

# Principles and practices for the implementation of Cloud based ERP in SMEs

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**Abstract.** Enterprise systems provide integrated information for all activities in an organization. These systems serve as a vital asset to any organization and hence it becomes mandatory to ensure their security. In the present scenario these services are offered on the cloud mainly to reduce inherent risk associated with the traditional enterprise systems. Cloud computing represents a significant shift in the way that IT resources are managed, operated, and consumed. This change exposes several benefits to enterprises, promoting greater IT efficiency and agility. This paper is intended to suggest a theoretical basis for studying the factors that influence SMEs' adoption of cloud computing. It will first explain the integration between the Technology-Organisation-Environment (TOE). Based on this technology innovation adoption process is influenced by three aspects of an enterprise's context. The technological context represents the internal and external technologies related to the organisation, both technologies that are already in use at the firm, as well as those that are available in the marketplace but not currently in use. These technologies may include either equipment or practice. The organisational context is related to the resources and the characteristics of the firm, e.g. size and managerial structure, while, finally, the environmental context refers to the arena in which a firm conducts its business; it can be related to surrounding elements such as industry, competitors and the presence of technology service providers. Enterprise Systems help in carrying out various tasks with greater operational efficiency and reliability. They also facilitate to keep information updated and available across the organization 24 \* 7. As enablers of successful business reengineering projects, they help the organizations to save money, keep their business data consistent, current and available, speed up business processes, and improve the quality and reliability of the processes.

## 1 Introduction

The Economy of underdeveloped countries mainly depends on Small and Medium sized Enterprises (SMEs). Small and medium sized enterprises (SMEs) form an essential ingredient of a country's economy as they are the main source of employment and technological development. They play a very important role in each market by significantly contributing to each country's Gross Domestic Product (GDP) and its labour market. Therefore proposing new strategies or developing new systems that can help SMEs become more efficient and productive is not only beneficial for SMEs but also for the economy as a whole. One of the strategies that can help SMEs become more efficient is the use of appropriate Information and Communication Technologies. The Size and structure of SMEs make them face many challenges. The main challenge is not to have access to enough resources (e.g. financial resources). According to THINK strategies (2002), various small businesses cannot afford the in-house staff needed to plan, design, implement, and manage increasingly complex software and hardware, and

networking kit in today's tough economic times, it is becoming increasingly hard for SMEs to justify such investment and on-going expenses. Many organisations are seeking alternative solutions that can reduce the total ownership costs of their ICT systems, with a few choosing to outsource them to third parties, in order to focus their limited time and resources on their core business. SMEs are very cost conscious; they should keep their costs under control. Although adopting new technologies help SMEs gain competitive advantage, it usually involves high cost. Cloud computing is a new phenomenon which helps SMEs tackling many issues such as cost and risk management. There is no universal definition for cloud computing; but in this paper cloud computing is defined as a computing paradigm in which the computing resources are delivered to customers over a network (e.g. Internet). Companies can access the available factors Influencing the adoption of Cloud Computing by SMEs. Cloud computing is considered as an innovation, because it offers a new method of computing by integrating the already existing technologies. The latest innovative technology in the business is Enterprise Resource Planning (ERP). Here we

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are going to integrate these two innovative concepts i.e. ERP and Cloud Computing.

In this research paper the factors that influence the adoption of cloud computing by SMEs is studied in order to investigate the factors that influence the SMEs' decision to adopt cloud computing. This study is originated from two prominent theories of this field. These two theories are Rogers's Diffusion of Innovation (DOI) theory and Tornatzky and Fleischer's Technology, Organization, and Environment (TOE) framework. There are four groups of variables which are the main factors of these theories that are environmental, organizational, human and technological factors. Each of these groups of factors consists of one or more constructs. Environmental factors group consists of External Support and Competitive Pressure. Organizational factors include Employee's IS knowledge and information intensity. Human factors are decision makers' Innovativeness, and their cloud knowledge. Last but not least, technological factors are cloud computing, Relative advantage, Cost, Security and Privacy, Trial ability, Complexity and compatibility with company's norms and technologies.

The TOE framework is an appropriate theoretical foundation to understand the factors that influence cloud computing adoption and outcomes. Although the TOE framework allows researchers to examine a broad set of factors. Cloud computing is one of the most recent Internet-related computing paradigms which help SMEs become technologically closer to large businesses. This new phenomenon makes it possible for companies to access sophisticated computing services over a network. There is no universal definition for cloud computing that explains all aspects of this new phenomenon. Concept of cloud computing dates back to 1950s (when mainframes were accessed by users from different terminals), it was during late 1990s when cloud computing started to become a buzz word; and companies gained a better understanding of cloud computing (EzeCastle Integration, 2012). The diffusion of cloud computing has many advantages at both micro and macro level. At micro level the diffusion of cloud is advantageous for SMEs. At macro level, it is beneficial for the economy and environment.

## 2 SMEs and Cloud computing

The size and structure of SMEs gives them some advantages including fast communication between employees and their managers and their ability to rapidly implement and execute decision. But in most cases these companies face many disadvantages. Most of the challenges that SMEs face are due to their lack of access to enough resources (Welsh & Wite, 1981). These resources include but not limited to financial and human resources. This limitation makes SMEs weaker than large companies in terms of financing, planning, control, training and also information technologies (Bilili & Raymond, 1993). Keeping cost under control is one the biggest challenges that SMEs faces. (Communications News, 2008) It is not feasible for SMEs to spend a significant amount of money on their Information

Technology (IT). In addition to their high cost, IT projects usually involve a high risk of failure too. About 20 percent of IT projects are cancelled before completion and less than a third are finished on time and within budget with expected functionality (Kappelman, McKeeman, & Zhang, 2006). Overall SMEs have low tolerance in bearing costs and risks that are involved in IT investment. Different studies have been conducted to investigate how to improve SMEs' operational efficiencies; and help them grow larger. For example Acs et al. proposed some changes in public policies that increase an SME's incentive to innovate (1997).

## 3 Diffusion of Innovation Theory

Diffusion of Innovation Theory (DOI) is mainly known as a theory developed by Everett Rogers, a Professor of rural Sociology, who wrote a book on this theory in 1962. However, Rogers is not the first person who introduced the concept of diffusion. One of the first studies regarding diffusion of innovation is the research conducted by Ratzel et al. (1928) who studied the trans-cultural diffusion. Another influential study is conducted by Lazarsfeld et al. (1944) who interrogated the voting behaviour of individuals. This study illustrated the importance of opinion makers' attitude in changing voters' mind. Theory of Diffusion of Innovation (DOI) is originated from six different disciplines anthropology, early sociology, rural sociology, education, industrial sociology and medical sociology; which were predominantly from sociology discipline. During the 1960s, these research traditions started to merge; and the current diffusion of innovation theory started to appear. The current version of DOI tries to discover the factors that influence the spread of a new idea or technology in a society (Rogers, 2003). Rogers defined some factors that impact the speed of diffusion in a society. Some of these factors are the innovations' characteristics, the nature of social system, communication channels and change agents'. Rogers defined some factors that impact the speed of diffusion in a society. Some of these factors are the innovations' characteristics, the nature of social system, communication channels and change agents'.

## 4 Innovation Decision Process

Roger defined the innovation-decision process as: "the process through which an individual or other decision making unit passes from first knowledge of an innovation, to forming an attitude toward the innovation, to a decision to adopt or reject, to implementation of the new idea, and to confirmation of this decision". He demonstrates that the innovation-decision process can be described as a stage that an individual (or other decision-making unit) passes through.

- Knowledge: The innovation-decision process starts with the knowledge stage. In this stage, the individual (or some other decision-making unit) is exposed to an innovation's existence

and gains an understanding of how it functions.

- Persuasion: This stage refers to situations when a client (or some other decision-making unit) shapes a favourable or unfavourable attitude about the new notion.
- Decision: It signifies the condition when a client (or some other decision-making unit) involves in activities that lead to a decision to adopt or not to adopt the innovation.
- Implementation: At the implementation phase, the individual (or some other decision-making unit) puts an innovation into actual use.
- Confirmation: The final stage refers to the state when an individual (or some other decision-making unit) try to reinforcement of an innovation-decision already made, or backs down from a previous adoption decision for one reason or another.

ICT innovation adoption cannot always be considered a simple process (Zappalà and Gray, 2006). Perhaps the most challenging question about this description of Rogers regarding the innovation adoption process is that, the stages listed above provide a sense of technological progression for adopters, the extent to which this process can be considered a linear process is not certain. "When an organisation learns to do something it did not know how to do before, and then proceeds to do it in a sustained way, a process of innovation has occurred" (Shepard, 1967, p. 470). In fact, firms, like consumers, differ in the likelihood and speed of their adoption of new innovations. However, the process of organisational innovation is almost dissimilar to the adoption of innovations by individuals. According to Pennings and Buitendam (1987), diffusion among organisations presents special challenges. Technology adoption is a complex developmental process (Straub, 2009). Firms have usually tried to apply a relatively steady and predictable prototype of development through a number of cumulative and identifiable stages (Van de Ven and Poole, 1995).

## 5 Technology-Organisation-Environment (TOE) Framework

The TOE is an organisation-level multi-perspective framework that was developed by Rocco DePietro, Edith Wiarda and Mitchell Fleischer (1990). TOE represents one segment of the innovation process, i.e. how the firm context influences the adoption and implementation of innovations (Baker, 2011). Based on this framework, the technology innovation adoption process is influenced by three aspects of an enterprise's context. The technological context represents the internal and external technologies related to the organisation, both technologies that are already in use at the firm, as well as those that are available in the marketplace but not currently in use (Baker, 2011). These technologies may include either equipment or practice. The organisational context is

related to the resources and the characteristics of the firm, e.g. size and managerial structure, while, finally, the environmental context refers to the arena in which a firm conducts its business; it can be related to surrounding elements such as industry, competitors and the presence of technology service providers. These three contexts present both constraints and opportunities for technological innovation (Tornatzky and Fleischer, 1990).

## 6 Integrating DOI and TOE to study the determinants of cloud computing adoption

The two theories such as the diffusion of innovation (Rogers, 2003) have been widely applied to studies looking at how innovations are adopted and diffused. This study, for a number of reasons, will also use the Technology, Organisation, and Environment (TOE) framework put forward by DePietro et al. (1990). First of all, despite the similarity in their concepts, 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 is better able to explain intra-firm innovation adoption. From their point of view, the reliable empirical support and solid theoretical basis are the main advantages of the TOE framework.

## 7 Constructs of TOE

### 7.1 Technological Context

In the original TOE framework, the technological context described both the internal and external technologies relevant to the firm (Rui, 2007; Oliveira and Martins, 2011). The central indicator for the adoption of a new IS innovation. The higher the perceived need for an innovation by an organisation, the higher the probability that it will adopt the innovation (Rogers, 2003; Lee, 2004).

- a. Uncertainty: Adoption of a new technology involves risk and uncertainty (Erumban and de Jong, 2006). Uncertainty refers to the extent to which the results of using an innovation can be guaranteed (Ostlund, 1974; Fuchs, 2005). Due to the open nature of the Internet, security risk has been recognised as a key factor hindering the use of some ICT technologies (Kalakota and Whinston, 1996).
- b. Compatibility: From a business perspective, there is a need for the technical and procedural requirements of the innovation to be compatible and consistent with values and the technological requirements of the adopting organisation (Lertwongsatien and Wongpinunwatana, 2003).
- c. Complexity: Complexity refers to "the degree to which an innovation is perceived as relatively difficult to understand and use" (Rogers, 2003, p. 257). Adopting a new technology may

confront SMEs with challenges in terms of changing the processes in which they interact with their business systems. New technologies have to be user-friendly and easy to use in order to increase the adoption rate (Parisot, 1995; Sahin, 2006).

- d. Trialability: This factor has been reported as one of the most fundamental components in the process of adopting a new technology (Kendall, 2001; Rogers, 2003).

## 7.2 Organisational Context

The Organisational context was found to be an important context for innovation adoption in previous studies (e.g. Ramdani, 2008). Four main factors are included in the organisational context and these are: firm size, top management support, innovativeness and prior IT experience.

## 7.3 Environmental Context

The key factors within the environmental context are: competitive pressure, type of industry, market scope and supplier efforts and external computing support

## 8 Conclusion

The findings of this paper has great value to the research community, managers and ICT providers, 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, while seemingly similar ones facing similar market conditions do not. On the other hand, however, cloud computing providers may need to improve their interaction with SMEs who are involved in the cloud computing experience, in an effort to create a healthy environment for cloud computing adoption, and to remove any vagueness surrounding this type of technology. Providers may need to clarify their position and stance when it comes to offering in-house versus clouds services, which in turn can affect clients' confidence. Pro spects appear to be willing to adopt cloud computing services despite security concerns, as they rely on the element of trust or it is the next issue for the future research that will concentrate on the security issues for the successful implementation of ERP with Cloud computing technology for SMEs.

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