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Proceedings of the 7th European Conference on Information Management and Evaluation

Faculty of Management

University of Gdańsk, Poland

12-13 September 2013

Edited by

Przemysław Lech

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Sopot
Poland

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Many thanks to the reviewers who helped ensure the quality of the full papers.

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E-Book ISBN: 978-1-909507-57-9
E-Book ISSN: 2048-8920
Book version ISBN: 978-1-909507-55-5
Book Version ISSN: 2048-8912
CD Version ISBN: 978-1-909507-58-6
CD Version ISSN: 2048-979X

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Understanding and Supporting Cloud Computing Adoption in Irish Small and Medium Sized Enterprises (SMEs)

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Abstract: Cloud Computing adoption has experienced a considerable rate of growth since its emergence in 2006. In 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 the cloud computing adoption phenomenon has to date primarily focused on its impact on the larger, multinational enterprises. However, one key area of the market where cloud computing is expected to hold considerable promise is that of the Small and Medium Sized Enterprise (SME). SMEs are recognized as being inherently different from their larger enterprise 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 of the financial burden associated with new technology adoption. This paper reports findings from a recent study of Cloud Computing adoption among Irish SMEs. Despite its suggested 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 the cloud lifecycle. These 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 paper puts forward recommendations to support the SME cloud adoption journey.

Keywords: cloud computing, SMEs, cloud adoption readiness, cloud non-adoption reasons

1. Introduction

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). McAfee (2011) regards Cloud Computing as "*a sea change—a deep and permanent shift in how computing power is generated and consumed. It's as inevitable and irreversible as the shift from steam to electric power in manufacturing*". Cloud Computing has evolved to become the top technology priority for organisations worldwide (Gartner, 2011). The estimated figure for cloud services worldwide in 2013 is $44.2bn (ENISA, 2009). 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).*

Because 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 in developing this paper, 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).

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. SMEs are an important and integral component of every country; they form a cornerstone of the EU economy, representing

99% of all enterprises. In the Republic of Ireland SMEs represent 98% of all companies employing less than 50 people, and constitute approximately 60% of the overall workforce (Central Statistics Office, 2008). Given the pivotal role SMEs play in the European economy, ensuring that they have a firm understanding of issues associated with cloud computing adoption is critical.

This paper presents results of an exploratory study on the cloud computing phenomenon in the Irish SME context. The structure of this paper is as follows: Section two outlines the methodological approach taken. Section three outlines survey findings. For those SMEs who have adopted Cloud Computing, the paper examines the steps those organizations have taken in preparing for migration to the cloud environment (section 3.2). For those SMEs who have not taken steps towards adopting Cloud, the paper examines the reasons behind this non-adoption (section 3.3). 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

The following are the research questions addressed in this paper:

- What degree of preparation do SMEs undertake prior to adopting Cloud Computing?
- What factors/reasons deter SMEs from adopting Cloud Computing?

This study employed a quantitative research approach. The merits of the questionnaire are linked to its ability to provide quantified data for decision-making, it provides a transparent set of research methods, it supports the presentation of complex data in a succinct format; and it provides the opportunity to apply a comparable methodology across longitudinal studies. This quantitative study was conceptualized from a theoretical base in order to ensure that the instrument employed in this process had prior validity, reliability and was appropriately designed to address and answer the research questions.

In developing questionnaire constructs, a detailed review of existing literature which focuses on reasons for technology adoption/non adoption, as well as readiness for new technology adoption was undertaken. This literature helped to frame the questionnaire's constructs - these constructs were then 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 a 5-point Likert scale. 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.

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 Ireland.

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.

3. Findings

3.1 Profile of respondents

The survey provided 95 usable responses. Each respondent organization was located in Ireland and employed less than 250 individuals. 70 percent (n=66) were micro-sized firms; 26 percent (n=25) were small firms, while 4 percent (n=4) were of medium size (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. 39 percent (n=37) were from the service sector, while only 13 percent (n=12) were from manufacturing.

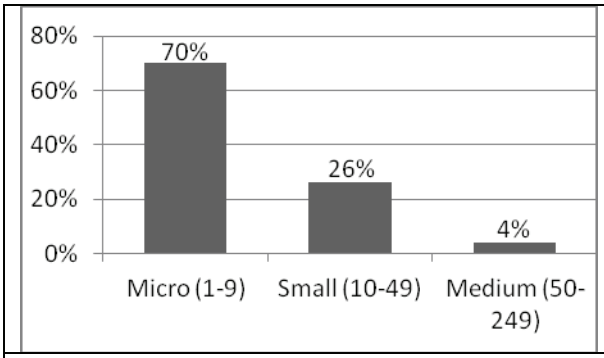

Figure 1: Respondent profile by firm size

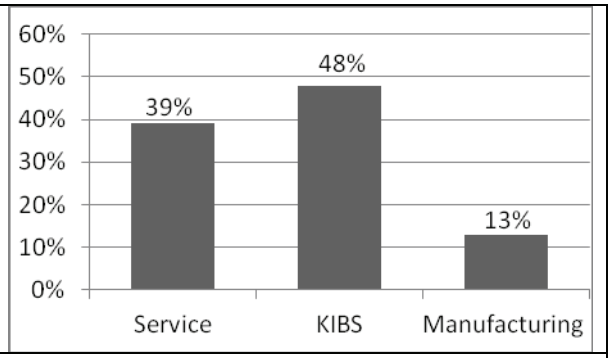

Figure 2: Respondent profile by sector

3.2 Adoption of cloud computing among SMEs – how prepared are they?

45 percent (n=43) of the survey respondents had adopted Cloud Computing; the most popular business service/process they had migrated to the cloud were email (40 percent, n=38), followed by sales and marketing (15 percent, n=14), CRM (11 percent, n=10), R&D (10 percent, n=9), finance (8 percent, n=8), software applications development (6 percent, n=6) and purchasing/ procurement (2 percent, n=2).

This section carefully considers the degree to which these respondent firms 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). Only 40 of the SMEs provided insight into the steps they took when migrating to the cloud.

Respondents were presented with a series of statements outlining possible steps to support cloud migration, and were asked to rate the extent to which these statements applied to their firms cloud adoption journey on a 5-point Likert scale (Figure 3). The findings indicate that three key areas received the greatest degree of attention from SMEs 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

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). 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.

48 percent of firms (n=19) 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.

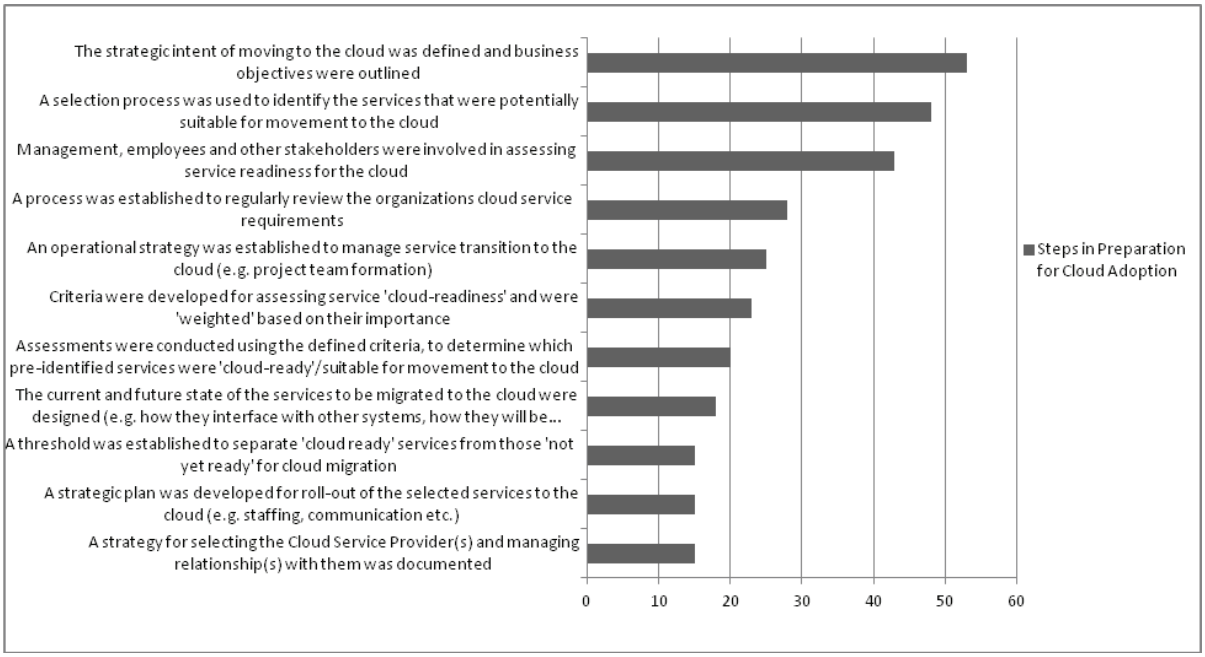

Figure 3: SMEs preparation for cloud adoption

43 percent of the survey respondents (n=17) 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. Previous studies by Caldeira and Ward (2003) highlight that top management attitudes and perspectives towards IT adoption explain differences in the levels of success achieved. 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.

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 followed less frequently by the survey respondents.

- 28 percent (n=11) established a process to regularly review the organizations cloud service requirements,
- 25 percent (n=10) established an operational strategy to manage service transition to the cloud,
- 23 percent (n=9) developed criteria for assessing service cloud-readiness,
- 20 percent (n=8) conducted assessments using the defined criteria, to determine which pre-identified services were cloud-ready,
- 18 percent (n=7) indicated that they considered/designed the current and future state of services to be migrated to the cloud.
- 15 percent (n=6) established a threshold to separate cloud ready services from those not yet ready for cloud migration,
- 15 percent (n=6) established a strategic plan for roll-out of the selected services to the cloud,
- 15 percent (n=6) documented a strategy for selecting the Cloud Service Provider(s) and managing relationship(s) with them.

3.3 Non-adoption of cloud computing among SMEs

48 percent (n= 46) of the respondent SMEs had not migrated any services or processes to the cloud environment. These cloud 'non-adopters' were primarily (54 percent, n=25) those firms from the services sector. This is a particularly interesting finding given the fact that Cloud Computing is reported in the literature

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. Survey respondents reasons for not adopting cloud computing are reported in this section (insights provided by 40 SMEs). Respondents were presented with a series of statements outlining possible reasons for not adopting Cloud Computing, and were asked to rate the extent to which these statements applied to their firms on a 5-point Likert scale (Figure 4).

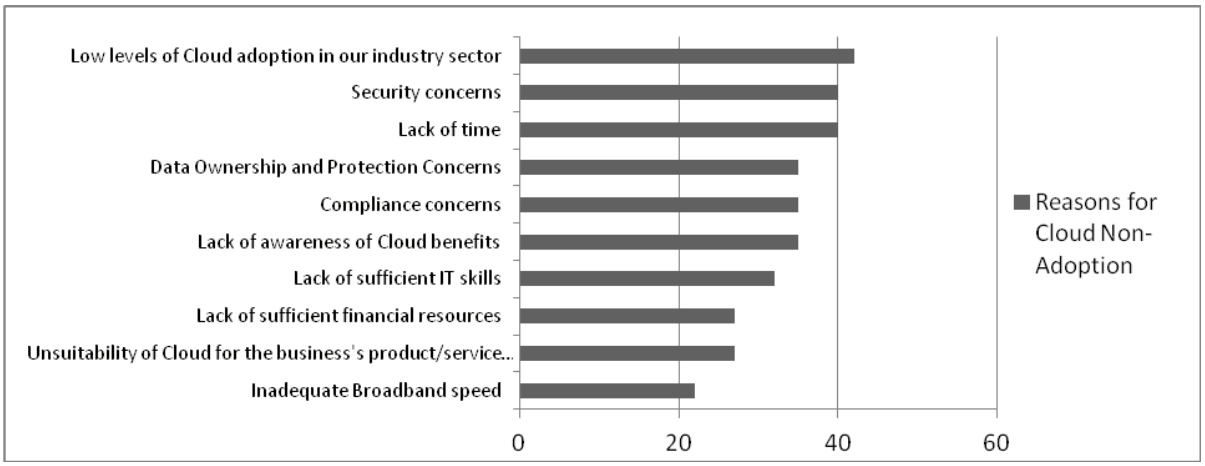

Figure 4: Reasons for not adopting cloud computing

40 percent of the respondents reported a lack of time as a key deterrent to the adoption process, while a further 32 percent 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 respondents. 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).

27 percent of the survey respondents felt that they had insufficient financial resources to support Cloud migration; to the authors this perceived barrier or reason for not adopting Cloud Computing highlights a lack of understanding of the cloud environment and how it can alleviate some SME financial concerns. 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.

22 percent of the survey respondents suggested 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). In relation to availability of a good quality Internet or broadband infrastructure, the Republic of Ireland's telecommunications market was late to open up to competition and only initiated broadband rollout in 2002 (Doherty, 2012). This slow start may have contributed to the fact that by 2006 the country had one of the lowest rates of broadband penetration in Europe (Point Topic, 2011). More recently, the Irish government have adopted an aggressive interventionist approach to broadband rollout (Doherty, 2012) and combined with the fact that Ireland has one of the youngest demographics in Europe, 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 OECD (2010) report where Ireland was ranked 22nd out of 33 countries in terms of fixed line broadband penetration rates and received the lowest ranking in Europe in terms of its average broadband speed (OECD, 2010).

4. What are the Implications of these survey findings? – recommendations for improvement

Analysis of the findings on SMEs preparation for cloud adoption, as well as the reasons for SMEs not adopting Cloud, result in some interesting implications. 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 between 43 percent and 53 percent 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 23 percent developed criteria for assessing cloud service readiness and only 20 percent used those criteria to assess actual cloud readiness. Other important preparation steps were poorly followed. For example, only 15 percent established a strategic plan for roll-out of the selected services to the cloud, and documented a strategy for selecting the Cloud Service Provider(s) and managing relationship(s) with them. The low levels of 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.

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.

Further, the reasons for cloud non adoption are quite varied. All of the following findings point to a lack of awareness and education surrounding cloud computing. For example, 27 percent of the survey respondents felt that they had insufficient financial resources to support Cloud migration; 40 percent reported a lack of time as a key deterrent, while a further 32 percent suggested they did not have the necessary IT skills to support migration; 35 percent were unaware of any Cloud Computing benefits, while others perceived it was not suitable for their product/service offering, or was not adopted within their industry sector.

Recommendation: A more concerted awareness/education campaign targeting Irish SMEs, on the inherent characteristics and benefits associated with cloud computing needs to be rolled out nationally. 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.

A particularly interesting finding from the SME context was the perception of some SMEs (22 percent) that their broadband speed was inadequate. Absence of a stable, high quality Internet connection is a key deterrent. As previously outlined, in a recent OECD (2010) report, Ireland ranked 22nd out of 33 countries in terms of fixed line broadband penetration rates and received the lowest ranking in Europe in terms of its average broadband speed. Despite strong broadband growth being experienced in recent years, Ireland's poor ranking is particularly concerning given the current economic climate and the fact that Ireland is a peripheral economy, both in the European Union (EU) and in global market terms (Doherty, 2012).

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 Irish 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 far from reaching generalisable conclusions. Nonetheless, the insights gained from the Irish 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 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.

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