

The Adoption of Cloud Computing by Indian SMEs – an Exploratory Study

Manisha Singh

Rajasthan College of Engineering for Women - Jaipur
Department of Computer Science and Engineering
RAJASTHAN TECHNICAL UNIVERSITY, KOTA (2016)

Abstract: Cloud computing adoption has experienced a considerable rate of growth since its emergence in 2006. By 2011, it had become the top technology priority for organizations worldwide and according to some leading industry reports the cloud computing market is estimated to reach \$241 billion by 2020. Reasons for adoption are multi-fold, including for example the expected realisation of benefits pertaining to cost reduction, improved scalability, improved resource utilization, worker mobility and collaboration, and business continuity, among others. Research into cloud computing adoption has to date primarily focused on the larger, multinational enterprises. However, one key area where cloud computing is expected to hold considerable promise is for the Small and Medium Sized Enterprise (SME). SMEs are recognized as being inherently different from their large firm counterparts, not least from a resource constraint perspective and for this reason, cloud computing is reported to offer significant benefits for SMEs through, for example, facilitating a reduction in the financial burden associated with new technology adoption. This paper reports findings from a recent exploratory study into Cloud Computing adoption among Indian SMEs. Despite its purported importance, this study found that almost half of the respondents had not migrated any services or processes to the cloud environment. Further, with respect to those who had transitioned to the cloud, the data suggests that many of these SMEs did not rigorously assess their readiness for adopting cloud computing technology or did not adopt in-depth approaches for managing their engagement with cloud. While the study is of an exploratory nature, nevertheless the findings have important implications for the development/ improvement of national strategies or policies to support the successful adoption of Cloud Computing technology among the SME market. This research has implications for academic research in this area as well as proposing a number of practical recommendations to support the SME cloud adoption journey.

Keywords: cloud computing, SMEs, cloud adoption readiness, reasons for cloud non-adoption, SME cloud adoption models, survey research

1. Introduction

Cloud Computing is defined by the US National Institute of Standards and Technology (NIST) as:

“A model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g. networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction” (Mell and Grance, 2011, p.2).

Cloud Computing affords organisations the opportunity to access on-demand IT services using Internet technologies on a free or pay-per-use basis, thereby enabling them to improve their strategic and technological agility, and responsiveness in the global business environment (Son et al, 2011). Hence, Cloud Computing reflects *“a sea change—a deep and permanent shift in how computing power is generated and consumed”*(McAfee, 2011). It has evolved to become the top technology priority for organisations worldwide (Gartner, 2016), The worldwide public *cloud services* market is projected to grow 16.5 percent in 2016 to total \$204 billion, up from \$175 billion in 2015, according to Gartner, Inc. The highest growth will come from *cloud system infrastructure services* (infrastructure as a *service* [IaaS]).

As Cloud Computing is a relatively new IT and business phenomenon, there remains many untapped areas of research in this field (Son et al, 2011). Of the studies reviewed, prior academic research has focused on issues including the emergence of and developments in Cloud Computing, Cloud deployment and delivery models, benefits and challenges in migrating to the Cloud, readiness for cloud adoption, among others. However, the majority discuss Cloud Computing topics with no references to company size, and for some it can be inferred that they are oriented more towards larger organisations. However, it is recognised that SMEs (defined by the European Commission as any enterprise with less than 250 employees) are inherently different from large enterprises (Street and Meister, 2004). Such differentiating characteristics include for example more limited human resources with lower levels of specialized skills and less formal training; more limited financial resources, revenue generating ability and available budgets; greater dependency on third parties for service delivery and increased propensity for outsourcing; simpler command structures; lower levels of bureaucracy and formality in processes/procedures; and greater agility and more rapid decision-making processes (Pemmaraju, 2010; Street and Meister, 2004).

Given, Cloud Computing's ability to support increased capacity or extended firms capabilities, without incurring extra costs which would have historically necessitated investment in infrastructure, software or staff training, it can be inferred that this technological platform may hold several opportunities for SMEs (Aljabre, 2012). However this emerging trend needs to be further researched from the SME perspective. For example, one key area of interest in the degree of preparation SMEs undertake when migrating services or processes to the cloud, as previous technology adoption studies have found that those SMEs who have a higher degree of organizational readiness are more likely to experience higher benefit realisation (Iacovou et al, 1995).

This paper presents results of an exploratory study into cloud computing adoption in the Indian SME context. The structure of this paper is as follows: Section two outlines the methodological approach taken. Section three outlines survey findings. A profile of survey respondents, and a profile of cloud adopters and non-adopters are provided in sections 3.1 and 3.2 respectively. For those SMEs who have adopted Cloud Computing, the paper examines the steps those organizations have taken to prepare for migration to the cloud environment (section 3.3). For those SMEs who have not taken steps towards adopting Cloud, the paper examines the reasons behind this non-adoption (section 3.4). Understanding the implications of these findings results in the development of a set of recommendations or policy steps that should be addressed at a national level to promote and support the SME cloud adoption journey (section 4). Section five draws a conclusion to the paper.

2. Methodology

This study employed a quantitative research approach through utilization of an online survey instrument (questionnaire). In this research work, the survey "An organization perspective on cloud computing" was launched 30th April 2016 through the online survey service Survey Planet. This survey is still available at this link <https://surveyplanet.com/57749111a7539ada6d46489c>. The online questionnaire is increasingly recognized as an invaluable means of data collection (Doherty, 2012) due to such benefits as higher response speed (Adams and Deans, 2000); lower respondent error (Weible and Wallace, 1998); and removal of interviewer bias (Van Selm and Jankowski, 2006).

In developing questionnaire constructs, a detailed review of existing literature which focuses on reasons for technology adoption/non adoption, as well as readiness for technology adoption was undertaken. This literature helped to frame the questionnaire's constructs - these constructs were then pilot tested with a sample of 20 SME owner/managers and senior academic researchers, and refined to ensure relevance and comprehension in the SME environment. The questionnaire gathered responses using 5-point Likert scales. A numerical score was associated with each response and this reflected the degree of attitudinal favourableness, with 'strongly disagree' associated with number '1' on the scale and 'strongly agree' associated with number '5'. The survey also consisted of a combination of open-ended and closed questions. The small number of open ended questions invited free comments where it was not always possible to predict the range of responses to a particular question (Frery, 1996). The use of closed questions served to generate and gather information quickly by the researcher (Boynton and Greenhalgh, 2004).

A purposive stratified sampling technique was employed in developing the sampling frame (Saunders et al, 2007) – using this sampling strategy units are chosen because they have specific characteristics that enable a core theme to be understood in greater detail. Purposive sampling ensures that key research themes are addressed and that diversity in each category is explored (Silverman, 2005). The sampling frame was stratified according to the following criteria:

- Firms must have less than 250 employees
- Firms must be located in India.

Within each SME, the owner or manager was chosen as the point of contact, as he/she was regarded as in the best position to answer questions pertinent to the research problem. The study's sample consisted of 1500 SMEs. The researchers aimed for a response rate of 7 percent in order to achieve 100 usable responses, which is deemed a suitable minimal level in a large population (Harrigan et al, 2008). The data collection process generated 95 usable responses, achieving a 6 percent response rate.

The following research questions were addressed in this study:

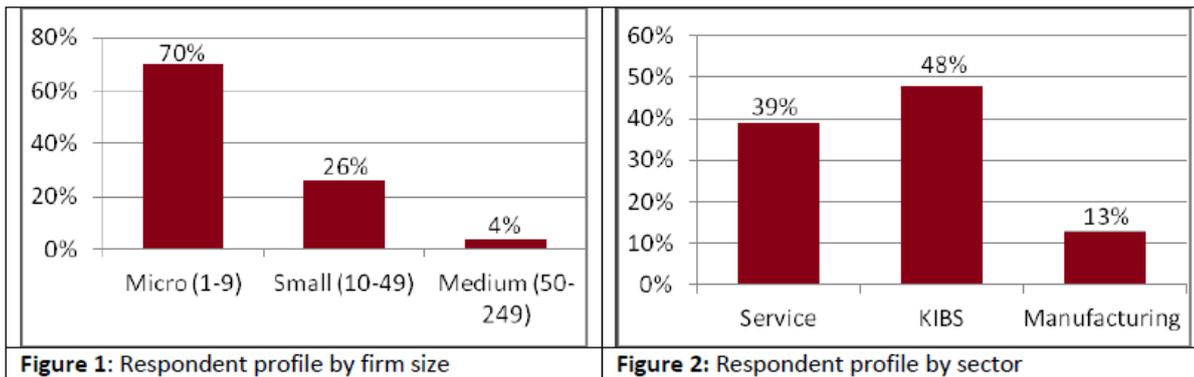
- RQ1. Determine the profile of Indian SME adopters and non-adopters of Cloud Computing
- RQ2. Outline the preparatory steps SMEs undertake in Cloud Computing Adoption
- RQ3. Discern the constraints to SME Cloud Computing adoption

3. Findings

3.1 Profile of respondents

The survey provided 100 usable responses. Each respondent organisation was located in India and employed less than 250 individuals. The majority of respondents (70 percent) were micro-sized firms, with from 1-9 employees; 26 percent were small firms, with between 10-49 employees; while 4 percent were of medium size with between 50-249 employees (see Figure 1). In terms of industry sectors (Figure 2), the largest sector, represented by almost half of all respondents (48 percent, n=46), were those firms from the Knowledge Intensive Business Services (KIBS) sector. The KIBS sector typically includes industries which rely heavily on the use of professional knowledge, such as hardware and software consultancy and supply; data processing; database activities; maintenance and repair of office, accounting and computing machinery; research and development in natural sciences, engineering, social sciences and humanities; legal activities; accounting and auditing; tax consultancy; market research;

business and management consultancy; architectural and engineering activities; technical testing and analysis; advertising; labour recruitment, among others. A significant minority of respondents (39 percent) were from the service sector (e.g. retail, wholesale, hospitality, leisure, tourism). The smallest group of respondents (13 percent, n=12) were from the manufacturing sector.



3.2 RQ1 – Determine the profile of Indian SME adopters and non-adopters of Cloud Computing

Almost half of all survey respondents (45 percent) have adopted Cloud Computing (known as ‘cloud adopters’) for their business. The majority of these cloud adopters (65 per cent) are from the Knowledge Intensive Business Services (KIBS) sector. This finding is in line with previous research (Mc Cole and Ramsey, 2004) which suggests that firms from the KIBS sector are more likely to adopt Internet related technologies than those firms from other sectors. Further, the majority of these cloud adopters (79 per cent, n=34) are micro firms with less than 10 employees. Given the Indian focus of this research and the large proportion of India’s economy made up of micro SMEs, this finding is not surprising. Further, in line with the assertion that the Internet and associated technologies can offer an important means of competitive advantage for those firms in a peripheral economy such as Ireland (Harrigan, 2008), it can be suggested that micro firms are adopting cloud computing in order to compete more effectively. The key application or business function that these cloud adopters had migrated to the cloud were email (84 percent, n=38), followed by sales and marketing (31 percent), CRM (22 percent), R&D (20 percent), finance (18 percent), software applications development (13 percent) and purchasing/ procurement (4 percent, n).

48 percent (n= 46) of the survey respondents had not migrated any services or processes to the cloud environment. These ‘cloud non-adopters’ were primarily (54 percent) those firms from the services sector. The level of non adoption is a particularly interesting finding given that Cloud Computing is reported to offer SMEs considerable benefits in terms of cost reduction (Aljabre, 2012; Armbrust et al, 2010; Geczy et al, 2012), improved resource utilization (Neves et al, 2011), and improved mobility and collaborative opportunities (Aljabre, 2012; Kynetix, 2009; Neves et al, 2011), among others.

The remaining 7 percent (n=6) of survey participants did not respond to this section of the survey.

3.3 RQ2 Outline the preparatory steps SMEs undertake in Cloud Computing Adoption

This section carefully considers the degree to which this study’s cloud adopters carefully prepared and established strategies to support the transition to the Cloud environment and the ongoing management of the cloud lifecycle. Understanding this degree of preparation is important as previous studies on technology adoption have found that “small firms with higher organizational readiness ... will be more likely to adopt and more likely to enjoy higher benefits than firms with low levels of readiness” (Iacovou et al, 1995). The study found that almost half of all respondents (45 percent, n=43) were cloud adopters, the majority of whom (93 percent, n=40) provided insight into the steps they took when migrating to the cloud. Figure 3 outlines the percentage of cloud adopters who followed each of the outlined steps to support cloud migration during their firms cloud adoption journey.

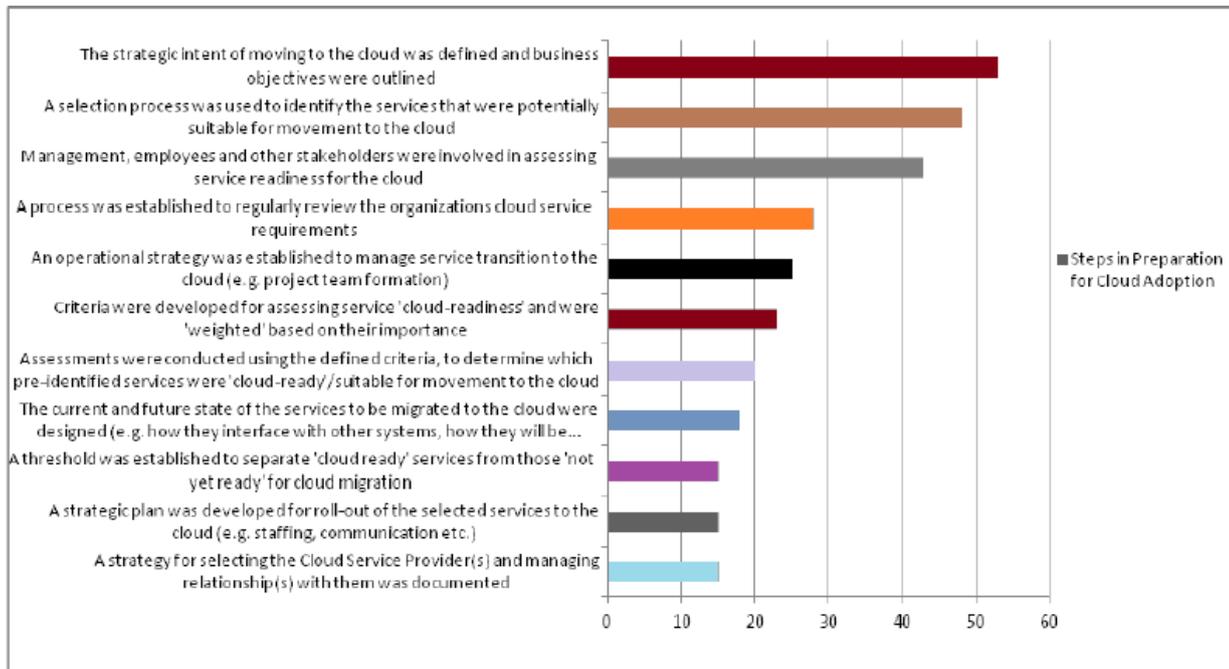


Figure 3: SMEs preparation for cloud adoption

Findings indicate that three key areas received the greatest degree of attention from the SME cloud adopters in terms of preparing for Cloud Computing. These include:

- Establishing the strategic intent and objectives of Cloud Computing adoption
- Establishing a process for identifying those services suitable for migration to the Cloud
- Involving stakeholders in assessing service readiness for the cloud

As outlined in Figure 3, findings indicate that the majority of cloud adopter SMEs in this study (53 percent; n=21) considered the importance of establishing the strategic intent and objectives of transitioning to cloud-based technology. As outlined in previous technology adoption studies, a key consideration in technology adoption is the alignment between the objectives of an organization's IT strategy and business strategy (Henderson and Venkatraman, 1992), as this is directly related to IS effectiveness and overall business/organizational performance (Chan et al., 1997). Many previous studies have found that such alignment with an organization's strategic objectives is important in maximising returns from ICT investments, in assisting in competitive advantage realization through ICT and in providing direction and flexibility to deal with new opportunities (Avison et al, 2004). From a Cloud Computing adoption perspective, Conway and Curry (2012) emphasize the importance of determining the organization's IT objectives, including the role of Cloud Computing within the IT strategy; understanding, managing and controlling the impacts on the business; aligning these objectives with business needs; and strategically planning the transition to the cloud environment. Similarly, Loebbecke et al (2012) recognise that migration to the cloud computing environment reshapes a company's IT landscape, and as such impacts significantly on IT strategy and performance.

48 percent of cloud adopters (see Figure 3) established a process for selecting those services that were potentially suitable for cloud migration. In line with the literature, one of the central tenets of Loebbecke et al's (2012) Cloud Readiness Model is the need for organizations to make informed, strategic decisions regarding which of their IT services are appropriate to migrate to the cloud environment, as poor selection decisions may prove operationally costly and may potentially negatively impact on business strategy. Loebbecke et al.'s (2012) cloud service selection process is composed of "identification, screening and categorization" phases, which involve identifying those IT services that warrant further investigation regarding their cloud readiness and establishing cloud-readiness assessment criteria relevant to the organization's context; evaluating the identified IT services against the assessment criteria and identifying which of the criteria are most critical; and establishing a soft threshold to separate IT services which are "likely cloud ready" from those that are "not yet cloud ready".

43 percent of the cloud adopters (see Figure 3) indicated that management, employees and other stakeholders were involved in assessing service readiness for the cloud. As outlined in the literature, the key differentiators of technology deployment's long-term success rest within the organizations internal context, in the form of managers and employees knowledge and skills (Bharadwaj, 2000; Peppard and Ward, 2004; Piccoli and Ives, 2005; Gregor et al., 2006; and Ray et al., 2005). Previous studies by Caldeira and Ward (2003) and Ramsey et al (2008) highlight that top management attitudes and perspectives towards IT adoption explain differences in the levels of success achieved. The strategic decisions made by management have a direct, positive influence on business operations and the enterprise's competitive position (Chuang et al., 2009). Hence, the involvement of managers should stretch from deciding to adopt, to planning, implementation and ex post activities to ensure ongoing alignment with the requirements and objectives of IS and business units (Nguyen, 2009). Further, ensuring employees are aware of new technology adoption and are involved in the adoption process yields higher success rates (Nguyen, 2009). From a cloud computing adoption perspective, the criticality of stakeholder involvement and influence is also emphasized by Conway and

Curry (2012), as failure to actively involve interested parties, particularly those from the user community, results in resistance to cloud migration. Loebbecke et al's (2012) model also emphasises the importance of management influence and employee buy-in throughout the process. In the model's application within Continental AG, 16 workshops involving management, employees and other stakeholders were held to collectively identify the cloud readiness assessment criteria and the IT services suitable for cloud migration.

Findings show that further preparatory steps for Cloud Computing adoption, as identified in the technology adoption literature (e.g. Conway and Curry, 2012; Loebbecke et al, 2012), were less apparent among the SME cloud adopters. These findings primarily relate to establishing detailed steps for determining cloud migration readiness, and the establishment of detailed strategies to support migration to and management of the cloud lifecycle:

- Determining detailed cloud migration readiness steps:
- 23 percent developed criteria for assessing service cloud-readiness
- 20 percent conducted assessments using the defined criteria, to determine which pre-identified services were cloud-ready
- 15 percent established a threshold to separate cloud ready services from those not yet ready for cloud migration

Although 48 percent (n=19) of the cloud adopters established a process for selecting potentially suitable services for cloud migration, the above findings in relation to establishing detailed cloud migration readiness steps indicate that this process was high level in nature. This is in line with reported findings in the literature on the nature of SMEs and their characterisation of having less formality in processes and procedures (Pemmaraju, 2010; Street and Meister, 2004).

- Establishing cloud migration and management strategies
- 28 percent established a strategy to regularly review the organizations cloud service requirements
- 25 percent established an operational strategy to manage service transition to the cloud
- 18 percent indicated that they considered/designed the current and future state of services to be migrated to the cloud
- 15 percent established a strategic plan for roll-out of the selected services to the cloud
- 15 percent documented a strategy for selecting the Cloud Service Provider(s) and managing relationship(s) with them

These findings in relation to establishing cloud migration and management strategies are not surprising, given SMEs more limited resources for engaging in technology project planning, their desire for greater agility in decision-making processes, and their orientation towards less formality in and documentation of strategies and plans (Pemmaraju, 2010; Street and Meister, 2004).

3.4 RQ3 - Discern the constraints to SME Cloud Computing adoption

The study found that almost half of all respondents (48 percent, n=46) were cloud non-adopters, the majority of whom (97 percent, n=40) provided insight into their reasons for not adopting cloud technology. Figure 4 outlines the percentage of cloud non-adopters who highlighted various reasons for not adopting cloud.

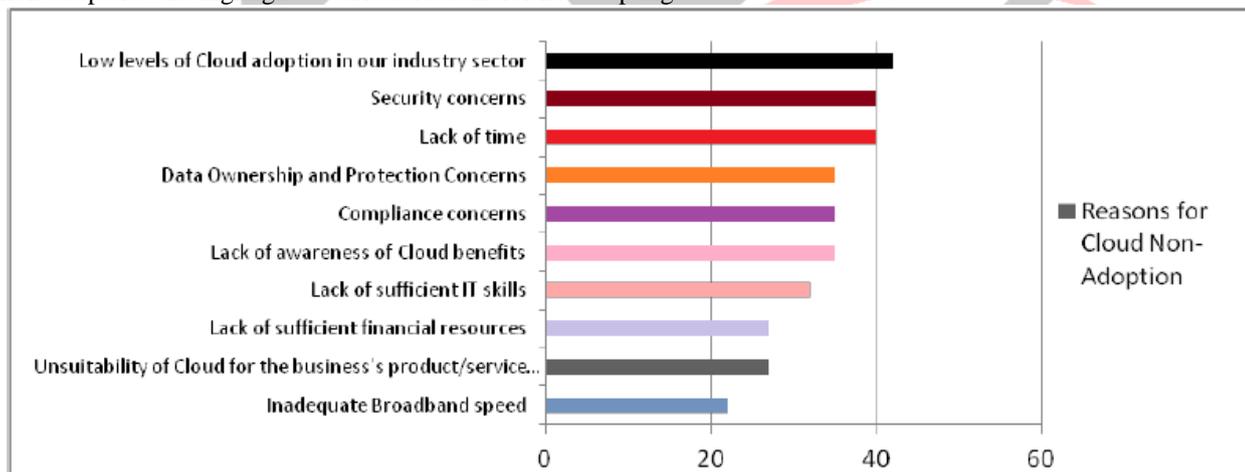


Figure 4: Reasons for not adopting cloud computing

40 percent (n=16) of the cloud non-adopters reported 'a lack of time' as a key deterrent to the adoption process, while a further 32 percent of the cloud non-adopters suggested they did not have the necessary IT skills to support migration. These findings are supported by Thong (1999) who states that the skills, time and staff required for effective technology adoption are not predominant issues in large organizations but represent considerable difficulties in smaller businesses.

Concerns regarding the security of the cloud environment (40 percent); data ownership and protection (35 percent.); and compliance (35 percent) were further obstacles to cloud migration identified by the SME survey cloud non-adopters. These largely mirrored concerns as found in other studies. A recent study, conducted by Frost and Sullivan for (ISC)2 in 2011 reported that Cloud Computing was one of the key areas that represented potential risks from an organizational perspective. Security concerns present the greatest barrier to cloud adoption (Armbrust et al, 2010; Iyer and Henderson, 2010; Luoma and Nyberg,

2011), due to the need for organizations to entrust external Cloud Service Providers with their business critical data. Such concerns include physical and personnel security in accessing machines and customer data, identity management in accessing information and computing resources, application security pertaining to applications that are available as a service via the cloud, and data confidentiality. Privacy, from the perspective of users needing to upload and store critical data in publically accessible data centers, as well as legalities surrounding data protection, confidentiality, copyright and audits are fundamental concerns (Yang and Tate, 2009). Rules pertaining to countries, country jurisdictions and industries impact on the free flow of data across boundaries (Iyer and Henderson, 2010). Hence, ensuring compliance with local, regional and global statutory and legal requirements represents a potential barrier to cloud adoption (SIM Advanced Practices Council, 2011). The physical location of the servers which store an organizations data is important under many nations' laws, due to different national legislations regarding privacy and data management. For example, within the EU, there are strict limitations on the flow of information beyond the user's jurisdiction (Iyer and Henderson, 2010; SIM Advanced Practices Council, 2011).

A minority of cloud non-adopters (27 percent, n=11) indicated that they had insufficient financial resources to support Cloud migration; this perceived barrier or reason for not adopting Cloud Computing may indicate a lack of understanding of the benefits of the cloud environment and how it may alleviate some SME concerns regarding lack of financial resources for new technology projects. While lack of financial resources typically limits SMEs ability to receive strategic benefits from new technology; a key characteristic of cloud computing is its ability to reduce the financial burden placed on SME's in technology adoption (Aljabre, 2012; Armbrust et al, 2010). For example, Cloud computing provides potential for significant cost reductions in, for example, capital acquisition, IT infrastructure operations and maintenance costs (Aljabre, 2012; Armbrust et al, 2010; Geczy et al, 2012; Iyer and Henderson, 2010; Luoma and Nyberg, 2011; Yang and Tate, 2009). Firms can switch from a CAPEX to an OPEX cost structure (Kynetix, 2009), and take advantage of the pay-per-use model (Armbrust et al, 2010). The authors' perception that this is an inherent misunderstanding of Cloud Computing characteristics is further supported by the finding that 35 percent of the survey respondents were unaware of any Cloud Computing benefits. As specified by one respondent, "I don't know how to set it up, or much about it". A further 27 percent believed Cloud Computing was unsuitable for their business/product offerings, while 42 percent of respondents didn't migrate services or processes to the cloud environment largely because they perceived that Cloud Computing was not widely employed in their specific industry sector.

A further minority of cloud non-adopters (22 percent) indicated that their broadband speed was inadequate. Cloud Computing relies on the quality and availability of the Internet connection and the cloud service itself (Kynetix, 2009), giving rise to business continuity concerns due to Internet downtime, connection unreliability or CSP outages (Armbrust et al, 2010). Further, latency or the delay incurred in transferring data packets is of concern especially for time-critical applications such as those used in financial markets and international trading (Kynetix, 2009). Latency of the Internet is unpredictable and such performance unpredictability and resulting data transfer bottlenecks impact on the realization of cloud computing power (Armbrust et al, 2010; Yang and Tate, 2009). More recently, the Indian government have adopted an aggressive interventionist approach to broadband rollout (Doherty, 2012) and combined with the fact that India has one of the youngest demographics in Asia, it has seen strong broadband growth in the last few years (Point Topic, 2011). However, much still remains to be done as highlighted in a recent Akamai's (2016) report where India was ranked 114th in terms of fixed line broadband penetration rates and received the lowest ranking in Asia-Pacific in terms of its average broadband speed (Akamai's, 2010).

4. Implications for research and practical recommendations from this exploratory study

Findings from this exploratory study into SMEs adoption of cloud computing have implications for other academics who are engaged in research in this area. Further, practical recommendations can also be made. Examination of the depth of preparation SMEs undertook prior to migrating to the Cloud environment suggests there is a substantial gap between what is published in the literature regarding steps to support cloud computing adoption and what is implemented in practice by the SME community. Specifically, only around half of the survey respondents determined the strategic intent and objectives of Cloud adoption; established a process for determining the services most suitable for the cloud environment; and involved key stakeholders throughout the process of assessing service readiness for the cloud. The depth of effort in for example the process applied to determine suitability for the cloud is somewhat questionable, as only the minority of SMEs developed criteria for assessing cloud service readiness and used those criteria to assess actual cloud readiness. Other important preparation steps were poorly followed with only a small number of SMEs establishing a strategic plan for roll-out of the selected services to the cloud, and documenting a strategy for selecting the Cloud Service Provider(s) and managing relationship(s) with them. The low levels of in-depth preparation correspond to some findings in the literature. For example, Iacovou et al (1995), state that many small organisations lack a required level of organizational readiness for adopting high-impact systems. However, the survey findings also suggest that approximately half of the SMEs in this study who adopted cloud computing did not engage in any preparation for migration to the cloud.

Given the fact that this exploratory study has highlighted a gap between what is currently published in the literature regarding cloud computing adoption and how SMEs are actually engaging in the cloud adoption process, this may point towards a lack of relevance of the findings from previous studies to the SME context. As aforementioned, it is commonly acknowledged that SMEs are inherently different from larger enterprises, and the lack of focus placed in the existing literature on the SME context could result in SMEs being disadvantaged in terms of relevant SME specific models and support/guidance for cloud migration. Although, establishing a process to identify potentially suitable services/processes for cloud migration was an activity many

SMEs engaged in, it appears that this process was high-level in nature. As outlined previously, this finding is supportive of the nature of SMEs and their tendency to be characterised by lower levels of formality in processes and procedures.

Recommendations: There is a need for a more concerted national effort led by Government and State Bodies to support SMEs who plan to engage in Cloud Computing Adoption. This requires the development of simple SME specific models/frameworks which emphasise and increase awareness of the preparatory steps SMEs should undertake to ensure efficient migration to the cloud environment. Similarly, within the academic community, a greater focus needs to be placed on developing a literature base which is specific to cloud computing adoption in the SME context. Given that the data analysis has found limited evidence to suggest that SMEs follow an in-depth set of steps (as reported in the current literature) in migrating services to the cloud, this finding reflects a more limited applicability of large organization cloud computing adoption models/guidance for SMEs. The academic community needs to further test and update existing models and develop new SME-specific models to support cloud migration. Such SME cloud models should be reflective of and aligned with the operational nature of many smaller enterprises – as such they need to be cognizant of the nature, degree of complexity and the inherent characteristics of SMEs. Recognizing that SMEs have more limited resources to invest in planning new technology projects, together with the fact that they are characterized by simpler command structures, lower levels of formality in processes/procedures, and greater agility and more rapid decision-making processes, any SME-specific cloud adoption model should be focused on a small number of steps, and be easy to understand and implement in order for it to be of relevance to the SME community. Similarly, the model should appreciate SMEs orientation towards lower levels of formality in procedures and less documentation of plans/strategies. The provision of such models and guidance may support improved readiness among SMEs for technology adoption. Guidance, in the form of a small number of simplistic, easy to understand steps, would encourage SMEs to be more strategic and prepared in their cloud adoption efforts. Similarly, availability of such a model and associated guidance may encourage greater levels of cloud computing adoption among SMEs, as approximately half of the respondents in this study had not adopted cloud computing. These models may be an important stimulus in enhancing economic competitiveness given the potential rewards cloud computing holds for SMEs.

Further, the reasons for cloud non adoption are quite varied. Findings indicate a lack of awareness of the benefits of cloud computing. For example, approximately a quarter of the survey respondents felt that they had insufficient financial resources to support Cloud migration; more than a third reported a lack of time as a key deterrent, while a further third suggested they did not have the necessary IT skills to support migration; were unaware of any Cloud Computing benefits, perceived it was not suitable for their product/service offering, or felt it was not adopted within their industry sector.

Recommendation: Although this is reflective of only a minority of the respondents, nonetheless, the roll out of a more concerted national awareness/education campaign targeting Indian SMEs, on the inherent characteristics and benefits associated with cloud computing may prove of benefit. Increasing benefits awareness should focus on how Cloud technology supports:

- Cost reduction through an ability to switch from a CAPEX to an OPEX cost structure (Kundra, 2011; Armbrust et al, 2010)
- Increased scalability and agility/adaptability by enabling firms to increase or decrease capacity (e.g. RAM, CPU, data storage) as the load/application demand dictates (Armbrust et al., 2010; Goscinski and Brock, 2010; Pyke, 2009; Su, 2011)
- Improved resourced utilisation, freeing employees from maintenance tasks and non-core activities to focus on core skills and competencies (Neves et al., 2011; Pyke, 2009) and eliminating the need for individual organisations to overprovision services or increase capacity to hedge against unexpected future requirements (Armbrust et al, 2010)
- Improved mobility and collaboration through better device independence, portability, and interconnection, thereby supporting the growing generation of teleworkers and project teams across geographical locations (Aljabre, 2012; Kynetix, 2009; Neves et al., 2011)
- Improved business continuity and transfer of the burden of disaster recovery to the cloud service provider (Kynetix, 2009)

Case studies, focused on how SMEs across a range of industry sectors have realised such benefits, could serve as a powerful catalyst in increasing awareness and stimulating an impetus to migrate to the cloud.

While much literature on the Cloud already exists, much of this presents a specific vendor perspective. What is required is an independent analysis of the impact of cloud computing in the SME context; this is critical to enabling SMEs to make informed decisions regarding the suitability of Cloud technology for their businesses. Such an awareness programme would help alleviate common misconceptions, and could for example specify the level of time investment required for common service/process transitions; could outline how lack of in-house skills may be addressed by the outsourcing of more complex services/processes to a cloud provider; and could offer cost benefit analysis findings in relation to savings made in comparison with any financial outlay associated with cloud transitioning. A possible strategy to support such education and awareness would be the establishment of an expertise centre whose purpose would be to provide SMEs with independent advice on management of the cloud lifecycle.

An interesting finding from the SME context was the perception of the minority of SMEs that their broadband speed was inadequate. Absence of a stable, high quality Internet connection can be a key deterrent for cloud migration. According to Akamai's 'State of the Internet' report India stands at 114th position (Akamai's 'State of the Internet';2016) with an average internet speed of 2.8 Mbps, and South Korea tops the list with an average internet speed with 26.7 Mbps. Its good to see that India's average speed increase with 11% quarter on quarter and 36% yearly growth. In 2013, India had the same rank(114) with an average internet speed of 1.3 Mbps and Peak internet connection speed is 10.6 Mbps. But still this speed is inadequate for SMEs .

Recommendation: Continued and aggressive broadband rollout by Government, with enhanced and fit for purpose broadband speeds available on a national basis, is critical to ensuring that all Indian SMEs are no longer disadvantaged and are in a position to harness the power of available information and communication technologies. At present, broadband is not available throughout Ireland on a stable "like-for like" basis; hence SMEs need to be made aware of current plans and time lines for high speed (e.g. fibre optic) broadband rollout and available alternatives (e.g. satellite). The issue of providers specifying a minimum broadband speed, as opposed to the current "up to" broadband speed is critical. Effective strategies to enable Government to hold service providers accountable for issues such as this and to show more support for smaller businesses is required.

5. Conclusions

This study was one of the first empirical studies to examine cloud computing adoption preparation and reasons for non-adoption among SMEs in Ireland. Given the study's exploratory nature and the limited sample of respondents, the authors are not suggesting the findings to be generalizable. Nonetheless, the insights gained from the Indian SME cloud survey respondents provide some interesting findings in terms of how the study's SMEs have engaged in the cloud adoption process and indeed the reasons behind some SMEs not adopting cloud computing. As cloud technology is asserted to hold significant benefit potential for SMEs, the authors believe that further efforts can be taken on a national scale and within the academic community to support greater understanding and adoption of cloud. Implementation of the key recommendations outlined in section four would be of considerable benefit to the SME market in overcoming any misconceptions of the cloud environment, in making informed decisions regarding cloud adoption, and in managing the adoption process and deriving the benefits that are inherent within cloud technology. Of particular interest would be the more focused development of a literature base specific to SME cloud computing adoption. This may take the form of development and testing of SME-specific cloud models and guidance, and cases studies focused on experiences of SMEs during the cloud migration process. Similarly, on a national scale, the provision of centres of expertise who offer vendor independent guidance and information to SMEs on cloud adoption would support more informed company decisions. The issue of broadband rollout remains important to ensure the necessary infrastructure is in place to support efficient exploitation of the power of cloud computing technology.

This exploratory cloud study will be expanded into other regions, more focused on the KIBS sector and using a larger sample size. In addition, a qualitative approach will also be incorporated in an effort to gain a richer picture of the current state of play with regard to cloud adoption by the SME.

6. Acknowledgement

I am really grateful to my research supervisor Er. Rajeev Yadav (Professor, Rajasthan College of Engineering for Women - Jaipur), Rajasthan Technical University of Kota as well as Department of Computer Science And Technology of Rajasthan College of Engineering for Women - Jaipur for all kinds of support and encouragement to carry out this research work.

References

- Adams, S. and Deans, K.R. (2000). Online Business in Australia and New Zealand: crossing a chasm, in Treloor, A. and Ellis, A. (Eds) *Proceedings of AUSWEB2K, The Sixth Australian World Wide Web Conference*, Southern Cross University, Lismore, 12-17th June, Cairns, pp.19-34.
- Akamai's('State of the Internet';2016) Retrieved from: <http://www.startupstalk.org/india-ranks-114th-in-global-internet-speed-south-korea-tops/> (Accessed Mar 24, 2016)
- Aljabre, A. (2012). Cloud computing for increased business value. *International Journal of Business and Social Science*, 3(1), 234-239.
- Armbrust, M., Fox, A., Griffith, R., Joseph, A.D., Katz, R., Konwinski, A., Lee, G., Patterson, D., Rabkin, A., Stoica, I. and Zaharia, M. (2010). A view of cloud computing. *Communications of the ACM*, 53, 50-58.
- Avison, D., Jones, J., Powell, P. and Wilson, D. (2004). Using and validating the strategic alignment model. *Journal of Strategic Information Systems*, 13, 223-246.
- Bharadwaj, A. (2000). A resource based perspective on Information Technology and firm performance: an empirical investigation. *MIS Quarterly*, 24(1), 169-196.
- Boynton, P.M and Greenhalgh, T. (2004), Selecting, designing, and developing your Questionnaire, *British Medical Journal*, 328, 1312-1315.
- Caldeira, M.M. and Ward, J.M. (2003). Using resource-based theory to interpret the successful adoption and use of information systems and technology in manufacturing small and medium-sized enterprises. *European Journal of Information Systems*, 12, 127-141.

- Chan, Y.E., Huff, S.L., Barclay, D.W. & Copeland, D.G. (1997). Business strategic orientation, Information Systems strategic orientation, and strategic alignment. *Information Systems Research*, 8(2), 125-150.
- Chuang, T.T., Nakatani, K., & Zhou, D. (2009). An exploratory study of the extent of Information Technology adoption in SMEs: an application of upper echelon theory. *Journal of Enterprise Information Management*, 22(1/2), 183-196.
- Conway, G. and Curry, E. (2012). Managing cloud computing – a lifecycle approach. *Proceedings of the 2nd International Conference on Cloud Computing and Services Science*. April 18-21st, Porto, Portugal.
- Doherty, E. (2012). Broadband adoption and diffusion: A study of Irish SMEs, *PhD Thesis*, University of Ulster, Coleraine.
- Ecorys (2012). EU SMEs in 2012: at the Crossroads. Retrieved from: http://ec.europa.eu/enterprise/policies/sme/facts-figures-analysis/performance-review/files/supporting-documents/2012/annual-report_en.pdf
- ENISA (2009). Cloud computing: benefits, risks and recommendations for information security. Retrieved from: <https://www.enisa.europa.eu/publications/cloud-computing-risk-assessment>
- Frary, R.B. (1996). Hints for designing effective questionnaires, *Practical Assessment, Research & Evaluation*, 5, (3), 1-6.
- Gartner (2016). Gartner Says Worldwide Public Cloud Services Market Is Forecast to Reach \$204 Billion in 2016. Retrieved from <http://www.gartner.com/newsroom/id/3188817> (Accessed 14th March 2016).
- Gecky, P., Izumi, N. and Hasida, K. (2012). Cloudsourcing: managing cloud adoption. *Global Journal of Business Research*, 6(2), 57-70.
- Gregor, S., Martin, M., Fernandez, W., Stern, S. & Vitale, M. (2006). The transformational dimension in the realization of business value from Information Technology. *Journal of Strategic Information Systems*, 15, 249-270.
- Goscinski, A. & Brock, M. (2010). Toward dynamic and attribute based publication, discovery and selection for cloud computing. *Future Generation Computer Systems*, 26, 947-70.
- Harrigan, P. (2008). Technology innovation in marketing: e-crm in Irish SMEs, *PhD Thesis*, University of Ulster, Coleraine.
- Harrigan, J.A., Rosenthal, R., and Scherer, K. (2008). *New Handbook of Methods in Non-Verbal Behaviour Research*. Oxford University Press.
- Henderson, J.C. and Venkatraman, N. (1992). Strategic alignment: A model for organizational transformation through technology. In Kochan, T.A. and Useem, M. (Eds), *Transforming Organizations*, Oxford University Press, Oxford.
- Iacovou, C.L., Benbasat, I. and Dexter, A.S. (1995). Electronic Data Interchange and small organizations: adoption and impact of technology. *MIS Quarterly*, December, 465-485.
- Iyer, B. and Henderson, J.C. (2010). Preparing for the future: understanding the seven capabilities of cloud computing. *MIS Quarterly Executive*, 9(2), 117-131.
- Kundra, V. (2011). Federal cloud computing strategy. Retrieved from: <http://www.cio.gov/documents/federal-cloud-computing-strategy.pdf>. (Accessed 12th June 2012).
- Kynetix Technology Group (2009). Cloud computing – a strategy guide for board level executives. Retrieved from: Microsoft Downloads. (Accessed 12th June 2012).
- Leimeister, S., Riedl, C., Bohm, M., and Krcmar, H. (2010). The business perspective of cloud computing: actors, roles and value networks. *Proceedings of the 18th European Conference on Information Systems*. 7th-9th June, Pretoria, South Africa.
- Loebbecke, C., Thomas, B., and Ulrich, T. (2012). Assessing cloud readiness at Continental AG. *MIS Quarterly Executive*, 11(1), 11-23.
- Luoma, E. and Nyberg, T. (2011). Four scenarios for adoption of cloud computing in China. *Proceedings of the European Conference on Information Systems*. Retrieved from: <http://aisel.aisnet.org/ecis2011/123> (Accessed 14th July 2013).
- McAfee, A. (2011). What every CEO needs to know about the Cloud. *Harvard Business Review*. November, pp124-132.
- McCole, P. and Ramsey, E. (2004). Internet-enabled Technology in Knowledge Intensive Business Services, *Marketing Intelligence and Planning*, 22, (6/7), 761-779.
- Mell, P. and Grance, T. (2011). The NIST definition of cloud computing, recommendations of the National Institute of Standards and Technology, Special Publication 800-145. Retrieved from: csrc.nist.gov/publications/nistpubs/800-145/SP800-145.pdf (Accessed 12th June 2012).
- Neves, F.T., Marta, F.C., Correia, A.M, Neto, M. (2011). The adoption of cloud computing by SMEs: identifying and coping with external factors. *Proceedings of the 11th Conference of the Portuguese Association of Information Systems*. 19th-21st October, Lisbon, Portugal. Retrieved from: http://run.unl.pt/bitstream/10362/6166/1/Neves_Marta_Correia_Neto_2011.pdf. (Accessed 3rd February 2012).
- Nguyen, T.H. (2009). Information Technology adoption in SMEs: an integrated framework. *International Journal of Entrepreneurial Behavior and Research*, 15(2), 162-186.
- Pemmaraju, K. (2010). Cloud Adoption: the difference between small and large companies. *Sand Hill Group*.
- Peppard, J. & Ward, J. (2004). Beyond Strategic Information Systems: towards an IS capability. *Journal of Strategic Information Systems*, 13, 167-194.
- Piccoli, G. & Ives, B. (2005). IT-dependent strategic initiatives and sustained competitive advantage: a review and synthesis of the literature. *MIS Quarterly*, 29(4), 747-776.
- Point Topic (2011). South Korea Broadband Overview, *Operator Source*. Retrieved from: <http://point-topic.com/content/operatorSource/profiles2/south-korea-broadband-overview.htm> (Accessed 25th July 2011).
- Pyke, J. (2009). Now is the time to take the cloud seriously. White Paper. Retrieved from: www.cordys.com/cordyscms_sites/objects/bb1a0bd7f47b1c91ddf36ba7db88241d/time_to_take_the_cloud_seriously_online_1_p_df. (Accessed 16th January 2012).
- Ramsey, E., Ibbotson, P. & McCole, P. (2008). Factors that impact technology innovation adoption among Irish professional service sector SMEs. *International Journal of Innovation Management*, 12(4), 629-654.

- Ray, G., Muhanna, W.A. & Barney, J.B. (2005). Information Technology and the performance of the customer service process: a resource-based analysis. *MIS Quarterly*, 29(4), 625-652.
- Saunders, M., Lewis, P. and Thornhill, A. (2007). *Research methods for business students*. Prentice Hall, Harlow.
- Silverman, D. (2005). *Doing qualitative research*. Sage Publications, London.
- SIM Advanced Practices Council (2011). Wisdom of clouds: learning from users. Retrieved from: <https://simnet.site-ym.com/store/default.asp> (Accessed 14th July 2012).
- Son, I., Lee, D., Lee, J., and Chang, Y. (2011). Understanding the impact of IT service innovation on firm performance: the case of cloud computing. *Proceedings of the PACIS 2011*. Retrieved from: <http://aisel.aisnet.org/pacis2011/180>. (Accessed 14th July 2012).
- Street, C. and Meister, D.B (2004). Small business growth and internal transparency: the role of Information Systems. *MIS Quarterly*, 28(3), 473-506.
- Su, N. (2011). Emergence of cloud computing: an institutional innovation perspective. *Proceedings of the 32nd*
- Thong, J. (1999). An integrated model of information systems adoption in small business. *Journal of Management Information Systems*, 15(4), 187-214.
- Van Selm, M. and Jankowski, N.W. (2006). Conducting online surveys, *Quality and Quantity*, 40, 435-456.
- Weible, R. and Wallace, J. (1998). Cyber research: the impact of the Internet on data collection, *Market Research*, 10 (3), 19-31.
- Yang, H. and Tate, M. (2009).

