

CLOUD COMPUTING ADOPTION

An Exploratory Study

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Abstract: The growing adoption of cloud computing is changing the way business information systems are developed, scaled up, maintained and paid for. This not only applies to large organisations, but also increasingly to small and medium-sized businesses (SMEs). In particular, cloud computing promises to improve the reliability and scalability of IT systems, which allows SMEs to focus their limited resources on their core business and strategy. In the SME context, technology adoption and usage decisions are influenced by many factors. This paper attempts to conceptualize cloud computing adoption and to enhance understanding of the range of factors affecting cloud computing adoption decision making in SMEs. Based on semi-structured interviews with SMEs and service providers in the North East of England, a number of factors were examined and found to affect the adoption process. By adopting the TOE framework as a theoretical basis, it has been found that cloud computing adoption decision is influenced by different types of factors and therefore, is not exclusive to one or two dimensions e.g. technological and organisational contexts, as presented in some previous ICT adoption studies. The main factors that were identified playing a significant role in SME adoption of cloud services were: relative advantage, uncertainty, geo-restriction, compatibility, trialability, size, top management support, innovativeness, industry, market scope, supplier efforts and external computing support. These findings have important implications and great value to the research community, business practitioners, and policy makers in terms of formulating better strategies for cloud computing adoption. For service providers, using the research model in this study can assist in increasing their understanding of why some SMEs choose to adopt cloud computing services. In this study, the authors present empirical evidence from Northeast of England where limited research efforts have taken place.

1 INTRODUCTION

The use of information and communication technologies (ICT) can improve business performance, and has provided many new opportunities for small and medium sized enterprises (SMEs, firms with 1-250 employees), enabling them to compete with large firms (Alberto and Fernando, 2007; Swash, 1998). In the United Kingdom, SMEs represent the vast majority of all enterprises, 99% according to BIS (2010), a figure which is not atypical for virtually all countries. In the new global market, ICT has become a central issue for competitiveness among SMEs (Harindranath et al., 2008). Cloud computing is not only of interest for large businesses, but also for small and medium-sized ones too (Jain and Bhardwaj, 2010), since they tend to have more limited resources in terms of time,

money and expertise (Wymer and Regan, 2005; Cragg and King, 1993). In-house IT requires specialised staff to plan, design, implement, and manage increasingly complex hardware, software, and networking equipment (Thinkstrategies, 2002). Some of the promised benefits from cloud computing can be very appealing for SMEs, which need to ensure they maximise their return on investment and remain competitive in an ever more demanding business environment. Despite their importance, limited research has studied the adoption, implementation and usage of ICT in the small enterprises within the UK context (Harindranath et al., 2008; Shiels, 2003). This paper seeks to contribute to a growing body of research on cloud computing, by studying the SME adoption process. Reviewing the literature concerning ICT innovation adoption present numerous studies about

different technologies, in turn, these studies list tens of factors that have been used to study the technology adoption decision of organisation. One criticism of much of the literature is the method of choosing the main factors that will be used in particular research. Therefore, the main research objective of this paper was to study the cloud computer adoption process. More specifically, our main research question was what are the major factors that influence the likelihood of cloud computing adoption in SMEs. The North East of England was selected for this study as it is a region that aspires to become home to innovative digital firms. After defining cloud computing, the literature review will be presented and the theoretical framework adopted in this study is discussed in detail. This is followed by a description of the study's overall research design and methodological issues. The paper continues by presenting the study's main findings, before highlighting future research avenues.

2 PREVIOUS STUDIES AND THIS RESEARCH

2.1 What is Cloud Computing?

Cloud computing services have been defined in many different ways. For instance, Buyya et al (2008, p.2) defined cloud computing as *"a type of parallel and distributed system consisting of collection of interconnected and virtualised computers that are dynamically provisioned and present as one or more unified computing resource based on service-level agreements established through negotiation between service provider and customer"*. Plummer et al (2008, p.3) defined cloud computing as *"a style of computing where massively scalable IT-related capabilities are provided as a service using Internet technologies to multiple external customers"*. According to Leimeister et al (2010) various researchers refer to cloud computing as a new paradigm and emerging technology, while others believe it is not really a new concept, as it uses traditional computing technologies. Either way, the on-demand computing model is expected to influence the way many enterprises approach IT-related services. IDC predict that spending on public IT cloud services will grow from \$16.5 billion in 2009 to over \$55 billion in 2014 (Gens, 2010). In turn this can help businesses improve the creation and delivery of IT solutions, by enabling them to access computing services more flexibly and

at reduced cost (Jain and Bhardwaj, 2010).

2.2 Theoretical Background

On a firm level, theories such as diffusion of innovation (Rogers, 2003) have been widely applied to studies looking at how innovations are adopted and diffused. In this paper we will use the Technology, Organisation, and Environment (TOE) framework put forward by Tornatzky and Fleischer (1990) for a number of reasons. First of all, the TOE framework is based on the Diffusion of innovation theory. Oliveira and Martins (2011) suggest that as the TOE framework includes the environment context, which is not included in the Diffusion of innovation theory, the former becomes better able to explain intra-firm innovation adoption. For them, the TOE framework has a solid theoretical basis, consistent empirical support, and the potential of application to IS adoption. Also, Rui (2007, p.13) notes that *"compared to Rogers' innovation diffusion model, the TOE framework (or those TOE-like frameworks) overcomes the domination of the technical perspective and provides a useful analytical tool to distinguish between the inherent qualities of an innovation and the motivations, capabilities, and broader environmental context of the adopting organisation"*. Finally, TOE has been applied successfully to numerous studies, for instance, Iacovou (1995) and Kuan and Chau (2001).

3 METHODOLOGY

This paper's main research objective is to study the cloud computing adoption process by SMEs in the North East of England. More specifically, our research questions aim to examine which factors and to what extent each of these factors influence the cloud adoption decision making by SMEs. For this exploratory work, a qualitative study was deemed appropriate as it enables deeper analysis of the underlying factors. Such an approach can then pave the way for an explanatory quantitative approach. With the purpose of exploring the impact of TOE factors on SME adoption of cloud computing services, initial empirical work using semi-structured interviews as the data collection method was conducted, as they can provide the necessary flexibility needed in an exploratory study. Sarosa (2007) suggest that using semi-structured interviews in the context of a qualitative approach may facilitate exploring all the factors and the communication of all stakeholders within an ICT

innovation adoption process.

Interviews opened with a discussion of the firm's background and key business activities. It then moved on to probe their currently adopted ICT technologies and discussed the major factors that affected their cloud computing adoption decision making process. Studies that adopt the TOE model have attracted criticism due to the way they pick and choose from a list of attributes that have been empirically tested on other IS innovations (Ramdani and Kawalek, 2007b). In order to avoid such bias, participants had the opportunity to discuss those factors they thought were of importance in their own cases, instead of structuring the discussion around the TOE attributes. When it came to participants (Table 1), using Rogers' adopter categorization, on the basis of innovativeness, nine cases have been categorized into three main groups. These were the service providers (F1-F3), SMEs that had already adopted cloud computing services (adopters) (F4-F6) and SMEs that intended to adopt cloud computing services in the next 3 years (prospectors) (F7-F9). To overcome the pro-adoption bias, this study focuses on both adopters and prospectors of cloud computing services. Moreover, cloud computing providers who participated in this research project were chosen to be providers for a variety of computing services, not just cloud services.

Table 1: Participant information.

| # | Industry | Adoption Stage | Interviewee's Position |
|----|-----------|-----------------|-------------------------------|
| F1 | IT | Provider | Operations Manager- for Cloud |
| F2 | IT | Provider | Managing Director |
| F3 | IT | Provider | Technical Services Director |
| F4 | Education | Already adopted | Technical Director |
| F5 | Financial | Already adopted | Electrical Department Manager |
| F6 | Legal | Already adopted | Quantum- Marketing Manager |
| F7 | Education | Prospector | Scientific Facilities Manager |
| F8 | Legal | Prospector | IT Manager |
| F9 | Retail | Prospector | Technical Manager |

4 FINDINGS & DISCUSSION

4.1 Technological Context

Relative Advantage: Firms are more likely to adopt Innovation when they perceive an innovation as offering a relative advantage (Lee, 2004). To do so, though, SMEs need to have a clear understanding of

the relative advantages of cloud services. In the current study, prospectors have referred to their late reaction to the lack of awareness about this type of service. Organisations that have already adopted cloud services (F4, F5, and F6) were aware of the benefits of this type of service. F8 and F9 justified their interest in cloud services, stating their expectation that cloud computing services could make them more effective and competent. For instance, cloud scalability and mobility could provide them with more control over their operations. Hinder

Uncertainty & Geo-restriction: Unlike previously studied ICT innovations for instance (Ramdani and Kawaiek, 2007a; Thong, 1999) it was found that SME adoption of cloud computing services is highly dependent on the level of uncertainty. Participants raise several points that can possibly cause concern about adopting cloud computing services. Among these one could mention security, privacy, geo restriction, accessibility, and vendor lock-in, with the first three being the most important ones. Service provider F3 confirmed that it was understandable that privacy and relinquishing total ownership are concerns for businesses, when considering adopting cloud computing. This may be addressed by building relationships with trusted service providers. As one of the participants stated: *"Yes, for sure, I appreciate that you feel like someone else has your data, but there has to be an element of trust"* (F9). The majority of early adopters and prospectors (F5, F6, F7, and F9) actually stated that they trusted service providers, which is of critical importance to adoption.

Much of the uncertainty around cloud computing was how data is handled and where it is stored. Adopting cloud services imply submitting information and computing operation to a remote vendor. Vendor can be local or national, and most often international. In turn this can generate concerns regarding the Differences in legislation across countries, data production policies, disaster recovery issues etc. As a result, a new factor, geo-restriction, was identified and found to be crucial for SMEs when considering adopting cloud computing services. This is clearly reflected in the answer by F2 *"Some companies that are hugely concerned about the sensitivity of data will be concerned about: where is our data, is it in UK? Or in Europe? Is it in USA? And sometimes, this is a big obstacle to overcome."* F5 agreed, stating that *"the confidentiality of our users' data, no chance we can put them at risk, or send them to other country"*. Early adopters and prospectors tend to underline this

point in any negotiation with service providers. Some SMEs might show no tolerance regarding this issue (F2, F4, F5, and F6). In summary this exploratory study has found evidence of a relationship between the adoption decision and uncertainty about cloud computing services. Still more explanatory research would have been useful to further our understanding on this front.

Compatibility & Complexity: SMEs expect adopted cloud services to be compatible and easy-to-use. Early adopters F5 and F6 expressed their satisfaction about the level of compatibility and complexity using cloud services. For prospectors (F7, F9), they expect it to be comfortable to use, at least after a short period of adoption. Cloud service providers claimed that most cloud services seem to be consistent with the firm's values and technology needs.

Trialability: In terms of the impact of the trialability, it was found to be particularly useful for the clients to try the product before the implementation, and this impacted on the adoption decision. This was the case for all participants, except for F4, which had the intention to adopt cloud services even before trying the product: *"Yes we tried it, but the intention was always there to use it. So it did not affect the adoption decision"*. Both early adopters and prospectors asserted that trialability affected their decision in a positive way. It appears that trying the technology helps reinforce the SME's choice.

4.2 Organisational Context

Organisation size: Organisation size has been shown to be a major factor in adopting ICT innovations in many previous studies. Start-ups and small businesses were found to be inclined to adopt cloud services. According to the data from the interviews (e.g. service provider F1, early adopter F5, and prospectors F7, F9), organisational size was found to be an important parameter for start-ups and small businesses, enabling them to change direction quickly and to be more flexible if needed. As F7 stated: *"we are a very small group , and we are controlling our destiny , and it's easy for us to do whatever we want...so yes, we are quite eligible in that respect"*.

Top management support: Regarding top management commitment and support, our findings are consistent with those of Ramdani and Kawaiek, (2007)a; Lertwongsatien and Wongpinunwatana, (2003); who found that without top management support, SMEs are less likely to adopt new

technologies. Services providers (F1, F2) noted that in many cases, it was the firm's chief executive and managing director who heard about the cloud and encouraged IT staff to investigate it further. In contrast, adopters and prospectors (F5, F6) stated that it was the IT department staff who suggests the adoption of cloud computing services, which was then supported by the top management team.

Prior experience and familiarity: This was another new factor identified in the responses of different types of participants in this study. Apart from F5, who stated that this factor has nothing to do with their adoption decision as a company, service providers, adopters and prospectors agreed that using similar technology, in particular, virtualization services, make adopters more comfortable with cloud services, as they are already familiar with these types of services: *"we had a virtual environment internally in the organisation and that was there for some time ... so yes, I guess it did."* (F9).

4.3 Environmental Context

Market scope and Industry: In the context of SME adoption of cloud services, it was found that this varied from industry to industry. Business industry was one of the organisational characteristics that Goode and Stevens (2000) listed as consistently associated with the adoption of technology. Both adopters (F4, F5 and F6) and prospectors (F7, F8) mentioned that cloud services are more relevant to sectors that have high computing requirements, typically related to the nature of the business operations in those sectors. Also, it was found that the wider the market area in which an SME operates, the more likely it is to adopt cloud services to support its business operations.

Competitive pressure: When it came to considering competitive pressure as a potential motivation for adoption, most of those interviewed (F4, F5, and F7) indicated that they did not consider this a significant factor. Unlike other previously studied IT innovations e.g. Crook and Kumar (1998); Grover (1993) competitive pressure is shown not to be an important factor for SMEs when making the adoption decision. Service provider (F3) defends this result on the basis that SMEs have bigger issues to consider when making the adoption decision beyond the competitive pressure.

Supplier efforts and external computing support: In-line with previous studies (Lippert and Forman, 2005; Hunter, 1999; Igarbaria et al., 1995) which demonstrate the availability of external

support to be positively related to adoption, in this study, the majority of participants who belong to provider, adopter and prospector groups, emphasised the importance of supplier efforts and external computing support in the decision making process.

4.4 Discussion

New technologies are expected to bring significant benefits and value to a company, well beyond those that already-adopted technologies deliver. Therefore, relative advantage is often used as a significant indicator in the ICT innovations literature (Chaudhury and Bharati; 2008, Ramdani and Kawaiek, 2007a; Lee, 2004; Thong, 1999). The client's innovativeness and self-motivation are sometimes not always enough; awareness and understanding of these advantages is important for the adoption decision. This draws the attention to the importance of the role that supplier marketing efforts can have.

Although in most cases in this study, early adopters and prospectors tended to rely on the element of trust in the service providers, uncertainty was still a serious hindering factor for adoption. Cloud security, privacy and giving ownership are main concerns for businesses. Moreover, the location of the data-centre was found to be a key issue in any negotiation between SMEs and service providers. A possible explanation for this might be that SMEs have a preference for their data to be physically stored in the UK, ensuring that cloud data-centres are subject to UK laws and legislation. Differences in legislation across countries can be significant enough to create a sense of uncertainty and to be a main barrier for cloud computing adoption and diffusion among SMEs. An important implication arising from this is that cloud computing providers need to carefully consider the location of their data centres. On the other hand, SMEs need to be aware about the legal issues stemming from data centre location and pay more attention to the services level agreement (SLA) in the first place to safeguard their rights. Taking these issues into consideration may lead to decreasing the level of uncertainty among SMEs.

Considering the organisational factors, prior experience or familiarity with similar technologies such as virtualization leads to an easier decision making process. Consumers gain a level of comparison from previous experience with similar services, or by a contrast of capabilities of the service with alternative services (Anjana et al., 2003; LaTour and Peat, 1979). Business size was one of

the organisational characteristics that Goode and Stevens (2000) listed as consistently associated with the adoption of technology. This factor has been found to apply equally well to large and small businesses (Goode and Stevens, 2000). In the case of small and start-up business, avoiding capital expenditure encourages them and increases their willingness to adopt the cloud. This is besides the fact that compared to large organisations, SMEs are more flexible. The present findings seem to be inconsistent with Low et al (2011), which found that larger firms have a higher probability of adopting cloud computing because they have more resources and may be better able to take on risk.

Finally, when it came to environmental factors, this study did not find any evidence that competitive pressure and observability were significant factors for adoption. This might simply be related to the low rate of diffusion for cloud computing among SMEs till now. Cloud service providers could encourage small businesses in many ways. For instance, they can allow them to try the product or service before committing to it, offering their customers the opportunity to determine the level of compatibility and complexity of the product. In turn this could help SMEs validate their choice and, therefore, reduce the perceived risks. Service providers can also demonstrate, using relevant successful case studies, the benefits of adopting cloud computing. Hence, this may lead to competitive pressure and observability needed for the diffusion. It is worth pointing out that given that in small businesses the CEO is often the owner-manager (Thong, 1999), in that case, sales pitches should not just be targeted to IT staff but also directly to the top management, for the reason that support and commitment from the top management team makes the company more likely to adopt new technologies. There was agreement among all participants in this study that innovativeness of the decision-maker or whether the organisational strategy was instilled with innovation had a great impact on the willingness to adopt new technologies. The nature of the sectors may also influence and in many cases even determine the level of IT infrastructure needed. This may explain why cloud computing may be more attractive for certain sectors but not others. Therefore, suppliers need to understand their clients' sectors and business first.

Finally, although adopters and prospectors underlined the importance of providers' activities to make SMEs adopt cloud services, in six cases of this study SMEs did not feel it was adequate until now. A possible explanation for this is the fact that at the

moment providers recognizes the changing IT industry-environment, and they are very active in order to be a facilitator for cloud services. At the same time, they have a lot of investment in in-house software and hardware. This can lead to an impression among stakeholders that cloud service providers themselves have no clear stance or vision about cloud computing. For instance, service provider (F2) did not hide the fact that they will not push SMEs in a specific direction, e.g. cloud computing: “Because we are not only a cloud computing provider, we don’t try to push them down a particular route”. Consequently, more research on this topic needs to be undertaken before discussing how service providers can play a role in cloud computing diffusion because clients would be affected by their service provider’s thought, and the extent to which the provider believes in the benefits that cloud computing can bring to their business.

5 CONCLUSIONS

“Computing services on-Demand” is gradually modifying the way information systems services are developed, scaled, maintained and paid for. The on-demand, pay-by-use method of cloud computing is based on a set of many pre-existing and well-researched trends such as utility computing, virtualization and Software-as-a-Service (SaaS). Although, many of the concepts do not appear to be new, the real innovation of cloud computing lies in the comprehensive way it provides computing services to the customer (Leimeister et al., 2010; Yadav and Zeng Wen, 2010). This study represents an early attempt to explore and develop an SME cloud computing adoption model that was theoretically grounded in the TOE framework. By adopting the TOE framework this study has shown that the three contexts of this framework (technological, organisational, and environmental) are connected to each other. In other words, cloud computing adoption is influenced by different types of factors and, therefore, is not exclusive to one or two dimensions e.g. technological & organisational contexts, as presented in some previous ICT adoption studies (e.g. Low et al., 2011). The main factors that were identified as playing a significant role in SME adoption of cloud services were: relative advantage, uncertainty, geo-restriction, compatibility, complexity, trialability, size, top management support, prior experience, innovativeness, industry, market scope, supplier efforts and external computing support. In contrast,

this study did not find any evidence that competitive pressure or observability were significant determinants of cloud computing adoption.

Future research could build on this study by examining cloud computing adoption in different sectors and industries and in different countries in both a qualitative and quantitative way. Given that SMEs are pervasive in all economies this will call for a careful selection of samples that can help provide a representative picture of cloud computing.

REFERENCES

- Alberto, B. M. & Fernando, L. L. 2007. A firm-level analysis of determinants of ICT adoption in Spain. *Technovation*, 27, 352-366.
- Anjana, S., Anitesh, B. & Andrew, B. W. 2003. Understanding the service component of application service provision: empirical analysis of satisfaction with ASP services. *MIS Q.*, 27, 91-123.
- BIS 2010. Statistical press release. Department for Business Innovation and Skills.
- Buyya, R., Chee Shin, Y. & Venugopal, S. Year. Market-Oriented Cloud Computing: Vision, Hype, and Reality for Delivering IT Services as Computing Utilities. *In: High Performance Computing and Communications, 2008. HPCC '08. 10th IEEE International Conference 25-27 Sept. 2008*. 5-13.
- Chaudhury, A. & Bharati, P. 2008. (2008). IT Outsourcing Adoption by Small and Medium Enterprises: A Diffusion Innovation Approach. *Proceedings of the Americas Conference on Information Systems (AMCIS)*.
- Cragg, P. & King, M. 1993. Small-firm computing: Motivators and inhibitors. *MIS Quarterly*, 17, 47-59.
- Crook, C. W. & Kumar, R. L. 1998. Electronic data interchange: a multi-industry investigation using grounded theory. *Information & Management*, 34, 75-89.
- Gens, F. 2010. IDC’s Public IT Cloud Services Forecast: New Numbers, Same Disruptive Story. IDC.
- Goode, S. & Stevens, K. 2000. An Analysis of the Business Characteristics of Adopters and Non-Adopters of World Wide Web Technology. *Information Technology and Management*, 11, 129-154.
- Grover, V. 1993. An Empirically Derived Model for the Adoption of Customer-based Interorganizational Systems*. *Decision Sciences*, 24, 603-640.
- Harindranath, G., Dyerson, R. & Barnes, D. 2008. ICT in Small Firms: Factors Affecting the Adoption and Use of ICT in Southeast England SMEs. *Proceedings of the 2008 European Conference on Information Systems (ECIS)*.
- Hunter, G. K. 1999. *Sales technology, relationship-forging tasks, and sales performance in business markets*. PhD, The University of North Carolina at Chapel Hill.

- Iacovou, C., Benbasat, I. & Dexter, A. 1995. Electronic Data Interchange and Small Organizations: Adoption and Impact of Technology. *MIS Quarterly*, 19, 465-485.
- Igbaria, M., Guimaraes, T. & Davis, G. B. 1995. Testing the Determinants of Microcomputer Usage via a Structural Equation Model. *Journal of Management Information Systems*, 11, 87-114.
- Jain, L. & Bhardwaj, S. 2010. Enterprise Cloud Computing: Key Considerations for Adoption. *International Journal of Engineering and Information Technology*, 2, 113-117.
- Kuan, K. & Chau, P. 2001. A perception-based model for EDI adoption in small businesses using a technology-organization-environment framework. *Inf. Manage.*, 38, 507-521.
- Latour, S. A. & Peat, N. C. 1979. Conceptual and Methodological Issues in Consumer Satisfaction Research. *Advances in Consumer Research*, 6, 431-437.
- Lee, G. & Xia, W. 2006. Organizational size and IT innovation adoption: A meta-analysis. *Information Management*, 43, 975-985.
- Lee, J. 2004. Discriminant Analysis of Technology Adoption Behavior: A Case of Internet Technologies in Small Businesses. *Journal of Computer Information Systems*, 44, 57-66.
- Leimeister, S., Riedl, C., Böhm, M., Krcmar, H. & 2010. The Business Perspective of Cloud Computing: Actors, Roles, and Value Networks. *In Proceedings of 18th European Conference on Information Systems ECIS 2010*.pp. 1-12.
- Lertwongsatien, C. & Wongpinunwatana, N. 2003. E-commerce Adoption in Thailand: An Empirical Study of Small and Medium Enterprises (SMEs). *Journal of Global Information Technology Management*, 6, 67-83.
- Lippert, S. K. & Forman, H. 2005. Utilization of information technology: examining cognitive and experiential factors of post-adoption behavior. *Engineering Management, IEEE Transactions on*, 52, 363-381.
- Low, C., Chen, Y. & Wu, M. 2011. Understanding the determinants of cloud computing adoption. *Industrial Management & Data Systems*, 111, 1006-1023.
- Oliveira, T. & Martins, M. 2011. Literature Review of Information Technology Adoption Models at Firm Level. *The Electronic Journal Information Systems Evaluation* 14, 110-121.
- Plummer, D. C., Bittman, T. J., Austin, T., Cearley, D. W. & Smith, D. M. 2008. Cloud Computing: Defining and Describing an Emerging Phenomenon. ed.: Gartner, Inc.
- Ramdani, B. & Kawaiek, P. 2007a. SME Adoption of Enterprise Systems in the Northwest of England: An Environmental, Technological and Organizational Perspective. *IFIP WG 8.6 - Organizational Dynamics of Technology-Based Innovation: Diversifying the Research Agenda*. Springer.
- Ramdani, B. & Kawalek, P. 2007b. SMEs & IS Innovations Adoption: A Review & Assessment of Previous Research. *Revista Latinoamericana de Administración*, 47-70.
- Rogers, E. 2003. *Diffusion of Innovations* New York, Free Press.
- Rui, G. 2007. *Information systems innovation adoption among organizations a match-based framework and empirical studies*. Degree of doctor of philosophy, National University of Singapore.
- Sarosa, S. 2007. *Information Technology Adoption Process within Indonesian Small and Medium Enterprises*. Doctor of Philosophy, University of Technology Sydney.
- Shiels, H., Mclvor, R., and O'reilly, D. 2003. Understanding the Implications of ICT Adoption: Insights from SMEs. *Logistics Information Management* 16, 312-326.
- Swash, G. 1998. UK business information on the Internet. *New Libarary World*, 99, 238-242.
- Thinkstrategies 2002. Solving the IT Challenges of Small and Mid-Size Organizations via "Utility Computing". THINKstrategies.
- Thong, J. 1999. An integrated model of information systems adoption in small businesses. *J. Manage. Inf. Syst.*, 15, 187-214.
- Tornatzky, L. & Fleischer, M. 1990. *The process of technology innovation*, Lexington, MA, , Lexington, Lexington Books.
- Wymer, S. A. & Regan, E. A. 2005. Factors Influencing e-commerce Adoption and Use by Small and Medium Businesses. *Electronic Markets*, 15, 438-453.
- Yadav, S. S. & Zeng Wen, H. 2010. CLOUD: A computing infrastructure on demand. *In: Computer Engineering and Technology (IC CET)*, 2010 2nd International Conference 16-18 April 2010. V1-423-V1-426.