, it will be increasingly difficult to decide which cloud provider can fulfil their QoS requirements. There will be a trade-off between the costs and the QoS of hosting a particular application, and this situation needs to be balanced, especially in hybrid cloud environments.

Understanding the Organizational Structure

With the strategic intent, the SMEs will engage with the cloud computing services for a long time. There was consensus that the SMEs should consider their future organizational structure in terms of growth and diversification. A number of key themes emerged relating to the structure of the SMEs. First, the SMEs need to understand the role of IT in their organization. As IDC Group (2011) puts it “*at the heart of the issue is whether IT is an integral part of the strategic thinking of a company or whether it is viewed as a servant to help execute plans that were crafted independently (p.5)*”. This perception of IT will have significant influence on how the SMEs value, and subsequently adopt the cloud computing services. The cloud computing services can contribute to the role of technology as a competitive differentiator, with innovative technology available in a scalable way across an organization. However, the SMEs need to see this value of IT, and look for this value in their cloud computing services. Furthermore, such thoughts on IT also contribute to better understanding the risks related to new investments. As McGladrey Group (2013) suggests, “*unanticipated risk can derail a cloud implementation and more importantly, present potentially disastrous results. In most situations, the benefits of cloud outweigh the risks, but organizations must be fully informed before making an investment (p.1)*.”

Another important consideration is the complication of the organizational structure. As the SMEs in the US could have as many as 700 employees, they may operate from more than one location. The SMEs existing IT infrastructure would influence the nature of cloud computing services. For example, the number of sites and their physical proximity can influence the decision to explore public cloud versus private cloud approaches. For SMEs with multiple sites, it can be appealing to use a private cloud for secure data transfer under the exclusive control of the organization (Sultan 2014). A private cloud can also extend to partners or other third parties to provide potential competitive advantage (IDC Group 2011).

Another factor that emerged relating to organizational consideration was the pace of organizational evolution. While the pace of growth is unpredictable, the SMEs would see gradual growth in their business. Growth resulting from mergers, acquisitions, and collaborations would put new demand on IT

infrastructure. The SMEs need to adopt an approach to the cloud computing services that recognizes the changes in future IT infrastructure requirements. For SMEs undergoing major change, cloud engagements today can set the stage for improved organizational flexibility tomorrow (IDC Group 2011). As the SMEs grow, mobility would become a key consideration. Considerations on employee mobility, the need for real time data, competitive intelligence would be important for SMEs while considering a path to the cloud computing services.

Understanding the External Factors

Another key consideration that emerged related to understanding the external factors that would influence the path to cloud computing services. Plummer (2012) from Gartner asserts that cloud adopters must recognise that public cloud providers offer services in the most standardized way possible. *“Buyers must recognise the importance of vendor viability and perform continual evaluations of their critical providers’ financial health in addition to assessing and monitoring data continuity and recovery capabilities.”* (Page 11) The published success stories on adoption of cloud computing services by the SMEs also indicated the important role of the intermediaries in providing the appropriate solutions to their cloud service needs. The SMEs should also consider and understand the competitive and the regulatory environment (Brender et al. 2013; IDC Group 2011; Lian et al. 2014; McGladrey 2013; Seddon et al. 2013). The IDC Group (2011) suggested that the changing competitive environment as well as the regulatory environment can provide strong incentives or disincentives for the adoption of different cloud computing solutions. They also suggest that if external constituents are resisting cloud adoption, it will still be appropriate to revisit those attitudes regularly because the increasing visibility of cloud solutions has been influencing receptivity to new approaches, just as much as changing costs and application capabilities. The SMEs should consider interoperability and contractual ‘lock-in’ issues as these may incur a significant cost and require a lot of effort to port the software and its data. The contractual complexities and inconsistencies (expensive exit clauses, data deletion) can lead to contractual ‘lock-in’ for the SMEs. Security is another issue that requires careful consideration (CISCO 2013; Lian et al. 2014; McGladrey 2013). McGladrey (2013) suggests that security capabilities can differ between vendors and cloud structure, and if not careful, organizations may simply be trading one type of risk with another. A cloud solution may technically be secure, but may not fully comply with legal and regulatory demands applicable to certain industries. The CISCO group (2013) suggests that the most important criteria for SMEs in choosing a provider of cloud services are those that align to a potential differentiation with network assets. These criteria include reliability, quality, security, and technical competency. Data security and trust was a major concern shared by all stakeholders, and this mostly related to the regulatory and compliance concerns. Thus, understanding the external environment would be important for SMEs while considering a path to the cloud computing services.

The Human Resources Capacity

The human resource capacity of the SMEs is another important consideration for a path to cloud computing services. In addition to the current capabilities of an IT staff and its ability to facilitate a move to new cloud resources, the interest and support of users must be considered (IDC Group 2011). While the implementation of cloud computing services will not require much adjustment by most employees, the fact implementation of any new solution that is designed to improve efficiency and effectiveness will mean that new learning can initially slow rather than advance productivity. There is a need to increase IT support needs when cloud solutions are first introduced. Lian et al., (2014) suggests that as the cloud computing services is a form of a new IT innovation, the role of key IT personnel will play an important role in the adoption decision process. For the SMEs, the staffs’ technological competencies would impact on their decision to adopt the cloud computing services.

Understanding the Value Expectations

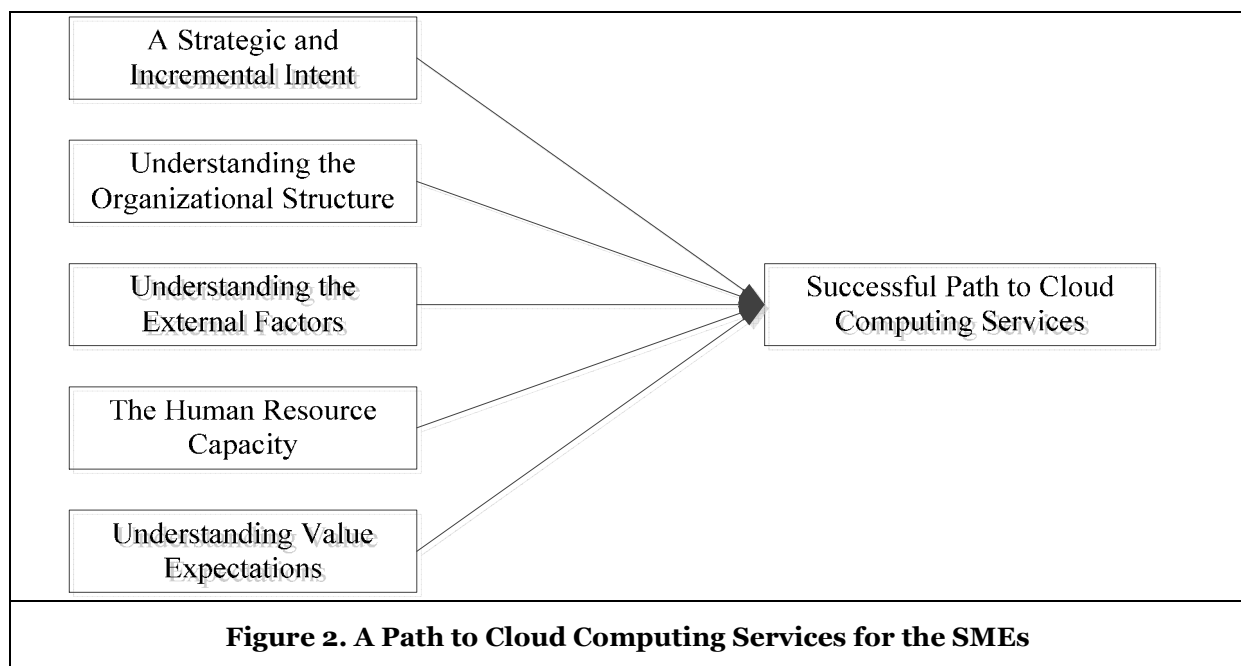
Another important consideration shared by the stakeholders was the value expectations from the cloud computing services. The SMEs should understand the value they wish to derive for the cloud resources. Cloud computing is ultimately about whether or not service consumers achieve certain outcomes by using cloud services (Plummer 2012). While return on investment (ROI) is one such outcome, but as Plummer (2012) suggests that if hard monetary savings is your most significant outcome, then you are likely to be

disappointed. There was a consensus that the SMEs must realize that most of the initial value from the cloud computing services would be intangible process-related and relationship-related. Importantly, the SMEs should target their cloud initiatives towards improving their existing processes and evaluate the investment against improvements in these processes. Further, focus on internal (between teams), and external (customers, suppliers) relationships is important. Plummer (2012) also notes, *"The question to ask first is, "What am I expecting to get out of using this service?" If you don't establish that up front, then you're just chasing ghosts in the cloud. And, believe me, ghosts hide well in "clouds.""* (Page 17) Thus, it is vital that the SMEs have realistic expectations on the value of the cloud computing services before adopting these services.

Discussion

In this study, we have addressed an important question of the key considerations for the SMEs on their path to adopting the cloud computing services. Our findings suggest that the SMEs take the path to the cloud computing services with a strategic intent by thinking big, yet starting small. The SMEs should also be aware of the current and future business environment, and this will influence their strategic focus on the cloud computing services. Awareness of the various external environmental factors, like the intermediaries, risks, compliance issues is also important. Despite the changes in the IT infrastructure landscape, the human resource capacity would prove vital in the success of the cloud computing services. Finally, the SMEs should take the path to the cloud computing services with clear and reasonable expectations on the value from the cloud computing services. These findings imply that the SMEs need to venture into the cloud computing services environment with a long-term commitment and with a proactive mindset. For the cloud computing service providers, there is a need for greater flexibility in the product range to meet the different requirements of the SMEs. The intermediaries require a better understanding of the SME business environment so they are able to assemble packages for the SMEs, and ensure a sustainable relationship with the SMEs. From a regulatory perspective, a proactive approach is required to provide greater confidence to the SME market to leverage the opportunities of the cloud computing service environment.

Consistent with our findings and discussion, we suggest the following model for a path to cloud computing services for the SMEs. It is only through testing such a model that we will be able to understand the relative importance of each of these factors to the question of how SMEs can move to cloud computing services.



Conclusion

We have presented important initial directions that SMEs should take when planning to adopt the cloud computing services. We feel these are important considerations irrespective of the nature and the size of the SME. Our next step will be to develop further and validate this model using a mixed methods design, and we hope to share the progress of this work at AMCIS 2014.

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